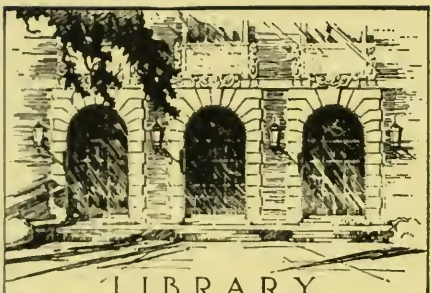

Bionomics, Systematics, and Phylogeny of *Lytta*, a Genus of Blister Beetles (Coleoptera, Meloidae)

RICHARD B. SELANDER

ILLINOIS BIOLOGICAL MONOGRAPHS: *Number 28*

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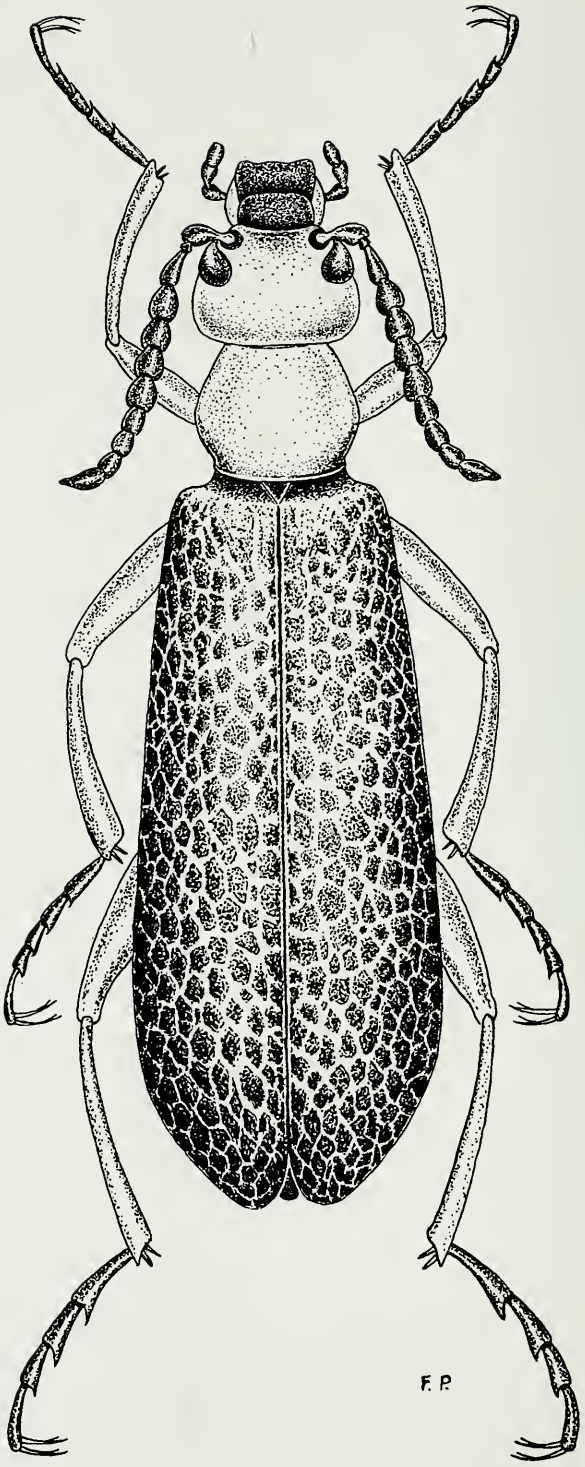
Bionomics, Systematics, and Phylogeny of *Lytta*, a Genus of Blister Beetles (Coleoptera, Meloidae)



Lytta magister, male (drawing by F. Pacheco)

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Contents

Introduction

The genus *Lytta*, with 128 currently assigned species, is one of the larger genera of the family Meloidae, which is a member of the section Heteromera of the superfamily Cucujoidea of the order Coleoptera. Adult Meloidae, known popularly as blister beetles, are rather slender, soft-bodied, long-legged, phytophagous insects. In the drier subtropical and tropical regions of the earth they form a very conspicuous part of the fauna, feeding gregariously, often in spectacular numbers, and at times causing severe damage to crops. In more mesic regions the family is not so well represented. In the larval stage Meloidae are unusual for Coleoptera in having a parasitic mode of life. Larval hosts are of limited variety: wild bees and grasshoppers. Meloid larvae begin life as active, strongly sclerotized campodeiform insects charged with the responsibility of locating their own food materials. In *Lytta* and a large number of related genera this is achieved by active searching; in other genera phoresy is involved. Developing larvae undergo hypermetamorphosis, passing through four morphologically and behaviorally different phases before reaching the pupal stage.

My attention was first drawn to the genus *Lytta* in the summer of 1950 when, while collecting insects at high elevation in the Wasatch Range of northern Utah, I found adults of the large, metallic greenish blue *cyanipennis* swarming on one of the native lupines. During this same summer I obtained eggs from some of the adult beetles and subsequently succeeded in rearing larvae of the species through several instars. Later, working in México, I had the opportunity to observe additional species of *Lytta* in their natural habitats and to secure additional larvae. In selecting the genus for study, I was influenced both by the experience I had had with the group in the field as well as by the knowledge that previously no attempt had been made to define the genus on a world basis, to incorporate both Old and New World species into a scheme of classification or phylogeny, or to revise the species of an entire continent. Further, since the genus stands in the midst of the complex and unwieldy tribe Lyttini, it seemed to me that a clarification of the limits and composition of the genus would be an especially important contribution to the study of the family.

Within limits imposed by time and the availability of material, the present study is as comprehensive as it has been possible to make it. A major part is devoted to a revision of the species of *Lytta* of the North

American continent. In the phylogenetic portions of the study the fauna of North America is treated at the specific level, while consideration of the fauna of the Old World is, of necessity, confined to main evolutionary lines. Similarly, the formal classification includes all the species of the genus in North America but only a part of the species in the Old World, i.e., those represented in collections studied or described rather fully in the literature. Species excluded from consideration for one reason or another are mentioned in the discussion of limits of the genus.

Historical Résumé

Bionomics. A detailed review of the history of discovery of the larva and mode of larval life of *Lytta* was given by Beauregard (1890) in his treatise on the family Meloidae.

According to Beauregard, the larva of *Lytta* was first discovered by Loschge, who in 1788 gave a short description of the first instar of *vesicatoria.* For the next three quarters of a century little of real consequence was published regarding the bionomics of the genus aside from scattered observations on mating behavior and other adult activities of *vesicatoria,* most of which are cited in the following pages under appropriate subdivisions of the discussion.

The association of the larval stages of *Lytta* with Hymenoptera was not established until after it had been shown that several other genera of Meloidae are larval parasites in the nests of bees. It was recognized, however, that larvae develop below the surface of the ground, for it became widely held among entomologists that the larvae of *Lytta* fed on the roots of plants. In 1875, Lichtenstein began a series of attempts to rear larvae of *vesicatoria* on the provisioned pollen of several species of bees. Reports of his progress appeared in numerous short notes that culminated in 1879 in the announcement of a completed rearing, using pollen of a species of *Ceratina* bee. Following this, Beauregard (1890) carried out additional rearings of *vesicatoria,* made further observations on the habits of larvae and adults, and described all immature stages in detail. His work is the last to contribute anything of significance to our knowledge of the bionomics of the genus *Lytta* in the Old World.

In more recent times, Linsley and MacSwain (1942, 1952, and 1958) and Linsley, MacSwain, and Smith (1956) have made observations on some aspects of the life histories of the North American species *Lytta melaena, tenebrosa* (as *occipitalis*), *chloris, stygica* (as *purpurescens*), *moerens,* and *variabilis.*

Data on bionomics contained in the published literature of *Lytta* are supplemented in the present work with information that I have recorded for the genus in the course of my study of the Meloidae over the past ten years.

Systematics. In the New World the main systematic works dealing with species now assigned to the genus are Horn's (1873) reviews of *Lytta* and *Pomphopoea* for the United States, Fall's (1901) revision of Horn's keys to the species of *Lytta*, Champion's (1892) synopsis of *Lytta* for México and Central America, and MacSwain's (1956) treatment of the first instar larvae of many of the species of *Lytta* and *Pomphopoea* of the United States. In the Old World the principal systematic works on the genus *Lytta* are Escherich's (1895) revision of some of the Palearctic species and Péringuey's (1909) revision of the South African species.

Horn, and later Fall, divided the species of the genus *Lytta* of the United States into three groups, as follows:

Group I. Antennae of male with intermediate joints (4-5-6-7) either deformed or much thicker than those which precede or follow. Antennae more or less moniliform in both sexes, gradually stouter to tip in the female and rarely longer than the head and thorax, never equal to half the length of body. Type, *C. vulnerata*, Lec.

Group II. Antennae not dissimilar in structure in the sexes, either moniliform or slender, always gradually stouter toward the tip, in several species longer than half the length of body. Types, *C. cardinalis*, Chev. (moniliform antennae) [misidentification of *fulvipennis* LeConte], *C. stygica*, Lec. (slender antennae).

Group III. Antennae with compressed joints; joints 5-10 usually broader than long, thorax very convex, somewhat spherical in form. Both hind tibial spurs slender and acute. Type, *C. compressicornis*, Horn.

In its final form (Fall, 1901), Group I of this classification included, in addition to *vulnerata* (= *cooperi*), the species *eucera, mutilata, peninsularis, quadrimaculata, margarita, magister, deserticola, morosa, melaena, nuttalli, cyanipennis, viridana, tenebrosa, lugubris* (= *ulkei*), *childi, funerea, puberula,* and *biguttata.* Group II included, in addition to *fulvipennis* and *stygica* (= *stolida, purpurescens,* and *difficilis*), the species *suavissima* (= *gentilis*), *moerens* (= *incommoda*), *insperata, molesta, reticulata, agrestis, cribrata, lecontei* (= *dichroa*), *occipitalis* (= *tenebrosa*), *chloris, nigripilis, auriculata, refulgens, aeneipennis, crotchi, nitidicollis, lugens,* and *rathvoni.* The species of Group III, along with *suavissima* Wellman, were later transferred from *Lytta* to form the epicautine genus *Linsleya* MacSwain (1951).

As constituted, both Groups I and II of Horn and Fall's classification are polyphyletic. In the main this is due to the fact that the incrassate condition of the intermediate male antennal segments characteristic of many of the North American species of *Lytta* has developed independently in two entirely distinct phylogenetic lines. In addition, both authors erred in their interpretation of this character. Actually, male and female antennae are to some extent dissimilar in all species of the genus *Lytta.* Further, the intermediate male antennal segments in some species, e.g., *fulvipennis,* although definitely incrassate, are no wider or only slightly

wider than the segments that precede and follow them. Again, the degree of enlargement of the intermediate segments may vary considerably within a single species. The highly subjective nature of the group criteria employed by Horn and Fall is shown dramatically by the fact that they placed *tenebrosa* and *occipitalis* in different groups, although these forms are in reality only geographical variants of the same species.

Champion did not propose a classification of the species he treated. In the selection of characters he tended to follow Horn. His key to species is incomplete, and the distinctions he made between species are in some cases inexact.

MacSwain proposed a division of the species of *Lytta* of the United States into four groups, one of which (Nitidicollis Group) he regarded as probably unnatural. Fundamentally, my studies of adult beetles have confirmed his conclusions concerning the systematics of the genus based on larval morphology (but not necessarily those based on adult morphology). As a result, I have adopted his concept of a Magister Group, Moerens Group, and Polita Group (herein called Stygica Group).

Methods and Terms

The classification proposed in the present work is a phylogenetic one. In essence this means that, so far as possible, the criterion for the formation of taxa is not degree of similarity or difference of the species but their phylogenetic relationships. Phylogeny as the theoretical basis for systematics has recently received a good deal of criticism from one group of systematists, but Simpson (1959) has, I think, answered their arguments. In preparing phylogenies for this study, much use has been made of the principle that the correct arrangement of species and higher categories is most likely to be the one that accounts for the origin and distribution of characters in the simplest manner. In many cases it has been possible to deduce with some confidence the primitive characters of taxa and then to trace the evolutionary lines from a hypothetical ancestral type. In others, it has been necessary to regard degree of morphological similarity (static relationship of Michener and Sokol, 1957) as indicative of phylogenetic relationship. In actual practice this last approach does not differ from the nonphylogenetic approach to systematics, although from a theoretical viewpoint the distinction between the two is a critical one.

About one-fourth of the North American species of *Lytta* show marked geographic variation. In dealing with species in which only a single character varies geographically or in which variation of characters is geographically discordant, I have simply described the variation observed. Where species exhibit concordant geographic variation, the concept of subspecies has proved convenient. In line with views expressed by Wilson

and Brown (1953), however, vernacular names have been used for the subspecies recognized here.

In mapping the geographic distribution of species of *Lytta,* definite locality records have been indicated by solid figures and indefinite ones, such as state records, by open figures.

Some comment about the keys in this work is in order. As far as practicable, the keys to subgenera, groups, subgroups, and species have been made phylogenetic, with the intention of their serving as convenient summaries of the morphological basis for the classification. Their ease of use in the identification of specimens has therefore been a minor consideration. Males will probably run in them satisfactorily, but in most cases they will not serve for the identification of females unless the group or subgroup to which a species belongs is already known. For the identification of females and (in many cases) more convenient identification of males, the artificial key beginning on page 35 should be used.

There are only a few morphological terms that require explanation. Vertex, as used in this work, refers to that part of the head capsule above the dorsal margin of the eyes. In describing the male genitalia, Michener's (1944) suggestion that the terms gonoforceps, gonostylus, and aedeagus be used in place of the terms tegmen, lateral lobe, and median lobe, respectively, has been followed. The term gonocoxal plate replaces the term basal piece. Reference to abdominal sterna is always to externally visible sterna. The fifth and sixth sterna are morphologically the seventh and eighth, respectively.

Antennal length is usually expressed in this work in terms of the point that the antennae reach relative to the pronotum. In determining this point the antennae are directed over the vertex and then posteriad along the dorsum of the body of the specimen. In a few cases, where more critical measurements are desirable, absolute antennal length is compared with fore tibial length.

Synonymies given for the species are complete except for references given in catalogs. For the spelling of place names the following works were consulted: *Rand McNally Road Atlas* for Canada and the United States; *Gazetter No. 15, México, of the United States Board on Geographic Names* for México; and the current *National Geographic Society Map of México and Central America* for Central America. Certain place names in México, such as San Luis Potosí, may refer to both a state and the capital city of the state. These are always interpreted in this work as state names, unless there is evidence to the contrary.

In the citation of bibliographic references, the system of abbreviation of names of journals contained in the *Style Sheet for Scientific Publications of The American Museum of Natural History* has been followed. In the text authors' names are not cited for taxa that are revised in this

study inasmuch as this and other bibliographic information is given in connection with the individual treatment of these taxa. For all other taxa authors' names are cited in the text at least once.

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Bionomics

This section is a summary of available information concerning the development, habits, and ecological relationships of the species of the genus *Lytta*. As will become evident, this information is fragmentary. For a large number of species of the genus even such basic data as food plant records are lacking, and our knowledge of details of larval development is based in great part on observations of a single species (*vesicatoria*).

So far as it is known, there are only two orders of insects that provide larval food material for Meloidae. Members of the meloine tribes Epicautini and Mylabrini feed on the eggs of grasshoppers; all other Meloidae parasitize the nests of wild bees, feeding on provisions and (in many cases) immature stages of the bees. On the basis of the phylogenetic position of the tribes Epicautini and Mylabrini indicated by studies of morphology, it seems reasonable to conclude that feeding on the eggs of grasshoppers is a specialized characteristic within the Meloidae. Interestingly, no major adaptive modification seems to have been necessary to permit the evolutionary change from parasitism of bees to parasitism of grasshoppers, for the general features of bionomics are similar for all Meloidae.

With the exception of a few degenerate species, e.g., members of the genera *Hornia* Riley and *Tricrania* LeConte, that do not leave the vicinity of their site of larval development, all Meloidae are phytophagous in the adult stage. Some species eat only pollen or leaves; others feed more generally. Members of the subfamily Meloinae oviposit in burrows in the ground excavated by the female beetles. Members of the subfamily Nemognathinae usually oviposit on their food plants. The only exception to this last rule occurs in the degenerate forms mentioned above. Larval development in all cases is hypermetamorphic, i.e., there are striking morphological differences between larvae of several of the instars. Larvae in the first instar invariably are active, strongly sclerotized forms. They actively seek out their food in all Meloinae except *Meloe* Linnaeus. In *Meloe* and in all Nemognathinae they attach to adult bees and are passively carried to their food. Once the larvae have begun feeding, they pass through three or four grublike instars. After feeding has been completed, they enter the inactive coarctate instar in which the appendages become rudimentary. A return to a grublike form takes place in the next instar, which is followed shortly by pupation and emergence of the adult beetle.

Economic Importance

Damage to cultivated plants. Although a few species of *Lytta* feed on cultivated plants, their attacks are of such a sporadic and local nature that they are not of major economic importance. In the eastern United States *Lytta* (*Pomphopoea*) *aenea*, *polita*, and *sayi* have been reported as pests of peaches, plums, apples, and pears. The adult beetles feed on the flowers and young fruit, at times causing severe local damage to commercial plantings. Three North American species of *Lytta* have been recorded from field crops. These are *moerens*, reported once from radishes; *nuttalli*, from beans, beets, oats, and barley; and *cyanipennis*, from beans and peas. Some of these records are probably based on accidental associations. In Europe feeding aggregations of adults of *vesicatoria* sometimes defoliate ornamental shrubs.

Medical importance. From an economic standpoint *Lytta* has long been of interest and importance as a source of cantharidin. This substance is an odorless, colorless anhydride found in all Meloidae with the possible exception of the species of the tribe Horiini. Its physical and chemical properties are discussed by Fumouze (1867) and Görnitz (1937). It has been obtained commercially from a number of species of Meloidae (particularly members of the genera *Mylabris* Fabricius and *Epicauta* Dejean), but by far the most important source has been *Lytta vesicatoria*, commonly known as the Spanish fly (*mouche d'Espagne*).

According to Beauregard (1890), cantharidin is produced in the third pair of seminal vesicles of the male and in the copulatory vesicle and ovaries of the female. It is distributed to the blood and other soft tissues of the body but is not incorporated into the exoskeleton. It has been shown that it is also present in the eggs and first instar larvae. Its function in the Meloidae is unknown. The characteristic odor of Meloidae is said to be produced not by cantharidin or any of its derivatives but by an unidentified essential oil (Fumouze, 1867).

For commercial purposes cantharidin is seldom used in its pure form; rather, the dried beetles are ground up to form a crude drug known as cantharides. The method of collection of adults of *Lytta vesicatoria* and their preparation as cantharides were described by Fumouze (1867). In the morning, before the beetles have recovered from the effects of the coldness of the night, large sheets of cloth are spread at the bases of trees upon which they feed. The trees are then shaken, and the beetles tumble onto the cloths. Beetles collected in this manner are killed in boiling water or hot vinegar and dried in the air or in ovens.

During the past century most of the cantharides used in Europe and the United States has come from eastern Europe and Italy. Considerable

variation of cantharidin content in samples of *vesicatoria* from different parts of Europe was reported by Fumouze (1867), with a range from 1.7 per cent cantharidin in a German sample (which Fumouze felt was probably adulterated) to 5.0 per cent in a sample from Trieste.

When administered to humans, cantharidin is an active irritant and vesicant. On the skin it produces "redness, smarting, and pain, followed very soon by small vesicles, which later coalesce into one large blister" (Cushny, 1901, p. 89). In the formation of the blister the outer layers of the epithelium separate from the corium, the cavity produced being filled with a yellow serous fluid containing leucocytes (Meyer and Gottlieb, 1926). Taken internally in large quantities cantharidin produces vesication of the mucous membranes, vomiting, purging, abdominal pain, and shock. Comparatively small quantities irritate the bladder, causing a constant desire to urinate. In women it reportedly can produce abortion, while in both sexes irritation of the urinary tract may lead to increased sexual desire.

In contrast to humans, some animals (chicken, hedgehog, and frog) reportedly have a high degree of immunity to cantharidin (see Cushny, 1901).

The history of the use of cantharidin can be traced in detail in the works of Fumouze (1867), Beauregard (1890), Escherich (1895), and Görnitz (1937). The ancient Greeks and Romans employed it as an aphrodisiac, poison, and medicinal drug. Its value as an aphrodisiac for humans has been disputed, but it seems to have been used as such until relatively recently and is still used in some countries in the breeding of cattle. It occupied a prominent position in heroic medicine, and until the present century it was commonly administered orally as a remedy for a variety of maladies, including tuberculosis and urinary disorders. At present its internal use has been largely discontinued, although it continues to enjoy some popularity as an irritant and counterirritant applied to the skin. For this purpose it is commonly used in the form of a "cantharides plaster" containing 0.1 gram of cantharides per square centimeter (Goodman and Gilman, 1941). According to Cushny (1901, p. 91), it has also been used as "a constituent of hair washes, its irritant action on the skin being credited with causing a more rapid growth of hair."

When applied to certain insects cantharidin acts as an effective nerve poison. The possibility of its use as an insecticide in this connection has been investigated by Görnitz (1937).

Enemies

Adult meloids are known to be attacked by nematodes, spiders, Hemiptera, ants, and ceratapogonid flies. There are, however, few specific

records of invertebrate predation, and only one of these involves a species of *Lytta.* This is *Lytta nuttalli,* which is preyed on by the mirid bug *Hadronema militaris* Uhler. Similarly, there is little specific information available regarding predation on meloids by vertebrates. A number of field records of birds, lizards, and toads eating members of the genus *Epicauta* have been reported, but there are no records of meloid predation by mammals. Marshall (1902), in Africa, found that several species of Mylabrini and single species each of *Eletica* Lacordaire and *Zonitis* Fabricius were consistently refused as food items by captive baboons and a falcon. Carpenter (1921) reported that two *Cercopithecus* monkeys whose food habits he studied in Africa did not eat meloids, although one of them tasted specimens. Pritchett (1903) reported negative results in her attempts to feed adults of *Lytta fulvipennis* to caged *Sceloporus* and *Gerrhonotus* lizards in Texas. According to Pritchett's account, the lizards seized three of several of the meloids offered but quickly rejected them. After briefly chewing a meloid, one of the *Gerrhonotus* lizards "began writhing and rubbing his mouth in the sand, appearing much distressed" (p. 279).

As larvae, species of *Lytta* and other Meloidae are subject to attack by a number of parasites and predators associated with their larval food materials. So far as it is known, however, none of these specifically attacks Meloidae. In this connection, it has been suggested by Linsley and MacSwain (1952) that in *Lytta* the larva's habit of burrowing away from the cell series in which it develops may serve as a means of protection against attack by enemies.

Activities of Adults

Seasonal distribution and longevity. Data on the seasonal distribution of adults are available for 63 of the 68 species of *Lytta* occurring in North America. Known periods of activity of adults range from one month (for 11 species) to ten months (for *magister* and *vulnerata*). The average length of the period in North America is three and one-half months. The period of activity of adults of *vesicatoria* in France is reported to last two and one-half months (Beauregard, 1890).

For the majority of species of *Lytta* the period of activity of adults falls in middle and late summer. However, in the subgenus *Poreospasta* it falls primarily in spring and early summer. Of the 21 species of this subgenus, only 3 (*nuttalli, cyanipennis,* and *viridana*) are recorded in the adult stage as late as August and only 1 (*nuttalli*) as late as September. Only three North American species of *Lytta* appear to be active as adults through the winter months. These are *polita* (recorded from mid-December to early June), *scituloides* (apparently active from mid-September to mid-May), and *eucera* (recorded in February and in every

month from May to December). There is no definite indication of more than one generation per year for any species of the genus.

It is highly doubtful that individual beetles live for the entire period of activity of adults of most species. Adults of *vesicatoria* live about four weeks under laboratory conditions (Beauregard, 1890). I have kept adults of several species of *Lytta* alive in captivity for periods of two to three weeks but have never determined how long it would be possible to maintain them. In all probability, adults of most species do not live much longer than those of *vesicatoria*. Consequently, emergence of adults of most species must take place over a period of several weeks. Beauregard noted that in France a first emergence of *vesicatoria* occurs in mid-May, followed by a second in mid-June, and a possible third a little later. This same author felt that this prolongation of time of emergence reflects differences in exposure of terrain in which the larvae develop as well as the fact that larvae remaining dormant over more than one winter attain the adult stage and emerge from the ground earlier than do individuals overwintering only a single year. Differences in latitude and elevation as well as annual climatic variation undoubtedly exert a great influence on the time of emergence of adult beetles of many species of *Lytta*. Nevertheless, it seems reasonable to suppose that the seasonal distribution of a given species is synchronized very closely with the period of nesting activity of its larval host or hosts.

General behavior. The gregarious habit of adults of the genus *Lytta* and many other genera of Meloidae probably functions in part as a mechanism to keep the beetles near nesting sites of host bees and thus to assure the larvae of a reasonable chance of finding their way into suitable bee cells.

Compared with adults of *Epicauta* and *Pyrota*, those of *Lytta* are for the most part slow-moving and unwary. Frequently they can be approached to within a distance of a few inches before they become disturbed. When disturbed they usually remain motionless or attempt to crawl away from the disturbing object; only rarely do they drop from their positions or take flight. They feign death and undergo reflex bleeding only when handled roughly. Some differences in general behavior exist between species. For example, adults of *ebenina* and *sanguinea* are more active and alert than those of such species as *quadrimaculata, eucera*, and *cyanipennis*.

Adults of most species are more active during the day than they are during the night. In some cases, adults spend the night on their food plants; in others, they crawl to the base of the plants and remain at ground level until morning. They are not attracted to light at night.

In the course of the present study the feeding habits of adults were observed at first hand for the species *variabilis, michoacanae, ebenina,*

plumbea, biguttata, scitula, quadrimaculata, eucera, sanguinea, mutilata, and *cyanipennis.* Adults of *mutilata* eat the entire body of their food plants, which are members of the parasitic plant genus *Cuscuta.* Adults of *eucera* and *cyanipennis* feed primarily on leaves, although in both species flowers are also eaten and seem to be preferred. The feeding habits of adults of *vesicatoria* are presumably similar to those of these last two species. Adults of the other species listed above apparently feed only on flowers (pollen and petals). From personal observation and from data found in the literature and on the labels of specimens examined, the following tentative generalizations may be made regarding the feeding habits of the genus. In the subgenera *Paralytta* and *Pomphopoea* and in all but one or two groups of *Poreospasta,* adults feed only on flowers. In the Cyanipennis Group (and possibly the Moerens Group) of *Poreospasta* and in the subgenus *Lytta* they feed on both flowers and leaves. In *Adicolytta* they may be restricted to flowers, e.g., *sanguinea,* or may eat both flowers and leaves, e.g., *eucera* and *mutilata.*

Food plant records for the North American species of *Lytta* are given in the following section of this work. Where the species of a subgenus or group exhibit marked preference for plants of one or a few families, this fact is mentioned in the discussion of the appropriate taxon. The families of plants which are of most importance as sources of food for adults of *Lytta* in North America are Leguminosae, Convolvulaceae, Compositae, Papaveraceae, and Rosaceae. In the Old World food plant records are available for only two species, both belonging to the subgenus *Lytta.* These are *caraganae,* which feeds on *Caragana* (Leguminosae), and *vesicatoria,* which has been recorded from plants of the families Oleaceae (*Fraxinus, Liqustrum, Olea,* and *Syringa*), Caprifoliaceae (*Lonicera, Sambucus,* and *Symphoricarpos*), and Salicaceae (*Populus* and *Salix*) (with some unverified records of attacks on cereals and other grasses) (Lichtenstein, 1877; Beauregard, 1890; Lampa, 1903; and Houlbert and Bétis, 1913).

In general, few if any species of *Lytta* are confined to a single species of plant. Some species seem to have a strong preference for representatives of a single genus of plants, while perhaps the majority show such a preference for members of a single family. Species that ordinarily feed on only one genus or family of plants can utilize other plants, at least as a dietary supplement. For example, *quadrimaculata* feeds only on Papaveraceae when it is available but in its absence will turn to Compositae.

There is evidence that some species of *Lytta* feed on the same kinds of plants that their bee hosts utilize as pollen sources. The advantage to the meloid of this relationship seems obvious, although the extent to which it is realized is uncertain.

Courtship and mating. Courtship in *Lytta* consists basically of the male taking a position directly above the female and attempting to stimulate her to accept genital contact. Stimulation seems to be derived principally from stroking, flagellation, or other manipulation of the female's antennae by the male's antennae and (in some cases) fore legs. When genital contact is achieved, the male dismounts and turns to face in the opposite direction from the female, in the usual mating position for species of the subfamily Meloinae.

Males frequently have the antennae and legs specially adapted for use in courtship activity. In *Paralytta, Adicolytta,* and a few species of *Poreospasta* the intermediate segments of the male antennae are enlarged, while in some species of the second subgenus they are further modified to form a clasping mechanism. Adaptations of the male legs are varied. In most species of the genus the tarsal pads of the male are larger and denser than those of the female. In *Adicolytta* the femora and tibiae of the fore and middle legs may be distorted. In *Poreospasta* the hind trochanters are sometimes spined or angulate, and the tibial spurs and first tarsal segment of the fore legs are frequently modified. Adaptations of this last sort are also found on the fore legs of species of the subgenus *Lytta* and on both the fore and middle legs of the *Pseudolytta.* In males of all species of the genus the last visible abdominal sternum is emarginate, which permits the aedeagus to be thrust forward during courtship.

Courtship behavior in *Lytta vesicatoria* was described by Goedart (1700), Audouin (1826), Fabre (1886), and Beauregard (1890). In this species the male begins courtship by gently stroking the under surface of the female's thorax with his fore and middle legs. Then the antennae are used to flagellate the head of the female, and the abdomen (which is elongated) is vibrated very rapidly as the male attempts to make genital contact. Periodically the male grasps the antennae of the female with his fore legs and pulls vigorously on them. A socket formed by the first tarsal segment and tibial spur on each fore leg of the male provides a device for holding the antennae of the female.

I have observed courtship activity in *Lytta cyanipennis* and *variabilis.* In *cyanipennis* the male extends the antennae forward and strokes the antennae of the female; at the same time he violently shakes his entire body and vibrates his abdomen (which is elongated) so rapidly that it is blurred. At one time a male under observation continued this behavior, with short periods of rest, for five hours. In *variabilis* the male uses his antennae to draw back the antennae of the female so that the second to fourth segments of first one and then the other of them are pressed into the finely punctulate, short-pubescent concavity on each side of his head. This alternate manipulation of the female antennae is repeated at intervals of about one second. The female sometimes

raises her antennae in response, facilitating the action of the male. The female may be stimulated by a chemical substance in the modified areas of the head of the male or by contact with the short setae present. Modifications of the head of the type found in the male of *variabilis* are characteristic of some 22 species forming the Variabilis and Reticulata groups of the subgenus *Paralytta*.

Mating in the genus *Lytta*, as in other Meloinae, generally lasts a long time. Pairs of adults of *vesicatoria* have remained coupled from 4 to 20 hours (Beauregard, 1890); a mating of *cyanipennis* observed by me lasted 11½ hours. Beauregard's (1890) suggestion that actual physiological mating or insemination is completed in a relatively short time is probably correct, although this has not been established definitely.

Adults continue to feed while coupled. In the course of their activities they frequently pull in opposite directions or hang from each other. However, their coupling mechanism is so effective that they seldom if ever lose contact accidentally. In fact, mating pairs sometimes experience difficulty in disengaging. In some cases the aedeagus of the male may even be pulled from his body.

Two structural adaptations of the genitalia are basic to the coupling mechanism. One is the presence of hooks on the aedeagus of the male. These provide for secure attachment by catching on folds of the vagina of the female. The other adaptation is the great reduction in length of the genital tube of the female. In most Coleoptera the genital tube is a long, membranous structure. In repose it is entirely concealed within the abdomen of the female; during oviposition it is extruded to its full length, which is often equal to that of the body of the beetle. Females with this type of genital tube would seem to be ill adapted for end-to-end mating with males because of the likelihood that the tube would be pulled out to its full length when mating individuals attempted to move in opposite directions.

Oviposition. Oviposition has been observed for *Lytta vesicatoria* by Beauregard (1890), Xambeau (1900), and others and for *cyanipennis* by myself. It differs little from the oviposition process described for other Meloinae. In *cyanipennis* the burrow excavated by the female varies from one to two and one-half inches in depth. All burrows observed ran downward at about a 45 degree angle. On a few occasions females were observed to abandon partially completed burrows and, after a short period of feeding, to begin excavation of new ones. They seemed to excavate their burrows more frequently in darkness or subdued light than in bright light.

Immediately after oviposition the female begins to pull soil down from the sides of the burrow to cover the egg mass. This activity continues for about ten minutes; at the end of this time the burrow is filled except

for a slight depression marking the entrance. The female does not use the head to tamp down the soil, as has been reported for some species of the genus *Epicauta* (Horsfall, 1943).

The only important difference between my observations of oviposition in *cyanipennis* and Beauregard's (1890) description of oviposition in *vesicatoria* is that the latter species "nearly always" places its eggs in two masses divided by a thin layer of soil. According to Beauregard, each of the masses is the product of a different ovary. The number of eggs produced by a female of *vesicatoria* is given by Beauregard as 80 to 250. The number of eggs laid by *cyanipennis* is comparable. In both species females presumably oviposit only once, and they generally die within a few days after ovipositing.

Development of Immature Stages

Incubation. The average incubation period for eggs of the 15 species of *Lytta* for which data are available is 16 days. The shortest period recorded is 8 days (for *cyanipennis*) and the longest 27 days (for *vesicatoria;* MacSwain, 1956). Seasonal variation in the length of the incubation period of *vesicatoria* was noted by Beauregard (1890). Eggs laid in June hatched in 21 days; eggs laid in July hatched in 17 to 18 days.

Number of larval instars. Early students of the bionomics of the Meloidae recognized four stages of larval development, not all of which correspond to separate instars. In recent times this procedure has been abandoned, but I have had to adopt it in the present discussion because of uncertainty as to the number of instars involved in larval development of *Lytta.* I am going to call the stages the first larval instar, grub stage, coarctate larval instar, and ultimate larval instar. In Beauregard's (1890) work on *Lytta vesicatoria* the first larval instar is termed the *première larve* or *triongulin;* the grub stage, the *seconde* or *deuxième larve;* the coarctate larval instar, the *pseudo-chrysalide;* and the ultimate larval instar, the *troisème larve.*

Uncertainty as to the number of larval instars in *Lytta* stems from conflicting reports of the grub stage or *deuxième larve.* Lichtenstein (1879) definitely indicated that this stage is composed of only three instars (*trois larves blanches*), which would make the coarctate instar the fifth and the ultimate instar the sixth. The coarctate stage of the genus *Lytta* has been referred to several times as the fifth larval instar by subsequent workers, e.g., Linsley and MacSwain (1942), but presumably none of these workers has actually observed the complete development of a species of *Lytta.*

In his account of rearings of *vesicatoria,* Beauregard (1890) mentioned three molts between the first larval instar and the coarctate larval instar. Put another way, his account, like Lichtenstein's, indicates that

there are only three instars during the grub stage. However, in his treatment of the morphology of the larvae of *vesicatoria*, Beauregard (1890) described and figured four different larval forms in the grub stage. These are his *seconde larve au troisème jour, première mue de la seconde larve, deuxième mue de la seconde larve,* and *troisième mue de la seconde larve.* On the basis of Beauregard's work these larval forms are sufficiently different morphologically that they almost certainly belong to separate instars.

The discrepancy between the number of larval instars recorded by Beauregard in his account of rearings and the number described in his treatment of larval morphology has to be accounted for by a failure on his part to observe one of the larval molts during the grub stage. That he might indeed have done this is suggested by the following remarks given on page 293 of his account of rearings.

Du 10 au 12, elle [the larva] subit d'assez profondes modifications; sa tête et surtout le premier anneau thoracique, grossissent beaucoup. La tête prend la position inclinée en bas, si caractéristique chez l'individu adulte, et les mandibules acquièrent une coloration brune à la pointe. C'est, dans le développement de cette larve, une phase que j'ai observée au cours de toutes mes éducations, et qui marque un nouvel état tres caractéristique de la seconde larve.

In the few rearings of *cyanipennis* that I carried out several years ago, only three instars were observed in the grub stage. Yet, upon re-examining my material I find striking morphological differences between a larval specimen recorded at the time of the rearings as an early fourth instar larva and one which was thought to be a late fourth instar larva. My findings are therefore like Beauregard's. Further, since the cast skins of larvae are relatively conspicuous in the grub stage, the only explanation I can offer for our apparent failure to record four instars in this stage is that the cast skin of one of the larvae is eaten by the larva of the following instar.

While it is evident that no definite statement regarding the number of larval instars in the genus *Lytta* can be made, the weight of evidence suggests that the grub stage is composed of second, third, fourth, and fifth larval instars. On this basis the coarctate instar is the sixth, and the ultimate larval instar is the seventh. Careful studies of *Epicauta* (Horsfall, 1941, 1942, and 1943) and of *Mylabris* (Paoli, 1938) have demonstrated the presence of seven definite larval instars in these genera. It would appear probable that this same number is also characteristic of the genus *Lytta.*

Larval hosts. Bees recorded as larval hosts of *Lytta* are listed in Table I. Except for the species of *Colletes* (Colletidae), all hosts are members of the family Anthophoridae. Data on the extent of parasitism by species of *Lytta* are available for a few nesting sites of bees. Linsley and Mac-

TABLE I. LARVAL HOSTS OF *Lytta*

Lytta SPECIES	LARVAL HOST	AUTHORITY
L. (*Paralytta*) *melaena*	*Diadasia bituberculata* (Cresson)	Linsley & MacSwain (1952)
L. (*Paralytta*) *tenebrosa*	*Anthophora linsleyi* Timberlake	Linsley & MacSwain (1942)
L. (*Paralytta*) *variabilis*	*Ptilothrix sumichrasti* (Cresson)	Linsley, MacSwain, and Smith (1956)
L. (*Poreospasta*) *chloris*	*Anthophora linsleyi* Timberlake	Linsley & MacSwain (1942)
L. (*Poreospasta*) *stygica*	*Anthophora linsleyi* Timberlake	Linsley & MacSwain (1942)
L. (*Poreospasta*) *moerens*	*Anthophora stanfordiani* Cresson	Linsley & MacSwain (1942)
	Colletes fulgidus Swenk	MacSwain (1956)
L. (*Lytta*) *vesicatoria*	*Colletes* sp.	Beauregard (1885)

Swain (1942) found larvae of *L. tenebrosa* in 1.45 per cent, *stygica* in 3.82 per cent, and *chloris* in 0.92 per cent of 759 cells of *Anthophora linsleyi.* They also reported *L. melaena* parasitizing 4.0 per cent of 377 cells of *Diadasia bituberculata* (Linsley and MacSwain, 1952). Parasitism of *Ptilothrix sumichrasti* by *L. variabilis* was reported to be at a low (but unspecified) level at several nesting sites in Zacatecas, México (Linsley, MacSwain, and Smith, 1956).

The larva of *Lytta chloris* requires the contents of but a single cell of its host to complete development (Linsley and MacSwain, 1942). Larvae of *tenebrosa, melaena,* and *vesicatoria* probably need the contents of more than one cell each. Therefore, as pointed out by Linsley and MacSwain (1952), extent of parasitism determined by counting the number of bee cells containing larvae of a species of *Lytta* may not be an accurate indication of the effect of parasitism on the host bee. In all probability larvae of *Lytta* attack single cells when parasitizing bees of relatively large body size and attack two or three cells each when parasitizing bees of smaller body size. In the former case they develop entirely on provisioned material. In the latter, they frequently encounter and attack immature stages of the bee.

In the laboratory larvae of *Lytta* have been reared on the provisions of a variety of bees. Lichtenstein's (1875) first success in inducing larvae of *vesicatoria* to feed under laboratory conditions was achieved with honey from the esophagus of the honey bee (*Apis mellifera* Linnaeus). Larvae were reared on this material to the late grub stage. Beauregard (1890) reared a larva of this same meloid to the early grub stage using *Apis* honey thickened by the addition of rose pollen. In other experiments larvae of *vesicatoria* were observed to feed on provisioned material of species of *Andrena, Ceratina, Eucera, Halictus, Megachile,* and *Osmia* (Lichtenstein, 1875, 1877, and 1879; Beauregard, 1890). Complete rearings were made with the *Ceratina, Halictus, Megachile,* and *Osmia* provisions. In my own rearings of *cyanipennis* (to the

coarctate larval instar) provisioned pollen and larvae and pupae of *Nomia melanderi* Cockerell were used as food.

First larval instar. Upon hatching, first instar larvae are pale in color. Within a few hours they darken and become very active, crawling rapidly over the ground and investigating holes and cracks in it. When touched they curl up into a ball. In *vesicatoria* they are said to be negatively phototactic (Beauregard, 1890). In *cyanipennis,* however, they are strongly positively phototactic; in the rearing cage they gathered in groups on the side nearest the source of light, and they would follow a light source at it was moved around the cage. As in the case of other meloids, first instar larvae of species of *Lytta* are capable of living an extended period of time while searching for nests of their hosts. Larvae of *vesicatoria* were kept alive at least one month without food by Beauregard (1890), and larvae of *cyanipennis* that I studied were still healthy 15 days after hatching (at which time they were given food).

The means of entry of first instar larvae into the cells of their hosts has not been determined. It seems likely that entry is made before the bee has finished provisioning its cell and while the cell is still open. It has also not been determined whether the larva destroys the egg of the bee before attacking the pollen material. It has been shown, however, that it is not necessary for a larva to feed on an egg before eating pollen.

Grub stage. Feeding of the first instar larva is completed in from one to ten days. The larval cuticle then splits along the epicranial suture and the line of dehiscence on the thorax, and the second instar larva emerges head first. With this instar the larva enters the grub stage. Larvae of *cyanipennis* in this stage observed by me fed alternately on pollen and the contents of the bodies of immature *Nomia* bees. While in the grub stage each of the meloid larvae consumed large amounts of pollen in addition to five to eight larval or pupal bees. From time to time they emitted long strings of yellow fecal material.

When replete the grub stage larva becomes restless and soon begins excavation of its resting chamber. In the laboratory the recorded length of the grub stage is 14 to 19 days for *vesicatoria* (Beauregard, 1890) and 36 days for *cyanipennis* (personal observation). In both species the larva spends the last half of the stage lying inactive in the resting chamber.

Coarctate larval instar. In the species of *Lytta* that have been studied, the coarctate larval instar is attained in late summer and normally lasts through the following winter. In the molt to this instar the cast skin of the grub stage larva is shed entirely except for a small portion that adheres to the tip of the abdomen of the coarctate larva. The coarctate larva is convex in form, with the appendages, as is usual for Meloidae

in this stage, reduced to mere stubs. According to Lichtenstein (1879), coarctate larvae of *vesicatoria* normally exude from the abdominal segments a clear liquid which subsequently hardens to form lenses, giving the body the appearance of being covered with diamonds. This phenomenon has not been observed for other species of *Lytta.*

Ultimate larval instar. The ultimate larval instar is reached in spring. Morphologically it is similar to the grub stage. In *vesicatoria* it lasts from 12 to 15 days, with an active period of 3 or 4 days (Beauregard, 1885 and 1890). In *tenebrosa* it lasts two or three weeks; during this time the larva constructs a pupal chamber near the surface of the soil (Linsley and MacSwain, 1942). Whether such a chamber is constructed by the larvae of other species of *Lytta* is not known.

Pupal stage. The pupal stage lasts an average of 15 days in *vesicatoria,* according to Beauregard (1890). Development of color in the pupa of *vesicatoria* was described in some detail by this same author (Beauregard, 1885).

Systematics and Phylogeny

Genus LYTTA Fabricius

Cantharis, Geoffroy, 1762, Histoire abrégée des insectes, vol. 1, p. 339. Oliver, 1795, Entomologie, ou histoire naturelle des insectes, Coléoptères, vol. 3, no. 46, p. 1. Lacordaire, 1859, Histoire naturelle des insectes, genera des Coléoptères, vol. 5, p. 676. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 103. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 437. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 293. Misapplication of *Cantharis* Linnaeus, 1758.

Lytta Fabricius, 1775, Systema entomologiae . . . , p. 260. LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 330. Escherich, 1895, Verhandl. Kaiserlich-Königlichen Zool.-Bot. Ges., vol. 44 (1894), p. 251. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 74.

Pomphopoea LeConte, 1862, Smithsonian Misc. Coll., vol. 3, art. 136, p. 273. (See p. 222 of present work for additional references.)

Poreospasta Horn, 1868, Trans. Amer. Ent. Soc., vol. 2, p. 139.

Pubescence fine, never obscuring surface or contributing appreciably to over-all color of beetle. Upper surface of body sparsely pubescent to glabrous; under surface always pubescent. Antennae elongate, usually longer in male than in female, basically moniliform (modified to serrate in male of *peninsularis;* subfiliform in female of *peninsularis* and in *polita*), not strongly compressed. Male antennae usually with intermediate segments broader than in female, so that antennae are not as strongly clavate; in many New World species two or more of the intermediate segments incrassate (sometimes distorted also), as wide as or wider than distal segments. Female antennae moniliform clavate, the segments becoming more moniliform distally. Mouth parts unmodified mandibulate. Elytra and hind wings fully developed, except in *sublaevis,* which has shortened elytra and lacks hind wings. Mesepisterna meeting broadly on midline of body; marginal area ample. Under surface of thorax never with a red spot or suffusion at center. Legs frequently modified in male. Middle tibiae bowed laterad except in males of the Eucera and Mutilata groups of the subgenus *Adicolytta.* Outer hind tibial spur usually thicker than inner one, usually obliquely truncate. Tarsal claws cleft to base or (*morrisoni* and *moesta*) with ventral blade fused solidly to dorsal one basally and much shorter than it (as in the Eupomphini); blades smooth, never serrate. Male sixth abdominal sternum emarginate, the emargination triangular or rounded. Male genitalia with gonoforceps uniformly sclerotized, without lightly sclerotized areas

at base of gonostyli; aedeagus primitively (and usually) with two well-developed ventral hooks, sometimes with only one, rarely with none.

Type species. The type species of *Lytta* is *Meloe vesicatoria* Linnaeus, as fixed by subsequent designation by Wellman (1910, p. 392). According to Wellman, "*vesicatoria* has by several authors (v. Escherich, Ver. k. k. zool.-bot. Gesell., 1894, p. 19) been designated as the type of the genus *Lytta* F." However, I have been unable to find any designation before Wellman's.

No type designation is needed for *Cantharis* of Geoffroy and subsequent authors who applied this name to species of Meloidae. Its usage in this manner is nothing more than a misapplication of the name.

Pomphopoea and *Poreospasta* are herein regarded as subgenera of the genus *Lytta*, and their type species are indicated in appropriate sections of the systematic treatment that follows.

Remarks. The generic synonymy given above is complete in that all synonyms are included. It is incomplete in that only those references of major significance are cited. A more nearly complete list of references was given by Borchmann (1917). The only major work not cited in his synonymy is MacSwain's (1956) study of the first instar larvae of *Lytta*.

Limits of the Genus

The genus *Lytta* is a member of the tribe Lyttini of the subfamily Meloinae (or Lyttinae, if *Meloe* is placed in a separate subfamily). This tribe includes, in addition to *Lytta*, some 26 named genera as well as several other genera still undescribed. Taxonomically the tribe is so poorly understood that it is quite impracticable to speculate on the phylogenetic relationships of the genera within it. In the past it has served as a convenient lumping-place for Meloidae not assignable elsewhere. Relatively recently attention has been called to its polyphyletic nature, two groups of species having been removed from the tribe following a study of their first instar larvae. Further restriction of the Lyttini is suggested in the following discussion.

One of the most vexing problems encountered in the course of this study has been that of establishing the limits of the genus *Lytta*. If the fauna of a single country or district is considered, it is relatively easy to draw up a diagnosis of the genus and to place it quite satisfactorily in a key to genera. As the geographic scope of treatment is increased, it becomes more and more difficult to characterize the genus and to separate it from others. Like others, I have been unable to find any single character or simple combination of characters that will distinguish members of the genus from other Meloidae, and I have therefore been forced to use a lengthy list of characters in framing my diagnosis of the genus (above).

In North America, the genus *Lytta* as herein defined has essentially the same composition as it does in current catalogs (Blackwelder, 1939 and 1945) except for: 1) inclusion of *moesta* and *morrisoni*, previously transferred to the genus from the Eupomphini (Selander, 1954); 2) removal by MacSwain (1951) of *sphaericollis* (Say), *compressicornis* (Horn), *convexa* (LeConte), and *suavissima* (Wellman) to form the genus *Linsleya* MacSwain in the tribe Epicautini; 3) inclusion of *Poreospasta sublaevis* (= *polita*), as first suggested by MacSwain (1956); 4) inclusion of the species of *Pomphopoea;* and 5) removal of the Central American *sanguineoguttata* Haag-Rutenberg to form the monotypic genus *Paniculolytta* Selander (1960).

The epicautine affinities of *Linsleya* have been satisfactorily demonstrated by MacSwain. The fact that the true relationships of the genus were not suspected until MacSwain's study of the first instar larva of one of the species is indicative of the difficulty of the problem of establishing generic limits and relationships within the tribe Lyttini on the basis of adult morphology alone.

MacSwain (1956) has also shown the close relationship existing between *sublaevis* and the group of western North American species of *Lytta* associated with *stygica*. I am in complete agreement with his decision to place *Poreospasta* in *Lytta,* but I feel that *sublaevis* and its relatives are sufficiently distinct that *Poreospasta* merits subgeneric rank.

Pomphopoea has almost invariably been accorded full generic status, and if I were to consider only the New World species of Lyttini, I would undoubtedly continue to regard it as a valid genus. However, its species are apparently more closely related to *Lytta vesicatoria*, the type of *Lytta,* than are any of the North American species of *Lytta*. This is confirmed by adult and larval morphology and by the similarity of the feeding habits of adults of *vesicatoria* and *Pomphopoea*. It is therefore necessary either to follow the arrangement suggested in the present work and reduce *Pomphopoea* to subgeneric rank or, less desirably, to elevate the other subgenera of *Lytta* to full generic rank.

Removal of *sanguineoguttata* from *Lytta* is arbitrary. The species agrees with the members of the subgenera *Paralytta* and *Adicolytta* in having incrassate male intermediate antennal segments, but there is no other basis for assuming that the species is more closely related to *Lytta* than to a number of other lyttine genera.

With the reduction of *Poreospasta* and *Pomphopoea* to subgenera of *Lytta* and removal of the genus *Pyrota* Dejean from the Lyttini (MacSwain, 1956), only two genera of Lyttini are now represented in North America: *Lytta* and *Paniculolytta*.

Lytta differs from *Paniculolytta* in the following characters: form much less elongate; male intermediate antennal segments not greatly length-

ened; male trochanters lacking a heavy tuft of stiff setae; aedeagus almost always with one or two ventral hooks. Some species of *Lytta* superficially resemble species of *Pyrota*, but the latter may be distinguished by their slender, tapered, often somewhat geniculate antennae, by the separation of the mesepisterna of the thorax, and by the fact that the posterior margin of the male sixth abdominal sternum is frequently turned sharply dorsad and is membranous. In addition, males of most species of *Pyrota* have the maxillary palpi (particularly the last segment) enlarged and modified in form. *Lytta sublaevis*, the only apterous species of the genus, is similar in general appearance to members of the genus *Meloe*. It is readily distinguished from them by its orange frontal spot, exposed scutellum, and in many cases the presence of red or orange on the vertex or pronotum or both.

For South America, Denier (1940) listed 12 species in *Lytta*, although he did not regard any of them as actually congeneric with the type of the genus. Subsequent work has confirmed this conclusion. In 1959, Kaszab removed the species *binotatithorax* Pic (= *seminigra* Borchmann), *bruchi* Pic, *catamarcensis* (Brèthes), *colon* (Burmeister), *dimidiata* Fischer (= *muelleri* Borchmann), *griseopubescens* Denier, *nigropicta* Denier, and *quadrilineata* (Haag-Rutenberg) (= *bilineatipennis* Pic) from *Lytta* and placed them in a new genus, *Acrolytta* Kaszab. My studies confirm Kaszab's and, in addition, indicate that the species *abbreviata* Klug, *inflaticeps* Beauregard (= *fissiceps* Haag-Rutenberg and *adonis* Pic), and *philippi* (Reed) should be removed from *Lytta*. New genera are proposed for these species elsewhere (Selander, 1960). With these changes the only South American species of Meloidae still assigned to *Lytta* is *neivai* Denier. I have not seen specimens of this species, but on the basis of its description, it will probably have to be removed from the genus also.

The relationships of the South American lyttines are obscure. Kaszab regards *Acrolytta* as most closely related to the Ethiopian genus *Afrolytta* Kaszab, but I fail to see the basis for this conclusion. All South American species of Lyttini that I have examined (including species of *Pseudomeloe* Fairmaire and Germain and *Picnoseus* Solier) agree in having a lightly sclerotized or membranous area on each of the gonostyli of the male genitalia. This fact leads me to believe that the lyttine fauna of South America may have been derived from a single ancestral type. In any event, I have found no evidence of close relationship between the genus *Lytta* and any of the South American lyttines.

In the Old World *Lytta* presently contains a very heterogeneous assemblage of species and is badly in need of critical revision. I have not studied enough material to justify making extensive formal changes in the classification of the Old World representatives of the genus.

Of the 23 species of Meloidae of the Ethiopian region formerly assigned to the genus *Lytta*, 7 were recently transferred from the genus by Kaszab (1959). The species *lucida* Haag-Rutenberg, *nitidula* Fabricius, *pallidipennis* Haag-Rutenberg, *semilineata* Haag-Rutenberg, and *sumptuosa* (Castelnau) are placed by Kaszab in the genus *Prolytta* Kaszab, while the species *amoena* (Péringuey) and *mashuna* (Péringuey) form the genus *Afrolytta* Kaszab. These transfers are supported by my studies of several of the species involved, although I do not share Kaszab's opinion that *Prolytta* is a lyttine genus. Rather, it seems necessary to erect a new tribe, Prolyttini, for this genus on the basis of the following combination of characters: wings with vein $2ndA_2$ present; sixth abdominal sternum hardly visible behind fifth; male gonostyli fused to apex; female genitalia lacking gonostyli.

If the characters of the species *spilotella* (Péringuey) are at all representative of the Ethiopian Spilotella Group as a whole, then it seems highly probable that this group should also be removed from the genus *Lytta* and from the tribe Lyttini. In addition to the nominate species, this group contains the species *elegantula* (Péringuey), *enona* (Péringuey), *namagua* Kaszab, *rubrolineata* Kaszab, *szekessyi* Kaszab, and *vellicata* Erichson. Its affinities would seem to be more epicautine than lyttine.

Few if any of the other Ethiopian species placed in *Lytta* are likely to be retained in this genus when they have been critically studied. These species are *bayoni* Pic, *benguellana* Pic, *brucci* Castelnau, *cantharoides* Thunberg, *carneola* (Péringuey), *exclamans* (Fairmaire), *fryi* (Wollaston), *myrmido* (Fairmaire), and *validicornis* (Fairmaire).

The Eurasian fauna includes a total of 43 species of Meloidae assigned to the genus *Lytta* at the present time. The only one of these found in Europe is *vesicatoria*, which also has an extensive range in Asia. Six of the species (*apicalis*, *aeneiventris*, *spissicornis*, *fissicollis*, *nigrifinis*, and *usta*) occur in the Oriental region; the rest are Palearctic in distribution. The relationships of 20 of the species are sufficiently clear, either from data given in the literature or from my personal examination of specimens, that they may be assigned to subgenera within *Lytta*. These species fall into five subgenera, four of which seem to be confined in distribution to Asia (see discussion in the following sections). The relationships of the remaining 23 species are unknown to me. Many of them are represented only by type material which has not been examined since the original descriptions were made, and it seems likely that some are synonyms of better-known species. A number of them probably will be transferred to other genera eventually; others are probably assignable either to the subgenera defined in the present work or to new subgenera. Clarification of the systematic position of these species will be a major

step in the advancement of our knowledge of the generic classification of the Lyttini. The species in question are *badakschanica* Kaszab, *bieti* Wellman, *cardonii* (Fairmaire), *dichroa* Fischer von Waldheim, *discipennis* (Fairmaire), *fissicollis* (Fairmaire), *flava* Thunberg, *flavicollis* Gyllenhal, *flavoangulata* (Fairmaire), *flaviventris* Ballion, *fulviceps* (Mäklin), *glabricollis* (Waterhouse), *impressicollis* Fairmaire, *laeta* (Waterhouse), *malatiensis* (Heyden), *manicata* Sahlberg, *marginicollis* Haag-Rutenberg, *melanura* Hope, *nigrifinis* (Walker), *punctata* Pallas, *rubra* Hope, *thibetana* Olivier, and *usta* (Fairmaire).

Classification

Conspectus. The genus Lytta is herein divided into 8 subgenera, 18 species groups, and 11 species subgroups. The proposed arrangement of these taxa is as follows.

- Subgenus PARALYTTA, new subgenus
  - Nitidicollis Group
  - Fulvipennis Group
  - Variabilis Group
    - Variabilis Subgroup
    - Koltzei Subgroup
    - Quadrimaculata Subgroup
  - Reticulata Group
    - Reticulata Subgroup
    - Deserticola Subgroup
  - Magister Group
    - Tenebrosa Subgroup
    - Melaena Subgroup
    - Magister Subgroup
- Subgenus ADICOLYTTA, new subgenus
  - Peninsularis Group
  - Eucera Group
  - Mutilata Group
- Subgenus POREOSPASTA Horn, new status
  - Stygica Group
  - Moerens Group
    - Moerens Subgroup
    - Cyanipennis Subgroup
    - Childi Subgroup
  - Luteovittata Group
  - Fairmairei Group
  - Clematidis Group
- Subgenus POMPHOPOEA LeConte, new status
  - Polita Group

Aenea Group
Sayi Group
Subgenus LYTTA Fabricius
Vesicatoria Group
Menetriesi Group
Subgenus PSEUDOLYTTA, new subgenus
Subgenus MESOLYTTA, new subgenus
Subgenus INDIOLYTTA, new subgenus

Basis. The present classification is based primarily on morphological characters of the adult beetles. However, data from morphology of lyttine larvae in the first instar given by MacSwain (1956) have been of great value in its formulation. First instar larvae have been described for 8 species of *Paralytta*, 2 of *Adicolytta*, 14 of *Poreospasta*, 2 of *Pomphopoea*, and 1 of *Lytta* (MacSwain, 1956; Selander, 1959). At the generic-subgeneric level the present classification differs from MacSwain's in that *Pomphopoea* is not accorded generic status. Yet MacSwain did call attention to the close relationship of *Pomphopoea* and *Lytta* indicated by his larval studies. It seems probable that all the subgenera of *Lytta* can be defined in the larval stage, although rather lengthy combinations of characters will be required for most of them. MacSwain's work contains a diagnosis of *Pomphopoea* and I have given a tentative diagnosis of *Adicolytta* (Selander, 1959).

Old World subgenera. The subgenera *Lytta*, *Pseudolytta*, *Mesolytta*, and *Indiolytta* are confined to the Old World and are not treated in detail in the present work. Their diagnostic characters are given in the key to subgenera that follows this discussion. Some additional information concerning them is given below.

The subgenus *Lytta* is divided into two groups. The Vesicatoria Group is characterized by having two spurs on each of the male middle tibiae and by the presence of mesal hooks on the gonostyli of the male genitalia. This group includes the species *vesicatoria* (Linnaeus), *roborowski* Dokhtouroff, *suturella* Motschulsky, *caraganae* Pallas, and *sifanica* Semenov. The Menetriesi Group has only a single spur on each of the male middle tibiae and lacks mesal hooks on the male gonostyli. The species of this group are *menetriesi* Falderman, *flavipennis* Motschulsky, *antennalis* (Marseul), and *regis-zahiri* Kaszab. The species of the subgenus form a very closely knit taxonomic unit. They were last treated by Escherich (1895).

The subgenus *Pseudolytta*, new subgenus, corresponds exactly to the Aeneiventris Group of Maran (1941). Its type species is hereby designated as *Lytta aeneiventris* Haag-Rutenberg. Other species included in the subgenus are *kwanhsiensis* Maran, *taliana* Pic, and *spissicornis* (Fairmaire).

The subgenus *Mesolytta,* new subgenus, is erected for two species of uncertain relationships. These are *Lytta coccinea* Ménétries, which is hereby designated as type species, and *deserti* Semenov.

The subgenus *Indiolytta,* new subgenus, contains a single species, *Lytta apicalis* Haag-Rutenberg, which automatically becomes its type species.

Key to Subgenera [1]

1. Labrum deeply emarginate (Figs. 155-58); fore femora concave on anterior side; male middle tibiae each with posterior spur long, curving strongly posteriad; gonostyli of male genitalia (Figs. 348-50) slender, glabrous, lacking mesal hooks; male intermediate antennal segments not incrassate; metallic green, blue, or aeneous beetles with femora and at least hind tibiae orange. North America..... .....*Pomphopoea* (p. 222)

   Labrum not deeply emarginate; fore femora not concave on anterior side; male middle tibiae with posterior spurs not modified as above; gonostyli of male genitalia variable; male intermediate antennal segments incrassate or not; if body metallic in color, femora and tibiae dark colored 2

2. Male intermediate antennal segments incrassate, with IV and V as wide as or wider than distal segments, or at least with IV wider than V; male fore tibiae each with two spurs; male hind trochanters neither spined nor angulate; gonostyli of male genitalia glabrous or essentially so, lacking mesal hooks; aedeagus generally with two well-developed ventral hooks, rarely with only one. North America.....3

   If male intermediate antennal segments incrassate (some North American species of *Poreospasta*), then male hind trochanters angulate or spined or gonostyli of male genitalia clothed with long setae, or both 4

3. Male intermediate antennal segments somewhat compressed and usually flattened on inner side but never asymmetrically produced or excavate; male middle tibiae sometimes impressed subapically and first segment of male middle tarsi sometimes weakly distorted, but male legs otherwise unmodified; gonostyli of male genitalia variable

[1] This key and the keys to groups, subgroups, and species given in the sections on the North American subgenera are designed to summarize the principal differences between taxa, without regard to ease of determination of individual specimens. Males should run satisfactorily in them; females cannot be run to subgenera (except for *Pomphopoea*). For the determination of females and as a convenience in the determination of males of the North American species of *Lytta,* an artificial key is provided, beginning on page 35.

but distinct in form from those of *Adicolytta;* male head often modified behind eyes. Southwestern Canada to Central America..... .....*Paralytta* (p. 49)

At least segments IV and V of male antennae conspicuously, asymmetrically distorted, except in the southern Mexican *erebea;* male trochanters with modified pubescence and male middle tibiae and either fore tibiae or middle femora modified for holding female during courtship, except in the Baja Californian *peninsularis;* gonostyli of male genitalia slender, either evenly rounded at apex or weakly lobed before apex (Figs. 324-30); male head never modified behind eyes. Primarily Mexican-Central American in distribution, with *mutilata* extending north into the southwestern United States..... .....*Adicolytta* (p. 137)

4. Male fore tibiae each with two spurs, or if with only a single spur (two North American species), the hind trochanters spined. North America and Asia 5

Male fore tibiae each with only a single spur; male hind trochanters not modified. Eurasia.....6

5. Gonostyli of male genitalia each bearing a mesal hook, or if hooks absent, then gonostyli clothed ventrally with long setae. North America and Asia.....*Poreospasta* (p. 157)

Gonostyli of male genitalia lacking mesal hooks, glabrous; female pygidium produced. India.....*Indiolytta* (p. 28)

6. Male middle tibiae each lacking posterior (inner) spur; male head deeply grooved behind eyes; head dark without a pale frontal spot; colors not metallic; antennal segments distinctly beadlike, well separated; first and second segments of male tarsi strongly distorted, modified for clasping; gonostyli of male genitalia entirely glabrous, lacking mesal hooks. China.....*Pseudolytta* (p. 27)

Male middle tibiae each with two spurs or lacking anterior (outer) spur; male head not grooved; head, if dark, usually with a pale frontal spot; second segment of male fore tarsi not modified; gonostyli of male genitalia sparsely clothed with setae (setae very short in *Mesolytta*) 7

7. Colors not metallic; head, if dark, lacking a pale frontal spot; gonostyli of male genitalia clothed with very short setae, lacking mesal hooks. Southwestern Asia.....*Mesolytta* (p. 28)

Head and body metallic green or blue; head with a pale frontal spot; gonostyli of male genitalia clothed ventrally with long setae, with or without mesal hooks. Eurasia.....*Lytta* (p. 27)

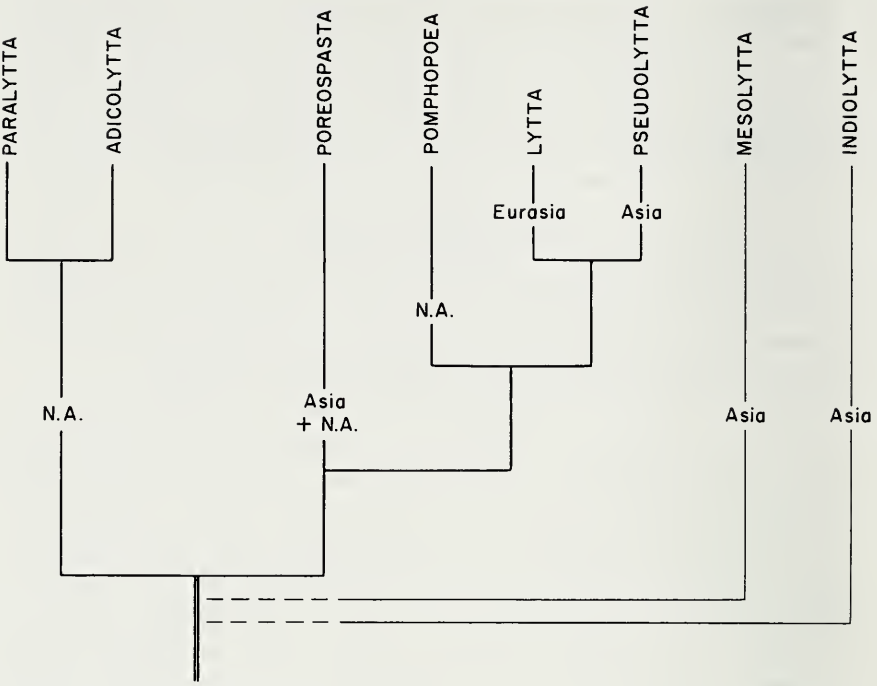


FIG. 1. Phylogeny of the subgenera of *Lytta*.

PHYLOGENY OF THE SUBGENERA

The suggested phylogenetic relationships of the subgenera of *Lytta* are shown in Figure 1. Two main lines may be recognized, one in North America which gave rise to *Paralytta* and *Adicolytta*, and another, probably originating in Asia, which produced *Poreospasta, Pomphopoea, Lytta,* and *Pseudolytta*. The relationships of *Mesolytta* and *Indiolytta* are extremely doubtful. These subgenera may have evolved as early branches of the second main line or they may represent offshoots from the *Lytta* stock which formed before the divergence of the two main lines. The first main line is characterized by having the male intermediate antennal segments at least weakly incrassate and the male genitalia simple in form and glabrous. Inasmuch as both *Paralytta* and *Adicolytta* feed to a great extent on Convolvulaceae, preference for or specificity to this family of plants was probably characteristic of their common ancestor. In *Paralytta* there has been divergence in different groups to such families as Compositae, Labiatae, and Papaveraceae. In *Adicolytta* one species has moved to Cucurbitaceae.

The second main evolutionary line of the genus lacks the antennal modification of the first except in a few North American species of

Poreospasta in which the condition is clearly due to convergence with the first main line rather than to relationship. Close relationship between the subgenera *Poreospasta* and *Lytta* is indicated by the similarity of the male genitalia in the more primitive members of each (the gonostyli have mesal hooks and are pubescent). In the adult stage *Pomphopoea* has the general facies and color of the subgenus *Lytta* as well as antennal similarities; in the larval stage, according to MacSwain (1956), there are several distinctive characters shared by the two subgenera. It is therefore logical to suppose that the two are closely related. *Pseudolytta* is similar to the subgenus *Lytta* in general facies also and in addition shows modifications of the male legs reminiscent of those in the latter subgenus.

On the basis of the phylogeny postulated in Figure 1, the earliest members of the second main line of the genus *Lytta* probably fed on Leguminosae. In *Poreospasta* the Moerens Group is apparently restricted to this family, while the Stygica Group has developed the ability to feed on Compositae and Papaveraceae also. Both *Pomphopoea* and the subgenus *Lytta* feed principally on shrubs and trees. In the subgenus *Lytta* recorded host families are Leguminosae, Oleaceae, Salicaceae, and Caprifoliaceae. *Pomphopoea* feeds mainly on Rosaceae.

Distribution [2]

The genus *Lytta* is primarily temperate in distribution, with only a few tropical representatives. Like other genera of Meloinae, it is not well represented on islands and does not occur at all on oceanic ones.

In the Old World the genus ranges through most of Eurasia, from Spain and England to Manchuria, Japan, southeastern China, and Ceylon. The subgenus *Lytta* is very widely distributed. *Mesolytta* occurs in the Transcaspian region; *Indiolytta,* in India; *Poreospasta,* in southwestern Asia; and *Pseudolytta,* in eastern China.

In the New World the genus is apparently limited to the North American continent, where it ranges from Canada to Panamá. The distribution in North America is considered in detail in the systematic sections that follow. Consequently, the present discussion is limited to a summary of the main distributional features of the subgenera and groups. Reference will be made to the maps shown in Figures 2-9. These were prepared by superimposing the ranges of the species for the various subgenera or groups. They are designed to show the total known range of each of the taxa as well as to indicate the pattern of distribution of the component species within this range.

Most of the North American species of *Lytta* occur in the arid and

[2] South American and Ethiopian species currently assigned to *Lytta* have been excluded from consideration in this section; see discussion of limits of the genus.

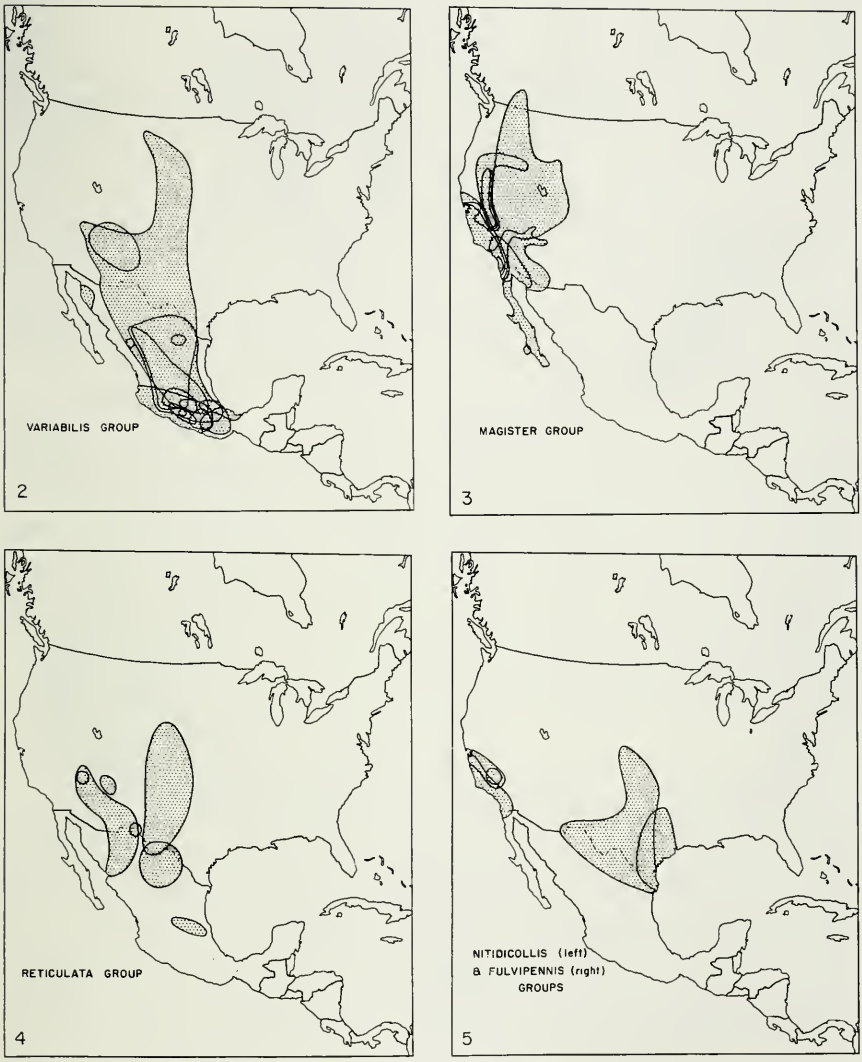
semiarid regions of the southwestern United States and the Central Plateau of México. Two main centers of distribution are evident: one in California (32 of the 51 species recorded from the United States occur there) and the other at the southern end of the Central Plateau.

The subgenera *Paralytta* and *Adicolytta* probably diverged from a common ancestor in North America. In *Paralytta* the Variabilis Group (Fig. 2) has undergone most of its evolution in southern México. The Magister Group (Fig. 3) presumably developed in the lowlands of California and only later entered the Sierra Nevada, the Sonoran Desert, and the Great Basin. The Reticulata Group (Fig. 4) is an offshoot of the Variabilis Group which apparently evolved in the more northern area it now occupies. The Fulvipennis and Nitidicollis groups (Fig. 5) are probably relicts of early, rather unsuccessful lines; their precise relationships are not clear.

Adicolytta (Fig. 6) probably originated in southern México. Its least-derived species (*peninsularis*) is found at the southern tip of the peninsula of Baja California, where it is obviously relict. On the Mexican mainland the least-derived form is *erebea*, which is known only from the mountains in the state of México. This species is most closely related to *eucera*, which ranges from northern México to Panamá. *Eucera* is the only species of the subgenus known to have deviated from the Convolvulaceae feeding habit, and its success as a species compared with that of *erebea* may be connected with this fact. *Mutilata* is remarkable as the only Mexican species of *Lytta* that crosses the Sonoran Desert and extends to the West Coast.

Poreospasta probably reached North America as an immigrant from Asia, where it is now represented by three species groups. In North America the subgenus is represented by two large groups. According to my phylogenetic conclusions, the Moerens Group (Fig. 7) has its more primitive members confined to the Pacific Coast. Three wide-ranging Rocky Mountain forms (*cyanipennis, viridana,* and *nuttalli*) assigned to the group would probably be placed in a separate group were it not for the fact that another species (*nigrocyanea*) is an almost perfect connecting link between them and the Pacific Coast forms. The species *nuttalli* is noteworthy in extending farther east than any species of *Lytta* outside the subgenus *Pomphopoea* and in having a disjunct population in the Sierra Nevada of California. An interesting point here is that while *nuttalli* occurs with *cyanipennis* in Idaho, Utah, and in the Sierra Nevada, it apparently cannot follow it through Oregon and Washington.

Except for the lack of a Rocky Mountain element and an extension by two species into the Sonoran Desert, the Stygica Group (Fig. 8) has a range much like that of the Moerens Group. All the species of the Stygica Group occur in California, and only three extend beyond the limits of



FIGS 2-5. Distribution of the groups of the subgenus *Paralytta*.

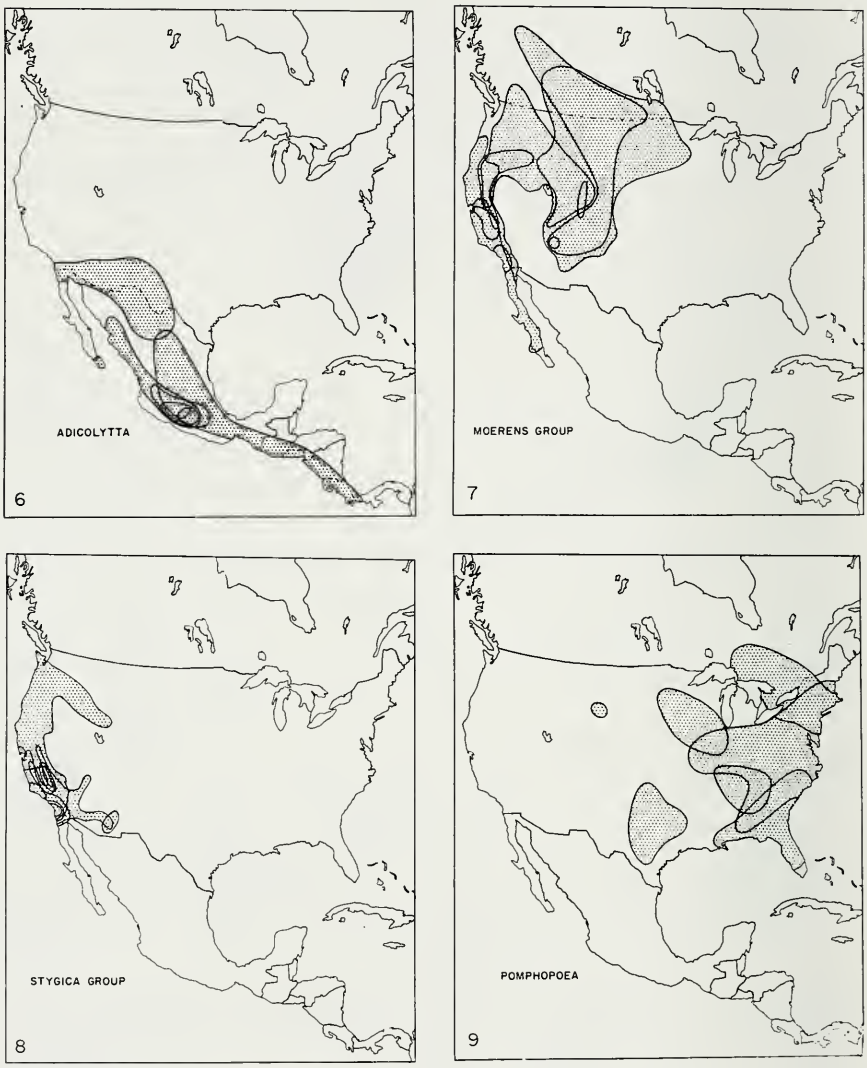


FIG. 6. Distribution of the subgenus *Adicolytta*.

FIGS 7-8. Distribution of groups of the subgenus *Poreospasta* in North America.

FIG. 9. Distribution of the subgenus *Pomphopoea*.

that state. Most of the species have a small range, and in general they are quite similar morphologically and ecologically. In southern California as many as seven species may occur at a single locality. Just what mechanism is involved in maintaining species limits within the group is perhaps the most intriguing unsolved problem in the genus *Lytta*.

Pomphopoea (Fig. 9) is a very distinctive element in the North American fauna, both morphologically and geographically. It evidently evolved from an immigrant stock which reached the North American Continent from Asia at a time when the deciduous forest was continuous through the Holarctic region. It is now restricted to the eastern United States, where it replaces the other subgenera of *Lytta*. Details of distribution of *aenea* and perhaps also of *sayi* would seem to indicate that at one time, probably following Pleistocene glaciation, there was a western expansion of range of the subgenus which has since been followed by a contraction, leaving isolated populations to the west of the present continuous range.

In North America important barriers to dispersal of the genus *Lytta* are extremely arid conditions such as those of the Sonoran and Mojave deserts, large mountain ranges, and tropical lowlands. The West Coast of the United States has been very effectively isolated. In a few groups inhabiting this area species have entered the Sierra Nevada, but only one line (the Cyanipennis Subgroup of *Poreospasta*) has succeeded in entering the Rocky Mountains, while only one species (*vulnerata*) has penetrated into the Great Basin. The Great Plains have been invaded by only two species (*reticulata* and *biguttata*). The eastern United States shows no western or Mexican influence whatsoever. The general distributional picture of *Lytta* in North America, then, is one of peripheral centers from which movement has been rather limited, so that the center of the continent is depauperate in species.

It is interesting to note that the distributional patterns displayed by *Lytta* in North America have little in common with those of some of the other genera of North American Meloidae. For example, in *Nemognatha*, which was recently revised by Enns (1956), the central area of the United States has a fairly good representation of species, only one small group is centered in California, and no group shows a definite southern Mexican center of distribution. Furthermore, except for one southeastern species (which is probably of Antillean origin), the eastern fauna is closely related to the western, apparently without close Old World affinities.

Artificial Key to the North American Species of *Lytta*

1. Wingless, with shortened elytra. California.....*sublaevis* (p. 163)
   Wings and elytra fully developed.....2

2. Bright metallic green, blue, aeneous, or brassy beetles with femora and at least hind tibiae orange; labrum deeply emarginate (Figs. 155-58). Eastern North America....3

   If body metallic in color, femora and tibiae metallic or black; labrum not or only shallowly emarginate....6

3. Elytra dull brassy; fore and middle tibiae black; male fore tibiae each with a broad impression on anterior side and with only a single spur. Southeastern United States....*polita* (p. 226)

   Elytra green, blue, or aeneous; all tibiae orange, at least at middle; fore tibiae lacking impression, each with two spurs....4

4. Male fore tibiae thickened, stouter than middle tibiae, bowed; female sixth abdominal sternum deeply grooved medianly at apex (Figs. 288-89)....5

   Male fore tibiae not thickened, no stouter than middle tibiae, not bowed; female sixth abdominal sternum not or only feebly grooved....*aenea* (p. 229)

5. Tibiae entirely orange; labral emargination extending to middle (Fig. 158); male fore femora contorted. Southeastern United States....*unguicularis* (p. 238)

   Tibiae narrowly black at base and apex; labral emargination not extending to middle (Fig. 157); male fore femora not contorted. Northeastern United States....*sayi* (p. 235)

6. Elytra strongly reticulate, with network of raised lines and enclosed cells clearly visible without magnification; elytra (except, rarely, extreme base) and under surface black; femora sometimes orange (with black base and apex)....7

   Elytra rugose, appearing granular or smooth without magnification; if elytra and under surface black, femora never orange....17

7. Tarsal pads (pale pubescence on ventral surface of tarsi) completely absent; head, pronotum, femora, and tibiae entirely orange; rest black. Southwestern United States and northern Sonora....*magister* (p. 128)

   Tarsal pads present; color pattern not as above....8

8. Pronotum hexagonal, strongly angulate at sides....9

   Pronotum circular or oval, rounded at sides....11

9. Pronotum spinose on lateral margin of disk on each side....10

   Pronotum not spinose....*vulnerata* (p. 130)

10. Head and pronotum orange; emargination of male sixth abdominal sternum deep, rounded (Fig. 248); a rare variant. Western United States east of the Sierra Nevada....*vulnerata* (p. 130)

Head and pronotum red; emargination of male sixth abdominal sternum shallow, very obtusely angulate at apex. Isla Santa Margarita, Baja California Sur.....*margarita* (p. 136)

11. Femora orange with black base and apex.....12

Femora black 13

12. Elytra coarsely reticulate, most of the cells at least .5 mm. in diameter; head with orange confined to dorsal margin (including tempora) and a large frontal spot. San Luis Potosí and Hildalgo.....
.....*corallifera* (p. 112)

Elytra finely reticulate, most of the cells less than .5 mm. in diameter; head orange with black at sides of frontal area. Southwestern United States and Sonora.....*deserticola* (p. 111)

13. Pronotoum black at center, broadly orange at sides; head with a large frontal spot. Southern Texas to Durango....*cribrata* (p. 109)

Color pattern not as above.....14

14. Pronotum black. Great Plains south to the Rio Grande.....
.....*reticulata* (p. 103)

Pronotum orange 15

15. Head, orange. Northeastern Arizona.....*agrestis* (p. 105)

Head black 16

16. Pronotum subcircular (Fig. 175); elytra coarsely reticulate, most of the cells at least .5 mm. in diameter. Rio Grande region, Texas
.....*mirifica* (p. 107)

Pronotum transversely oval (Fig. 176); elytra finely reticulate, most of the cells less than .5 mm. in diameter. Northwestern Arizona...
.....*arizonica* (p. 108)

17. Ventral blade of each tarsal claw fused basally with dorsal blade and much shorter than it, appearing as at ventral tooth. California
.....18

Tarsal claws cleft to base, with blades free, subequal in length...19

18. Elytra moderately densely clothed with semierect setae; tarsal claws distinctly curved; pronotum often orange.....*morrisoni* (p. 55)

Elytra essentially glabrous; tarsal claws nearly straight; pronotum always black .....*moesta* (p. 56)

19. Elytra partially or entirely red, orange, or yellow.....20

Elytra entirely black or metallic.....31

20. Elytra entirely pale in color.....21

Elytra partially black or dark brown.....27

21. Under surface and legs largely or entirely orange.....22

Under surface and legs entirely black.....24

22. Body and legs entirely orange; length, 16 mm.-27 mm. Michoacán Morelos, and Guerrero.....*sanguinea* (p. 148)
At least tarsi black or brown; pronotum usually with a pair of black spots on disk.....23

23. Head black or largely so; male pygidium strongly, narrowly produced at middle (Fig. 209); an uncommon variant. Southern México .....*quadrimaculata* (p. 93)
Head orange; male pygidium not so produced. Arizona, New Mexico, Sonora, and Chihuahua.....*biguttata* (p. 86)

24. Head and pronotum black.....25
Head and pronotum orange.....26

25. Elytra a rich dark red; head and pronotum sparsely punctate and pubescent. Southern México.....*cardinalis* (p. 155)
Elytra orange; head and pronotum densely punctate and pubescent. Nebraska to Texas and (probably) Coahuila...*fulvipennis* (p. 58)

26. Pronotum transverse, with a pair of black spots on disk at middle. Texas and northern Tamaulipas.....*lecontei* (p. 60)
Pronotum elongate, immaculate. Southern California and northern Baja California Norte.....*nitidicollis* (p. 54)

27. Elytra each with a broad brown discal vitta which begins at or near humerus and extends to or near to apex. Sonoran Desert region of Sonora.....*sonorae* (p. 85)
Elytra not as above.....28

28. Elytra black, each with lateral margin and a broad discal vitta yellow (Fig. 161). Puebla, Guerrero, and Oaxaca...*scitula* (p. 90)
Elytra not as above.....29

29. Elytra black at apex. Southern México.....*proteus* (p. 97)
Elytra orange or yellow at apex.....30

30. Elytra (Fig. 159) each usually with a black spot at apical third and another at basal third, rarely with basal spot missing; elytral suture pale (except where spots may reach it); male pygidium strongly, narrowly produced; female sixth abdominal sternum strongly cupped. Southern Chihuahua and the Rio Grande to southern México.....*quadrimaculata* (p. 93)
Elytra (Fig. 160) never with a black spot at basal third; elytral suture usually black for basal half; male pygidium not produced as above; female sixth abdominal sternum not strongly cupped.... .....*biguttata* (p. 86)

31. Pronotum partially or entirely yellow, orange, or red.....32
Pronotum entirely black or metallic.....51

32. Pronotum strongly angulate at sides (Fig. 184), orange with a black or piceous anterior marginal area which sometimes extends posteriad as a median stripe; vertex orange, almost always with a median black stripe or fine line; rest of body and legs black, without metallic luster. California and Baja California..... ..... *vulnerata* (p. 130)

Pronotum not strongly angulate at sides; color pattern not as above 33

33. Vertex orange or red..... 34

Vertex black or metallic..... 40

34. Pronotum elongate, orange, with a wide black median stripe. Southern end of the Central Valley of California. *hoppingi* (p. 171)

Pronotum not as above..... 35

35. Elytra and under surface metallic green or blue; pronotum transverse; head and pronotum hairy; length, 5 mm.-12 mm. Southwestern California..... *aeneipennis* (p. 174)

Elytra and under surface black, not at all metallic; pronotum not transverse 36

36. Elytra essentially glabrous; under surface dark pubescent; pronotum without calluses on disk..... 37

Elytra clothed with semierect, conspicuous silver pubescence (producing a dusty effect macroscopically); average distance between setae near lateral margin of elytra about equal to length of a single seta; under surface pale pubescent; pronotum with a pair of large, strongly elevated calluses on disk. Southern México..... ..... *proetus* (p. 97)

37. Antennal segments IV–X triangular (males, Fig. 91) or subtriangular (females), produced on one side apically; under surface clothed with long shaggy pubescence; black with red head and pronotum. Southern Baja California Sur..... *peninsularis* (p. 141)

Antennae, under surface, and distribution not as above..... 38

38. Pubescence pale on head, pronotum, and under surface; pronotum campanuliform, one-tenth longer than wide; elytra piceous rather than a true black; tarsal pads hardly differentiated from rest of tarsal pubescence; male antennae without asymmetrically distorted segments (Fig. 64). Southern California and Baja California..... ..... *nitidicollis* (p. 54)

Pubescence dark; pronotum not as above; elytra a true black; tarsal pads distinct; male antennae with segments IV and V asymmetrically distorted (Figs. 95-96)..... 39

39. Pronotum immaculate; antennal callosities and lower margin of frontal area of head black. Coahuila, Durango, Baja California Norte, extreme southern California, Arizona, and New Mexico... ..... *mutilata* (p. 152)

    Pronotum with a pair of large black spots on disk at middle (very rarely absent); entire front of head (not including epistoma) orange. Southern Sonora to Jalisco and Colima; thence southwest to Veracruz and Guerrero..... *erythrothorax* (p. 150)

40. Head entirely black, without an orange frontal spot. México....41

    Head black or metallic with an orange frontal spot.....44

41. Elytra metallic bluish purple or green. Veracruz, Guerrero, and Oaxaca..... *bipuncticollis* (p. 82)

    Elytra black 42

42. Head and pronotum coarsely, densely punctate; elytra sparsely pubescent; first segment of female hind tarsi with some pale setae beneath at apex.....43

    Head and pronotum finely, very sparsely punctate; elytra glabrous; first segment of female hind tarsi entirely black pubescent. Michoacán and Guerrero..... *michoacanae* (p. 70)

43. Antennal segments short, in part wider than long; male head behind eyes at most very shallowly concave. Southern Chihuahua to southwestern México (state) and Puebla..... *variabilis* (p. 63)

    Antennal segments more elongate, none wider than long; discal pronotal spots very small, faint; male head behind eyes deeply concave. Nuevo León..... *scituloides* (p. 67)

44. Pronotum orange with a pair of black spots on disk at middle, each spot on or covering a smooth, impunctate callus. México (primarily southern), exclusive of Baja California.....45

    Pronotum not as above. California and Baja California.....47

45. Elytral pubescence short, very sparse, inconspicuous, usually black; male pygidium strongly, narrowly produced (Fig. 209)..... ..... *quadrimaculata* (p. 93)

    Elytral pubescence moderately long, conspicuous; male pygidium not produced as above.....46

46. Pubescence on head pale golden; male head behind (and above) eyes deeply concave..... *scitula* (p. 90)

    Pubescence on head piceous; male head behind eyes not concave ..... *proteus* (p. 97)

47. Pronotum decidedly elongate, orange with a wide black median stripe..... *hoppingi* (p. 171)

    Pronotum not as above..... 48

48. Metallic green or bluish green 49
Black, without metallic luster 50

49. Pronotum with a large green median spot; elytra with long pubescence confined to base. Fresno and Kern counties, California .....
..... *refulgens* (p. 175)
Pronotum entirely orange; elytra clothed throughout with long, erect pubescence. Los Angeles County to San Diego County, California ..... *crotchi* (p. 177)

50. Pronotum hexagonal (Fig. 190); male hind trochanters armed with a ventral spine at apex. Central Valley of California .....
..... *molesta* (p. 216)
Pronotum subquadrate (Fig. 191); male hind trochanters not spined. Central California south to Baja California Sur .....
..... *childi* (p. 218)

51. Head entirely black or metallic, lacking even a pale frontal spot .. 52
Head with at least a small orange or red frontal spot, sometimes with orange or red on vertex also 65

52. Elytra each with three distinct costae, these producing an undulate surface. Durango ..... *canelas* (p. 79)
Elytra without costae, not undulate 53

53. Pronotum elongate, one-fifth longer than wide; male intermediate antennal segments not incrassate. Southwestern California .....
..... *lugens* (p. 172)
Pronotum not as above; not occurring in California 54

54. Males 55
Females 60

55. Sixth abdominal sternum shallowly emarginate; lateral lobes of sternum not produced (Figs. 225 and 227) 56
Sixth abdominal sternum deeply emarginate; lateral lobes of sternum produced (Figs. 228, 229, and 231) 58

56. Elytral pubescence short, sparse, not noticeable macroscopically. Southern México 57
Elytral pubescence long, dense, producing a dusty effect macroscopically. Southwestern United States ..... *puberula* (p. 68)

57. Head and pronotum more or less coarsely, densely punctate; elytra at least sparsely pubescent, distinctly rugose ..... *variabilis* (p. 63)
Head and pronotum finely, sparsely punctate; elytra essentially glabrous, obsolescently rugose, nearly smooth. Tlaxcala and Puebla to Tabasco ..... *ebenina* (p. 72)

58. Lateral lobes of sixth abdominal sternum divergent (Fig. 231); pronotum relatively smooth.....*augusti* (p. 80)
Lateral lobes of sixth abdominal sternum not appreciably divergent (Figs. 228-29).....59

59. Elytra conspicuously clothed with moderately long, moderately dense pubescence; emargination of sixth abdominal sternum U-shaped, extending more than half length of sternum (Fig. 229) .....*koltzei* (p. 76)
Elytra essentially glabrous; emargination of sixth abdominal sternum broadly triangular, extending at most one-third length of sternum (Fig. 228).....*plumbea* (p. 74)

60. Elytral pubescence long, dense, producing a dusty effect macroscopically; black, without metallic luster. Southwestern United States.....*puberula* (p. 68)
Elytral pubescence not as above. Southern México.....61

61. Sixth abdominal sternum truncate; black, without metallic luster 62
Sixth abdominal sternum shallowly, triangularly emarginate at apex (Figs. 275-76) 63

62. Head and pronotum coarsely or moderately coarsely, densely punctate; elytra rugose, not shinier than head and pronotum, sparsely but clearly pubescent; first segment of hind tarsi with some pale setae beneath at apex; antennae as in Figure 121. Southern Chihuahua to southwestern México (state) and Puebla.....
.....*variabilis* (p. 63)
Head and pronotum finely, sparsely punctate, finely granular, dull; elytra nearly smooth, essentially glabrous, shinier than head and pronotum; first segment of hind tarsi entirely black pubescent; antennae as in Figure 122. Tlaxcala and southern Puebla to Tabasco .....*ebenina* (p. 72)

63. Distal antennal segments as wide as or wider than long (Fig. 126); antennae short, not reaching middle of pronotum; pronotum relatively smooth. Oaxaca, Veracruz, and Puebla.....*augusti* (p. 80)
Distal antennal segments longer than wide; antennae longer, reaching basal third of pronotum; pronotum strongly alutaceous.....64

64. Elytra metallic dark blue or bluish green, moderately densely clothed with pale pubescence; pronotum not transversely oval (Fig. 171). Central Michoacán to eastern Puebla.....*koltzei* (p. 76)
Elytra black with a tinge of dark blue, essentially glabrous, with a few black setae at base and apex; pronotum transversely oval (Fig.

170). Guanajuato and Michoacán to Distrito Federal..... ..... *plumbea* (p. 74)

65. Upper surface essentially glabrous; vertex or at least tempora orange or red; male antennal segments IV–VI distorted; length, 14 mm.-32 mm. Coahuila and Durango to Panamá..... ..... *eucera* (p. 144)

Without the above combination of characters.....66

66. Southern México (Nayarit and Guanajuato southward).....67

United States, Baja California, and the northern tier of Mexican states 69

67. Upper surface essentially glabrous; all clothing setae of body black. Michoacán and México (state)..... *erebea* (p. 143)

Upper surface conspicuously pubescent; at least elytral pubescence pale 68

68. Pubescence pale golden on head; male head behind (and above) eyes deeply concave..... *scitula* (p. 90)

Pubescence piceous on head; male head behind eyes not concave ..... *proteus* (p. 97)

69. Vertex or at least tempora orange.....70

Vertex black or metallic.....71

70. Elytra glabrous, black. Central and southern California..... ..... *tenebrosa* (p. 116)

Elytra clothed with long, fine pubescence, usually metallic green or bluish green. Southern California, Baja California, Arizona, and southern Utah..... *auriculata* (p. 165)

71. Mandibles nearly straight; tarsal pads (pale pubescence on under surface of tarsi) completely absent; entirely black except for pale frontal spot. California..... *funerea* (p. 126)

Mandibles strongly curved; tarsal pads present on at least fore and middle legs 72

72. Males 73

Females 94

73. First fore tarsal segment bent, somewhat twisted, with a deep, socket-like excavation anteroventrally at base; bright metallic green, blue, purple, or violaceous; intermediate antennal segments distinctly incrassate; pronotum hexagonal.....74

First fore tarsal segment not so modified; lacking combination of other characters listed above.....76

74. Antennal segments IV–VIII flattened and clothed with long, erect

setae on one side.....*viridana* (p. 213)
Antennal segments IV-VIII not so modified.....75

75. Elytra generally violet, at least on margins, rarely entirely green; pubescence on under surface of thorax pale; lateral lobes of fifth abdominal sternum angulate (Fig. 219).....*nuttalli* (p. 205)
Elytra lacking violet color; pubescence on under surface of thorax piceous; lateral lobes of fifth abdominal sternum rounded (Fig. 220).....*cyanipennis* (p. 209)

76. Fore tibiae each with a single spur.....77
Fore tibiae each with two spurs.....78

77. Antennae clavate (Fig. 110); hind trochanters angulate on ventral margin, not spined. Oregon and California.....*moerens* (p. 196)
Antennae with intermediate segments incrassate, in part as wide as distal segments; hind trochanters each armed with a distinct spine on ventral margin. Wyoming and Colorado...*nigrocyanea* (p. 202)

78. Intermediate antennal segments incrassate, in part as wide as or wider than distal segments; black without metallic luster.....79
Intermediate antennal segments not incrassate, narrower than distal segments 85

79. Hind trochanters each armed with a distinct spine on ventral margin (Fig. 162); sixth abdominal sternum extremely elongate, deeply cleft medianly (Fig. 266). Coastal southern California.....
.....*insperata* (p. 201)
Hind trochanters not spined; sixth abdominal sternum not elongate, triangularly emarginate 80

80. Middle tibiae each with a deep, impunctate, glabrous impression on anterior side apically; pygidium distinctly produced. Southern California 81
Middle tibiae unmodified; pygidium not produced.....82

81. Pronotum as in Figure 181; pygidium blunt at apex (Fig. 213); lateral lobes of sixth abdominal sternum not slender (Fig. 244)...
.....*melaena* (p. 122)
Pronotum as in Figure 182; pygidium very acute at apex (Fig. 214); lateral lobes of sixth abdominal sternum produced as slender processes (Fig. 245).....*morosa* (p. 124)

82. Antennal segments IV–VII with erect pale setae on ventral side...
.....*tenebrosa* (p. 116)
Antennal segments IV–VII not so modified.....83

83. Pronotum subquadrate (Fig. 191); mesal surface of fore tibiae densely lined with golden pubescence; lateral lobes of sixth ab-

dominal sternum curving ventrad at apex, not hemispherical (Fig. 270)..... *childi* (p. 218)

Pronotum subhexagonal, with obtuse lateral angles (Figs. 179-80); fore tibiae not as above; lateral lobes of sixth abdominal sternum produced, hemispherical (Fig. 243).....84

84. One or both spurs on each hind tibia flattened, sticklike (Fig. 195); wings pale brown; genitalia as in Figure 318..... ..... *blaisdelli* (p. 119)

Both spurs on each hind tibia obliquely truncate (Fig. 194); wings colorless..... *lugubris* (p. 120)

85. Hind trochanters each armed with a distinct spine near apex. Central Valley of California..... *molesta* (p. 216)

Hind trochanters not spined.....86

86. Hind trochanters angulate on ventral margin.....87

Hind trochanters not angulate.....88

87. Head and pronotum sparsely punctate; lateral lobes of sixth abdominal sternum not divergent (Fig. 264); posterior fore tibial spur often much reduced in size. Oregon and California..... ..... *moerens* (p. 196)

Head and pronotum densely punctate; lateral lobes of sixth abdominal sternum strongly divergent (Fig. 265). Northern Arizona ..... *navajo* (p. 200)

88. Black, with dark metallic blue or green elytra; conspicuously clothed throughout with rather long, more or less erect pubescence; sixth abdominal sternum as in Figure 255.....89

Not as above.....90

89. Pubescence colorless apically or entirely colorless, at least on under surface of body; genitalia as in Figure 332. Southern California, Baja California, Arizona, and southern Utah... *auriculata* (p. 165)

Pubescence piceous; genitalia as in Figure 333. Sierra Nevada and northern coastal region of California..... *nigripilis* (p. 169)

90. Pronotum elongate, one-fifth longer than wide; black. Southwestern California..... *lugens* (p. 172)

Pronotum not elongate.....91

91. Elytra violet or green with a violet luster (not brassy); rest of body green or brassy; pubescence colorless. Sacramento and Calaveras counties, California, south to Tulare County, California..... ..... *rathvoni* (p. 178)

Not as above.....92

92. Head and pronotum distinctly microreticulate, more or less satiny

in texture; sixth abdominal sternum relatively flat, shallowly, evenly emarginate (Fig. 262); antennal segments elongate, more cylindrical (Fig. 106); pubescence colorless (Kern and Tulare counties, California) or piceous (central western California)..... .....*chloris* (p. 179)

Head and pronotum smooth or relatively so; sixth abdominal sternum medianly impressed, moderately deeply, triangularly emarginate; antennal segments more moniliform; pubescence piceous..93

93. Hairy, conspicuously clothed throughout with long, straight, erect pubescence; green. Central western California...*comans* (p. 192)

Pubescence shorter, less erect, especially on upper surface; elytral pubescence very short, subrecumbent, and inconspicuous, or if longer, erect setae present, these confined to immediate base; green, blue, or black. Idaho, Washington, Oregon, California, and southern Arizona.....*stygica* (p. 185)

94. Black with dark metallic blue or green elytra; conspicuously clothed throughout with long, more or less erect pubescence; sixth abdominal sternum as in Figure 282.....95

Not as above; either black throughout or metallic throughout..96

95. Pubescence colorless apically or entirely colorless, at least on under surface of body. Southern California, Baja California, Arizona, and southern Utah.....*auriculata* (p. 165)

Pubescence piceous. Sierra Nevada and nothern coastal region of California.....*nigripilis* (p. 169)

96. Sixth abdominal sternum with a narrow, U-shaped emargination (Fig. 287); pronotum subquadrate; black. California and Baja California.....*childi* (p. 218)

Sixth abdominal sternum without such an emargination.....97

97. Pronotum elongate, one-fifth longer than wide; black. Southwestern California (San Bernardino and Los Angeles counties to San Diego County).....*lugens* (p. 172)

Pronotum not elongate.....98

98. Head and pronotum very densely punctate, very densely clothed with long, erect, silky pubescence; black with or without a dark blue luster; elytra dark blue or indigo. Wyoming and Colorado... .....*nigrocyanea* (p. 202)

Not as above; if within range of *nigrocyanea,* then bright metallic in color 99

99. Elytra coarsely, strongly rugose (subreticulate), dull; black with a metallic bluish luster; head and pronotum deeply, densely punctate. Northern Arizona.....*navajo* (p. 200)

Elytra finely rugose, no more strongly so than usual for genus; if black with a metallic luster (some *moerens*), then head and pronotum not densely punctate and range not including northern Arizona 100

100. Outer hind tibial spur cylindrical, four times as wide as inner spur; black. Southwestern California and the Central Valley . . . 101

Outer hind tibial spur twice or less than twice as wide as inner spur 102

101. Pale frontal spot at least half as wide as frontal area between eyes; sixth abdominal sternum emarginate (Fig. 286). Central Valley of California . . . . . *molesta* (p. 216)

Pale frontal spot at most one-fourth as wide as frontal area between eyes; sixth abdominal sternum entire. Ventura County to San Diego County, California . . . . . *insperata* (p. 201)

102. Bright metallic green, blue, purple, or violaceous 103

Nonmetallic black, or black with metallic bluish luster (most *moerens* and some *stygica*) 109

103. Elytra violet or green with a violet luster; hind trochanters smoothly rounded on ventral margin; pubescence colorless throughout. Sacramento and Calaveras counties, California, to Tulare County, California . . . . . *rathvoni* (p. 178)

If elytra violet hind trochanters angulate on ventral margin, pubescence piceous on upper surface of body, and pronotum strongly hexagonal 104

104. Elytra violet, at least on margins; hind trochanters angulate; pubescence pale on under surface of body. Alberta and Minnesota to Arizona and New Mexico, with a disjunct population in the Sierra Nevada of California . . . . . *nuttalli* (p. 205)

Elytra lacking violet color 105

105. Pronotum distinctly hexagonal, with well-marked lateral angles (as in Fig. 189); apex of fore tibiae flared on posterior side; sixth abdominal sternum moderately deeply emarginate; hind trochanters often angulate on ventral margin 106

Pronotum subhexagonal to nearly quadrate, without well-marked lateral angles; fore tibiae not so modified; sixth abdominal sternum not or only shallowly emarginate; hind trochanters never angulate on ventral margin 107

106. Individual setae on under surface entirely piceous; hind trochanters often angulate. Southern British Columbia to northern California, southern Utah, and southern Wyoming . . . . . *cyanipennis* (p. 209)

Individual setae on under surface colorless apically, piceous basally; hind trochanters never angulate. Peace River region of British Columbia and southern Manitoba to eastern Wyoming, Colorado, southeastern Utah, northern New Mexico, and nothern Arizona. Strictly allopatric with *cyanipennis*.....*viridana* (p. 213)

107. Head and pronotum distinctly microreticulate, more or less satiny in texture; brilliant brassy green; pubescence colorless (Kern and Tulare counties, California) or piceous (central western California).....*chloris* (p. 179)

Head and pronotum smooth or relatively so; pubescence piceous 108

108. Hairy, conspicuously clothed throughout with long, straight, erect pubescence; green. Central western California...*comans* (p. 192)

Pubescence shorter, less erect, especially on upper surface; elytral pubscence very short, subrecumbent, and inconspicuous, or if longer, erect setae present, these confined to immediate base; green or blue. Idaho, Washington, Oregon, California, and southern Arizona.....*stygica* (p. 185)

109. First segment of middle tarsi densely pale pubescent (padded) beneath; first segment of hind tarsi also pubescent beneath, but pubescence pale only in apical part of segment; often with a metallic luster 110

First segment of both middle and hind tarsi glabrous beneath between lateral fringing bristles (completely lacking pads); never with a metallic luster.....111

110. Tarsal claws heavy, strongly curved (Fig. 203); pubescence on under surface of body often pale. Oregon and California..... .....*moerens* (p. 196)

Tarsal claws slender, less strongly curved (Fig. 202); pubescence on under surface of body always piceous. Washington, Oregon, and northern California.....*stygica* (p. 185)

111. Head and pronotum granular, coarsely punctate, alutaceous; pronotum subhexagonal, with obtuse lateral angles (Figs. 178-80) 112

Head and pronotum smooth, finely, sparsely punctate; pronotum without lateral angles (Fig. 181).....114

112. Hind tibial spurs distinctly dissimilar, the outer spur twice as wide as inner spur and obliquely truncate, and the inner spur flattened; pronotum widest near anterior margin (Fig. 178). Yolo and Marin counties, California, to San Diego County, California..... .....*tenebrosa* (p. 116)

Hind tibial spurs similar in size and often in shape; pronotum more nearly hexagonal, widest near middle (Figs. 179-80). Idaho, Oregon, and the Sierra Nevada of California.....113

113. Sixth abdominal sternum with hind margin turned gradually dorsad; one or both spurs of each hind tibia flattened, sticklike (Fig. 195).....*blaisdelli* (p. 119)

Sixth abdominal sternum with hind margin turned abruptly dorsad, at a right angle; both spurs of each hind tibia obliquely truncate (Fig. 194).....*lugubris* (p. 120)

114. Pronotum somewhat quadrate (Fig. 181), as wide as long; fore tarsi nearly as long as fore tibiae. Southern California and the Yuma, Arizona, region to the tip of Baja California.....
.....*melaena* (p. 122)

Pronotum subcircular, one-tenth or more wider than long; fore tarsi four-fifths as long as fore tibiae. In and near costal ranges in extreme southern California.....*morosa* (p. 124)

Subgenus PARALYTTA, new subgenus

Small to moderately large beetles. Colors usually nonmetallic; a distinct metallic luster in some Mexican species, but color never brilliantly metallic throughout. Head when black with or without a pale frontal spot. Male antennae a little longer than in female, reaching at most three segments beyond base of pronotum; male intermediate antennal segments incrassate, with at least IV and V fully as wide as or wider than distal segments, or if intermediate segments narrower, then IV wider than V (and IV and V usually wider than VI and VII); incrassate segments somewhat compressed and usually flattened to some extent on inner side but never asymmetrically produced or excavate. Female antennae clavate. Elytral surface rugose or reticulate. First segment of male middle tarsi weakly distorted in a few species and male middle tibiae subapically impressed in a few others; male legs not otherwise modified. Each tibia with two spurs. Hind tibial spurs generally strongly dissimilar (exceptions in *blaisdelli* and *lugubris*), with outer spur much wider than inner spur and obliquely truncate and inner spur excavate and only slightly thickened. Male genitalia with gonostyli lacking mesal hooks, glabrous, tapered; aedeagus usually with two well-developed ventral hooks, rarely with only one.

Type species. Lytta magister Horn.

Remarks. This is the largest of the subgenera of *Lytta*, with 36 species, divided into five groups. It is restricted in distribution to the North American Continent. Its range extends from British Columbia, Canada, through the western half of the United States, to southern México. Most

of the species found in the United States occur also in México, while 16 of the species are strictly Mexican in distribution. On the basis of both adult and larval morphology, the subgenus most closely resembles and is probably most closely related to the subgenus *Adicolytta*.

The majority of host plants recorded for species of *Paralytta* belong to the families Compositae, Convolvulaceae, and Papaveraceae. Other families represented by dependable records are Boraginaceae, Campanulaceae, Leguminosae, Liliaceae, Scrophulareaceae, Labiatae, and Primulaceae. According to my field observations on eight species of the Variabilis Group, the principal food of the adults of this group, and perhaps of the other groups as well, is pollen. Petals are sometimes eaten, but I have never observed feeding on the foliage of the host plants. Larval hosts have been recorded for three species (Table I).

The relationships of the species of *Paralytta* suggested by my study are shown in Figure 10 and are discussed in the following paragraphs. It will be evident that I have based my phylogeny on static relationships to a large extent in this subgenus.

The Variabilis and Reticulata groups are sufficiently alike that they might reasonably be combined as a single group. In the males of all species of both groups the surface of the head behind the eyes is densely micropunctate and finely punctate, and the setae in this region are very short. In most members of the Variabilis Group this area is also either flattened or impressed. This modification of the head is un-

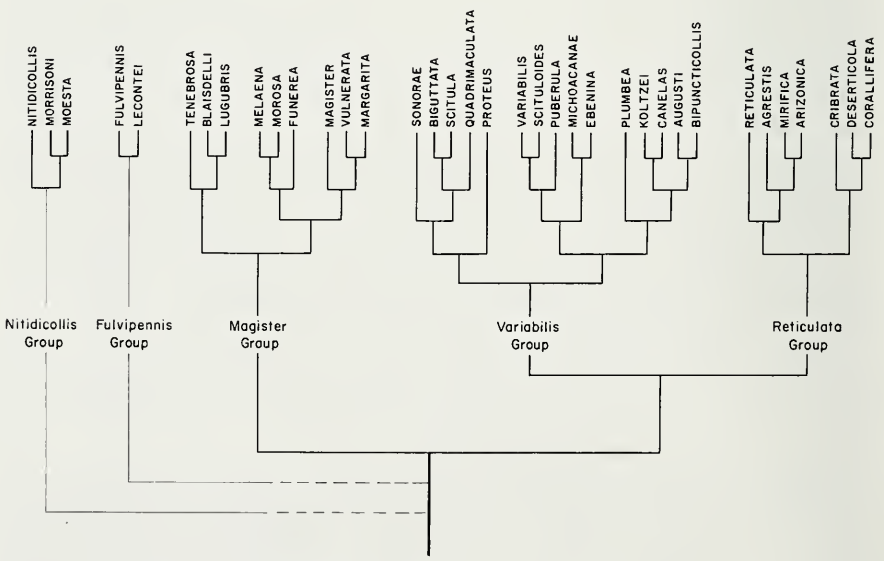


FIG. 10. Phylogeny of the subgenus *Paralytta*.

doubtedly a specialized character, and for this reason the two groups presumably belong to a distinct phyletic line. The Reticulata Group is further specialized in having reticulate, rather than rugose, elytra. It cannot, to my way of thinking, be derived from any of the three subgroups of the Variabilis Group; it is therefore necessary to postulate that the two groups diverged from an early ancestral type. In the Variabilis Group line the pronotal disk has developed a pair of smooth calluses, which is present in all species except *ebenina*. The Variabilis Group proliferated primarily in central and southern México; only two of its species (*biquttata* and *puberula*) are found as far north as the northern border of México. On the other hand, the Reticulata Group has its distribution centered in the southwestern United States and adjacent northern México, with an extension onto the Great Plains (*reticulata*) and another into central México (*corallifera*).

Within the Variabilis Group the Variabilis and Koltzei subgroups may be derived as branches of a line which lost the pale frontal spot of the head while retaining or largely retaining the essentially black coloration which I believe is primitive for the subgenus. In the Quadrimaculata Subgroup the spot has been retained, and there has been a well-developed trend for the development of pale colors on the body and legs. In addition, all the species of the subgroup except *sonorae* have a characteristic distortion of the first segment of the male middle tarsi. A somewhat similar modification is found in two species of the Koltzei Subgroup (*augusti* and *bipuncticollis*), apparently as the result of convergent evolution. Within the Reticulata Group two main lines may be distinguished on the basis of the presence or absence of the frontal spot (absent in the Reticulata Subgroup) and on the basis of a difference in the general form of the male genitalia.

The Magister Group represents a distinct line which apparently underwent most of its evolutionary development in the far-western United States, well to the north and west of the presumed evolutionary centers of the Variabilis and Reticulata groups. The Tenebrosa Subgroup is an essentially montane offshoot of the main line of the group which apparently had an early origin in view of its morphological distinctness and the lack of modification of the male pygidium. The other two subgroups agree in having the pygidium produced and in having the male middle tibiae at least weakly distorted. There is also a tendency for reduction of the tarsal pads in these two subgroups, the pads having been lost independently in *magister* and *funerea*.

Taken as a whole, the Magister Group is much more sharply defined morphologically in the larval stage than in the adult. According to MacSwain (1956, p. 78), who has described the larvae of five of the nine included species, the Magister Group in the larval stage is distinguished

from all other Lyttini by the following characters: "maxillary palpus with three or more long setae on anterior dorsal margin of second segment, setae longer than third segment; first two segments of maxillary palpi unequal, well sclerotized, broad." These characters are assuredly specializations, and since the group in the adult stage is more primitive than the Variabilis and Reticulata groups in several characters, including the absence of modification of the male head, it is reasonable to conclude that the group diverged from the paralyttine stock before the evolution of the lines forming the Variabilis and Reticulata groups.

The Fulvipennis Group closely approaches the Variabilis Group but does not have the head of the male modified. It might conceivably represent an offshoot of the Magister Group line, but there is nothing in particular to suggest this in the adult morphology. Unfortunately, larval morphology cannot at present be brought to bear on this problem since the larvae of *fulvipennis* and *lecontei* are unknown. Pending additional information, I regard the Fulvipennis Group as a primitive line which evolved independently of the other groups of the subgenus *Paralytta*.

The Nitidicollis Group contains three Californian species of uncertain relationships. The species *nitidicollis* is a form which on the basis of both adult and larval morphology cannot be satisfactorily placed within any of the other groups of the subgenus but which seems to lack any obvious specialization, except possibly with regard to adult coloration. In the adult stage *morrisoni* is quite similar to *nitidicollis* with the important exception that it has the two blades of the tarsal claws fused basally, as in the members of the tribe Eupomphini. The tarsal claws of *moesta* are modified in the same manner, but this species is otherwise distinct enough from both *nitidicollis* and *morrisoni* that it is a little difficult to believe that the modification of its claws and those of *morrisoni* stems from a common ancestor. On the contrary, were it not for the modified claws and the lack of modification of the male middle tibiae, *moesta* would fit nicely into the Magister Group next to *funerea*. It is hoped that larval studies will help to resolve the difficulties here outlined.

Key to Groups

1. Tarsal claws with ventral blade fused basally with dorsal blade and much shorter than it.....Nitidicollis Group (part) (p. 53)
   Tarsal claws cleft to base, with blades subequal in length.....2
2. Male head behind eyes more densely micropunctate, more finely punctate, and usually duller than at center of vertex and clothed with distinctly shorter setae; this region also frequently flattened or impressed; if elytra reticulate, male pygidium not produced; if

elytra rugose, pronotum usually with a pair of smooth calluses (exception in *ebenina*) 3

Male head not modified as above (setae behind eyes shortened in *nitidicollis,* but surface sculpture normal) 4

3. Elytra rugose or rugose punctate; pronotum usually with a pair of calluses ..... Variabilis Group (p. 61)

Elytra strongly reticulate; pronotum without calluses ..... Reticulata Group (p. 101)

4. Pronotum hexagonal or male pygidium triangularly produced, or both; elytra rugose or reticulate, black ..... Magister Group (p. 113)

Pronotum campanuliform or transversely oval, without lateral angles; pygidium not produced; elytra rugose, usually orange 5

5. Pronotum broad, transversely oval ..... Fulvipennis Group (p. 57)

Pronotum narrow, campanuliform .. Nitidicollis Group (part) (p. 53)

NITIDICOLLIS GROUP

Colors nonmetallic. Head when black with a pale frontal spot. Head quadrate; tempora broadly rounded, not prominent; surface smooth, sparsely micropunctate, finely punctate, subglabrous. Male head not modified behind eyes, except that setae in this area are shortened in *nitidicollis.* Male antennae reaching about base of pronotum; male intermediate segments (IV–VII) weakly incrassate. Pronotum campanuliform, longer than wide; surface similar to that of vertex. Elytra rugose. Legs unmodified. Tarsal pads poorly differentiated from rest of tarsal pubescence. Tarsal claws either cleft to base and with blades subequal in length (*nitidicollis*) or with ventral blade fused basally with dorsal blade and much shorter than it. Male sixth abdominal sternum shallowly emarginate. Male pygidium produced (*moesta*) or not. Aedeagus with two ventral hooks.

Remarks. As mentioned above, this group is probably an unnatural one. Included in it are the species *nitidicollis, morrisoni,* and *moesta.* The last two of these species differ from all other Lyttini in having the two blades of the tarsal claws fused, as in the members of the tribe Eupomphini. All three species have a similar general facies and exhibit certain peculiarities of the tarsal pubescence. None can be placed in any of the other groups of *Paralytta* without making major changes in the definitions of these groups.

The species *morrisoni* and *moesta* have essentially the same range, in central California (Fig. 5). *Nitidicollis* is found in southern California and on the peninsula of Baja California.

Key to Species

1. Tarsal claws cleft to base, with blades subequal in length; head, pronotum, and (usually) elytra orange.....*nitidicollis* (p. 54)
   Tarsal claws with ventral blade fused basally with dorsal blade and much shorter than it; at least head and elytra black.....2
2. Elytra moderately densely clothed with semierect setae; tarsal claws distinctly curved; emargination of male sixth abdominal sternum sparsely pubescent; male pygidium not produced; pronotum often orange.....*morrisoni* (p. 55)
   Elytra essentially glabrous; tarsal claws nearly straight; emargination of male sixth abdominal sternum densely lined with short setae; male pygidium produced; pronotum always black....*moesta* (p. 56)

Lytta (*Paralytta*) *nitidicollis* (LeConte)

Cantharis nitidicollis LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 160. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 112; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.
Lytta nitidicollis, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 332. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 84, pl. 15.

Black. Head and pronotum rich brownish or reddish orange. Elytra and scutellum either a similar (but often duller) orange or (rarely) piceous. Wings light brown. Pubescence yellow on head, pronotum, and elytra (unless these last are piceous), silver on under surface of body, piceous or nearly so on legs. Length: 12 mm.-17 mm.

Head sparsely punctate. Pronotum one-tenth longer than wide; surface nearly always weakly alutaceous but otherwise as on vertex. Elytra weakly rugose, very finely, obscurely punctate, essentially glabrous. Ventral surface of first segment of middle and hind tarsi densely pubescent, but pubescence hardly differentiated (except occasionally at apex of segment) from rest of pubescence of segment; other tarsal segments with better developed, undivided, pale pads. Tarsal claws slender, weakly curved, cleft to base, with blades subequal in length.

Male. Head with setae behind eyes somewhat shortened, but integument in this region not modified. Antennae as in Figure 64; segments a little more elongate than in *morrisoni*. Fifth abdominal sternum moderately deeply emarginate. Emargination of sixth sternum rounded, lined with short setae; lateral lobes of sternum subacute. Pygidium not produced. Genitalia as in Figure 290.

Female. Antennae as in Figure 117. Sixth abdominal sternum feebly emarginate medianly.

Type locality. San Diego, California.

Geographic distribution. Santa Clara County, California, south an unknown distance on the peninsula of Baja California. (See Fig. 11.)

Seasonal distribution. May 29—July 20.

Records. UNITED STATES: *California*: State label only, 28; Dulzura, July, 1; Gavilan Peak, May, 4; Gilman Hot Springs, Riverside County, June, July, 16; La Jolla, July, 1; Pasadena, June, 1; Riverside (MacSwain, 1956); San Diego, 6 (4 in May); San Diego County, 1; Santa Clara County, 2.

MÉXICO: *Baja California* [*Norte?*]: (Fall, 1901, p. 299).

Remarks. The elytra are entirely piceous in the specimen from La Jolla and in one of the two specimens from Santa Clara County, California. In the other specimen from Santa Clara County they are orange irregularly suffused with piceous.

The larva of *nitidicollis* has been described by MacSwain (1956). The type is in the Museum of Comparative Zoology.

Bionomics. The specimens from Gavilan Peak, California, are recorded from *Salvia multiflora* (Labiatae).

Lytta (*Paralytta*) *morrisoni* (Horn)

Calospasta morrisoni Horn, 1891, Proc. Amer. Philos. Soc., vol. 29, p. 102. Wellman, 1909, Ent. News, vol. 20, p. 24.

Lytta morrisoni, Selander, 1954, Coleopterists' Bull., vol. 8, p. 11.

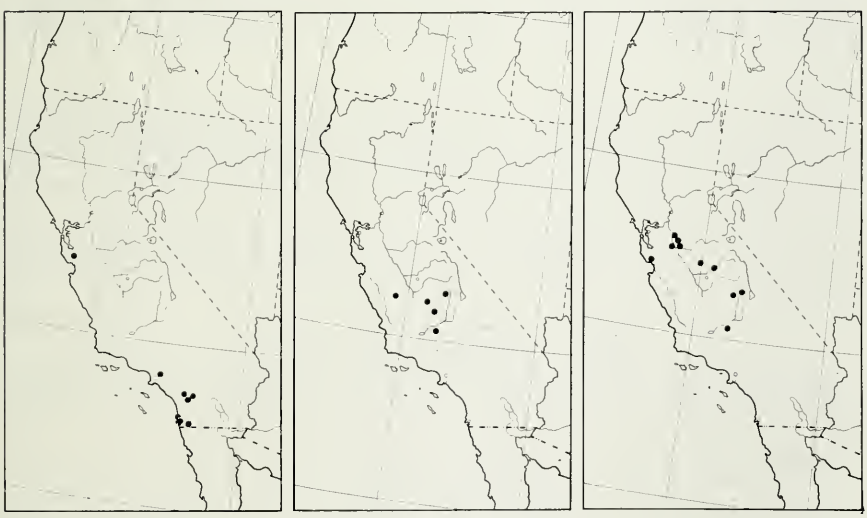


Fig. 11 (left). Distribution of *Lytta nitidicollis.*

Fig. 12 (center). Distribution of *Lytta morrisoni.*

Fig. 13 (right). Distribution of *Lytta moesta.*

Black. Pronotum orange or black. Frontal spot elongate, triangular, one-third or less as wide as frontal area between eyes. Wings dull brown. Length: 12 mm.-17 mm.

Head one-tenth longer than wide; surface moderately densely punctate. Eyes wider than in *moesta*. Pronotum slightly longer than wide; surface a little less densely punctate and pubescent than on vertex. Elytra impunctate, moderately densely clothed with short, semierect setae. Wings relatively broad. Ventral surface of first segment of tarsi densely clothed with pubescence which is not differentiated from that of rest of tarsi; rest of segments with pale pads, but the setae of these only slightly recumbent and not greatly different in texture from rest of tarsal pubescence. Tarsal claws distinctly curved; ventral blade fused basally with dorsal blade and about half as long as it.

Male. Antennae as in Figure 65. Fifth abdominal sternum shallowly but obviously emarginate. Emargination of sixth sternum as in Figure 222, sparsely pubescent; lateral lobes of sternum rounded. Pygidium not produced. Genitalia as in Figure 291; gonostyli cylindrical, hardly tapered, bluntly rounded at apex; gonocoxal piece truncate.

Female. Antennae as in Figure 118. Sixth abdominal sternum entire.

Type locality. Southern California.

Geographic distribution. Central California. (See Fig. 12.)

Seasonal distribution. April 15—May 9.

Records. UNITED STATES: *California*: Coalinga, May, 3; Edison, April, 10; Kaweah, 4; Kern County, 2; Southern California, 11; Tipton, April, 1; south of White River, April, 3.

Remarks. The pronotum is entirely black in 2 of the 11 specimens labeled Southern California and in 2 of the 3 specimens from Coalinga. In the third specimen from Coalinga it is largely black but has some orange coloring. In all specimens from Edison, Kaweah, Tipton, and south of White River it is orange.

The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Lytta (*Paralytta*) *moesta* (Horn)

Calospasta moesta Horn, 1878, Trans. Amer. Ent. Soc., vol. 7, p. 59; 1891, Proc. Amer. Philos. Soc., vol. 29, p. 101. Wellman, 1909, Ent. News, vol. 20, p. 24.

Lytta moesta, Selander, 1954, Coleopterists' Bull., vol. 8, p. 11.

Black. Frontal spot elongate oval, one-third or less as wide as frontal area between eyes. Wings very pale yellowish brown, darker at apex. Length: 16 mm.-20 mm.

Head slightly longer than wide; surface moderately densely punctate.

Pronotum elongate; surface a little more coarsely and densely punctate than on vertex, sometimes sparsely alutaceous. Elytra impunctate, essentially glabrous. Wings narrower than in *morrisoni*. Ventral surface of tarsi densely clothed with suberect black pubescence of about same color, length, and texture as rest of tarsal pubescence; hind tarsi sometimes ventrally glabrous along midline. Tarsal claws nearly straight; ventral blade fused basally with dorsal one and usually less than half as long as it.

Male. Fifth abdominal sternum entire or only feebly emarginate. Emargination of sixth sternum as in Figure 233, densely lined with short setae. Pygidium (Fig. 204) produced, blunt at apex. Genitalia as in Figure 292.

Female. Pygidium not or only weakly produced. Sixth abdominal sternum entire.

Type locality. California.

Geographic distribution. Central California. (See Fig. 13.)

Seasonal distribution. April 2—September 15.

Records. UNITED STATES: *California*: State label only, 2; Edison, April, 1; Friant, April, 1; Kaweah, 4; Kismet, September, 5; Manteca, August, 2; Modesta, September, 1; Potwisha, Sequoia National Park, 2000 ft.-5000 ft., May, 1; Ripon, 3; Santa Cruz, April, 4; Tulare County, 3; Westley, July, 1.

Remarks. The type is in the collection of the Academy of Natural Sciences of Philadelphia.

FULVIPENNIS GROUP

Elytra immaculate yellow or orange. Pubescence pale on elytra, black elsewhere. Head subquadrate; tempora broadly rounded, not prominent; surface smooth, finely punctate. Male head not modified behind eyes. Male antennae reaching about middle of pronotum; male intermediate segments (IV–VII) weakly incrassate, subequal, as wide as or very slightly wider than following segments. Eyes broad, bulged. Pronotum transversely oval, without distinct calluses. Scutellum densely punctate and pubescent. Elytra rugose, dull, very finely, densely punctate, subglabrous. Legs unmodified. Outer hind tibial spur unusually thick, cylindrical, expanded distally, three times as wide as inner spur. Tarsal pads well developed, undivided; pale pubescence (pad) of first segment of middle and hind tarsi of female and hind tarsi of male limited to apex. Tarsal claws heavy, cleft to base, with blades subequal in length. Male fifth abdominal sternum moderately deeply emarginate. Emargination of male sixth sternum shallow; a fine groove extending anteriad from apex of emargination; lateral lobes of sternum not produced. Female

sixth sternum truncate, lacking groove. Pygidium not produced. Aedeagus with two ventral hooks.

Remarks. This group contains two species: *fulvipennis* and *lecontei.* These species occur together in eastern Texas, including the Rio Grande Valley, with *fulvipennis* ranging west to eastern Arizona and north, on the Great Plains, to Nebraska (Fig. 5).

Key to Species

1. Head and pronotum black, densely punctate, and densely pubescent ..... *fulvipennis* (p. 58)
   Head and pronotum orange or yellow (pronotum with two black spots), sparsely punctate, and sparsely pubescent... *lecontei* (p. 60)

Lytta (*Paralytta*) *fulvipennis* LeConte

Lytta fulvipennis LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 331; 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 447. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 351, pl. 2, fig. 1.

Cantharis cardinalis, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 112; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Misidentifications.

Cantharis fulvipennis, Horn, 1885, Trans. Amer. Ent. Soc., vol. 12, p. 111. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298. Wickham, 1902, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 5, p. 301. Pritchett, 1903, Biol. Bull., vol. 5, pp. 275, 279.

Black. Elytra rich brownish yellow or orange. Head with a diamond-shaped orange frontal spot. Wings yellow, except apical fourth brown. Pubescence pale on elytra, piceous elsewhere. Length: 11 mm.-26 mm.

Head with sides nearly parallel above eyes; surface moderately shiny, very finely, densely punctate; average distance between punctures about equal to diameter of a single puncture; pubescence moderately long, erect, moderately dense. Pronotum generally wider than long (rarely no wider than long), widest at middle; disk even, sometimes with a small, shallow impression on each side behind middle; surface as on head but more densely punctate and pubescent; midline and a few small, scattered areas on disk impunctate.

Male. Antennae as in Figure 66; emargination of sixth abdominal sternum (Fig. 224) shallowly triangular. Genitalia as in Figure 293.

Female. Antennae as in Figure 119.

Type locality. Texas.

Geographic distribution. Coastal Plain of Texas northwest to extreme southeastern Arizona (Chiricahua Mountains) and north on the Great Plains to southwestern Nebraska. (See Fig. 14.) The range undoubtedly extends some distance into México, although there are no Mexican records at present.

In addition to the material listed below, I have seen a series of five specimens in the United States National Museum labeled "near Hanksville, base of Henry Mountains, Utah, June 1936, E. Bowles." This locality is so distant from what may be considered the established range of the species that it seems likely that the specimens in question were accidentally mislabeled.

Seasonal distribution. The earliest collection date for specimens I have examined is March 2; the latest, July 14. According to Dillon (1952), the species occurs in Texas as late as September.

Records. UNITED STATES: *Arizona*: Cove Creek Canyon, Chiricahua Mountains, July, 11. *Colorado*: (Horn, 1873). *Kansas*: Ashland, June, 4; Barker County, 1468 ft., 1; Belvidere, June, 2; Cheyenne County, 3300 ft., 1; Clark County, 1962 ft., June, 8; Comanche County, 2089 ft., 1; Kiowa County, 7 (5 in July); Rawlins County, July, 1; Sun City, June, 3; Wellington, 1. *Nebraska*: Haigler, July, 1; Stratton, July, 4. *New Mexico*: Artesia, 1. *Oklahoma*: Lawton, 1; Rosston, 4; Quartz Mountain State Park, June, 43. *Texas*: State label only, 16; Abilene, June, 2; Austin, May, June, 5; Baby Head, May, 1; Baird, June, 1; Bastrop, 2; Bell County, June, 3; Big Spring, July, 12; Brownwood, June, 2; Burnet County, June, 1; Carrizo Springs, April, 1; Dallas, 4; Dilley (Dillon, 1952); Eagle Pass, May, 1; Edinburg, April, 2; Fort Sam Houston, June, 1; Gillispie County, June, 2; Hidalgo County, May, 1; Hillsboro, June,

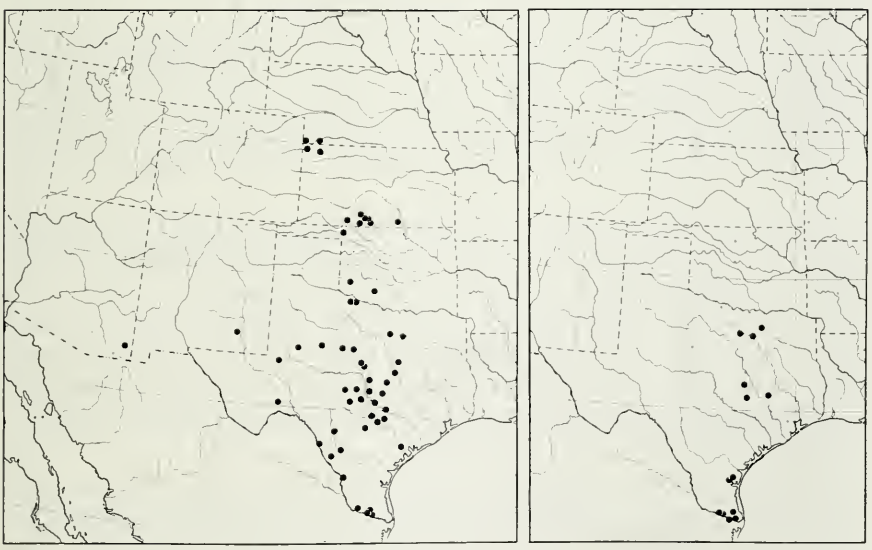


Fig. 14 (left). Distribution of *Lytta fulvipennis.*

Fig. 15 (right). Distribution of *Lytta lecontei.*

8; Lamposas, June, 1; Laredo, April, 1; Luling, May, 5; McAllen, March, 1; McLennan County, June, 2; Mason, May, 8; Mission, March, 4; New Braunfels, May, June, 30; Odessa, May, 1; Oklaunion, June, 13; Pease River, 2 mi. east of Vernon, 1000 ft.-1500 ft., July, 2; 5 mi. east of Rio Grande [City], April, 3; Round Mountain, 6; Sabinal, May, 1; San Antonio, May, June, 7; Sanderson, June, 2; Sequin, June, 3; Sweetwater, 1; Tarrant County (Dillon, 1952); Taylor, April, May, 9; Temple, May, 3; Victoria, May, 3; Waco, June, 4; Zephr, June, 3.

Remarks. This species is easily recognized by its unique color pattern. It exhibits little in the way of individual variation and none of a geographic nature.

Three of the females examined have greatly enlarged heads. In two of them the head is strongly triangular, while in the third it retains the normal, more or less quadrate form. I have observed similar anomalies in a few specimens of several other species of Meloidae, among them *Lytta erythrothorax.* Two of the specimens of *fulvipennis* belong to the large series from Big Spring, Texas; the other specimen is recorded merely from Texas, without precise locality data. The type of *fulvipennis* is in the Museum of Comparative Zoology.

Bionomics. According to label data, adults of *fulvipennis* have been collected on *Helianthus* and "thistle" (Compositae) in Texas and on *Argemone platyceras* (Papaveraceae) in Texas and Oklahoma.

Lytta (*Paralytta*) *lecontei* Heyden

Lytta dichroa LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 332. Not Fischer von Waldheim, 1823-24, Entomographie de la Russie et genres des insectes . . . , vol. 2, p. 230.

Cantharis dichroa, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 111; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298.

Lytta lecontei Heyden, 1890, Wiener Ent. Zeitung, vol. 9, p. 99. Van Dyke, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 131. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 352.

Black. Vertex and upper frontal area, pronotum (except margins), and elytra rich brownish orange or yellow. Pronotum with a small black spot on each side of disk before middle. Wings yellow, with apex a little darker. Pubescence pale on elytra, black elsewhere. Length: 13 mm.-20 mm.

Head with sides weakly to moderately divergent above eyes; vertex shiny, finely, sparsely punctate, usually with a few micropunctures intermixed with others; frontal area (especially lower half) distinctly more densely, deeply punctate than vertex, with a shallow impression on each side or with a deep, continuous impression between eyes (in which case vertex appears tumid); pubescence short, erect. Pronotum one-tenth

wider than long, widest at middle; disk smooth, shiny, more irregularly punctate and pubescent than vertex; a shallow median impression at base. Elytral punctures not well defined.

Male. Antennae as in Figure 67; anterior spur of fore and middle tibiae longer and stouter than posterior spur. Pale pubescence (pad) of first segment of middle tarsi limited to apex (as in female). Emargination of sixth abdominal sternum shallowly oval. Genitalia as in Figure 294.

Female. Antennae as in Figure 120.

Type locality. Boundary of the United States and México.

Geographic distribution. Eastern Texas and the lower end of the Rio Grande Valley (Texas and Tamaulipas). (See Fig. 15.)

Seasonal distribution. March 20—September 9.

Records. UNITED STATES: *Texas*: State label only, 12; Alamo, April, 2; Bell County, June, 1; Bishop, April, 3; Brazos County, September, 1; Brownsville, March, April, 4; Dallas, 2 (1 in May); Fort Worth, May, 4; Harlingen, March, 1; Kingsville, 1; McAllen, April, 1; McKinney, 1; Taylor, May, 3.

MÉXICO: *Tamaulipas*: Río Rico, August, 1.

Remarks. The type of *dichroa*, and thus of *lecontei*, is in the Museum of Comparative Zoology.

Bionomics. The three specimens from Bishop, Texas, are recorded as "feeding on primrose" (Primulaceae). In addition, there are single records each from alfalfa and beans (Leguminosae), *Monarda citridosa* (Labiatae), oats (Gramineae), and sunflower (Compositae), and two records from cotton (Malvaceae). At least some of these records undoubtedly represent accidental associations.

VARIABILIS GROUP

Male head behind eyes more densely micropunctate, more finely punctate, and usually duller than at center of vertex, and clothed with much shorter (very short) setae; this region usually flattened or impressed. Male antennae with intermediate segments weakly to very strongly incrassate. Eyes broad, prominent. Pronotum oval, circular, or campanuliform; disk almost always with a smooth, impunctate callus on each side at or near middle (sometimes poorly developed; absent consistently only in *ebenina*). Elytra rugose or finely rugose reticulate; reticulations when present never clearly defined macroscopically. Outer hind tibial spur two to three (rarely four) times as wide as inner spur. First segment of male middle tarsi sometimes bent. Tarsal pads moderately to poorly developed, undivided. Tarsal claws cleft to base, with

blades subequal in length. Pygidium produced or not. Aedeagus with two ventral hooks or (*bipuncticollis* and *proteus*) with only one.

Remarks. This group contains 15 species, divided into three subgroups. It is primarily Mexican in distribution (Fig. 2).

Key to Subgroups

1. Head with at least a pale frontal spot; elytra usually partially or entirely pale; under surface and legs often pale, at least in part.... .....Quadrimaculata Subgroup (p. 84)
   Head entirely black, lacking a pale frontal spot; elytra, under surface, and legs entirely black or dark metallic.....2
2. Male sixth abdominal sternum shallowly emarginate; lateral lobes of sternum not produced; female sixth abdominal sternum truncate.... .....Variabilis Subgroup (p. 62)
   Male sixth abdominal sternum deeply emarginate; lateral lobes of sternum produced; female sixth abdominal sternum shallowly, triangularly emarginate at apex.....Koltzei Subgroup (p. 73)

Variabilis Subgroup

Black throughout (with or without a faint metallic luster) or with pronotum pale, bimaculate. Head lacking a pale frontal spot. First segment of male middle tarsi unmodified. Male fifth abdominal sternum feebly emarginate, almost entire. Male sixth sternum shallowly emarginate; lateral lobes of sternum not produced. Female sixth sternum truncate.

Remarks. This subgroup contains the species *variabilis, scituloides, puberula, michoacanae*, and *ebenina*. Of these, only *puberula* is known to occur north of the Mexican border. The first three species listed form a very homogeneous complex, while *michoacanae* and *ebenina* are more distinctly differentiated. The known host plants of the subgroup include species of Papaveraceae (*ebenina*), Convolvulaceae (*variabilis, michoacanae*), and Campanulaceae (*puberula*).

Key to Species

1. Head and pronotum coarsely or moderately coarsely, densely punctate; elytra at least sparsely pubescent; first segment of female hind tarsi with some pale setae beneath at apex.....2
   Head and pronotum finely, sparsely punctate; elytra essentially glabrous; first segment of female hind tarsi entirely black pubescent..4
2. Elytral pubescence short, sparse, not noticeable macroscopically (average distance between setae greater than length of a single seta); pronotum black or orange. México.....3

Elytral pubescence relatively long, dense, conspicuous macroscopically, producing a dusty effect (average distance between setae distinctly less than length of a single seta); pronotum black. Southwestern United States..... *puberula* (p. 68)

3. Male head behind eyes deeply concave; antennal segments more elongate, none wider than long; when pronotum orange, discal spots very small, faint..... *scituloides* (p. 67)

   Male head behind eyes flattened or very shallowly concave; antennal segments short, in part wider than long (Fig. 68); pronotum black or orange with larger discal spots..... *variabilis* (p. 63)

4. Pronotum orange; head and pronotum smooth, shiny; elytra distinctly rugose; pubescence pale on under surface..... *michoacanae* (p. 70)

   Pronotum black; head and pronotum finely granular, dull; elytra obsolescently rugose; pubescence black on under surface..... *ebenina* (p. 72)

Lytta (*Paralytta*) *variabilis* (Dugès)

Cantharis variabilis Dugès, 1869, La Naturaleza, vol. 1, p. 111, fig. 11; 1889, An. Mus. Michoacano, vol. 2, p. 107. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 447.

Lytta variabilis, Selander, 1954, Jour. Kansas Ent. Soc., vol. 27, p. 90. Linsley, MacSwain, and Smith, 1956, Bull. Southern California Acad. Sci., vol. 55, pp. 93-95.

Black (a little brassy in fresh material). Pronotum either orange with two black discal spots (rarely small dots on each side at middle) or completely black. Wings light brown. Pubescence silver (except, often, on tibiae and tarsi), dark, or dark on upper surface and legs and silver on under surface, not conspicuous macroscopically. Length: 7.5 mm.-13.0 mm.

Head with sides divergent above eyes; surface typically coarsely, deeply, densely punctate, with punctures crowded on frontal area and center of vertex, producing a rough surface; frontal area generally with a transverse, less densely punctate or impunctate region at center between eyes; pubescence moderately long, erect. Pronotum (Fig. 168) transverse, at least one-tenth wider than long; disk somewhat flattened, especially before middle, with a broad impression on midline at base; surface typically roughened by coarse, deep punctures like those on vertex; midline and pair of calluses impunctate; pubescence as on vertex but slightly shorter, tending to slant toward calluses on each side. Elytra rugose, lacking distinct punctures except for some fine ones near base; pubescence sparse, semierect; average distance between setae at middle of elytra at least equal to length of a single seta. Tarsal claws (Fig. 199) heavy, very strongly curved.

FIG. 16. Distribution of *Lytta variabilis* (circles) and *Lytta scituloides* (squares).

Male. Head behind eyes flattened or shallowly concave. Antennae (Fig. 68) short, reaching middle of pronotum; segments III–V weakly incrassate; IV largest, as wide as VIII; V and VI similar in size; VI–VIII progressively wider; VIII–X subequal in width; segments short, VI–X as wide as or wider than long. Sixth abdominal sternum (Fig. 225) very shallowly emarginate, almost truncate. Pygidium with hind margin usually more oval in outline than in female but lacking a distinct apex. Genitalia as in Figure 295; aedeagus with hooks moderately variable in form.

Female. Antennae (Fig. 121) definitely short of middle of pronotum; segments VI–X as in male. Pad of first segment of middle tarsi limited to apical half.

Type locality. Guanajuato, Guanajuato.

Geographic distribution. Central Plateau of México from southern Chihuahua to southwestern México (state) and Puebla. (See Fig. 16.)

Seasonal distribution. June 28—September 7.

Records. MÉXICO: *Chihuahua*: Santa Bárbara, 6200 ft., September, 9. *Durango*: Durango, 5; Francisco Madero, September, 1; Guadalupe Victoria, September, 2; Nombre de Dios, July, 1. *Guanajuato*: State label

only, 10; 14 mi. south of San Luis de la Paz, September, 6; San Miguel Allende, August, 22; Tupátaro (Dugès, 1889). *Hidalgo*: Jacala, about 5000 ft., August, 1; Pachuca, 8000 ft., July, 15. *Jalisco*: Encarnación de Díaz, July, 2; 12 mi. south of Encarnación de Díaz, August, 1; 96 km. southwest of Guadalajara, 3500 ft., July, 2; La Punta, August, 35. *México*: 20 (highway) mi. southwest of Acambay, 8500 ft., August, 1; 6 mi. north of Aculco, 6500 ft., August, 3; Atlacomulco, 8100 ft., August, 3; Temescaltepec, 3. *Puebla*: Puebla, 1. *Querétaro*: kilometer 320, near Hacienda Balvanera, July, 14. *San Luis Potosí*: San Luis Potosí, 2. *Zacatecas*: 17 mi. north, 1.5 mi. south, and 9 mi. south of Fresnillo (Linsley, MacSwain, and Smith, 1956); Guadalupe, June, 1; 5 mi. south of Sombrerete, 7000 ft., September, 1; 2 mi. south of Trancosa, 8000 ft., August, 27.

Remarks. This species shows geographically discordant polymorphic variation in the color of the pronotum and the color of the pubescence (Fig. 17). The pronotum is either orange with a pair of black discal spots or entirely black. In the northern part of the range of the species (Chihuahua, Durango, and Zacatecas) the orange phase apparently

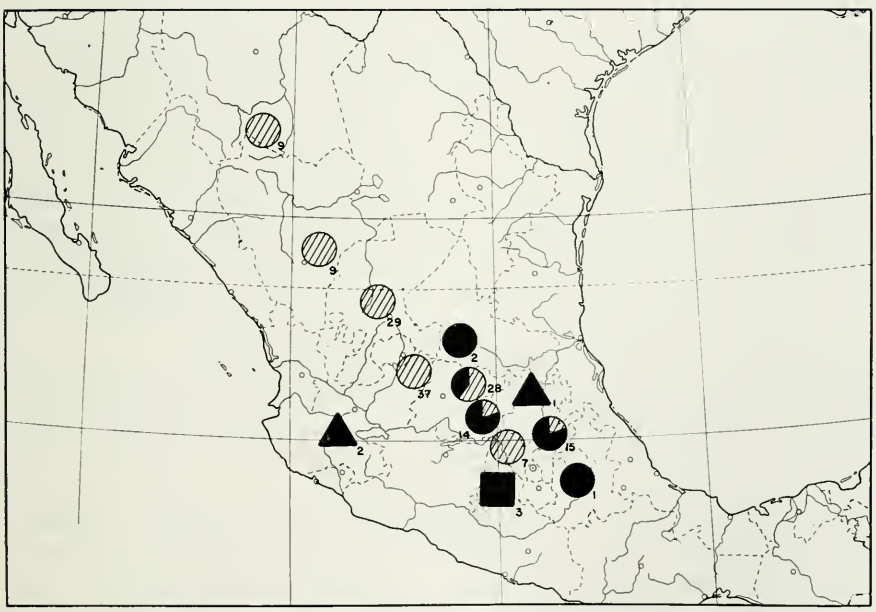


Fig. 17. Polymorphic variation in *Lytta variabilis*. Circles indicate silver pubescence, triangles black, and the square a combination of black and silver. Black area of figures indicates percentage of sample with black pronotum and lined area percentage with orange pronotum. Number of specimens in each sample is shown by small numerals. Where all specimens from a state have the same characters, they are combined to form a single sample.

TABLE II. COLOR PHASE COMPOSITION IN MIXED SERIES OF *Lytta variabilis*

LOCALITY	ORANGE PHASE	BLACK PHASE	TOTAL NUMBER OF SPECIMENS
Guanajuato (state)	1	9	10
14 miles south of San Luis de la Paz, Guanajuato	1	5	6
San Miguel Allende, Guanajuato	16	6	22
Hacienda Balvanera, Querétaro	3	11	14
Pachuca, Hidalgo	3	12	15

occurs to the exclusion of the black phase. In the southern part of the range mixed series have been taken in Guanajuato, Querétaro, and Hidalgo (Table II). I have observed individuals of the two color phases feeding on the same plant in Querétaro, and I have seen a male of the black phase pinned *in copulo* with a female of the orange phase from the state of Guanajuato. Other southern samples consist of either the black or orange phase, but none is large enough to justify the conclusion that the population it represents is composed entirely of a single phase.

Pubescence color varies independently. Over most of the range of the species it is silver. In a specimen from Jacala, Hidalgo, and in two specimens from southwest of Guadalajara, western Jalisco, it is black. In three specimens from Temescaltepec, México, it is black on the upper surface of the body and on the legs (except coxae) and silver on the under surface of the body.

The specimens from southwest of Guadalajara (a male and a female collected by F. G. Werner) have the head and pronotum less coarsely punctate than usual for the species, and the sides of the head in the male are more deeply concave than in any other male examined.

The specimens from Temescaltepec (all males) differ from typical *variabilis* in a number of morphological features, as follows: head and pronotum much more finely punctate; punctures shallower, only about half usual diameter, densely, uniformly arranged but not crowded; surface of head and pronotum smooth, shiny, not at all rough or reticulate; pronotal disk more evenly and strongly convex; emargination of sixth abdominal sternum more evenly arcuate; lateral lobes of sternum more prominent, moderately angulate; and with gonostyli (Fig. 296a) relatively short, stubby; aedeagus (Fig. 296b) with dorsal hook more massive and ventral hooks closer to each other. In addition, two of the specimens have the pygidium (Fig. 205) more strongly produced than do any other specimens of *variabilis* examined. The pygidium is also produced in the third specimen but within the normal range of variation in *variabilis*.

The status of the western Jalisco and Temescaltepec populations deserves further study. In particular it should be noted that at Toluca, México, *variabilis* occurs in typical form within 50 miles of Temescaltepec. I would not be surprised to find that some sort of reproductive isolation has been established between typical *variabilis* and the Temescaltepec population, but it seems preferable to assign the Temescaltepec material tentatively to *variabilis* until more information is obtained.

The type of *variabilis* has been lost. Following Dugès' original interpretation (that the orange phase is varietal), I have designated as neotype a specimen of the black phase. This is a female from "Guanajuato" in the British Museum (Natural History).

Bionomics. With one exception, a specimen from Nombre de Dios, Durango, labeled as from *Asclepias,* all host plants recorded for *variabilis* belong to the family Convolvulaceae. Dugès (1869) recorded the type material of *variabilis* from "*Convolvulus arborea.*" I collected the specimen from southwest of Acambay, state of México, from a flower of *Ipomoea stans* and the series from south of Trancosa, Zacatecas, from near Hacienda Balvanera, Querétaro, and from near San Luis de la Paz, Guanajuato, from flowers of *I. longifolia.* The specimens from southwest of Guadalajara, Jalisco, are from "morning-glory flowers."

Linsley, MacSwain, and Smith (1956) have recorded *variabilis* as one of a number of insect species competing with the emphorine bee *Ptilothrix sumichrasti* (Cresson) for pollen of *Ipomoea longifolia* and *I. pringlei* in the Fresnillo region of Zacatecas. These authors also found *variabilis* lightly parasitizing *Ptilothrix* nesting sites. Whether this parasitism merely reflects the proximity of the bee nests to flowers of *Ipomoea* (*P. sumichrasti* is oligolectic on *Ipomoea*) or is in some way more directly connected to the host plant relationships of bee and parasite is not clear.

Lytta (*Paralytta*) *scituloides,* new species

Black. Prosternum and gula orange in holotype, black in other specimens. Pronotum pale orange with a small blackish discal dot on each side at middle. Pubescence silver. Wings dark brown. Length: 8 mm.-14 mm.

Differs structurally from *variabilis* as follows.

Head with sides nearly parallel above eyes; surface more uniformly punctate, as in *puberula;* punctures not crowded. Pronotum not transverse, only slightly wider than long; surface smoother, less densely punctate.

Male. Head behind eyes deeply, concavely impressed, even more so than in *scitula.* Antennae (Fig. 69) longer, nearly reaching base of pronotum; segments proportionately more slender, none wider than long.

Genitalia with dorsal hook of aedeagus very evenly rounded on dorsal margin.

Female. Antennae nearly as in male except that intermediate segments are not enlarged.

Geographic distribution. Nuevo León and eastern Coahuila. (See Fig. 16.)

Seasonal distribution. September 13—March 24.

Type material. Holotype female and paratype females from [Villa] Allende, [Nuevo León], October 1917, A. Busck. Allotype male from "S J Allende," November 1929. Holotype and allotype in the United States National Museum; paratype in my collection.

Additional records. MÉXICO: *Coahuila*: Saltillo, September, 1. *Nuevo León*: Apodaca, March, October, 2; Cola de Caballo [near Monterrey], February, 1; Monterrey, October, 2; Villa de Santiago, February, 1.

Remarks. The head of the male is even more deeply impressed behind the eyes in this species than in *scitula.* However, in *scituloides* the impression does not follow the margin of the eye forward, and it therefore does not affect the outline of the head in frontal view. The similarity of this modification in *scituloides* and *scitula* seems to be the result of convergence, since other morphological characters indicate that the two species are not closely related. *Scituloides* is actually very similar to *variabilis* and may prove to be only a geographic variant of it.

Lytta (*Paralytta*) *puberula* LeConte

Lytta puberula LeConte, 1866, Smithsonian Misc. Coll., vol. 6, no. 162, p. 162; 1866, Proc. Acad. Nat. Sci. Philadelphia, p. 349.

Cantharis puberula, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 109. Cockerell, 1898, New Mexico Agr. Exp. Sta. Bull. no. 28, p. 173. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297. Wickham, 1902, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 5, p. 301.

Black. Wings very pale brown. Pubescence silver, dense, conspicuous macroscopically, producing a distinct dusty effect throughout. Length: 7 mm.-11 mm.

Differs structurally from *variabilis* as follows.

Head usually more uniformly punctate; punctures seldom crowded on frontal area and center of vertex, pubescence much longer. Pronotum (Fig. 169), as a rule, more evenly rounded at sides, seldom transverse, varying from as wide as long to one-tenth wider than long; disk usually smoother, more evenly convex; calluses usually small, less distinct, occasionally obsolete; pubescence fully as long and as conspicuous as on vertex. Elytral pubescence much denser, twice as long (as long as or longer than that of pronotum); average distance between setae at middle

of elytra distinctly less than length of a single seta. Tarsal claws (Fig. 200) more slender and less strongly curved.

Male. Genitalia as in Figure 298.

Type locality. Fort Whipple, Arizona.

Geographic distribution. Northern half of Arizona to extreme southwestern Colorado and central southern New Mexico. (See Fig. 18.)

Seasonal distribution. July 17—September 5.

Records. UNITED STATES: *Arizona*: Coconino County, August, 1; Flagstaff, July, August, 20; Fort Whipple (LeConte, 1866); Grand Canyon, July, 1; 5 mi. south of Grand Canyon, 6800 ft., August, 1; McNary, August, 4; Oak Creek Canyon, 6000 ft., 1; Peach Springs, Hualpai Indian Reservation, September, 2; Prescott, 12; Show Low, August, 2; White Mountains, August, 2; Williams, July, August, 9; Yavapai County, July, August, 28. *Colorado*: Durango, July, 5; Mesa Verde, July, 1. *New Mexico*: Cloudcroft, 9000 ft., 7 (4 in July); Cont[inental] D[ivide,] Ten[aja] (not located), 2; Fort Wingate, 1.

Remarks. The distal antennal segments in *puberula* tend to be a little more slender proportionately than in *variabilis*, but at best this difference is a very subtle one.

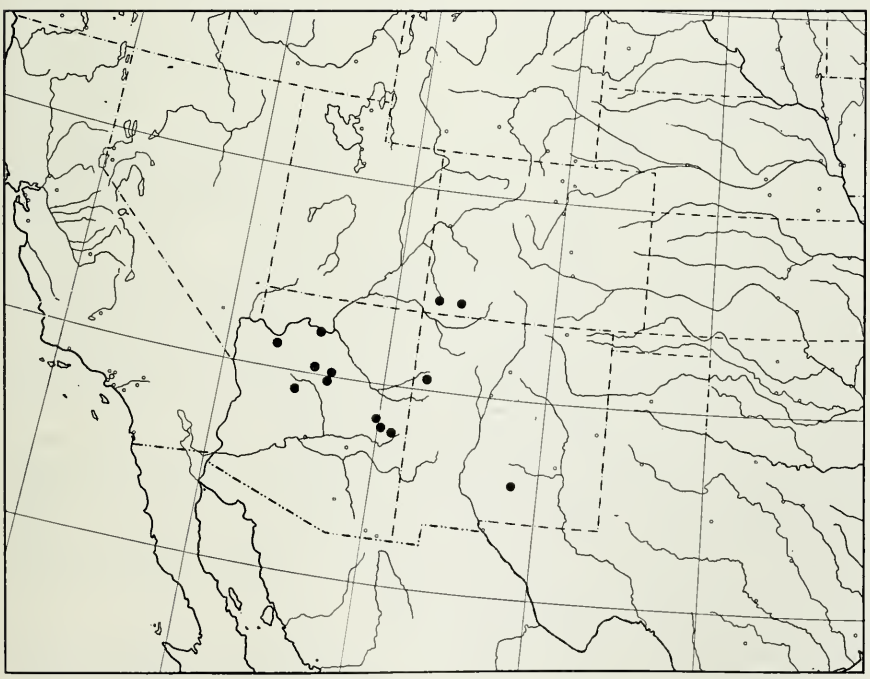


Fig. 18. Distribution of *Lytta puberula*.

It is unlikely that any difficulty will be encountered in recognizing this species since the only other member of the Variabilis Group occurring in the United States is *biguttata*. Moreover, the dusty effect produced by its dense pubescence separates *puberula* from all other black forms of *Lytta* except one of the color varieties of the Mexican species *proteus*.

This species is unusual in two respects. It is the only species of the subgenus *Paralytta* known to occur on plants of the family Campanulaceae, and its range is disjunct in relation to the ranges of the other members of its subgroup. According to my interpretation of relationships, *puberula* is a very close and somewhat specialized relative of *variabilis*. Evidently, at one time the range of the common ancestor of these two species extended north well into Arizona and New Mexico. Subsequently, its range was interrupted through the lower regions of these states and adjacent México, with the *puberula* line persisting as a population adapted to conditions at higher elevations in the north and the *variabilis* line being restricted to the central and southern portions of the Central Plateau.

The type of *puberula* is in the Museum of Comparative Zoology.

Bionomics. Four specimens are recorded from *Campanula* (Campanulaceae) at Cloudcroft, New Mexico.

Lytta (*Paralytta*) *michoacanae* (Champion)

Cantharis michoacanae Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 447.

Lytta michoacanae, Selander, 1954, Jour. Kansas Ent. Soc., vol. 27, p. 89.

Black (a little brassy in fresh material). Prothorax orange; pronotum with a black discal spot on each side at middle. Wings pale brown. Pubescence black on upper surface, silver on under surface, dark but with a golden luster on legs. Length: 7 mm.-11 mm.

Head with sides parallel or convergent above eyes; surface smooth, very shiny, finely, very sparsely punctate; pubescence very short, erect. Eyes unusually large, very prominent. Pronotum subcircular, as wide as or barely wider than long; disk transversely, shallowly impressed before middle, evenly convex behind, not impressed on midline or at base; discal spots elevated on impunctate calluses; basal margin more deeply emarginate than in *variabilis;* surface finely, very sparsely punctate at sides, nearly impunctate at center; pubescence consisting of a few very short, erect setae. Elytra rugose, lacking distinct punctures except at base; glabrous (actually with a few very short setae visible in proper light). Tarsi more slender than in related species.

Male. Head behind eyes clothed with extremely short setae but otherwise unmodified. Antennae (Fig. 70) reaching base of pronotum; segments IV and V subequal in size, roughly as wide as VI, a little

compressed but not perceptibly incrassate except in comparison with same segments in female; VI–VIII progressively slightly wider; segments longer than broad. Sixth abdominal sternum as in Figure 226; lateral lobes of sternum obtuse. Pygidium not produced. Genitalia as in Figure 299.

Female. Antennae as in male except that segments IV and V are visibly narrower than VI.

Type locality. Huetamo, Michoacán.

Geographic distribution. Lower elevations from central Michoacán to eastern Guerrero. (See Fig. 19.) All known localities for *michoacanae* are within the valley system of the Río Balsas and its tributaries.

Seasonal distribution. July 13—August 20.

Records. MÉXICO: *Guerrero*: Iguala, 3; 30 km. south of Iguala, 2300 ft., farmland, July, 25; Mexcala [Mezcala], 1350 ft., August, 1; 5 mi. north-northeast of Mexcala, 2000 ft., August, 5; 9 km. north of Zumpango [del Río], 2800 ft., August, 18. *Michoacán*: Huetamo, 2 (paratypes); Tacámbaro [de Codallos] (Champion, 1892).

Remarks. Specimens of this species superficially resemble small specimens of the orange phase of *variabilis* but are easily separable on the basis of the color of the pubescence on the upper surface of the body (pale in orange-phase *variabilis*) as well as by structural characters.

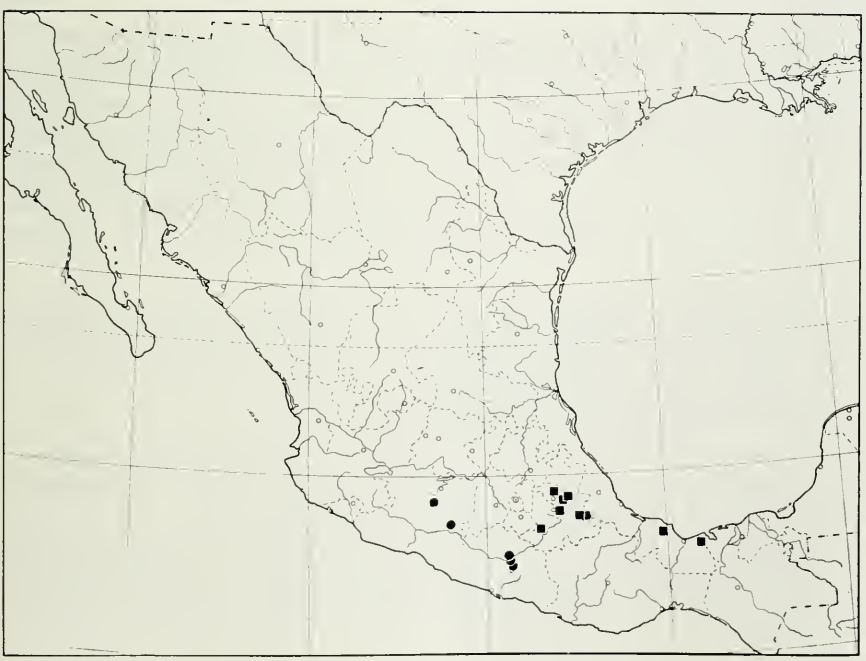


Fig. 19. Distribution of *Lytta michoacanae* (circles) and *Lytta ebenina* (squares).

The material from Guerrero agrees in every detail with the two paratypes I have seen from Michoacán. The type is in the British Museum (Natural History).

Bionomics. The specimens from 9 km. north of Zumpango del Río and from 30 km. south of Iguala, Guerrero, were collected on flowers of Convolvulaceae.

Lytta (*Paralytta*) *ebenina* (Dugès)

Cantharis ebenina Dugès, 1877, La Naturaleza, vol. 4, p. 66, pl. 2, fig. 10; 1889, An. Mus. Michoacano, vol. 2, p. 103. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 443.

Black. Wings pale brown. Pubescence black. Length: 10 mm.-15 mm.

Head transverse, decidedly wider than long, strongly triangular; tempora prominent; surface finely granular, dull; vertex finely, sparsely punctate; frontal area more densely punctate, but punctures not crowded; pubescence short, erect. Pronotum transversely suboval, at least one-tenth wider than long; disk flattened, with a large impunctate area on each side but without distinct calluses; surface as on vertex but more irregularly punctate; center of disk nearly glabrous. Elytra obsolescently rugose, nearly smooth, shinier than head and pronotum, impunctate, nearly glabrous (with only a few very short setae). Tarsal claws heavy, strongly curved.

Male. Head behind eyes flattened. Antennae (Fig. 71) not quite reaching base of pronotum; segments III–VI weakly incrassate; IV largest, as wide as or a little wider than X; V and VI slightly smaller, both wider than VII; segments longer than broad. Sixth abdominal sternum as in Figure 227. Pygidium not produced. Genitalia as in Figure 300.

Female. Antennae (Fig. 122) reaching just beyond middle of pronotum. Pad of first segment of middle tarsi limited to apical half, of hind tarsi absent.

Type locality. México.

Geographic distribution. Tlaxcala and southern Puebla to Tabasco (La Venta ruins). (See Fig. 19.)

Seasonal distribution. May—June 29.

Records. MÉXICO: Country label only, 6. *Puebla*: Amozoc, July, 13; Esperanza, 5; Matamoros Izúcar [Izúcar de Matamoros] (Champion, 1892). *Tabasco*: La Venta [ruins], May, 4. *Tlaxcala*: 4 mi. and 5 mi. east of Apizaco, June, 342; highway 18, border of Tlaxcala and Puebla, July, 1; 4 mi. northwest of Huamantla, June, 31; 2.5 mi. west of El Carmen, June, 27. *Veracruz*: Boca del Monte (Dugès, 1889); San Andrés [Tuxtla], 1.

Remarks. This species is distinguished from all other black species of *Lytta* by the combination of dull, finely granular head and pronotum; shiny, nearly smooth elytra; and the absence of a pale frontal spot.

There is a specimen in the Haag-Rutenberg collection in the Zoologische Staatsammlung in Munich labeled as from Panamá (Koltze), but this locality is almost certainly in error.

The type of *ebenina* has been lost. As neotype I have designated a male from San Andrés Tuxtla, Veracruz, in the British Museum (Natural History).

Bionomics. The three series of specimens recorded from the state of Tlaxcala were collected in 1955 from the flowers of *Argemone platyceras* (Papaveraceae). Feeding seemed to be confined to pollen. At each of the localities *ebenina* was associated on the host plant with *Lytta quadrimaculata.*

Koltzei Subgroup

Black or dark metallic blue or green throughout, or with pronotum pale, bimaculate. Head lacking a pale frontal spot. First segment of male middle tarsi unmodified or slightly thickened and weakly bent. Male sixth abdominal sternum deeply emarginate; lateral lobes of sternum produced. Female sixth sternum shallowly, triangularly emarginate at apex.

Remarks. This subgroup contains the species *plumbea, koltzei, canelas, augusti,* and *bipuncticollis.* Except for *canelas,* which has been recorded only from a single locality in Durango, the species of the subgroup are restricted in range to southern México. Based on records for only two species (*koltzei* and *plumbea*), the host plants of the subgroup are species of Convolvulaceae and Papaveraceae.

Key to Species

1. Antennae longer, reaching or extending beyond base of pronotum in male, reaching at least basal third of pronotum in female; pronotum strongly alutaceous, coarsely, densely punctate; male middle tarsi unmodified; lateral lobes of male sixth abdominal sternum not appreciably divergent; aedeagus with both ventral hooks well developed; pronotum black 2

   Antennae, shorter, not extending beyond basal third of pronotum in male, not reaching middle of pronotum in female; pronotum relatively smooth, less coarsely, less densely punctate; first segment of male middle tarsi slightly thickened, weakly bent; lateral lobes of male sixth abdominal sternum divergent; aedeagus with apical ventral hook small or obsolete 4

2. Emargination of male sixth abdominal sternum broadly triangular, extending at most one-third length of sternum (Fig. 228); lateral lobes of sternum broadly triangular; elytra black with a tinge of blue, not costate, essentially glabrous; pubescence pale on under surface, black elsewhere.....*plumbea* (p. 74)

   Emargination of male sixth abdominal sternum U-shaped, extending at least half length of sternum (Figs. 229-30); lateral lobes of sternum slender 3

3. Elytra dark blue or green, not costate, moderately densely, conspicuously pubescent; pubescence silver on at least elytra and under surface. Michoacán to Puebla.....*koltzei* (p. 76)

   Elytra black, tricostate, essentially glabrous; pubescence black throughout. Durango.....*canelas* (p. 79)

4. Pronotum black; aedeagus with apical hook small (Fig. 304c).....
   .....*augusti* (p. 80)

   Pronotum orange; aedeagus with apical hook obsolete (Fig. 305c)...
   .....*bipuncticollis* (p. 82)

Lytta (*Paralytta*) *plumbea* Haag-Rutenberg

Cantharis plumbea Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 38.

Cantharis monilicornis Dugès, 1881, La Naturaleza, vol. 5, p. 142, pl. 4, fig. 3; 1889, An. Mus. Michoacano, vol. 2, p. 96. *New synonymy.*

Cantharis koltzei, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 444. Misidentification.

Black tinged with dark blue. Upper surface, particularly head and pronotum, with a brassy or iridescent luster, often faint. Wings brown. Pubescence golden or silver on under surface, black elsewhere. Length: 7 mm.-14 mm.

Head with tempora much more well defined and quadrate than in *koltzei;* surface canaliculate, shiny, coarsely, deeply, very densely punctate; punctures crowded on frontal area and most of vertex; pubescence moderately long, erect. Eyes smaller and less prominent than in *koltzei;* head at level of eyes at most only slightly wider than at tempora, usually not as wide. Pronotum as in Figure 170, as wide as or a little wider than long; disk uneven, transversely impressed just before middle; a deep, groovelike impression on midline from near middle to base; calluses impunctate, often small, poorly defined; two shallow foveae often present on each side of disk, one near basal corner and another just behind callus; basal margin of pronotum strongly recurved on midline; surface roughly alutaceous, shiny, coarsely, densely punctate; pubescence as on vertex. Elytra rugose punctate basally, merely rugose elsewhere, essentially glabrous, with a few setae at base and apex.

Male. Head behind eyes not noticeably flattened. Antennae (Fig. 72) reaching base of pronotum; segments IV–VI moderately incrassate; IV largest, V and VI progressively smaller; VI barely wider than X; VII–X more moniliform than preceding segments, progressively barely wider, not much longer than wide. First segment of middle tarsi unmodified. Fifth abdominal sternum feebly emarginate, almost entire. Emargination of sixth sternum (Fig. 228) deeply, broadly subtriangular, extending one-fifth to one-third length of sternum; lateral lobes of sternum moderately produced, broadly triangular. Pygidium weakly produced. Genitalia as in Figure 301, very similar to those of *koltzei;* aedeagus with two well-developed ventral hooks, these more widely separated than in related species.

Female. Antennae (Fig. 123) reaching about basal one-third of pronotum. Sixth abdominal sternum (Fig. 275) very shallowly emarginate at apex.

Type locality. Of *plumbea,* México; of *monilicornis,* Uruapan [del Progreso], Michoacán.

Geographic distribution. Central Plateau of México from Guanajuato and nothern Michoacán to the Distrito Federal. (See Fig. 20.)

Fig. 20. Distribution of *Lytta plumbea* (circles) and *Lytta augusti* (squares).

Seasonal distribution. June 26—August 14.

Records. MÉXICO: Country label only, 1 (type of *plumbea*). *Distrito Federal*: Mexico City, 1. *Guanajuato*: Guanajuato, 1; Moroleón (Dugès, 1889). *México*: Toluca, 8800 ft., July, August, 37; 1.8 mi. southeast of Toluca, 8800 ft., July, 406. *Michoacán*: Carapan, July, 1; Pátzcuaro, 6500 ft., August, 2; Quiroga (Dugès, 1889); Tancítaro, 6000 ft.-6600 ft., August, 29; Uruapan [del Progreso] (Dugès, 1881).

Remarks. Lytta plumbea resembles *koltzei* but is distinguished in both sexes by its darker, less metallic coloration, heavier and shorter antennae, and subglabrous elytra, as well as by differences in the shape of the pronotum and the sixth abdominal sternum.

Some variation in details of surface sculpturing and in the relative lengths of the antennal segments is evident in the long series of specimens studied. Otherwise the species seems to be relatively stable in its structural characters.

Champion thought Dugès (1889, p. 97) referred to *koltzei* (*cyanescens*) in recording a metallic variety of *plumbea* (*monilicornis*) from Quiroga, Michoacán, but this is not a safe assumption in view of the range of color variation in *plumbea*.

As lectotype of *plumbea* I have designated a female in the Zoologische Staatssammlung in Munich (Haag-Rutenberg collection) labeled "Mexico, Klug, Coll. Germar."

Dugès' type apparently having been lost, I have designated as neotype of *monilicornis* a male in the British Museum (Natural History) from Guanajuato, [Guanajuato] (Sallé collection).

Bionomics. The specimens from Toluca and vicinity, state of México, and the specimen from Carapan, Michoacán, were collected on *Argemone platyceras* (Papaveraceae). Four specimens from Tancítaro, Michoacán, labeled as from poppy, are probably from *Argemone* also. In the Toluca area the beetles occurred in the flowers of the host plant either singly or in groups of two to six. Some feeding on the petals was observed, but it was concluded that the principal food material of the adults is pollen. One or more individuals of *Lytta quadrimaculata* were present in about half the flowers containing *plumbea*.

In addition to the above data, there is a record of two specimens of *plumbea* on flowers of morning-glory (Convolvulaceae) at Pátzcuaro, Michoacán.

Lytta (*Paralytta*) *koltzei* Haag-Rutenberg

Lytta koltzei Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 38.

Lytta koltzei var. *cyanescens* Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 38. *New synonymy.*

Lytta humilis Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 39. Denier, 1940, Rev. Ent., vol. 11, p. 802. *New synonymy.*

? *Cantharis atrovirens* Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 104. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 449. *New synonymy.*

Cantharis cyanescens, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 444.

Cantharis humilis, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 445.

Lytta koltzei var. *minor* Borchmann, 1917, Coleopterorum catalogus, pt. 69, p. 95.

Head and pronotum black with an iridescent luster, reflecting blue, violet, and green. Elytra metallic dark blue or bluish green. Under surface and femora black with a distinct metallic dark blue luster. Tibiae and tarsi black. Wings brown. Pubescence silver, piceous tipped with silver, or entirely piceous on head and pronotum; silver on elytra, under surface, and femora; usually piceous on tibiae and tarsi. Length: 7 mm.-13 mm.

Head subcanaliculate, shiny, coarsely, deeply, densely punctate; punctures crowded on frontal area and center of vertex; pubescence moderately long, erect. Eyes large; head clearly wider at level of eyes than at tempora. Pronotum as in Figure 171, varying from one-tenth longer than wide to slightly wider than long; disk uneven, transversely impressed just before middle and on midline at base; calluses sometimes indistinct, never strongly elevated; surface roughly alutaceous, shiny, coarsely, densely punctate; pubescence as on vertex. Elytra rugose punctate basally, merely rugose elsewhere; pubescence moderately long, semierect, moderately dense, conspicuous; average distance between setae equal to length of a single seta.

Male. Head behind eyes not noticeably flattened. Antennae (Fig. 73) reaching one or two segments beyond base of pronotum; segments IV–VI weakly incrassate; IV and V subequal in size; VI slightly narrower than V, barely wider than X; VII like VIII or intermediate in size and form between VI and VIII; VIII–X more moniliform than preceding segments; segments elongate, IV–X at least one-half longer than wide. First segment of middle tarsi unmodified. Fifth abdominal sternum moderately deeply emarginate at center. Emargination of sixth sternum (Fig. 229) very deep, U-shaped, extending more than half length of sternum; lateral lobes of sternum strongly produced as slender, nearly parallel processes, either subtruncate or rounded at apex. Pygidium not produced. Genitalia as in Figure 302 (gonostyli in lateral view sometimes more bluntly rounded at apex than shown); aedeagus with two well-developed hooks.

Female. Antennae (Fig. 124) reaching base of pronotum; distal segments less elongate than in male, much as in female of *plumbea* and *canelas.* Sixth abdominal sternum as in Figure 276 or more shallowly emarginate than shown and with blunter lateral lobes (as in *canelas*).

Type locality. Of *cyanescens* and *atrovirens,* México. The type locality of *koltzei* and of *humilis* is supposedly Panamá, but this is probably incorrect (see below).

Geographic distribution. Central Michoacán to central eastern Puebla. (See Fig. 21.)

Seasonal distribution. August 3—October 24.

Records. MÉXICO: Country label only, 4 (including a paratype of *koltzei*). *Distrito Federal*: Mexico City, 1; Tlalpam [Tlalpan], September, 1. *México*: Real de Arriba, [near] Temescaltepec, 1; Temescaltepec, 19. *Michoacán*: *Pátzcuaro,* 6500 ft., August, 2. *Morelos*: 6 mi. north of Cuernavaca, 7500 ft., August, 3; 9 km. south of Tres Cumbres, 7700 ft., August, 6; Tres Marías [Tres Cumbres], October, 1. *Puebla*: Esperanza, 1. PANAMÁ [?]: Country label only, 5 (from type series of *koltzei* and *humilis*).

Remarks. In addition to the male sexual characters, the conspicuously

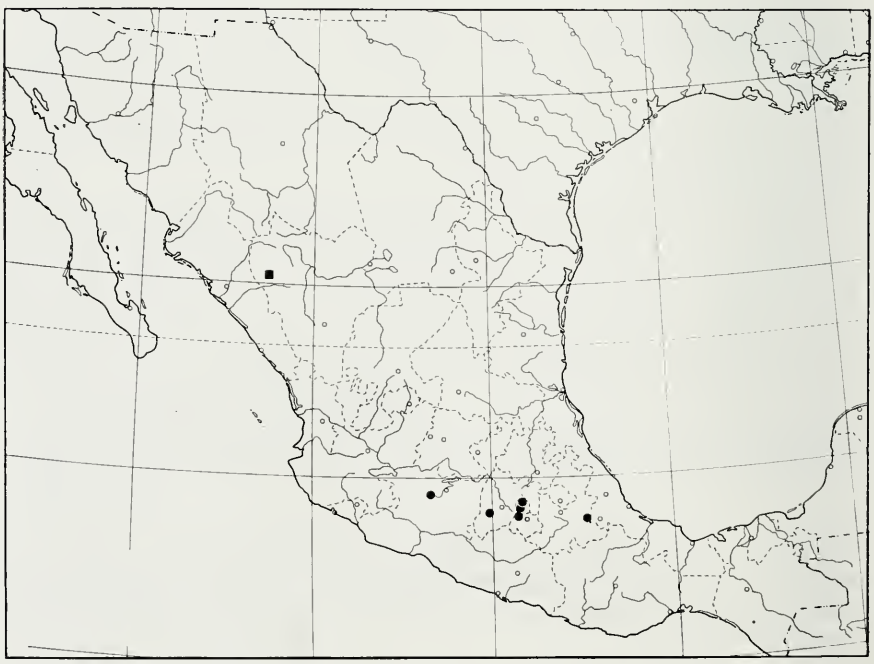


Fig. 21. Distribution of *Lytta koltzei* (circles) and *Lytta canelas* (square).

pubescent elytra readily distinguish this species from other species of the Koltzei Subgroup. Structurally it most closely resembles *canelas*.

The type series of *koltzei* consists of three females. Two of these specimens (including one which I have designated as lectotype) are labeled "Panama, Koltze;" the other specimen is labeled "Mexico, Bates." As lectotype of the variety *cyanescens* I have designated a male labeled "Mexico, V. Hyd." The type series of *humilis* consists of two males and a female labeled with the same data as the type of *koltzei*, and in the same hand; I have designated as lectotype one of the males. I have carefully compared all the material mentioned above and am quite certain that only a single species is represented. All of it is in the Zoologische Staatssammlung in Munich.

The label "Panama, Koltze" mentioned above would seem to be erroneous inasmuch as there have been no other records of the present species south of the state of Puebla, México. In this connection it should be stated that as far as I know, the only other specimen of *Lytta* in the Haag-Rutenberg collection bearing this particular label is a representative of *ebenina*, another species which has not otherwise been recorded south of México (the state of Tlaxcala in this case).

Cantharis atrovirens was described by Dugès from a single specimen, since lost. Its description could apply to *koltzei* except that the outer hind tibial spur is said to have the "form of a spear." I have placed *atrovirens* as a questionable synonym of *koltzei* on the assumption that either Dugès' description is inexact or that the specimen he described was aberrant.

Bionomics. The specimens from near Tres Cumbres, Morelos, were collected on flowers of morning-glory (Convolvulaceae).

Lytta (*Paralytta*) *canelas*, new species

Cantharis plumbea, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 443. Misidentification.

Lytta plumbea, Vaurie, 1950, Amer. Mus. Novitates, no. 1477, p. 43. Misidentification.

Black. Head and pronotum with a faint brassy luster. Wings brown. Pubescence black. Length: 9 mm.-12 mm.

Head somewhat canaliculate, moderately shiny, coarsely, deeply, densely punctate; punctures for most part crowded; pubescence moderately long, erect. Pronotum as in Figure 172 or more nearly circular than shown, barely wider than long; disk with a deep transverse impression just before middle and an equally deep one on midline at base; basal margin strongly recurved; calluses strongly elevated, impunctate; a large, distinct fovea just behind each callus, sometimes joined with basal impression; surface roughly alutaceous, moderately shiny, coarsely, densely punctate; pubescence as on vertex. Elytra unique for *Lytta* in being

distinctly costate; three costae present on each elytron, producing an undulate surface; first costa extending from base midway between scutellum and humerus to near apex, separated from second costa by a depression containing a nervule; second costa extending from humerus almost to apex; third costa less well defined than others, located on inflexed part of elytron, fused with second costa at humerus and not extending much beyond middle of elytron; surface of elytra rather dull, rugose punctate except near apex (where punctures become indistinct), essentially glabrous, with only a few very short setae.

Male. Head behind eyes flattened, clothed with setae about half as long as those on frontal area. Antennae reaching base of pronotum; segments IV–VI weakly incrassate; IV largest, a little wider than X; V and VI progressively slightly smaller, both wider than VII; VII–X more moniliform than preceding segments, progressively barely wider; segments longer than wide. First segment of middle tarsi unmodified. Fifth abdominal sternum shallowy emarginate. Emargination of sixth sternum (Fig. 230) very deep, U-shaped, extending half length of sternum; lateral lobes of sternum strongly produced as slender, parallel processes, rounded at apex. Pygidium not produced. Genitalia as in Figure 303; aedeagus with two well-developed ventral hooks.

Female. Antennae not reaching base of pronotum. Sixth abdominal sternum as in Figure 277, shallowly emarginate at apex.

Geographic distribution. Known only from the type locality, in western Durango. (See Fig. 21.)

Seasonal distribution. Unknown.

Type material. Holotype male, allotype female, and three paratypes (one male, two females) from Canelas, Durango, collected by Becker.

Remarks. The costate elytra immediately distinguish *canelas* from all other species of *Lytta*. Structurally *canelas* is most similar to *koltzei*.

The present description is based on five of the six specimens which Champion mistakenly assigned to *plumbea*. I have not seen the sixth specimen of his series.

Lytta (*Paralytta*) *augusti* Haag-Rutenberg

Lytta variabilis var. *augusti* Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 38 (footnote).

Cantharis subviolacea Champion, 1892-93, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, pp. 445, 463, pl. 21, fig. 22.

Lytta augusti, Selander, 1954, Jour. Kansas Ent. Soc., vol. 27, p. 89, fig. 1.

Head and pronotum black with a brassy luster. Elytra metallic dark blue or purple, or black with a blue or purple luster. Under surface of abdomen and femora black with a metallic blue luster. Under surface

of thorax, tibiae, and tarsi black. Wings pale brown. Pubescence fine, either pale with black base or entirely pale. Length: 11 mm.-15 mm.

Head shiny, moderately densely, coarsely to finely punctate, with a tendency when coarsely punctate for partial fusion of punctures, producing short canaliculations; frontal area impunctate and impressed at center between eyes; pubescence moderately long, erect. Pronotum suboval, a little more than one-tenth wider than long; disk rather even, somewhat flattened before middle; calluses at least weakly elevated; a fovea usually present just behind each callus; midline impunctate, impressed, impression widening at base; surface not alutaceous, very shiny; punctures as on vertex or much sparser, especially at center; pubescence slightly shorter than on vertex. Elytra rugose, lacking distinct punctures except for some fine ones near base; pubescence short, semierect, very sparse; setae inconspicuous unless entirely pale, separated by a distance as great as or greater than length of a single seta. Outer hind tibial spur spoon-shaped.

Male. Head behind eyes flattened. Antennae (Fig. 74) short, at most reaching basal third of pronotum; segments III–V weakly incrassate; III barely wider than in female; IV largest, as wide as VI; V slightly enlarged in comparison with same segment in female; VI–X progressively slightly wider; segments short, at least in part wider than long. Middle tibiae nearly straight. First segment of middle tarsi very slightly thickened, very weakly bent in dorsal view (as in *bipuncticollis*). Fifth abdominal sternum shallowly emarginate. Emargination of sixth sternum (Fig. 231) very deep, somewhat triangular, extending half length of sternum; lateral lobes of sternum strongly produced as slender, moderately divergent processes, rounded at apex. Pygidium not produced. Genitalia as in Figure 304; aedeagus with two ventral hooks, but apical hook extremely small.

Female. Antennae (Fig. 126) not reaching middle of pronotum; segments III and IV equal in size. Sixth abdominal sternum with a small triangular emargination at apex; lateral lobes of sternum obtuse.

Type locality. Of *augusti,* México; of *subviolacea,* [La] Parada or Durasnal, both in Oaxaca.

Geographic distribution. Recorded from central Oaxaca and the Veracruz-Puebla border southwest of Orizaba. (See Fig. 20.)

Seasonal distribution. The only recorded collection date is August 1.

Records. MÉXICO: Country label only, 2 (including lectotype). *Oaxaca*: Durasnal (not located), 1 (paratype of *subviolacea*); [La] Parada, 1 (paratype of *subviolacea*); Oajaca [Oaxaca de Juárez], 2. *Veracruz*: El Puerto, 7000 ft., 31 mi. southwest of Orizaba, August, 2.

Remarks. In a male and female from El Puerto, Veracruz, all clothing setae are entirely silver. In the other specimens examined the setae of the upper surface are piceous tipped with gold or silver, while the setae of the under surface are silver for most of their length, becoming piceous at the immediate base.

The specimen (a female) from La Parada, Oaxaca, exhibits bilaterally symmetrical distortion of the fore and middle legs. The femur and tibia of one of the middle legs of this specimen are shown in Figure 193. The fore legs are similarly distorted, except that the femora and tibiae are not bent.

The Haag-Rutenberg series of *variabilis* in the Zoologische Staatssammlung in Munich includes a male and two females of *augusti,* all bearing the label "Mexico, Deyrolle." These are unquestionably the specimens referred to as "*variabilis* var. *augusti*" by Haag-Rutenberg. I have designated one of them (the male) as the lectotype of *augusti.* The type of *subviolacea* is in the British Museum (Natural History).

Lytta (*Paralytta*) *bipuncticollis* Haag-Rutenberg

Lytta bipuncticollis Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 36.

Cantharis bipuncticollis, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 443, pl. 20, fig. 21.

Head black. Pronotum orange, finely margined with black, and with a black discal spot on each side at middle. Elytra metallic dark bluish purple or green. Under surface and femora black with a metallic blue or bluish green luster. Tibiae and tarsi black. Wings brown. Pubescence black. Length: 12 mm.-17 mm.

Head smooth, shiny, finely, sparsely, irregularly punctate; an impunctate area at center of frontal area between eyes; pubescence moderately long, erect. Pronotum suboval, varying from slightly wider than long to fully one-fifth wider than long; sides more strongly convergent apically than basally; disk even, somewhat flattened, especially at center before middle; midline impunctate; impressed; discal spots elevated on impunctate calluses; surface smooth, finely, sparsely punctate; pubescence short, sparse, erect. Elytra rugose, lacking distinct punctures except for some fine ones near base; pubescence fine, sparse, semierect, difficult to detect except in proper light; setae at middle of elytra separated by an average distance about equal to length of a single seta. Outer hind tibial spur spoon-shaped.

Male. Head behind eyes flattened. Antennae short, reaching middle of pronotum; segments III–VI incrassate; III barely wider than in female; VI wider than VII but similar in form; VII–X progressively slightly wider; segments short, VI–X as wide as or wider than long. In one male

(Córdoba, Veracruz) segments IV and V are unusually large, IV being wider than, and V as wide as, X; in the other male studied (Mochitlán, Guerrero), IV is not wider than V and both are only about as wide as VII. Middle tibiae a little expanded in comparison with those of female. First segment of middle tarsi slightly thickened, very weakly bent in dorsal view. Fifth abdominal sternum shallowly emarginate. Emargination of sixth sternum (Fig. 232) very deep, triangular, extending less than half length of sternum; lateral lobes of sternum strongly produced as slender, strongly divergent processes, subacute at apex. Pygidium not produced. Genitalia as in Figure 305; aedeagus with a single ventral hook (apical hook obsolete).

Female. Antennae not reaching middle of pronotum; segment III slightly wider than IV. Sixth abdominal sternum as in Figure 278; lateral lobes of sternum acute.

Type locality. México.

Geographic distribution. Central Veracruz (Jalapa) to eastern Guerrero and central Oaxaca. (See Fig. 22.)

Seasonal distribution. Unknown.

Records. MÉXICO: Country label only, 4 (including lectotype). *Guerrero*: State label only, 4; Amula (Champion, 1892); Mochitlán, 1. *Oaxaca*:

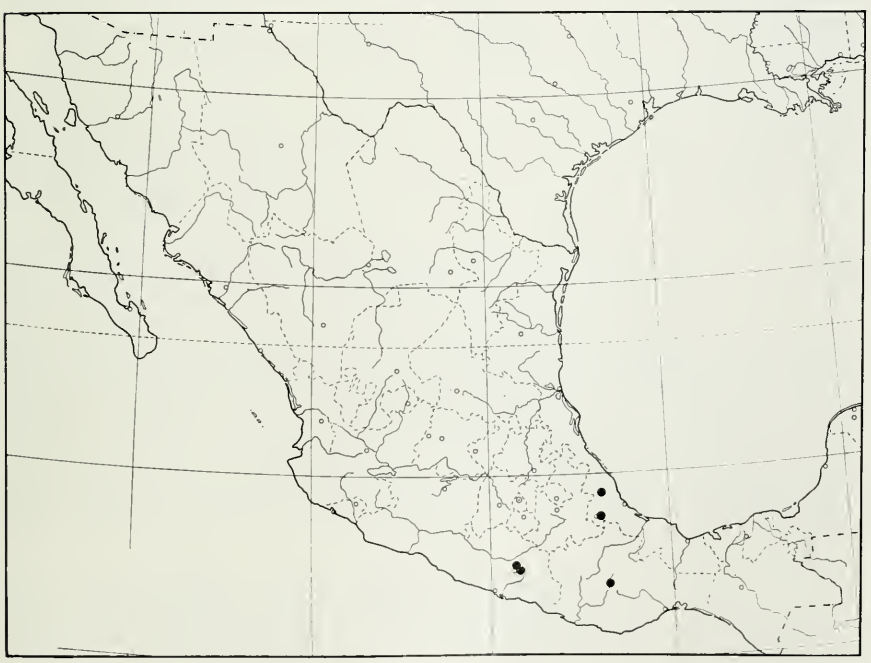


Fig. 22. Distribution of *Lytta bipuncticollis*.

Oaxaca [de Juárez] (Champion, 1892). *Veracruz*: Córdoba, 2; Jalapa (Champion, 1892).

Remarks. From all other North American species of *Lytta* having an orange or red pronotum, *bipuncticollis* is easily recognized by its bluish or greenish elytra.

Structurally *bipuncticollis* most closely approaches *augusti.* In males of both species the pygidium may overlap the sixth abdominal sternum to the extent that the true shape of the latter is obscured.

Included among the material examined are 3 of the 15 specimens studied by Champion for the Biologia Centrali-Americana report. As lectotype of *bipuncticollis* I have designated a male labeled "Mexico, V. Heyd." in the Zoologische Staatssammlung in Munich (Haag-Rutenberg collection).

Quadrimaculata Subgroup

Head when dark with a pale frontal spot. Pronotum usually pale, bimaculate, varying occasionally to entirely black. Elytra partially or entirely pale (except some *proteus* and *scitula*). Under surface and legs often pale, at least in part. First segment of male middle tarsi bent in dorsal view, excavate on anterior side for reception of anterior middle tibial spur (except in *sonorae*). Male sixth abdominal sternum deeply emarginate; lateral lobes of sternum produced. Female sixth sternum truncate (except in *biguttata*). Pygidium produced.

Remarks. This subgroup contains the species *sonorae, biguttata, scitula, quadrimaculata,* and *proteus.* Except for *biguttata,* the species of the subgroup are not known to occur outside México. However, it is not unlikely that *sonorae,* now recorded from Sonora, ranges north into Arizona. *Scitula* and *proteus* seem to be restricted to southern México. *Quadrimaculata* is widely distributed on and south of the Central Plateau. *Biguttata* is the most widely distributed species of *Lytta* in North America, with a range extending from Montana to near the southern end of the Central Plateau of México. Adults of the Quadrimaculata Subgroup feed on species of Convolvulaceae, Papaveraceae, and Compositae.

All the species of the subgroup except *sonorae* are extremely variable in color in the adult stage. This is in contrast to the condition in the species of the Variabilis and Koltzei subgroups where color is stable or relatively so (the color of the pronotum and pubescence is geographically variable in *variabilis*).

Key to Species

1. Emargination of male sixth abdominal sternum at least as wide as deep, clearly not dividing visible portion, extending less than half

actual length of sternum; male gonostyli neither extremely broad nor truncate; aedeagus with a pair of ventral hooks.....2

Emargination of male sixth abdominal sternum much deeper than wide, nearly or completely dividing visible portion, extending nearly three-fourths actual length of sternum (Fig. 174); male gonostyli extremely broad in lateral view, truncate (Fig. 309b); aedeagus with a single ventral hook (Fig. 309c).....*proteus* (p. 97)

2. Male middle tarsi not modified; intermediate segments of male antennae weakly incrassate (Fig. 75); elytra each with a long, dark discal vitta reaching or approaching humerus and apex. Sonora.....
.....*sonorae* (p. 85)

First segment of male middle tarsi bent, excavate basally on anterior side; intermediate segments of male antennae at least in part strongly incrassate; elytra not as above.....3

3. Male pygidium strongly, narrowly prolonged medially (Fig. 209); elytra orange, each usually with a black spot at apical and basal third (Fig. 159), rarely with one or both spots absent.....
.....*quadrimaculata* (p. 93)

Male pygidium not strongly, narrowly prolonged medially; elytra never with a black spot at basal third.....4

4. Male head behind eyes slightly flattened, not concave; elytra yellow, usually with a black spot, short vitta, or pair of vittae on each at apical fourth (Fig. 160). United States and México.....
.....*biguttata* (p. 86)

Male head behind (and above) eyes deeply concave; elytra black, each often with lateral margin and a broad discal vitta yellow (Fig. 161). Southern México.....*scitula* (p. 90)

Lytta (*Paralytta*) *sonorae* Van Dyke

Lytta sonorae Van Dyke, 1947, Pan-Pacific Ent., vol. 23, p. 156.

Orange. Antennae, palpi, and tarsi brown. Pronotum with a small black discal spot on each side just behind middle and a smaller spot on lateral margin of disk just before middle. Under surface of thorax sometimes partially suffused with black. Each elytron with a broad brown discal vitta which begins at or near humerus and which may or may not reach apex. Wings colorless. Pubescence pale golden or silver. Length: 7.5 mm.-8.0 mm.

Head with surface smooth, shiny, rather finely, sparsely punctate; pubescence scattered, erect. Pronotum as in *biguttata,* but basal margin more shallowly emarginate at center. Elytral surface as in *quadrimacu-*

lata, more strongly rugose than in *biguttata;* pubescence conspicuous, regularly distributed, semierect.

Male. Head behind eyes weakly flattened. Antennae (Fig. 75) reaching base of pronotum; segments III–VI weakly incrassate; IV largest, as wide as X, not curved; VII–X a little longer than wide. First segment of middle tarsi unmodified. Fifth abdominal sternum entire. Emargination of sixth sternum (Fig. 233) deeply semicircular; sternum impressed at center; lateral lobes of sternum relatively broad, subacute. Pygidium produced as in Figure 206; apex acute. Genitalia similar in most respects to those of *biguttata;* aedeagus as in Figure 297.

Female. Sixth abdominal sternum truncate at apex.

Type locality. Carbó, Sonora.

Geographic distribution. This is the only species of the Variabilis Group except *biguttata* known to occur in the Sonoran Desert. It has been recorded only from the type locality, which is approximately 45 miles north of Hermosillo, Sonora. (See Fig. 23.)

Seasonal distribution. Collected November 24. A relatively late seasonal distribution is suggested, which may account for the apparent rarity of the species.

Records. MÉXICO: *Sonora*: Carbó, November, 10 (type series).

Remarks. The type series of *sonorae*, collected in 1933 by H. S. Gentry, is in the collection of the California Academy of Sciences. In the holotype and one of the paratypes the elytral vittae begin at the humerus and extend to the apex; in the other specimens they are short of both the humerus and the apex.

Lytta (*Paralytta*) *biguttata* LeConte

Lytta biguttata LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 332; 1866, Proc. Acad. Nat. Sci. Philadelphia, p. 349. Ulke, 1875, *in* Report upon the geographical and geological explorations and surveys west of the 100th meridian, vol. 5, p. 825. Carruth, 1931, Ent. News, vol. 42, p. 54 (as *biguttata* Say). Tanner, 1934, Ann. Ent. Soc. America, vol. 27, p. 45. Vaurie, 1951, Amer. Mus. Novitates, no. 1477, p. 43, fig. 14. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 350. Selander, 1956, Bull. Brooklyn Ent. Soc., vol. 51, p. 116.

Cantharis biguttata, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 109. Snow, 1883, Trans. Kansas Acad. Sci., vol. 8, p. 43. Champion, 1892-93, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, pp. 445, 464, pl. 21, fig. 23. Wickham, 1896, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 3, p. 169 (as *biguttata* Say). Cockerell, 1898, New Mexico Agr. Exp. Sta. Bull. no. 28, p. 173; 1901, Ent. News, vol. 12, p. 40. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297. Wickham, 1902, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 5, p. 301. Fall and Cockerell, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 210.

Cantharis bivirgata Dugès, 1881, La Naturaleza, vol. 5, p. 140, pl. 4, fig. 2.

Cantharis alfredi Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 98. New name proposed in error for *bivirgata*.

Cantharis alemani Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 106.

Cantharis biguttata var. *bivirgata*, Champion, 1893, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 464, pl. 21, fig. 24.

Lytta biguttata pallens Selander, 1956, Bull. Brooklyn Ent. Soc., vol. 51, p. 119, figs. 1-3, 4A.

Lytta biguttata biguttata, Selander, 1956, Bull. Brooklyn Ent. Soc., vol. 51, p. 112, figs. 1-3, 4B-D.

Lytta biguttata bivirgata, Selander, 1956, Bull. Brooklyn Ent. Soc., vol. 51, p. 125, figs. 2, 4E.

Head varying from black (with an orange frontal spot) to completely orange. Antennae black, with basal segments sometimes orange. Pronotum (Fig. 173) orange, finely margined with black; disk commonly with a black spot on each side just behind middle, sometimes also with a black dot on lateral margin before middle; discal spots sometimes extended to base of pronotum or fused, or both. Elytra (Fig. 160) yellow or orange, each with a brown or black spot or short vitta at apical fourth, or with a pair of black submarginal vittae, or immaculate; elytral suture usually finely margined with black for basal third to half (black margin occasionally broadened, fusing with discal spot). Under surface varying from largely black to entirely orange. Femora and tibiae varying from black to orange; tarsi black or brown. Wings varying from dark brown to nearly colorless. Pubescence silver or pale golden, conspicuous throughout. Length: 7 mm.-13 mm.

Head smooth, shiny, sparsely to densely punctate; pubescence rather long, erect. Pronotum subcircular; basal margin more strongly recurved and much more deeply emarginate than in related species; disk strongly declivous basally; calluses poorly defined; surface smooth, shiny, more shallowly punctate than head, very sparsely punctate at center of disk; pubescence as on vertex. Elytra more weakly rugose than in related species; pubescence erect, variable in length.

Male. Head behind eyes slightly flattened. Antennae (Fig. 76) reaching base of pronotum or nearly so; segment III weakly incrassate; IV–VI strongly incrassate; IV largest, clearly wider than distal segments, not curved; VII slightly incrassate, intermediate between VI and VIII in size and shape; VIII–X moniliform, longer than wide. Fifth abdominal sternum shallowly emarginate. Sixth sternum as in *scitula* (see Fig. 234) or with emargination semicircular in form. Pygidium (Fig. 208) produced, oval, not at all acute. Genitalia as in Figure 306.

Female. Sixth abdominal sternum truncate or shallowly, triangularly emarginate at apex (Fig. 279).

Type locality. Of *biguttata*, Santa Fe, New Mexico; of *alemani*, [Ciu-

dad] Lerdo, Durango; of *b. pallens*, Douglas, Arizona; of *bivirgata*, Silao, Guanajuato.

Geographic distribution. State of México north to southern Utah and western Texas; thence north on the Great Plains to South Dakota and Montana.

Seasonal distribution. March—October.

Records. I have departed from my usual procedure in the present case by listing the records for the species by race.

Typical race: UNITED STATES: *Colorado*: Antonito (Wickham, 1902); Canon City (Wickham, 1902); Colorado Springs, June, 5; Cortez, July–August, 5; Denver, June–July, 4; Fort Collins (Wickham, 1902); near Hoehne, August, 1; Rocky Ford, September, 1; Sterling, July, 1; Trinidad, June–August, 4. *Kansas*: Cheyenne County, 3300 ft., July, 3; Dresden, July, 4; Gove County, 2813 ft., 3; Logan County, 3322 ft., 2; Quinter, July, 2; Wallace County, 3400 ft., July, 2. *Montana*: Phillips County, June, 1. *Nebraska*: Dix, July, 73; Mitchell, July, 1; Palisade, July, 1. *New Mexico*: Bandelier, August, 1 (not located); Broadview, August, 1; Cimarron, August, 1; Gallinas Canyon (Snow, 1883); Glorieta (Fall and Cockerell, 1907); near Hot Springs, Las Vegas, 7000 ft., August, 1; Koehler, 2; near Koehler, prairie, 1; Las Vegas, July, 6; Loving, May, September, 32; Maxwell, July, 6; Pecos (Fall and Cockerell, 1907); Raton, August, 7; San Jose, July, 1; Santa Fe, July–August, 11; Torrance County, 1. *South Dakota*: Ardmore, July, 5; Belle Fourche, July, 1; Cottonwood, June, 4; Highmore, June, 2; Haakon County (Carruth, 1931). *Texas*: Alpine, June–August, 4; The Basin, 5000 ft., Big Bend National Park, June, 1; Brady, May, 1; Chisos Mountains, Big Bend National Park, July, 1; Cotulla, March–May, 44; Dalhart, June, 1; Davis Mountains, July, 1; 100 mi. east of El Paso, July, 1; Fort Davis (Dillon, 1952); 20 mi. north of Fort Davis, 4000 ft., September, 1; 5 mi. north of Langtry, June, 1; Marfa, July, 17; Mason, May, 1; Odessa, May, 2; Pine Springs, Culbertson County, August, 1; Presidio, June–August, October, 27; Sanderson, May, 2; 11 mi. north of Valentine, August, 5. *Wyoming*: 40 mi. north of Lusk, July, 1; Wheatland, August, 1.

MÉXICO: *Coahuila*: Cabos (Vaurie, 1950); Guadalupe, August, 1; La Gloria, south of Monclova (Vaurie, 1950); La Rosa (Vaurie, 1950); Paila (Vaurie, 1950); 5 mi. north of Saltillo, 5100 ft., August, 4; San Pedro [de Colonias], June, 1; 25 mi. southeast of San Pedro [de Colonias] (Vaurie, 1950); Torreón, June–August, 5. *Durango*: [Ciudad] Lerdo, May, August, 3; San Lucas (Vaurie, 1950); Yerbanís, Cuencamé District (Vaurie, 1950). *San Luis Potosí*: El Huizache, 4500 ft., August, 1.

Pale race: UNITED STATES: *Arizona*: 12 mi. west of Bisbee, 3; Camp Apache (Ulke, 1875); Carrizo Creek, highway 60, Navajo County,

August, 1; Cave Creek, Chiricahua Mountains, 5000 ft.-6000 ft., August, 1; Chiricahua Mountains, August, 4; Copper Basin, near Prescott, 1; Cornville, September, 1; near Del Rio Verde River, Yavapai County, September, 2; Dewey, 1; Douglas, July, September–October, 18; Douglas to Chiricahua Mountains, September, 2; near Fort Whipple (LeConte, 1866); Gila Valley, Graham County, 1; Hereford, August, 5; 10 mi. southwest of Kayenta, 6000 ft., August, 4; Lochiel Station, August, 3; Mormon Lake, 6900 ft., August, 1; Nogales, September–October, 4; Onion Flat, Chiricahua Mountains, August, 1; Peach Springs, Hualpai Reservation, September, 2; 7 mi. east of Pearce, August, 2; Pinery Canyon, 5000 ft., west slope Chiricahua Mountains, August, 1; Prescott, August, 8; San Bernardino Ranch, 3750 ft., Cochise County, August, 9; Santa Rita Mountains, July, 1; Seligman, 4; Senator Mine, near Prescott, September, 1; Sierra Ancha Mountains, Gila County, July, 9; Springerville, August, 1; Yarnell, September, 4; Walnut [National Monument], 1; Washington Mountains, near Nogales, September, 1; White Mountains, September, 1; Williams, August, 1. *New Mexico*: 21 mi. southeast of Alamagordo, August, 3; Albuquerque, August, 3; Artesia, July, 12; Cambray, September, 9; Carlsbad, August, 2; Deming, August, 3; 33 mi. east of Deming, 4300 ft., August, 2; Fort Wingate, October, 1; 18 mi. east of Gallup, August, 8; Las Cruces, June, September, 3; 49 mi. west of Las Cruces, August, 2; 10 mi. east of Las Cruces, 4400 ft., September, 1; Mescalero Reservation, September, 2; Mesilla Valley (Cockerell, 1898); Mule Creek, Grant County, 2; Roswell (Fall and Cockerell, 1907); Silver City, August, 5; Socorro (Cockerell, 1898); White Sands Proving Ground, 4000 ft., September, 2. *Texas*: El Paso, 1; McNary, May, September, 5. *Utah*: Pintura, August, 3; St. George, 2; Zion National Park, 10.

MÉXICO: *Chihuahua*: 20 mi. east of San Miguel, Sonora, August, 3; 20 mi. northwest of Nueva Casas Grandes, August, 2.

Southern México race: MÉXICO: *Guanajuato*: State label only, 1; Silao (Dugès, 1881); Tupátaro (Dugès, 1889); 1 mi. east of Villagrán, July, 2. *México*: 14 mi. west of Toluca, July, 1.

Remarks. The present treatment is abbreviated as I have already presented an analysis of variation in this species, together with synonymical notes and distribution maps, in another paper (Selander, 1956). In the paper cited, three subspecies of *biguttata* were recognized. Such an arrangement seems to be useful, at least for the present time, but I now prefer to use vernacular, rather than scientific, names for the races. I therefore propose to substitute the name "typical race" for *b. biguttata*, "pale race" for *b. pallens*, and "southern México race" for *b. bivirgata*.

At the time my paper was published there was a wide distributional gap between the typical race in Coahuila and Durango and the southern México race in the states of Guanajuato and México. Since then I have

received a female of *biguttata* collected August 22, 1954 by J. G. Chillcott at El Huizache, in central eastern San Luis Potosí. This specimen differs from all others that I have seen in that the lateral lobes of the sixth abdominal sternum are acutely produced and the emargination of the base of the pronotum forms a deep, slotlike incision. It has the antennae and elytral pubescence of the typical race; on this basis I have assigned it to that race. In color it differs from the typical race in having the black discal mark on each elytron much broadened and extending from before the middle to near the apex, as in some specimens of the southern México race. It is otherwise heavily marked in that the discal spots of the pronotum extend to the base and the legs are entirely black.

The type of *biguttata* is in the Museum of Comparative Zoology. The type of *b. pallens* is in the collection of the University of California at Berkeley (examined). The type of *bivirgata* having been lost, I have designated as neotype a specimen labeled "Guanajuato, F. Duges, Samml. Cl. Müller," in the Zoologische Staatssammlung in Munich. This specimen belongs to the typical form as described by Dugès. The type of *alemani* cannot be located, but pending the opportunity of studying topotypical material, I have refrained from designating a neotype.

Bionomics. This species occurs on a variety of Compositae. According to label data, specimens of the typical race have been collected on *Applopappus spinulosus, Bahia absinthifolia, B. pedata,* and *Baileya multiradiata* at Presidio, Texas; on guayule (flowers) at Loving, New Mexico; on "sunflowers" at Quinter, Kansas; and on *Verbesina encelioides* at Cotulla, Texas. I have collected specimens on *Hymenoxys richardsoni* near Gallup, New Mexico, and on an unidentified composite near Villagrán, Guanajuato.

In addition to the above, there is a record of a single specimen from *Petalostemum* (Leguminosae) at San Jose, New Mexico, and Cockerell (1901) recorded specimens from *Cleome serrulata* (Capparidaceae) at Las Vegas, New Mexico. Both records should be regarded as questionable unless verified.

Dugès (1881) recorded a host plant for the southern México race under the vernacular name "sin collar." This plant's identity is unknown to me.

Lytta (*Paralytta*) *scitula* (Champion)

Cantharis scitula Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 446, pl. 20, fig. 25.

Cantharis signaticollis Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 446, pl. 20, fig. 24. *New synonymy.*

Head black with an orange frontal spot (rarely with labrum and under side of head partially orange also). Pronotum varying from orange with

a fine black margin and a pair of large black discal spots near middle to entirely black. Scutellum black. Elytra black with lateral margin and a broad discal vitta from base to near apex varying from yellow (Fig. 161) to a dark pitchy brown which is just perceptibly lighter in shade than rest of elytra. Wings light brown. Legs varying from orange with apex of femora and distal tarsal segments infuscate to entirely black. Under surface of thorax black. Abdomen varying from orange with first four sterna black except at sides to entirely black. Pubescence pale golden. Length: 7 mm.-10 mm.

Head with vertex smooth, shiny, moderately coarsely, deeply, moderately densely punctate; surface of frontal area similar but punctures becoming denser, rather crowded; pubescence moderately long, erect. Pronotum subcircular, as long as wide; basal margin distinctly emarginate on midline, but not so deeply as in *biguttata;* midline impunctate before middle; discal calluses large, weakly elevated; surface and pubescence as on vertex. Elytral surface finely rugose reticulate; pubescence moderately long, semierect, conspicuous with magnification, denser on apical half than on basal half.

Male. Head behind and above eyes deeply impressed; impression following dorsal margin of eye forward to the extent that side margins of head above eyes are distinctly concave in frontal view. Antennae (Fig. 77) reaching base of pronotum; segment III moderately incrassate, IV and V strongly so, VI weakly so, IV and V distinctly wider than following segments; IV largest, concave on inner side, weakly curved; V flat on inner side, not curved; VI slightly wider than VII; VII–X longer than wide, progressively slightly wider. Fifth abdominal sternum deeply, broadly emarginate. Emargination of sixth sternum (Fig. 234) very deep, broadly triangular; sternum impressed at center; lateral lobes of sternum acutely produced. Pygidium produced as in Figure 208. Genitalia as in Figure 307.

Female. Antennae as in *quadrimaculata*, not attaining base of pronotum. Sixth abdominal sternum (Fig. 280) truncate at apex, more strongly cupped than in any related species except *quadrimaculata* and *proteus.*

Type locality. Of *scitula,* Chilpancingo [de los Bravos], 4600 ft., Guerrero; of *signaticollis,* Matamoros Izúcar [Izúcar de Matamoros], Puebla.

Geographic distribution. Southwestern Puebla, eastern Guerrero, and northwestern Oaxaca. (See Fig. 23.)

Seasonal distribution. Collected in May and September.

Records. MÉXICO: *Guerrero*: Chilpancingo [de los Bravos], 4600 ft. (Champion, 1892). *Oaxaca*: Nochixtlán, September, 2. *Puebla*: Amozoc, July, 9; Atlixco, May, 6; Matamoros Izúcar [Izúcar de Matamoros], 2 (paratypes of *signaticollis*); [Izúcar de] Matamoros, September, 11.

FIG. 23. Distribution of *Lytta scitula* (circles) and *Lytta sonorae* (square).

Remarks. The presence of a deep concavity on each side of the head in the male distinguishes *scitula* from all other species of *Lytta* except *scituloides.* In the latter species the concavity, although actually deeper than in *scitula,* does not extend far forward enough to affect the outline of the head in frontal view. In other respects *scitula* and *scituloides* are not particularly similar, as is indicated by the fact that they have been assigned to different subgroups in the present classification.

It is of interest to note that the modification of the head of males of *scitula* and *scituloides* is paralleled in males of the Old World genus *Oenas* Latrielle. In *Oenas,* however, the concavity is much deeper and is rather sharply margined.

The darkest and the palest combinations possible within the range of color variation described above are represented among specimens studied. Between these extremes a number of intermediate combinations are represented, indicating that the variation is continuous.

Scitula was originally described from Guerrero on the basis of a male having the pronotum and abdomen black, the elytra yellow vittate, and the legs partially orange. This specimen is in the British Museum (Natural History). Drawings of its genitalia have been made available to me through the courtesy of C. M. F. von Hayek.

Champion's description of *signaticollis* was based on four specimens from Puebla having the pronotum partially orange, the elytra entirely black or with the lateral margin yellow, and the legs and abdomen black. The type, a male, is also in the British Museum (Natural History). Included among the material I have studied are two paratypes of *signaticollis,* including the male figured in the Biologia Centrali-Americana.

Bionomics: The series from Amozoc, Puebla, was collected on flowers of a species of Compositae which has not as yet been identified. The beetles were feeding on pollen.

Lytta (*Paralytta*) *quadrimaculata* (Chevrolat)

Cantharis quadrimaculata Chevrolat, 1834, Coléoptères du Mexique, fasc. 4, p. [17]. Dugès, 1869, La Naturaleza, vol. 1, p. 108; 1889, An. Mus. Michoacano, vol. 2, p. 99. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 105. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 440, pl. 20, fig. 14. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296.

Cantharis octomaculata, Peñafiel y Barranco, 1866, Gaceta Méd. México, vol. 2, p. 225, pl. 1. Jiménez, 1866, Gaceta Méd. México, vol. 2, p. 228.

Cantharis fasciolata Jiménez, 1866, Gaceta Méd. México, vol. 2, p. 253, pl. Dugès, 1869, La Naturaleza, vol. 1, p. 107, pl. 1, fig. 5.

Cantharis bifasciatus Dugès, 1869, La Naturaleza, vol. 1, p. 106.

Cantharis quadrimaculata var. *bifasciata,* Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 441, pl. 20, figs. 15-16.

Lytta fasciolata, Denier, 1935, Rev. Argentina Ent., vol. 1, p. 25.

Lytta quadrimaculata, Vaurie, 1950, Amer. Mus. Novitates, no. 1477, p. 41, fig. 13. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 349. Selander, 1959, Proc. Ent. Soc. Washington, vol. 61, p. 208.

Head black, with sides of vertex sometimes in part orange in the male. Pronotum yellowish orange, finely margined with black, with a large black discal spot on each side near middle and almost always a small black dot on lateral margin of disk just before middle; discal spots sometimes extending to base of pronotum as thick vittae. Elytra usually yellowish orange with four black or brown spots of variable size and shape (Fig. 159), rarely entirely yellowish orange or entirely black. Under surface of thorax black. Legs varying from entirely black to orange with apex of femora black. Abdomen entirely black or with some or all of the terga and sides of sterna orange; orange areas of sterna progressively larger toward apex of abdomen, those of fifth sternum sometimes meeting broadly on midline. Wings brown. Pubescence varying from silver throughout to black throughout. Length: 10 mm.-21 mm.

Head distinctly wider than long; tempora rather prominent; surface smooth, shiny, moderately coarsely, deeply, moderately densely punctate; pubescence erect. Pronotum subcircular to nearly campanuliform, depending on degree of curvature of sides, about as long as wide; basal margin usually distinctly emarginate on midline; disk often broadly im-

pressed along midline, calluses weakly elevated; surface smooth, shiny, more finely, weakly, and almost always more sparsely punctate than vertex; center of disk usually subimpunctate; pubescence shorter and less conspicuous than on vertex. Elytra finely rugose reticulate; base relatively smooth, very finely punctate; posteriorly the punctures are gradually enlarged to form cells between weak reticulations; pubescence short, very sparse, inconspicuous.

Male. Head behind eyes flattened or very weakly concave. Antennae (Fig. 78) extending one or two segments beyond base of pronotum; segments III–VII strongly incrassate; IV largest; V–VII progressively narrower; VIII–X much narrower, longer than wide. Fifth abdominal sternum shallowly emarginate. Emargination of sixth sternum (Fig. 235) very deep, broadly triangular; sternum flattened at center; lateral lobes of sternum acutely produced. Pygidium strongly and narrowly prolonged at middle, the projection variable in shape (Fig. 209). Genitalia as in Figure 308; ventral hooks of aedeagus unusually variable.

Female. Sixth abdominal sternum truncate at apex; margin turned strongly dorsad so that sternum is strongly cupped (as in *scitula* and *proteus*). Pygidium rounded.

Type locality. Of *quadrimaculata,* Orixaba [Orizaba, Veracruz]; of *octomaculata,* either Mineral del Chico or Atotonilco el Grande, both in Hidalgo; of *fasciolata* and *bifasciatus,* México.

Geographic distribution. Widespread at elevations between 4500 ft. and 9000 ft. on the Central Plateau of México and adjacent southern highlands from Jalisco, Michoacán, México (state), Puebla, and central western Veracruz north to southern Chihuahua and the Rio Grande. (See Fig. 24.)

Records of *quadrimaculata* from Texas are based on specimens collected many years ago. Horn (1873) mentioned specimens "said to have been collected in Texas near the Mexican border." Dillon's (1952) record is based on an old specimen in the United States National Museum labeled "Tex 6766, Collection C. V. Riley." In the absence of more recent records there is some doubt in my mind as to whether *quadrimaculata* actually occurs north of the Rio Grande, but inasmuch as there are reliable records from Nuevo León and Coahuila, there is no real reason to ignore the Texas records.

Vaurie (1950) erred in the identification of two of the localities recorded for *quadrimaculata* by earlier workers. Thus "pueblo del Puente" (given as "El Puente" by Vaurie) of Dugès (1869) is a locality in Hidalgo, not Nayarit, and the Almolonga of Champion (1892) is in all probability the settlement of that name in Veracruz, not that in southern Oaxaca.

Seasonal distribution. May 23—October 29.

Records. UNITED STATES: *Texas*: State label only, 1; "near the Mexican boundary" (Horn, 1873).

MÉXICO: Country label only, 20. *Aguascalientes*: El Retono, 10 mi. east of Aguascalientes, August, 1; 4 mi. southwest of Aguascalientes, 6100 ft., October, 1. *Chihuahua*: Salaices, 5200 ft., September, 1. *Coahuila*: 15 mi. south of Arteaga, July, 1. *Distrito Federal*: Chapultepec, Coapa, Guadalupe, San Ángel, Santa Fé, Tlalpam [Tlalpan], and district label only, July, August, October, 28. *Durango*: Durango, 10 (9 in July); 6 mi. south of Durango, August, 1; San Lucas [Ocampo], 6700 ft., August, 1; Sierra de Durango, 2; Villa [Ciudad] Lerdo, 8. *Guanajuato*: Guanajuato (Dugès, 1889). *Hidalgo*: Atotonilco el Grande (Peñafiel y Barranco, 1866); Mineral del Chico (Peñafiel y Barranco, 1866); Pachuca, May, June, 13; 16 mi. east of Pachuca, 7900 ft., June, 4; "pueblo del Puente" (Dugès, 1869). *Jalisco*: Guadalajara, September, 7; La Punta, August, 4; 4 mi. west of Mazamitla, 6800 ft., October, 11; Ojuelos de Jalisco, 7400 ft., August, 3; Sayula (Champion, 1892); Zapopan, September, 3; Zapotlán [Ciudad Guzman], 2. *México*: Amecameca, June, 1; Atlacomulco, 8500 ft., August, 2; Chapingo, September, 1; Cortez Pass, west slope, 9000 ft., July, 2; 4 mi. north and 10 mi. northwest of Ixtlahuaca, July, 60; San

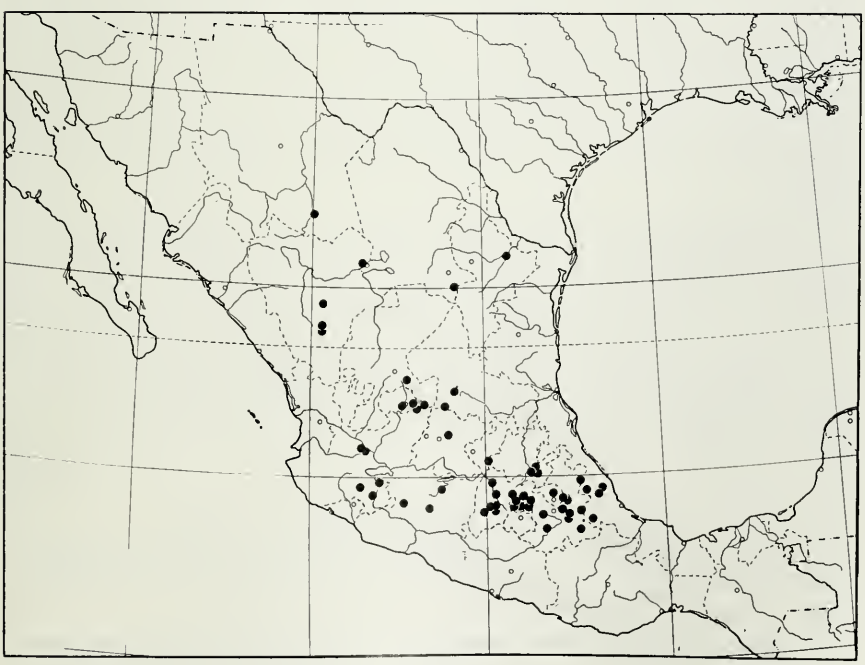


Fig. 24. Distribution of *Lytta quadrimaculata*.

Rafael, 8100 ft., September, 8; Temescaltepec, 3; Tlalnepantla, September, 1; Toluca and surrounding region (4 mi. east, 1.8 mi. southeast, 26 mi. south, 14 mi. west, and 14 mi. and 15 mi. northwest), July, August, 303; Zinacantepec, July, 8. *Michoacán*: Morelia, September, 33; Tacámbaro [de Codallos] (Champion, 1892); Tancítaro, 8600 ft., August, 3. *Nuevo León*: 15 mi. southwest of China, July, 1. *Puebla*: 5 mi. south of Acatzingo, July, 8; Amozoc, July, 42; Atlixco, 2; Esperanza, 10; Matamoros Izúcar [Izúcar de Matamoros] (Champion, 1892); Tecamachalco, July, 1; Tehuacán, 2; 5 mi. northeast of Teziutlán, 4700 ft., June, 9. *Querétaro*: 10 mi. east of San Juan del Río, 6500 ft., 7. *San Luis Potosí*: Hacienda de Bleados [Bledos?], 4; San Luis Potosí, 7. *Tlaxcala*: 4 mi. and 10 mi. east of Apizaco, July, 16; 2.5 mi. west of El Carmen, June, 12; 4 mi. northwest and 9 mi. east of Huamantla, June, July, 20. *Veracruz*: Almolonga, 1; Jalapa, 1; Limón, July, 21; Orizaba, 9; Perote, 8500 ft., July, 42. *Zacatecas*: Ojocaliente, September, 1.

Remarks. This is one of the most variable species of the genus *Lytta*. Variable characters include the color of the pubescence, legs, male antennae, and abdomen; elytral color pattern; shape of the male pygidium; and form of the aedeagus. In general the variation is geographical, with a considerable degree of concordance, tending to set off the population of Veracruz, Puebla, and Tlaxcala from the rest of the species.

Although I originally prepared a detailed analysis of variation in *quadrimaculata* for inclusion in the present revision, so much material from critical areas has accumulated in the past three years that it seems preferable to delay publication of this until all the data can be incorporated in it. I have described the first instar larva elsewhere (Selander, 1959).

The present location of Chevrolat's type is unknown to me. In the cases of *octomaculata* and *fasciolata*, all the type material has been destroyed. As neotype of *octomaculata* I have designated a male in the collection of the California Academy of Sciences labeled "Pachuca, 8000 ft., Hidalgo, July 1937, K. Maehler collection"; and as neotype of *fasciolata*, a male in the British Museum (Natural History) labeled "Mexico, Sallé collection." A type was probably never designated for *bifasciatus* as Dugès credited the species to Sturm. There are a few specimens in the Dugès collection at the Instituto de Biología in Mexico City that may belong to the series on which Dugès' description was based, but there is no way of establishing this with certainty. A neotype designation seems to be in order, then, and I have designated the neotype of *octomaculata* as the neotype of *bifasciatus* also.

Bionomics. Adults of this species are found on species of Papaveraceae and Compositae. The principal food plant seems to be *Argemone platy-*

ceras (Papaveraceae), the common prickly poppy of the Central Plateau. I have collected the beetles on this plant at a number of localities in the states of México, Puebla, and Tlaxcala. Adults also feed on other Papaveraceae, as shown by the fact that in 1957 I found an individual feeding on *Eschscholtzia* in Coahuila. In the same year I also found the species feeding on both *Argemone* and a species of Compositae at Amozoc, Puebla. Two other records of Compositae as food plants are in the literature: Peñafiel y Barranco (1866) reported it from *Viguiera dentata,* and Dugès (1869) reported it from *Bidens leucantha.* In the same paper Dugès also recorded the species from a "*Scymus.*" Chevrolat (1834) stated that his specimens were found on a species of "marguerite blanche." I have been unable to establish the identity of these last two plants.

According to my observations, pollen is the primary food of adults of *quadrimaculata,* although some petal tissue is also eaten, at least on *Argemone.* The adult beetles are relatively sluggish: when disturbed they will sometimes fly, but their usual reaction is to crawl to the edge of the flower upon which they have been feeding and to drop to the foliage beneath or to the ground. Their color pattern offers fairly effective camouflage when they are feeding at the centers of *Argemone* flowers.

Two other species of the Variabilis Group feed on *Argemone;* where the range of *quadrimaculata* overlaps the ranges of these, it is common to find individuals of *quadrimaculata* feeding on the same flowers with individuals of one or the other of these species. In the states of Puebla and Tlaxcala the species associated with *quadrimaculata* in this way is *ebenina.* In the state of México it is *plumbea.* Both associates appear to have the same feeding habits and behavior as *quadrimaculata* except that they are slightly more active and alert. No antagonism between individuals of different species has been observed, nor do the individuals of one species seem to be in the least disturbed by the presence of the others. In one instance I saw a male *quadrimaculata* mount a female *ebenina* and unsuccessfully attempt copulation. Normally, however, males confine their mating attempts to females of their species.

In 1957 I obtained eggs from adults of *quadrimaculata* collected live July 14 at Amozoc, Puebla. The eggs were deposited sometime between July 20 and 24 (the exact date was not noted); they produced larvae July 30.

Lytta (*Paralytta*) *proteus* Haag-Rutenberg

Lytta proteus Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 37.

Cantharis sobrina Dugès, 1881, La Naturaleza, vol. 5, p. 143, pl. 4, fig. 6; 1889, An. Mus. Michoacano, vol. 2, p. 97.

Cantharis bipartita Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 106.

Cantharis proteus, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 448, pl. 20, figs. 22-23.

Black. Head with vertex and center of frontal area brownish orange varying to completely black except for an elongate orange frontal spot. Pronotum varying from brownish orange with a black discal spot on each side at middle to completely black. Elytra brownish orange with apex to as much as apical two-thirds black, or black with only humeri orange, or completely black. Wings dark brown. Pubescence piceous on head; usually paler, varying to silver or gold, on pronotum (especially basal half); silver on elytra and under surface, producing a dusty effect macroscopically where surface is black. Length: 8 mm.-16 mm.

Head smooth, shiny, moderately coarsely, deeply, densely punctate; punctures not crowded except on lower frontal area; pubescence moderately long, rather silky, more or less erect. Pronotum as in Figure 174, usually longer than wide (rarely as wide as long); basal margin very shallowly emarginate at center; calluses large, strongly elevated; surface smooth, shiny, coarsely, densely punctate; pubescence as on vertex, tending to slant toward callus on each side. Elytra rugose, impunctate; pubescence semierect, conspicuous, longer on sutural half of each elytron than on lateral half; average distance between setae near lateral margin about equal to length of a single seta.

Male. Head behind eyes not noticeably flatter than in female. Antennae (Fig. 79) reaching or slightly surpassing base of pronotum; segments III–VII very weakly incrassate, as wide as or barely wider than VIII–X, which are subcylindrical. Fifth abdominal sternum moderately deeply, triangularly emarginate. Emargination of sixth sternum (Fig. 236) extremely deep, U-shaped, extending nearly three-fourths length of sternum; sternum impressed at center; lateral lobes of sternum strongly produced as slender processes, bluntly rounded at apex. Pygidium (Fig. 210) weakly produced, acute at apex. Genitalia as in Figure 309; gonostyli in lateral view extremely broad, truncate; aedeagus with a single ventral hook; dorsal hook unusually massive.

Female. Antennae as in Figure 125, not reaching base of pronotum. Sixth abdominal sternum truncate at apex; margin turned strongly dorsad so that sternum is strongly cupped (as in *quadrimaculata* and *scitula*).

Type locality. Of *proteus*, México; of *sobrina*, Pénjamo, Guanajuato; of *bipartita*, Chilpancingo, Guerrero.

Geographic distribution. Southern Nayarit and central southern Guanajuato to southeastern Guerrero, northern Oaxaca, and southwestern Puebla. (See Fig. 25.)

Seasonal distribution. September 3—December 2.

Records. MÉXICO: Country label only, 4. *Colima*: Colima, 2; Tonila, 5. *Distrito Federal*: Mexico City (Champion, 1892); Tlalpan, September,

3. *Guanajuato*: Pénjamo, 1. *Guerrero*: Acahuizotla, 3500 ft., October, 4; Chilpancingo, 4600 ft., October, 2; Garcidueña (not located) (Dugès, 1889); Hacienda de la Imagen (Champion, 1892); Rincón, 2800 ft., October, 3; Taxco, October, 2; Tierra Colorado, 2000 ft., October, 2; Venta de Peregrino, 2. *Jalisco*: Guadalajara, 2 (1 in September); Zapopan, September, 1. *México*: [San Juan] Teotihuacán, November, 4; Temescaltepec, 12. *Michoacán*: 7 mi. south of Arteaga, 3100 ft., December, 5; Jungapeo, September, 1; Tacámbaro, October, 1. *Morelos*: Alpuyeca, 1100 m., October, 2; Tepoztlán, 1750 m., September, October, 4. *Nayarit*: 4 mi. south of Santa Isabel, October, 26; 4 mi. northwest of Tepic, October, 51. *Oaxaca*: Huajuapan [de León], 1957 m., September, 1. *Puebla*: [Izúcar de] Matamoros, 7 (3 in September); Puebla, 1.

Remarks. While possessing the diagnostic features of the Quadrimaculata Subgroup, *proteus* is not particularly close morphologically to any of the other included species. The presence of only a single ventral hook on the aedeagus at first suggested a possible relationship between *proteus* and *bipuncticollis* (in the Koltzei Subgroup), but a study of other characters has made it apparent that the loss of one of the hooks must have taken place independently in these two species.

Although color variation in *proteus* is more or less continuous, it is

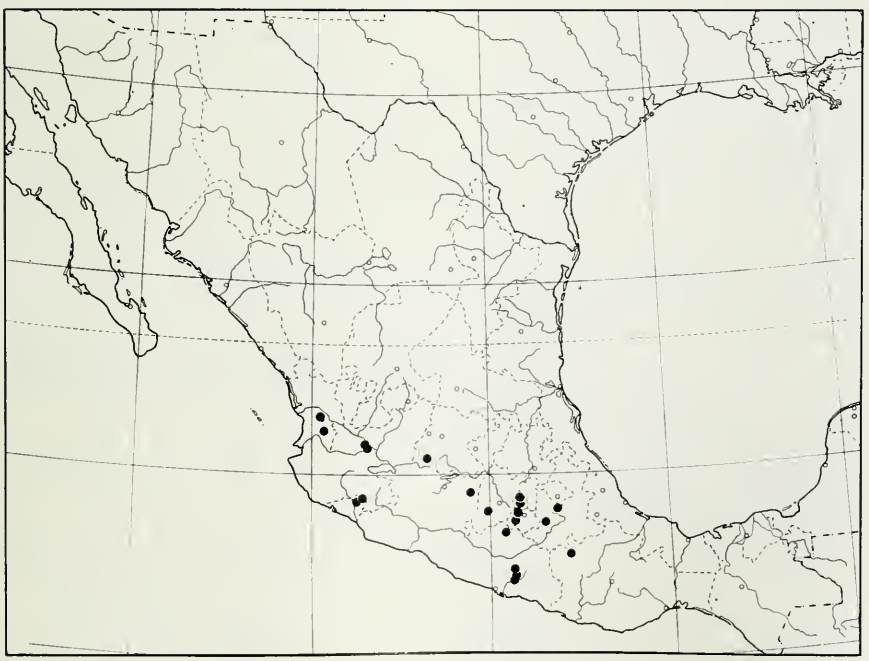


Fig. 25. Distribution of *Lytta proteus*.

useful to treat it in terms of varieties, as outlined in Table III. These varietal categories readily accommodate the vast majority of specimens examined; only occasionally has it been necessary to make an arbitrary assignment.

As shown in Table III, specimens with a black pronotum (varieties *a* and *b*) and those with an orange pronotum (varieties *c* through *f*) are about equally represented in the material studied. Some correlation exists between the color of the pronotum and that of the elytra; this is indicated by the fact that a good majority of the specimens with a black pronotum have entirely black elytra, while a majority of those with an orange pronotum have some orange on the elytra as well. Among the specimens with an orange pronotum, the vertex varies in color regardless of the color of the elytra. Unexpectedly, the vertex is orange in a larger proportion of the specimens with entirely black elytra than of those with some orange on the elytra. It is noteworthy that the vertex is always black when the pronotum is black, with the result that two of the eight possible color combinations are eliminated.

From the data contained in Table III it is concluded that the genetic basis of color variation in *proteus* is fairly complex and that an interaction of factors is probably involved.

When analyzed on the basis of samples from individual states (Table IV), color variation of the head, pronotum, and elytra, whether treated separately or in terms of the various combinations represented by the varieties just discussed, seems to exhibit no significant correlation with geographic distribution. Many additional data are needed, however, before this point can be established with certainty.

As lectotype of *proteus* I have designated a specimen of variety *f* in the Zoologische Staatssammlung in Munich (Haag-Rutenberg collection).

TABLE III. COLOR VARIETIES OF *Lytta proteus* AND THEIR FREQUENCY DISTRIBUTION IN MATERIAL STUDIED

	COLOR VARIETY	NUMBER OF SPECIMENS	PERCENTAGE OF SPECIMENS
Pronotum (and vertex) black			
Elytra black	*a*	56	38.4
Elytra in part orange	*b*	19	13.0
Pronotum orange, bimaculate			
Elytra black			
Vertex black	*c*	2	1.4
Vertex orange	*d*	16	11.0
Elytra in part orange			
Vertex black	*e*	29	19.9
Vertex orange	*f*	24	16.4

TABLE IV. FREQUENCY DISTRIBUTION OF COLOR VARIETIES IN SAMPLES OF *Lytta proteus*

SAMPLE	*a*	*b*	*c*	*d*	*e*	*f*
Nayarit	34	6			24	13
Jalisco	2		1			
Guanajuato	1					
Colima	4	1		1		1
Michoacán				1		6
México and Distrito Federal	5	1	1	10	2	
Morelos	2	4				
Puebla	2	5			1	
Oaxaca		1				
Guerrero	4	1		4	2	2
State unknown	2					2

The types of *sobrina* and *bipartita* have been lost. As neotype of *sobrina* I have designated a male of variety *a* from Pénjamo, Guanajuato. This specimen was formerly in the collection of Sallé, to whom it was probably sent by Dugès. As neotype of *bipartita* I have designated a male of variety *f* from Rincón, Guerrero. Both neotypes are now in the British Museum (Natural History).

RETICULATA GROUP

Colors nonmetallic; elytra black. Head with or without a pale frontal spot. Head quadrate, about as long as wide; frontal area flattened; surface minutely granular, sparsely micropunctate. Male head behind eyes more densely micropunctate, more finely punctate, and duller than at center of vertex, clothed with shorter (very short) setae, but not flattened or impressed. Male antennae reaching base of pronotum or extending a little beyond; segments elongate; IV–VII weakly to strongly incrassate. Eyes broad, prominent. Pronotum subcircular or transversely oval; disk lacking calluses. Elytra strongly reticulate, minutely granular, dull, subimpunctate, essentially glabrous. Legs unmodified. Tarsal pads moderately developed; pale pubescence (pad) of first segment of middle tarsi limited to apical half or third, of hind tarsi to extreme apex. Tarsal claws cleft to base, with blades subequal in length. Male fifth abdominal sternum shallowly emarginate. Male sixth sternum shallowly sulcate on midline; emargination lined with short setae. Pygidium not produced. Male genitalia with gonostyli stocky, truncate or obtusely rounded at apex; gonocoxal plate with lateral margins extending mesad at base as short, blunt processes; aedeagus stocky, deep, with two ventral hooks of nearly equal size.

Remarks. This group contains seven species, none of which is particularly strongly differentiated morphologically from the others. These

may be divided into two subgroups on the basis of characters of color and a rather subtle difference in the form of the gonostyli of the male genitalia. The distribution of the group is centered in the southwestern United States and adjacent northern México, with an outlying species, *corallifera*, of more southern distribution in San Luis Potosí and Hidalgo (Fig. 4).

The strongly reticulate, black elytra distinguish members of the Reticulata Group from all other members of the genus *Lytta* except three species (*magister*, *vulnerata*, and *margarita*) of the Magister Group. The relationships of the Reticulata Group are clearly with the Variabilis Group. As mentioned before, the two groups could easily be treated as a single unit, since they agree in most characters, including the peculiar modification of the head in the male.

The only species of the Reticulata Group whose host plant relationships are known is *reticulata*, which feeds on Convolvulaceae.

Key to Subgroups

1. Pronotum unicolored; front of head between eyes entirely black or with at most a vaguely defined orange suffusion; male genitalia with gonostyli straight, not bowed (as in Fig. 310a) ..... Reticulata Subgroup (p. 102)

   Pronotum bicolored; front of head between eyes largely orange or with a well-defined orange spot; male genitalia with gonostyli bowed (as in Fig. 314a) ..... Deserticola Subgroup (p. 108)

Reticulata Subgroup

Front of head between eyes entirely black or with a vaguely defined orange suffusion (some *arizonica*). Pronotum unicolored. Legs entirely black. Male genitalia with gonostyli straight, not bowed.

Remarks. This subgroup contains the species *reticulata*, *agrestis*, *mirifica*, and *arizonica*. The last three of these appear to be quite localized in distribution and are rare in collections.

Key to Species

1. Entirely black; elytra coarsely reticulate ..... *reticulata* (p. 103)

   Pronotum orange 2

2. Head orange above eyes ..... *agrestis* (p. 105)

   Head entirely black 3

3. Pronotum subcircular (Fig. 175); elytra coarsely reticulate, most cells at least .5 mm. in diameter. Rio Grande region near El Paso, Texas ..... *mirifica* (p. 107)

Pronotum transversely suboval (Fig. 176); elytra finely reticulate, most cells less than .5 mm. in diameter. Northwestern Arizona..... .....*arizonica* (p. 108)

Lytta (*Paralytta*) *reticulata* Say

Lytta reticulata Say, 1824, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 305. Horn, 1872, Rept. U.S. Geol. Surv. 1871, p. 390. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 351. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 85.

Cantharis reticulata, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 111; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298. Milliken, 1921, U.S. Dept. Agr. Bull. no. 967, p. 5, fig. 2.

Black or piceous. Head lacking a pale frontal spot. Wings dark brown. Length: 10.5 mm.-22.0 mm.

Head alutaceous, moderately shiny, deeply, densely punctate; pubescence short, erect. Pronotum subcircular, barely to one-tenth wider than long; disk convex, often impressed on each side behind middle; surface sculpture and pubescence as on vertex except at center of disk, which is impunctate and glabrous, punctures denser behind middle than before. Scutellum densely punctate and pubescent. Elytra coarsely reticulate, most cells .5 mm. or more in diameter. Hind tibiae moderately bowed. Outer hind tibial spur no longer than inner spur, two to three times as wide. Pad of first segment of middle tarsi limited to apical third.

Male. Antennae (Fig. 80) with intermediate segments only slightly incrassate; IV–VI no wider or longer than VII. Emargination of sixth abdominal sternum (Fig. 237) moderately deep, broadly triangular; lateral lobes of sternum well rounded. Genitalia as in Figure 310; gonostyli truncate.

Female. Antennae as in Figure 127.

Type locality. "Inhabits Arkansa" (Say, 1824).

Geographic distribution. Great Bend section of Texas north through the Great Plains to western Nebraska and southwestern Wyoming. (See Fig. 26.)

Inasmuch as there is no other evidence that this species ranges west of the Great Plains, I have disregarded two specimens in the Carnegie Museum (Klages collection) labeled Monticello, San Juan County, Utah, August 1920.

Seasonal distribution. April (Dillon, 1952)—October. May 15 is the earliest collection date of any specimen examined.

Records. UNITED STATES: *Colorado*: State label only, 2; Akron, July, 14; Fort Morgan, July, 2; 15 mi. west of Fort Morgan, July, 1; Fountain Valley School, Colorado Springs, August, 1; Hardin, August, 1;

Hudson, July, 1; La Junta, August, 1; Logan County, August, 1; Roggen, July, 1; Sterling, September, 1; Wray, July, 3. *Kansas*: State label only, 7; Clark County, 1962 ft., June, 2; Garden City, June, July, 6; Gove County, 2500 ft., 2; Hamilton County, 3350 ft., August, 3; Seward County, July, 1; Syracuse, May, 2; Wallace County, 3000 ft., 3. *Nebraska*: 32 mi. south of Gordon, August, 5; "Sand Hills," September, 1. *New Mexico*: State label only, 1; 5 mi. east of Acme, August, 75; Portales, July, 12; Roosevelt County, July, 1; Tucumcari, June, 3. *Oklahoma*: State label only, 1; Woodward, June, 1. *Texas*: Amarillo, July, 1; Brownfield, May, 4; Canadian, June, 1; Ector County, May, 5; Higgens, May, 1; Lamesa (Dillon, 1952); Presidio (Dillon, 1952).

Remarks. This is the most widely distributed and most commonly collected species of the Reticulata Group. It is easily recognized since it is the only entirely black species of *Lytta* with reticulate elytra.

The first instar larva of *reticulata* has been described by MacSwain (1956). Say's type has been lost. As neotype I have designated a male in the Snow collection, University of Kansas, from 32 mi. south of Gordon, Sheridan County, Nebraska.

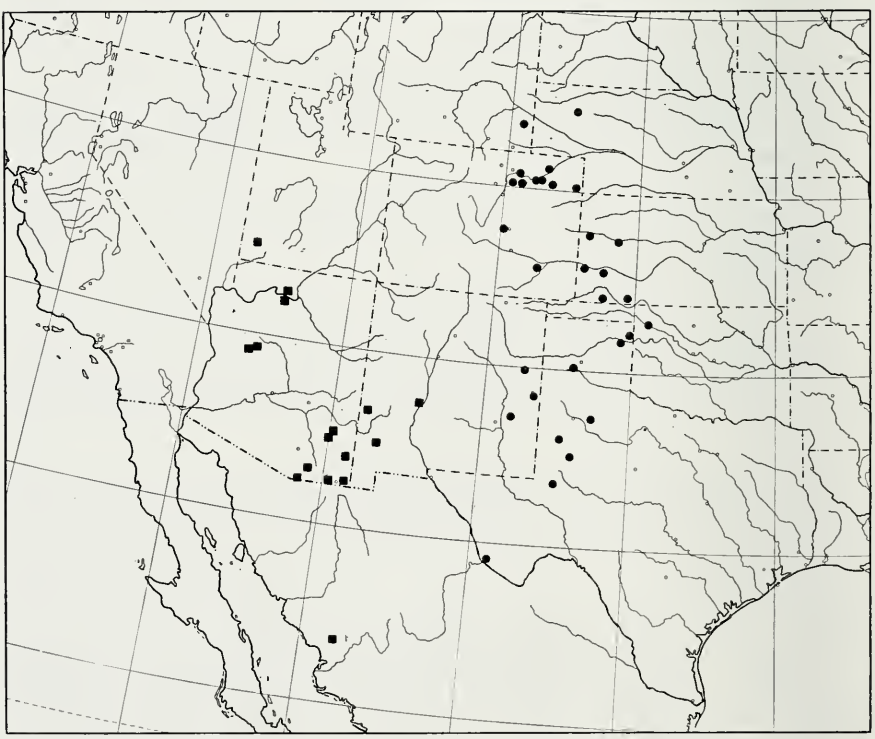


FIG. 26. Distribution of *Lytta reticulata* (circles) and *Lytta deserticola* (squares).

Bionomics. Milliken (1921) reported that in the course of his work at Garden City, Kansas, "adults were taken on the bush morning-glory (*Ipomoea leptophylla*), excepting one which was found on alfalfa." Included in the material from Garden City which I have studied is one of Milliken's specimens from bush morning-glory (Convolvulaceae), two specimens collected by him on "creeping bur," and a specimen without the collector's label from sugar beet. Dillon (1952) reported "wild morning-glory" as a host plant in Texas.

Lytta (*Paralytta*) *agrestis* (Fall)

Cantharis agrestis Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 302.
Lytta agrestis, Maehler, 1939, Pan-Pacific Ent., vol. 15, p. 65.

Black. Vertex and upper frontal area of head, entire pronotum, and base of elytra reddish orange. Orange area of elytra not reaching lateral margins, extending farthest posteriad along subsutural nervule, generally conspicuous but sometimes almost piceous and rather poorly defined. Wings dark brown. Length: 13 mm.-17 mm.

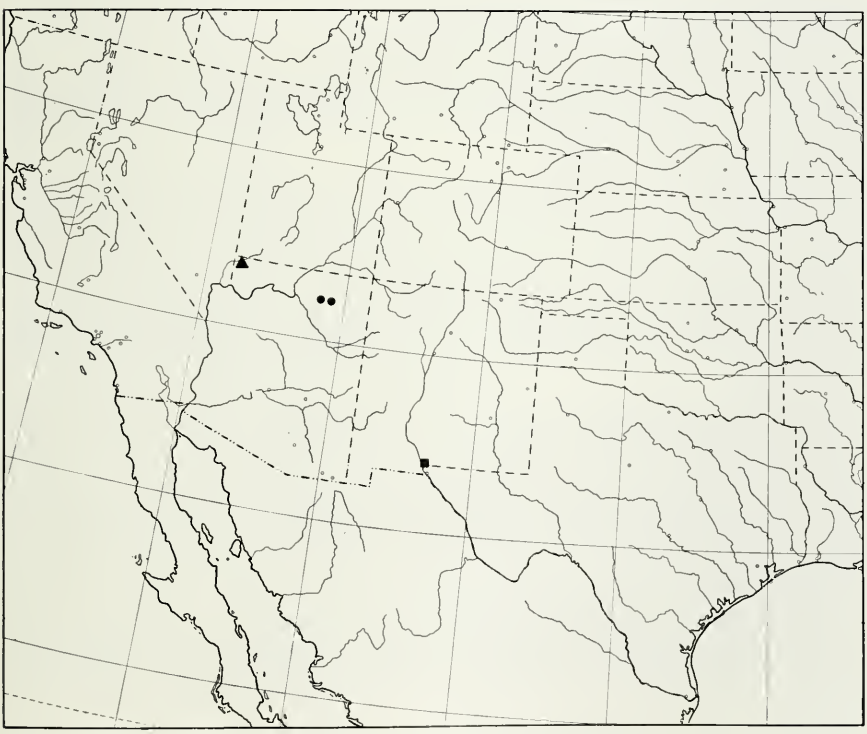


Fig. 27. Distribution of *Lytta agrestis* (circles), *Lytta mirifica* (square), and *Lytta arizonica* (triangle).

Head smooth, shiny, moderately coarsely, weakly, sparsely, irregularly punctate; pubescence short, erect, especially distinct against pale area. Pronotum subcircular, one-tenth or less wider than long; disk evenly, weakly convex, a shallow fovea on each side behind middle; surface sculpture and pubescence as on vertex. Scutellum having a few punctures and setae. Elytra moderately coarsely reticulate; reticulations intermediate in coarseness between those of *reticulata* or *mirifica* and *deserticola* or *arizonica*. Outer hind tibial spur longer than inner spur, three to four times as wide. Pad of first segment of middle tarsi limited to apical third or half.

Male. Antennae (Fig. 81) with intermediate segments moderately incrassate; V–X progressively shorter and narrower. Emargination of sixth abdominal sternum (Fig. 238) moderately deep, somewhat rounded; lateral lobes of sternum broadly rounded. Genitalia as in Figure 311; gonostyli truncate.

Female. Antennae as in Figure 128.

Type locality. Arizona.

Geographic distribution. Painted Desert, in the Navajo country of northeastern Arizona. (See Fig. 27.)

Seasonal distribution. July 13—August 27.

Records. UNITED STATES: *Arizona*: State label only, 6 (including 2 cotypes); Painted Desert, August, 2; Tuba City, 6 (1 in July); 20 mi. east of Tuba City, July, 3.

Remarks. The elytra give the impression of having been washed basally with some of the orange color of the pronotum. Heretofore, this feature has seemed diagnostic of *agrestis,* but it is now known to occur also, in a much less well-marked form, in some *mirifica* and *arizonica.* Moreover, variation in the shade and extent of the orange elytral marking in *agrestis* is such that individuals with entirely black elytra will probably be found eventually.

The specimens from 20 mi. east of Tuba City, Arizona, are three of four males previously recorded by Maehler (1939). These were collected July 26, 1937, and July 27, 1937, not June 26, 1938, as stated by Maehler. Two of the specimens are in the American Museum of Natural History; the other specimen is in the collection of the California Academy of Sciences.

Agrestis was described by Fall from three specimens taken at an unrecorded locality in Arizona. Two of these specimens are in the United States National Museum. The type is in the Museum of Comparative Zoology.

Lytta (*Paralytta*) *mirifica* Werner

Lytta mirifica Werner, 1950, Psyche, vol. 57, p. 133, figs. 1, 3.

Black. Head lacking a pale frontal spot. Pronotum dark reddish orange. Immediate base of elytra sometimes suffused with orange. Wings nearly colorless except for clouded, light brown apex. Length: 14 mm.-21 mm.

Head alutaceous, moderately shiny, coarsely, deeply, sparsely to moderately densely punctate, subglabrous. Pronotum (Fig. 175) subcircular, not appearing transverse, averaging (eight specimens) .08 (.03-.11) wider than long; sides rounded but with a suggestion of lateral angles just before middle; disk evenly, weakly convex, a shallow fovea or broad impression on each side behind middle; surface as on vertex but more regularly sculptured; punctures and setae confined mainly to sides. Scutellum rather narrow, rounded, moderately densely punctate, generally foveate, clothed with short setae. Elytra coarsely reticulate, most cells .5 mm. or more in diameter. Outer hind tibial spur longer than inner spur, two to three times as wide. Pad of first segment of middle tarsi limited to apical third or half.

Male. Antennae (Fig. 82) with intermediate segments slightly incrassate; V–X progressively a little shorter and narrower. Emargination of sixth abdominal sternum (Fig. 239) moderately deep, broadly triangular; lateral lobes of sternum broadly rounded. Genitalia as in Figure 312; some variation present in the shape of the gonocoxal piece; gonostyli obtusely rounded at apex.

Female. Antennae as in Figure 129. Genitalia with each gonocoxite consisting of a single, undivided sclerite.

Type locality. Anthony, New Mexico.

Geographic distribution. Known only from the type locality, in the Rio Grande Valley. (See Fig. 27.)

Seasonal distribution. May 23—July 15.

Records. UNITED STATES: *New Mexico*: Anthony, May–July, 90.

Remarks. This species is very similar to its presumed nearest relative, *arizonica*. It differs mainly in having the pronotum more nearly circular in shape and of a slightly different color and the elytra more coarsely reticulate. *Mirifica* and *arizonica* are the only species of *Lytta* possessing the combination of black head, orange pronotum, and reticulate elytra.

The only material of this species known at the present time is a series of more than 100 specimens collected at the type locality in 1941 by R. H. Crandall. The type is in the Museum of Comparative Zoology.

Lytta (*Paralytta*) *arizonica* Selander

Lytta arizonica Selander, 1957, Proc. Ent. Soc. Washington, vol. 59, p. 141.

Black. Head suffused on frontal area with dark orange or piceous. Pronotum yellow-orange. Immediate base of elytra sometimes suffused with orange. Wings uniformly dark brown. Length: 13 mm.-20 mm.

Differs structurally from *mirifica* as follows.

Pronotum (Fig. 176) transversely oval, averaging (13 specimens) .15 (.11-.22) wider than long; sides more evenly rounded, particularly from middle to apex. Scutellum wider. Elytra rather finely reticulate, all or nearly all cells less than .5 mm. in diameter.

Male. Genitalia with gonocoxal piece tending to be slightly shorter and more truncate.

Female. Genitalia with anterior end of each gonocoxite separated from posterior portion by a membranous area.

Type locality. Littlefield, Arizona.

Geographic distribution. Valley of the Virgin River in northwestern Arizona. (See Fig. 27.)

Seasonal distribution. The type series was collected April 20.

Records. UNITED STATES: *Arizona*: Littlefield, April, 13 (type series).

Remarks. The orange color at the base of the elytra, when present, is scarcely noticeable without close inspection. The same is true in *mirifica*. In *agrestis*, on the other hand, it is conspicuous even when least developed.

The type of *arizonica* is in the American Museum of Natural History (examined).

Deserticola Subgroup

Front of head between eyes largely orange or with a well-defined orange spot. Pronotum bicolored. Male genitalia with gonostyli bowed in dorsal or ventral view.

Remarks. This subgroup contains the species *cribrata*, *deserticola*, and *corallifera*. The first of these agrees with the species of the Reticulata Subgroup in the form of the male sixth abdominal sternum and in having entirely black legs. *Deserticola* and *corallifera* differ from all other species of the Reticulata Group in having this sternum deeply, roundly emarginate and the femora largely orange.

Key to Species

1. Femora black; emargination of male sixth abdominal sternum moderately deep, broadly triangular; elytra finely reticulate; head black

with an orange frontal spot.....*cribrata* (p. 109)

Femora orange with black apex and base; emargination of male sixth abdominal sternum deeper, rounded.....2

2. Elytra finely reticulate, most cells less than .5 mm. in diameter; head orange with black at sides of frontal area. Southwestern United States and Sonora.....*deserticola* (p. 111)

Elytra coarsely reticulate, most cells at least .5 mm. in diameter; head with orange confined to dorsal margin (including tempora) and a large frontal spot. San Luis Potosí and Hidalgo...*corallifera* (p. 112)

Lytta (*Paralytta*) *cribrata* LeConte

Lytta cribrata LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 447. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 352.

Cantharis cribrata, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 111; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298.

Cantharis intricata Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 441, pl. 20, fig. 18. *New synonymy.*

Cantharis pilsbryi Skinner, 1906, Ent. News, vol. 17, p. 217.

Lytta intricata, Vaurie, 1950, Amer. Mus. Novitates, no. 1477, p. 43.

Black. Head with a diamond-shaped orange frontal spot which is three-fifths or more as wide as frontal area between eyes. Pronotum bordered at sides with orange, except at base and apex. Wings uniformly dark brown or very pale brown with darker costal region and apex. Length: 18 mm.-20 mm.

Head smooth, shiny, very finely, weakly, very sparsely punctate, subglabrous; punctures slightly deeper and more distinct than in *deserticola;* tempora more quadrate. Pronotum subcircular, one-tenth to one-fifth wider than long; sides more evenly rounded than in *deserticola;* disk evenly convex, a small impression near each lateral margin at and behind middle; surface as on vertex but punctures confined to sides. Scutellum as in *deserticola.* Elytra rather finely reticulate, most cells less than .5 mm. in diameter. Outer hind tibial spur slightly longer than inner spur, about twice as wide. Pad of first segment of middle tarsi limited to apical half.

Male. Antennae as in *deserticola* (see Fig. 83) but longer, reaching one or two segments beyond base of pronotum, and with segments IV–VI in some specimens not as strongly incrassate, no wider than distal segments. Emargination of sixth abdominal sternum moderately deep, broadly triangular, as in *mirifica* (see Fig. 239). Genitalia as in Figure 313; gonostyli truncate.

Female. Antennae as in *deserticola* (see Fig. 130), but longer.

Type locality. Of *cribrata*, vicinity of Eagle Pass, Texas; of *intricata*, Villa [Ciudad] Lerdo, Durango; of *pilsbryi*, High Bridge, Pecos River, Texas.

Geographic distribution. Central Chihuahua and northeastern Durango northeast to the Chinati Mountains and Eagle Pass, Texas. (See Fig. 28.)

Seasonal distribution. August 15—October 14. Skinner's (1906) record of April 27 for the type series of *pilsbryi* seems doubtful, especially since there is no date given on the label of the cotype specimen I have studied.

Records. UNITED STATES: *Texas*: Chinati Mountains, 6 (5 in October); High Bridge, Pecos River, 1 (cotype of *pilsbryi*); vicinity of Eagle Pass (LeConte, 1853).

MÉXICO: *Chihuahua*: 12 mi. northwest of Gran Morelos, August, 4; Ojinaga, October, 1. *Durango*: Villa [Ciudad] Lerdo, 2 (paratypes of *intricata*).

Remarks. The black vertex and femora at once separate *cribrata* from both *deserticola* and *corallifera.* In addition, the pronotum is more extensively marked with black than in either of these species. The form of the emargination of the sixth abdominal sternum of the male of *cribrata* is distinctive within the limits of the subgroup.

Two paratypes of *intricata* from Durango differ from specimens of *cribrata* from Texas and Chihuahua only in that their wings are pale brown with darker costal region and apex rather than uniformly dark

FIG. 28. Distribution of *Lytta cribrata* (circles) and *Lytta corallifera* (squares).

brown. According to C. M. F. von Hayek (*in litt.*), the wing color of the type of *intricata* is the same as that of the paratypes studied.

On the basis of a cotype in the American Museum of Natural History, *pilsbryi* differs in no way from *cribrata*. It has already been reduced to synonymy by Dillon (1952).

A specimen of *Lytta* said to approach the type of *cribrata* was recorded from 20 mi. east of Tuba City, Arizona, by Maehler (1939), but from distributional evidence it seems unlikely that this was the species actually represented.

The type of *cribrata* is in the Museum of Comparative Zoology; the type of *intricata* is in the British Museum (Natural History); and the type of *pilsbryi* is in the collection of the Philadelphia Academy of Sciences.

Lytta (*Paralytta*) *deserticola* Horn

Lytta deserticola Horn, 1870, Trans. Amer. Ent. Soc., vol. 3, p. 90. .
Cantharis deserticola, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 111; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 310. Wickham, 1896, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 4, p. 311. Cockerell, 1898, New Mexico Agr. Exp. Sta. Bull. no. 28, p. 173. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296. Fall and Cockerell, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 210.

Black. Vertex and frontal area of head orange; frontal area between eyes bordered at sides with black, each border at epistomal suture about one-third as wide as frontal area, becoming narrower above. Pronotum reddish orange, finely margined with black; two or four small black spots in a transverse row at middle of disk; spots variable in size, at one extreme reduced to faint dots, at the other fused to one another or with apical black border, or both; when four spots are present, mesal pair usually larger than lateral pair (Fig. 177). Wings dark brown. Femora reddish orange with broadly black base and apex. Basal black area of fore femora extending to, or nearly to, middle of segment; of middle femora somewhat smaller; of hind femora confined to extreme base of segment or absent. Length: 11 mm.-23 mm.

Head smooth, shiny, very finely, weakly, very sparsely punctate, subglabrous. Pronotum (Fig. 177) subcircular, one-tenth or less wider than long; disk evenly convex, one or two shallow impressions on each side near middle; surface as on vertex but punctures confined to sides. Scutellum with a few fine punctures and setae and a median fovea or sulcus. Elytra rather finely reticulate, most cells less than .5 mm. in diameter. Outer hind tibial spur slightly longer than inner spur, about twice as wide. Pad of first segment of middle tarsi limited to apical half.

Male. Antennae (Fig. 83) with intermediate segments moderately incrassate; V–X progressively shorter and narrower. Emargination of sixth

abdominal sternum (Fig. 240) deep, rounded; lateral lobes of sternum bluntly rounded, not convergent. Genitalia as in Figure 314; gonostyli truncate; gonocoxal piece unusually short.

Female. Antennae (Fig. 130) with segments VI–VIII each barely shorter than IV or V; IX and X slightly shorter than VIII.

Type locality. South of Fort Whipple, Arizona.

Geographic distribution. Southern Sonora north through southeastern Arizona and southwestern New Mexico to southwestern Utah (Iron County). (See Fig. 26.)

Seasonal distribution. July—September 28.

Records. UNITED STATES: *Arizona*: Bisbee, 1; Chiricahua Mountains, August, 1; Cochise County, 1; south of Fort Whipple (Horn, 1870); Graham Mountains, 9000 ft., September, 1; Grand Canyon, September, 1; Grand Canyon Rim Camp Ground, August, 1; Grand Canyon, north rim, August, 1; Nogales, 2; 5 mi. west of Portal, 5400 ft., August, 1; San Bernardino Ranch, 3750 ft., Cochise County, August, 2; Santa Rita Mountains, 1; Skull Valley, September, 1; Thatcher, September, 1. *New Mexico*: State label only, 10 (1 in July); Cooney, August, 2; Socorro County, 1; Walnut Creek, near Silver City (Cockerell, 1898). *Utah*: Antelope Springs, Iron County, 2.

MÉXICO: *Sonora*: State label only, 3; Río Mayo, September, 1.

Remarks. The orange vertex and femora and the more deeply, roundly emarginate sixth abdominal sternum of the male easily distinguish this species and *corallifera* from other members of the Reticulata Group. From *corallifera*, *deserticola* is separated primarily by its more finely reticulate elytra, by differences in the color pattern of the head and pronotum, and by the form of the emargination of the sixth abdominal sternum of the male.

The type of *deserticola* is in the collection of the Academy of Natural Sciences of Philadelphia.

Lytta (*Paralytta*) *corallifera* Haag-Rutenberg

Lytta corallifera Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 35.

Cantharis corallifera, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 441, pl. 20, fig. 17.

Black. Tempora and top of head (except at midline) reddish orange; frontal area with an elongate orange spot which is three-fifths as wide as frontal area between eyes and is narrowly produced almost to epistoma. Pronotum bordered at sides with reddish orange, as in *cribrata*, but borders extending onto base of pronotum, where they are separated only by a narrow black stripe on midline. Wings pale brown, with darker costal

region and apex. Femora reddish orange with broadly black base and apex; basal black area larger and more variable in size than in *deserticola;* orange area of fore femora sometimes more extensive than that of middle femora. Hind tibiae sometimes in part orange. Length: 16 mm.-23 mm.

Head smooth, shiny, very finely, weakly, very sparsely punctate, subglabrous; punctures more distinct than in *deserticola.* Pronotum subcircular, one-tenth to nearly one-fifth wider than long; disk evenly convex, several small impressions near each lateral margin at and behind middle; surface as on vertex but punctures confined to sides. Scutellum as in *deserticola.* Elytra coarsely reticulate (as in *reticulata* and *mirifica*), most cells .5 mm. or more in diameter; basal sixth of elytra not or only feebly reticulate. Outer hind tibial spur slightly longer than inner spur, two to three times as wide. Pad of first segment of middle tarsi limited to apical half.

Male. Antennae as in *deserticola* (see Fig. 83). Emargination of sixth abdominal sternum (Fig. 241) very deep, definitely semicircular, at least as wide as long; lateral lobes of sternum narrow, convergent. Genitalia as in Figure 315; gonostyli truncate.

Female. Not studied.

Type locality. México.

Geographic distribution. Central Plateau of México from southwestern San Luis Potosí to northern Hidalgo. (See Fig. 28.)

Seasonal distribution. The single specimen studied for which seasonal data were recorded was collected August 27.

Records. MÉXICO: Country label only, 2. *Hidalgo*: Jacala, August, 1. *San Luis Potosí*: Sierra de San Miguelito, 1. *State unknown*: "Alton. s., *ex* Coll. J. Sturm," 1.

Remarks. The female of this species apparently has not been collected. The specimen from Sierra de San Miguelito is one of four studied by Champion. As lectotype I have designated a specimen in Zoologische Staatssammlung in Munich (Haag-Rutenberg collection) labeled "Mexico, Baden."

MAGISTER GROUP

Head when black always with a pale frontal spot. Head and pronotum subglabrous, those setae present very short, erect. Male head not modified behind eyes. Male antennae reaching at least as far as base of pronotum; male intermediate segments (IV–VII or VIII) weakly to strongly incrassate; distal segments slightly longer than wide. Eyes narrow. Pronotum hexagonal to subcircular, lacking calluses. Elytra either rugose or reticulate; surface impunctate, essentially glabrous. Male

middle tibiae sometimes impressed apically. First segment of male middle tarsi never modified. Male fifth abdominal sternum shallowly emarginate or entire. Pygidium often produced, especially in male (always distinctly produced if pronotum is not hexagonal). Aedeagus with two ventral hooks, the second one sometimes greatly enlarged.

Remarks. This group contains nine species, divided equally into three subgroups. Its range extends from the peninsula of Baja California and the extreme northwestern corner of mainland México to British Columbia (Fig. 3).

In the adult stage the Magister Group is most clearly distinguished from the Variabilis and Reticulata groups by the absence of modification of the male head behind the eyes. From the Fulvipennis Group it is distinct in having the pronotum hexagonal or the male pygidium produced, or both. This same combination of characters will distinguish it from the species of the Nitidicollis Group except *moesta*, which is at once distinct in having the blades of the tarsal claws fused. The known larvae of the Magister Group are separable from all other Lyttini on the basis of characters of the maxillary palpi (MacSwain, 1956).

Within the Magister Group MacSwain's larval studies have demonstrated the presence of a major subdivision between *magister* and *vulnerata* on the one hand and *morosa, funerea,* and *blaisdelli* on the other. The first group corresponds to my Magister Subgroup, which also includes *margarita*, the larva of which is unknown. Within the second group of species MacSwain has shown that the larvae of *morosa* and *blaisdelli* share more similarities with each other than either does with the larva of *funerea*. However, judged by details of adult morphology, *morosa* and *funerea* appear to be much more closely related to each other than either is to *blaisdelli*. In the present instance I think the evidence of adult morphology is the more conclusive, and it is suggested that the similarities of the larvae of *morosa* and *blaisdelli* not shared by *funerea* are, in the main at least, primitive characters once possessed also by *funerea* but modified in the course of its evolution from an immediate common ancestor with *morosa*.

Key to Subgroups

1. Pronotum strongly hexagonal, with prominent, sharp lateral angles at middle (Figs. 183-84); head and pronotum usually at least in part orange; elytra coarsely reticulate or rugose; inner side of tibiae glabrous, except for a fine line of coarse setae along one or both edges ..... Magister Subgroup (p. 127)

   Pronotum not as above, the lateral angles obtuse when present; pronotum black; elytra rugose; tibiae normally pubescent on inner side, lacking lines of setae along inner edges 2

2. Male middle tibiae each with a deep, impunctate, glabrous impression on anterior side apically; pronotum campanuliform or subcircular, without lateral angles (Figs. 181-82), always smooth; pygidium distinctly produced.....Melaena Subgroup (p. 122)
Male middle tibiae unmodified; pronotum subhexagonal, with obtuse lateral angles (Figs. 178-80), usually granular and alutaceous; pygidium not produced; male genitalic type distinctive (see below)...
.....Tenebrosa Subgroup (p. 115)

Tenebrosa Subgroup

Entirely black (except for pale frontal spot) or with vertex pale. Head and pronotum usually granular and alutaceous. Pronotum subhexagonal, as wide as or wider than long, with obtuse lateral angles (Figs. 178-80). Scutellum rounded. Elytra rugose. Tibiae normally pubescent, lacking lines of setae along inner edges. Middle tibiae less strongly bowed than in other subgroups. Male middle tibiae not impressed apically. Hind tarsal pads represented only by some pale pubescence near edges of ventral side of second to fourth segments. Male fore and middle tarsal pads well developed, dense, both larger and denser than in female. Pygidium rounded, not distinctly produced. Male genitalia with apical foramen of median tube extending to or nearly to apex of aedeagus; dorsal sclerite of aedeagus relatively slender, not forming a heavy, strongly recurved hook.

Remarks. In the adult stage this subgroup is the most distinctive of the three comprising the Magister Group. It contains the species *tenebrosa, blaisdelli,* and *lugubris.* The first of these is quite different from the other two both morphologically and geographically and could reasonably be placed in a separate subgroup. The range of the subgroup is centered in California, with an extension along the Sierra Nevada into Oregon and thence eastward to southwestern Idaho. The host plant families recorded for the subgroup are Compositae (*tenebrosa*) and Scrophulariaceae (*blaisdelli*).

Key to Species

1. Pronotum nearly quadrate, widest near apical margin (Fig. 178); segments IV–VII of male antennae with erect pale setae on ventral side; male sixth abdominal sternum with lateral lobes not produced (Fig. 242); ventral hooks of aedeagus subequal (Fig. 316c); hind tibial spurs distinctly dissimilar in form; head variable in color.....
.....*tenebrosa* (p. 116)
Pronotum more nearly hexagonal, widest near middle (Figs. 179-80); male antennae not modified as above; male sixth abdominal sternum

with lateral lobes produced, hemispherical (Fig. 243); second ventral hook of aedeagus greatly enlarged (Figs. 317c-18c); head black with a small orange frontal spot between eyes.....2

2. Male genitalia as in Figure 317; wings pale brown, with at least apex darker, more opaque; one or both spurs of each hind tibia flattened, sticklike (Fig. 195); female sixth abdominal sternum with hind margin gradually turned dorsad.....*blaisdelli* (p. 119)

Male genitalia as in Figure 318; wings colorless; both spurs of each hind tibia obliquely truncate (Fig. 194); female sixth abdominal sternum with hind margin turned abruptly dorsad, at a right angle... .....*lugubris* (p. 120)

Lytta (*Paralytta*) *tenebrosa* (LeConte)

Cantharis tenebrosa LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 160. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 108; 1874, Trans. Amer. Ent. Soc., vol. 5, p. 38. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297.

Lytta tenebrosa, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 333.

Cantharis occipitalis Horn, 1883, Trans. Amer. Ent. Soc., vol. 10, p. 312. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298. *New synonymy.*

Lytta occipitalis, Linsley and MacSwain, 1942, Amer. Midland Nat., vol. 27, p. 406, tbl. 1, fig. 6.

Black. Head with an orange frontal spot or with vertex and upper frontal area orange. Wings very light brown. Length: 12 mm.-20 mm.

Head triangular, as wide as or slightly wider than long; tempora prominent; surface variably sculptured, densely micropunctate, variably punctate. Pronotum (Fig. 178) nearly quadrate, much wider than long; sides nearly straight, divergent from base to near level of apex, then suddenly rounded and convergent; disk transversely convex; surface granular, densely alutaceous. Elytra weakly to obsolescently rugose. Outer hind tibial spur enlarged, obliquely truncate, twice as wide as inner spur; inner spur flattened.

Male. Antennae (Fig. 84) not quite reaching base of pronotum; segments IV–X nearly or fully as wide as long; IV–VII weakly incrassate, flat on inner side, clothed there with erect pale setae; V and VI, which are largest, at most only slightly wider than IX or X. Fore tarsi slightly longer than fore tibiae. Emargination of sixth abdominal sternum (Fig. 242) shallow; lateral lobes of sternum not produced, not hemispherical. Pygidium as in Figure 211. Genitalia as in Figure 316; aedeagus with ventral hooks subequal, variable.

Female. Antennae as in Figure 131.

Type locality. Of *tenebrosa*, San Diego, California; of *occipitalis*, southern California.

Geographic distribution. California, from Yolo and Marin counties south to San Diego County. (See Fig. 29.)

Seasonal distribution. April 23—June 15.

Records. UNITED STATES: *California*: State label only, 20; Arrowhead Springs (Fall, 1901, p. 185); Arvin, March, 4; 20 mi. east of Bakersfield (Linsley and MacSwain, 1942); Carmel, May, 1; Clarksburg, April, 1; Fairfax, May, 1; Gavilan Hills, April, May, 3; Gavilan Peak, Riverside County, April, 2; Kern County, 2; Lemoncove, March, 12; Miramar, May, 4; Mojave Desert, April, 6; Oil City, Kern River, April, 2; Palomar, May, 1; Paraiso Springs, April, 1; Perris, April, 1; Potrero, 3; Riverside, April, 6; San Diego, 5 (1 in May); San Diego County, 4 (1 in April); Simmler, March, 9; Terminus, Tulare County, March, 4; Visalia, June, 8.

Remarks. A most unusual feature of this species is the presence of erect pale setae on the inner side of some of the intermediate antennal segments in the male. A very similar specialization has developed independently in *viridana.*

In the present state of our knowledge, this species appears to be represented by three morphologically distinct and geographically dis-

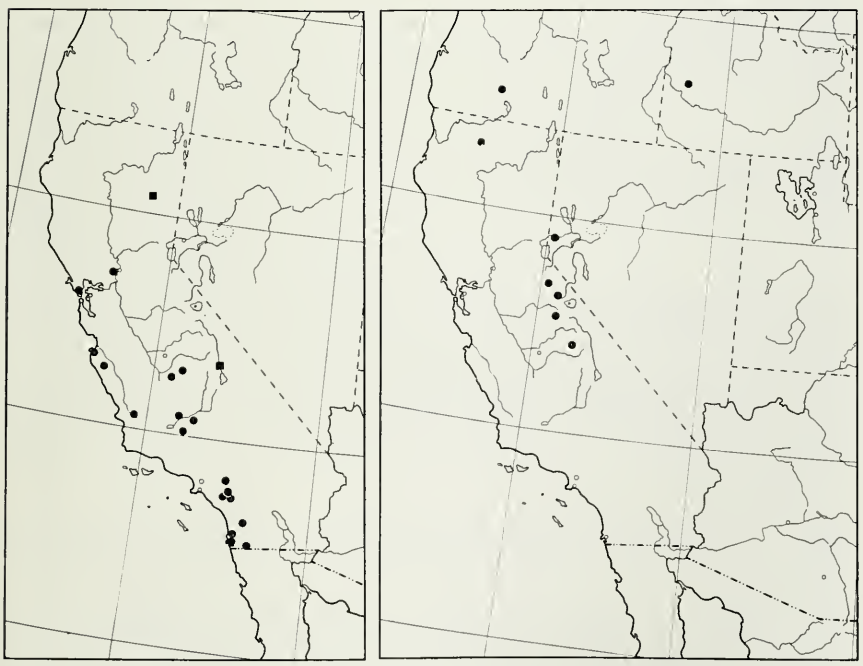


Fig. 29 (left). Distribution of *Lytta tenebrosa* (circles) and *Lytta lugubris* (squares).

Fig. 30 (right). Distribution of *Lytta blaisdelli.*

continuous populations or races. These intergrade to some extent by variation. It should be noted that in comparing the pronotal surfaces of the races in the diagnoses given below, reference is made to the basic texture of the surfaces exclusive of the alutaceous markings, which are about equally strong in all three races.

The typical race occurs in extreme southern California, from San Diego County north to the San Bernardino Mountains. It is characterized as follows: head black with a small, rounded or oval orange frontal spot which is less than one-third as wide as frontal area between eyes; vertex and pronotum finely rugose, strongly granular, dull; vertex moderately coarsely, densely punctate; average distance between punctures on vertex subequal to diameter of a single puncture; elytra rugose. This is the form originally described by LeConte as *tenebrosa.*

The northern coastal race occurs from Yolo and Marin counties south along the coast to San Luis Obispo County. It differs from the typical race as follows: frontal spot larger, triangular or diamond-shaped, at least half as wide as frontal area between eyes; vertex smoother, shinier, less coarsely, less densely punctate; pronotum slightly smoother; elytra generally a little more weakly rugose. In a few specimens the frontal spot tends to encroach on the vertex.

The Central Valley race is found at the southern end of the Central Valley of California, in Tulare and Kern counties. In it the pale area of the head encompasses both the center of the frontal area (as in the northern coastal race) and the vertex, except for a short black median stripe. Occasionally there is also a small red mark at the center of the pronotal disk. The surface of the vertex is as finely sculptured as in the northern coastal race, and the pronotum is even smoother and shinier, being nearly as finely sculptured as the vertex. The elytra are obsolescently rugose. This is the form previously accorded specific rank under the name *occipitalis.* With respect to color, this race intergrades with the preceding in that the pale area of the head in a specimen from Oil City and in one from Lemon Cove is confined largely to the frontal area.

The type of *tenebrosa* is in the Museum of Comparative Zoology. The type of *occipitalis* is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. The specimens from Gavilan Peak were collected from *Baeria* (Compositae). One of the specimens labeled "Mojave Desert" is from "sage."

Some aspects of the life history of this species (as *occipitalis*) have been studied by Linsley and MacSwain (1942). At a nesting site of *Anthophora linsleyi* Timberlake south of Bakersfield, California, these authors found *tenebrosa* infesting 11 or 1.45 per cent of a total of 759 bee cells examined. According to their observations, the larva may re-

quire the contents of more than one cell for complete development. Emergence was recorded in early May. It was noted that adults fed primarily on petals of flowers, although some pollen was eaten also. The name of the host plant was not given.

Lytta (*Paralytta*) *blaisdelli* (Fall)

Cantharis blaisdelli Fall, 1909, Canad. Ent., vol. 41, p. 166.
Lytta blaisdelli, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 83.

Black. Frontal spot small. Wings pale brown, with at least apical region darker and more opaque. Length: 10 mm.-16 mm.

Head as wide as long; tempora moderately prominent; surface moderately densely micropunctate, rough to smooth, variably punctate. Pronotum (Fig. 179) as wide as to much wider than long; surface variable. Elytra rugose. Hind tibial spurs slender, similar in size; outer spur flattened or very obliquely truncate; inner spur flattened.

Male. Antennae (Fig. 85) reaching base of pronotum; segments IV–VII moderately incrassate; VII only slightly narrower and shorter than VI, obviously longer and wider than IX or X. Fore tarsi as long as fore tibiae. Sixth abdominal sternum as in *lugubris* (see Fig. 243). Pygidium as in Figure 212. Genitalia as in Figure 317.

Female. Antennae as in Figure 132. Fore tarsi slightly shorter than fore tibiae. Hind margin of sixth abdominal sternum turned dorsad but not abruptly so, not at a right angle to rest of sternum.

Type locality. Siskiyou County, 2750 ft., California.

Geographic distribution. A montane species ranging from southwestern Idaho to the Klamath Mountains and thence south along the Sierra Nevada. (See Fig. 30.)

Seasonal distribution. May 25—July 26.

Records. UNITED STATES: *California*: Cantara, Siskiyou County, 2416 ft.-2750 ft., July, 12; Lake Alpine, July, 2; Paradise Valley, Yosemite National Park, July, 1; Siskiyou County, July, 8; Sonora Pass, 9000 ft.-10,000 ft., July, 135; South Fork of Kings River, 6000 ft., Fresno County, May, 1. *Idaho*: State label only, 4; Boise, June, 2. *Nevada*: Reno, June, 1. *Oregon*: Garfield Park, Crater Lake National Park, July, 2.

Remarks. In the series of specimens from Siskiyou County, California, the head is relatively smooth and rather finely, sparsely punctate, and the wings are pale brown in the anal region basad of vein 1A, becoming darker and opaque elsewhere. These characters apply also to specimens from the Kings River and Paradise Valley, California. In the specimens from Idaho, Nevada, and Oregon the head and pronotum are rough and coarsely, moderately densely punctate, the pronotum being, in addition, densely alutaceous; the antennal segments of the male are perceptibly

less elongate than in the California material mentioned; and the wings are dark and opaque only in the apical region. The long series from Sonora Pass, California, is like the Idaho, Nevada, and Oregon material except that the head and pronotum vary in some specimens to a smooth, finely sculptured condition like that of California specimens from other localities. A pair of specimens from Lake Alpine, California, are coarsely sculptured and otherwise typical of the rough form.

Coarsely sculptured specimens of *blaisdelli* closely resemble *lugubris*. These two species are usually separable on the basis of the hind tibial spurs, but in some cases it may be necessary to use wing color or characters of the male genitalia in order to distinguish between them in all certainty.

The first instar larva of *blaisdelli* has been described by MacSwain (1956). The type is in the Museum of Comparative Zoology.

Bionomics. Two of the specimens from Sonora Pass, California, are recorded from *Castilleja;* four others from the same locality were taken on *Pentstemon.* Both genera belong to the family Scrophulariaceae.

Lytta (*Paralytta*) *lugubris* (Horn)

Cantharis lugubris Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 107. Schwarz, 1890, Insect life, vol. 2, p. 288. Fall, 1909, Canad. Ent., vol. 41, p. 167.

Lytta lugubris Ulke, 1875, *in* Report upon the geographical and geological explorations and surveys west of the 100th meridian, vol. 5, p. 812, pl. 16, fig. 2 (homonymic synonym); 1882, Bull. Brooklyn Ent. Soc., vol. 4, p. 42 (reprint of 1875 paper). Denier, 1940, Rev. Ent. Argentina, vol. 10, p. 423.

Cantharis ulkei Beauregard, 1889, Bull. Soc. Ent. France, p. ccxxii (new name for *lugubris* Ulke, unnecessarily proposed); 1890, Les insectes vésicants, p. 498 (new name proposed a second time). Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297.

Black. Frontal spot small, elongate. Wings colorless. Length: 15 mm.-19 mm.

Head triangular, as broad as long; tempora moderately prominent; surface rough, densely micropunctate, granular, coarsely, moderately densely punctate. Pronotum (Fig. 180) as wide as or slightly wider than long; surface as on vertex. Elytra rugose. Hind tibial spurs equal in size, moderately thickened, obliquely truncate (Fig. 194).

Male. Antennae reaching base of pronotum; segments IV–VII moderately incrassate; VII slightly narrower than VI, obviously longer and wider than VIII; VIII noticeably longer and wider than IX or X. Fore tarsi as long as fore tibiae. Emargination of sixth abdominal sternum (Fig. 243) moderately deep, semicircular; lateral lobes produced, hemispherical; emargination lined with short, coarse setae. Pygidium as in *blaisdelli* (see Fig. 212). Genitalia as in Figure 318.

Female. Fore tarsi slightly shorter than fore tibiae. Hind margin of sixth abdominal sternum turned abruptly dorsad, at a right angle to rest of sternum.

Type locality. Owens Valley, California (Ulke, 1875).

Geographic distribution. Known from three definite localities, all in the Sierra Nevada of California. Recorded also, by state label, from Oregon and Nevada. (See Fig. 29.)

Seasonal distribution. June 27—July 12.

Records. UNITED STATES: *California*: State label only, 6; Hallelujah Junction, Lassen County, June, 1; Norvell, July, 8; Cal. [Owens Valley], 2. *Nevada*: State label only, 2. *Oregon*: State label only, 1. Also, from the Horn collection, one specimen labeled W[ashington] T[erritory] and three without data.

Remarks. The specimen from Hallelujah Junction, California, is atypical in that the inner hind tibial spur is more obliquely truncate than the outer one and the gonostyli of the male genitalia are unusually robust.

This species has been generally credited to Ulke, but Horn's description has priority of two years. *Lytta lugubris* Haag-Rutenberg (1880), proposed for a species now placed in *Epicauta,* is a junior homonym of Ulke's name (and Horn's), not a senior homonym as Beauregard (1889, and 1890) believed when he substituted the name *ulkei* for *lugubris* Ulke. Presumably Beauregard was under the impression that *lugubris* Ulke dated from the 1882 reprint of Ulke's description, or, more likely, that Haag-Rutenberg's *lugubris* had priority because of its early usage (as a *nomen nudum*) in the Dejean Catalogue, where it was credited to Klug. (Beauregard also erred in giving the range of *lugubris* Ulke as Illinois.) The case against *ulkei* was clearly stated by Denier (1940), who proposed for Haag-Rutenberg's *lugubris* the substitute name *luguberrima.*

There are, according to G. Wallace (*in litt.*), nine specimens under the name *lugubris* in the Ulke collection at the Carnegie Museum, each bearing the label "Cal." These are undoubtedly the specimens from Owens Valley, California, upon which Ulke based his description and from which a lectotype of *lugubris* Ulke should be designated. According to H. J. Grant, Jr., the Horn collection at the Academy of Natural Sciences of Philadelphia contains a total of 18 specimens, 2 of which (a male and a female mounted on the same pin) bear the same label as the material in the Ulke collection. Because Horn described his *lugubris* from specimens received from Ulke, it must be assumed that the pair of specimens labeled "Cal." in his collection are the only ones eligible for lectotype selection. From this pair I have designated the male as lectotype of *lugubris* Horn.

Melaena Subgroup

Black. Head and pronotum smooth, sparsely micropunctate, finely or very finely, sparsely punctate. Head quadrate; tempora broadly rounded, not prominent; dorsal margin nearly straight. Pronotum campanuliform or subcircular, without lateral angles. Scutellum rounded. Elytra rugose. Tibiae normally pubescent, lacking lines of setae along inner edges. Middle tibiae strongly bowed. Male middle tibiae with a deep, impunctate, glabrous impression on anterior side apically. Outer hind tibial spur about twice as wide as inner spur, obliquely truncate. Pygidium produced. Male genitalia with apical foramen of median tube not extending to apex of aedeagus; dorsal sclerite of aedeagus forming a heavy, strongly recurved hook.

Remarks. This subgroup contains the species *melaena, morosa,* and *funerea.* These are easily distinguished from all other species of *Paralytta* by the strongly modified middle tibiae of the male. The range of the subgroup includes the southern two-thirds of California, the Yuma, Arizona, region, and the peninsula of Baja California. Host plants have been recorded only for *funerea,* which occurs on Compositae.

Key to Species

1. Mandibles nearly straight; tarsal pads completely absent, the ventral side of tarsi glabrous between ventral fringes; tarsal claws nearly straight for basal three-fourths; male sixth abdominal sternum and pygidium as in Figures 215 and 246, respectively....*funerea* (p. 126)

   Mandibles strongly curved; tarsal pads present on at least fore and middle legs; tarsal claws curved from base.....2

2. Pronotum (Fig. 181) somewhat quadrate, as wide as long; male pygidium (Fig. 213) obtusely rounded or truncate at apex; male sixth abdominal sternum with lateral lobes not slender (Fig. 244); female fore tarsi nearly as long as fore tibiae.....*melaena* (p. 122)

   Pronotum (Fig. 182) subcircular, one-tenth to one-fifth wider than long; male pygidium (Fig. 214) very acute at apex; male sixth abdominal sternum with lateral lobes produced as slender processes (Fig. 245); female fore tarsi four-fifths as long as fore tibiae.....
   .....*morosa* (p. 124)

Lytta (*Paralytta*) *melaena* LeConte

Lytta melaena LeConte, 1858, Proc. Acad. Nat. Sci. Philadelphia, p. 76. Linsley and MacSwain, 1952, Pan-Pacific Ent., vol. 28, p. 134, tbl. Linsley and MacSwain, 1958, Wasmann Jour. Biol., vol. 15, pp. 229, 230.

Cantharis melaena, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 105; 1896, Proc. California Acad. Sci., ser. 3, vol. 6, p. 371. Fall, 1901, Occas.

Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297.

Black. Frontal spot about one-fourth as wide as frontal area between eyes. Apical half of wings brown, basal half almost colorless. Length: 14 mm.-22 mm.

Head finely, sparsely punctate. Labrum distinctly emarginate. Last segment of labial palpi elongate, hatchet-shaped. Pronotum (Fig. 181) quadrate campanuliform, as wide as long; disk more coarsely and a little more densely punctate than vertex, weakly alutaceous, so as to be duller. Hind tarsal pads represented only by some pale setae along ventral edges of one or more of second to fourth segments, or completely absent. Tarsal claws weakly curved from base.

Male. Antennae (Fig. 86) with segments IV–VI moderately incrassate; VII somewhat compressed but only slightly wider than VIII; VII very slightly larger than IX or X. Fore tarsi slightly longer than fore tibiae. Pads of fore and middle tarsi well developed, dense, silvery. Emargination of sixth abdominal sternum (Fig. 244) moderately deep; lateral lobes of sternum moderately produced, rounded. Pygidium (Fig. 213) obtusely rounded or broadly truncate at apex. Genitalia as in Figure 319.

Female. Fore tarsi nearly as long as fore tibiae. Fore and middle tarsal pads smaller and less dense than in male. Pygidium rounded.

Type locality. State of Sonora.

Geographic distribution. Southern California and the Yuma, Arizona, region south to the tip of the peninsula of Baja California. (See Fig. 31.)

Cockerell's (1898) record of Organ, New Mexico, and Fall's (1901) record of Temescal [Alameda County], California, have been rejected as probably based on misindentifications. There is a specimen in the collection of Cornell University mislabeled Texas.

Seasonal distribution. March—July 2.

Records. UNITED STATES: *Arizona*: Yuma, 1. *California*: State label only, 14 (1 in March); Barrett Springs, April, 3; The Gavilan [Peak], March, July, 4; Gilman Hot Springs, May, July, 6; Riverside, 5; San Diego, April, May, 5; Tanbark Flat, June, 1; Tehachapi, May, 8.

MÉXICO: *Baja California Sur*: San José de Gracia (Horn, 1896); San José del Cabo, 2; Santa Margarita Island [Isla Santa Margarita] (Horn, 1896). *Sonora*: (LeConte, 1858).

Remarks. The specimens from Baja California seem to differ in no respect from specimens collected in California. The type is in the Museum of Comparative Zoology.

Bionomics. Larvae and pupae of *melaena* have been found in resting cells in a nesting site of the emphorine bee *Diadasia bituberculata*

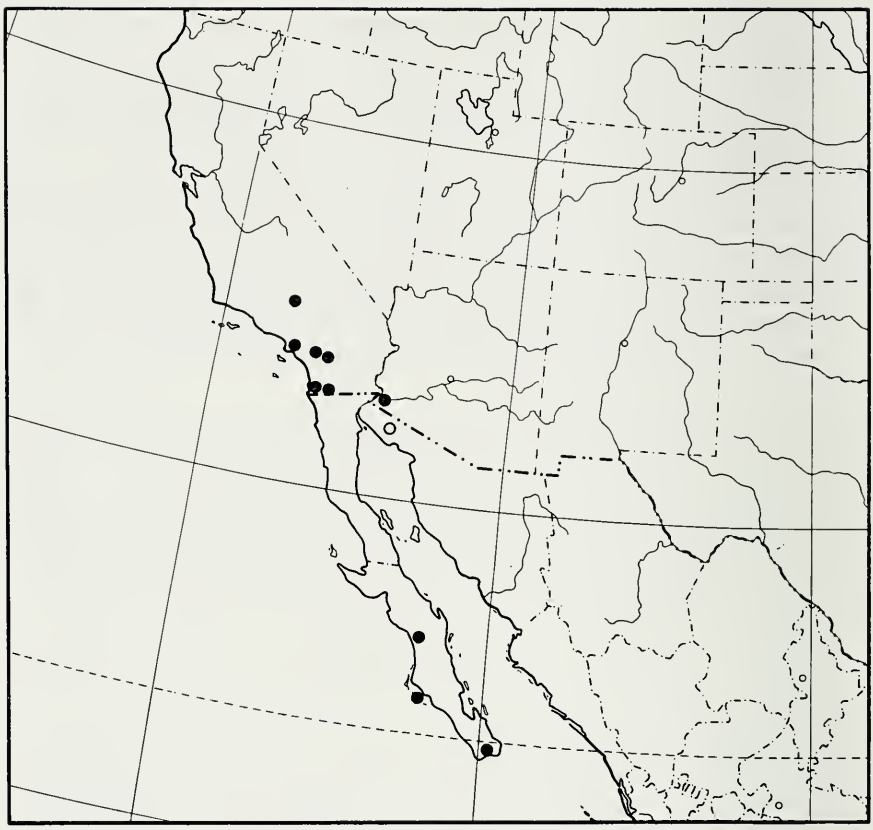


FIG. 31. Distribution of *Lytta melaena*.

(Cresson) near Barrett Springs, San Diego County, California (Linsley and MacSwain, 1952 and 1958).

Lytta (*Paralytta*) *morosa* (Fall)

Cantharis morosa Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 301.
Lytta morosa, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 82, pl. 15.

Black. Frontal spot about one-third as wide as frontal area between eyes. Body frequently in part piceous, especially sides of pronotum. Wings light yellowish brown. Length: 12.5 mm.-17.0 mm.

Head finely, very sparsely punctate. Labrum distinctly emarginate. Last segment of labial palpi as wide as long, hatchet-shaped. Pronotum (Fig. 182) subcircular, one-tenth to one-fifth wider than long; disk convex; surface as on vertex. Hind tarsal pads represented only by some pale setae along ventral edge of second to fourth segments. Tarsal claws curved from base.

Male. Antennae (Fig. 87) with segments IV–VII strongly incrassate; VII narrower than VI but obviously longer and wider than VIII; VIII a little larger than IX or X. Fore tarsi short, about five-sixths as long as fore tibiae. Fore and middle tarsal pads only moderately developed, no larger or denser than in female. Emargination of sixth abdominal sternum (Fig. 245) deeply semicircular, densely lined with short setae; lateral lobes of sternum strongly produced, slender, acute. Pygidium (Fig. 214) very acute at apex. Genitalia as in Figure 320.

Female. Antennae as in Figure 133. Fore tarsi about four-fifths as long as fore tibiae. Pygidium less acute at apex, much as in male of *funerea* (see Fig. 215).

Type locality. Temecula, Warners Ranch, or Poway, California.

Geographic distribution. Extreme southern California, in and near the Coastal Range. (See Fig. 32.)

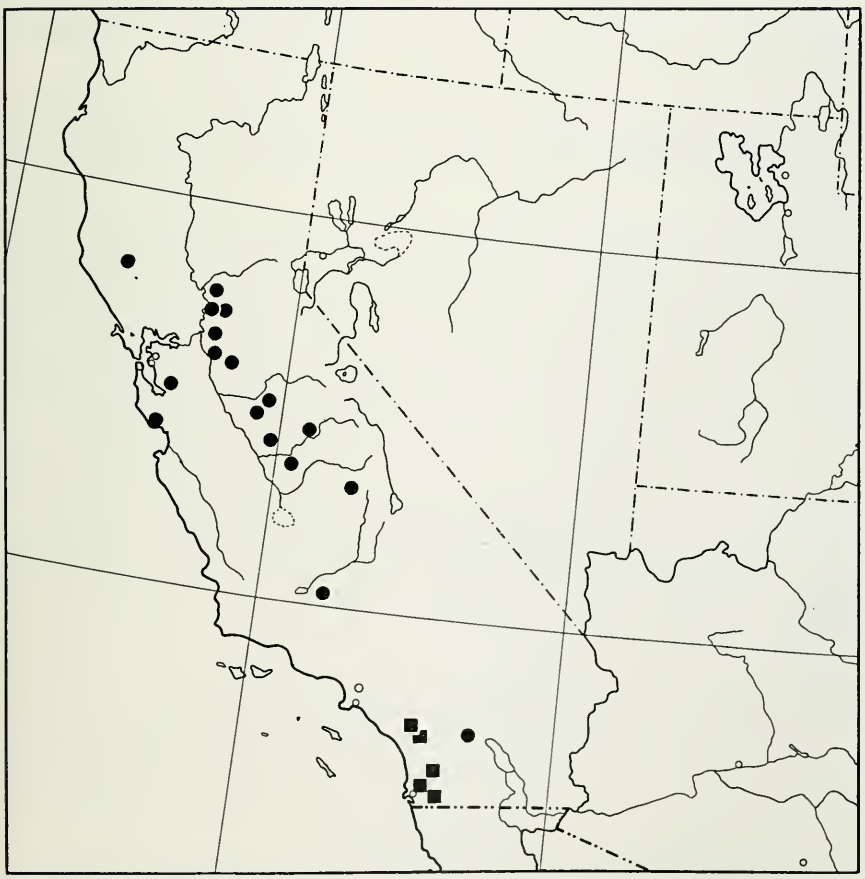


Fig. 32. Distribution of *Lytta funerea* (circles) and *Lytta morosa* (squares).

Seasonal distribution. August 27—September 14.

Records. UNITED STATES: *California*: State label only, 3; Alpine, September, 5; Gavilan Hills (MacSwain, 1956); Lake Elsinore, September, 2; Poway, 1; San Bernardino County (Fall, 1901); Temecula, August, 1 (cotype); Warners Hot Springs, San Diego County, August, 35; Warners R[anch], San Diego County, 2.

Remarks. The first instar larva of this species has been described by MacSwain (1956).

The type of *morosa* is in the Museum of Comparative Zoology. The "cotype" specimen I have examined is in the United States National Museum. The specimens from Poway, Temecula, and Warners Ranch are probably eutopotypes, but there is no indication that they were included in Fall's type series.

Lytta (*Paralytta*) *funerea* (Fall)

Cantharis funerea Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 301.
Lytta funerea, Selander, 1954, Coleopterists' Bull., vol. 8, p. 11. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 80, pls. 13, 15.

Black. Frontal spot generally no less than one-third as wide as frontal area between eyes. Sides of pronotum, basal half of elytra, and legs rarely piceous. Wings very pale yellowish brown. Length: 13.0 mm.-18.5 mm.

Head finely, sparsely punctate. Labrum truncate. Mandibles nearly straight, quite unlike those of any other species of the genus. Last segment of labial palpi quadrate. Pronotum subcircular, at least as long as wide, generally elongate; disk convex; surface as on vertex. Tarsal pads completely lacking, the ventral side of segments glabrous between ventral fringes. Tarsal claws nearly straight for basal three-fourths, curved at apex; ventral blade a little shorter than dorsal one but not fused to it.

Male. Antennae (Fig. 88) with segments IV–VII moderately incrassate; VII shorter and narrower than VI but obviously longer and wider than VIII. Fore tarsi as long as fore tibiae. Emargination of sixth abdominal sternum (Fig. 246) broadly triangular; lateral lobes of sternum not noticeably produced. Pygidium (Fig. 215) broadly triangular posteriorly. Genitalia as in Figure 321.

Female. Antennae as in Figure 134. Fore tarsi slightly shorter than fore tibiae. Pygidium even more bluntly produced than in male.

Type locality. Lake, Sacramento, or Tulare County, California.

Geographic distribution. California, from Riverside County north to Santa Cruz, Lake, and (western) Placer counties. (See Fig. 32.)

Seasonal distribution. March 15—October 15.

Records. UNITED STATES: *California*: State label only, September,

3; Arvin, March, September, 8; Consumnes [River], August, 7; Fresno, June, August, September, 26; Indian Wells, Inyo County, May, 2; Kern County, March, 3; Kismet and 1 mi. northeast of Kismet, 300 ft., September, 10; Lake County (Fall, 1901); Merced, June, September, 5; Merced Falls, September, 1; North Fork, Madera County, October, 2; Perkins, September, 49; Ripon, 1; Roseville, August, September, 7; Santa Cruz, April, 2; Sequoia National Park, July, 2; Tesla, October, 5; Tulare County, 1; western San Joaquin County, 1; Woodlake, 5.

Remarks. This is the only all-black species of *Paralytta* lacking tarsal pads. With respect to the form of the tarsal claws it approaches *moesta* (Nitidicollis Group).

The first instar larva of *funerea* has been described by MacSwain (1956). The type is in the Museum of Comparative Zoology.

Bionomics. Adults have been recorded from "tarweed" at Arvin, from *Hemizonia* (Compositae) at and near Kismet, and from *Centromadia* (Compositae) at Woodlake.

Magister Subgroup

Usually contrastingly bicolored. Head and pronotum smooth, sparsely micropunctate, very finely, weakly, very sparsely punctate. Pronotum strongly hexagonal, with prominent, sharp lateral angles. Scutellum acutely triangular. Elytra strongly, coarsely reticulate or (some *vulnerata*) merely rugose. Fore and hind tibiae glabrous on inner side except for a fine line of coarse, short setae along each inner edge; middle tibiae similar, but with line of setae along posterior inner edge only. Middle tibiae strongly bowed. Male middle tibiae more or less concave on anterior side apically but lacking a distinct impression. Pygidium produced. Male genitalia with apical foramen of median tube not extending to apex of aedeagus; dorsal sclerite of aedeagus forming a heavy, strongly recurved hook.

Remarks. This distinctive subgroup contains the species *magister, vulnerata,* and *margarita.* Its most striking feature is the reticulate condition of the elytra, but it should be noted that this character fails in one of the races of *vulnerata.* Elsewhere within the genus *Lytta* reticulate elytra are found only in the Reticulata Group of the present subgenus.

The Magister Subgroup has a wide distribution in the arid regions of North America west of the Rocky Mountains. Species of Compositae seem to be the principal host plants of the subgroup, although *magister* has been recorded also from plants of several other families.

Key to Species

1. Femora and tibiae orange (rarely piceous, in which case head and pronotum are piceous also); head not distinctly triangular; elytra

always coarsely reticulate; tarsal pads completely lacking; male sixth abdominal sternum as in Figure 247 ..... *magister* (p. 128)

Femora and tibiae black; head distinctly triangular; tarsal pads present on all but first segment of middle, or middle and hind, tarsi 2

2. Vertex (head above eyes) and pronotum orange, with or without a median black stripe; elytra varying from coarsely reticulate to rugose; emargination of male sixth abdominal sternum deep, rounded (Fig. 248) ..... *vulnerata* (p. 130)

Head (including lower frontal area) and pronotum red; elytra coarsely reticulate; emargination of male sixth abdominal sternum shallow, very obtusely angulate at apex. Isla Santa Margarita, Baja California Sur ..... *margarita* (p. 136)

Lytta (*Paralytta*) *magister* Horn

Lytta magister Horn, 1870, Trans. Amer. Ent. Soc., vol. 3, p. 90. Tanner, 1928, Ann. Ent. Soc. America, vol. 21, p. 273. Jaeger, 1938, The California deserts, pp. 54-55, fig. MacSwain, 1943, Ann. Ent. Soc. America, vol. 36, p. 361, fig. 3; 1956, Univ. California Publ. Ent., vol. 12, p. 79. Selander, 1958, Trans. Kansas Acad. Sci., vol. 61, p. 79, fig. 1.

Cantharis magister, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 106. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296.

Black. Head, prothorax, femora, and tibiae consistently orange over almost the entire range of the species, darkened to piceous black in the population of the Pinacate lava cap in extreme northwestern Sonora. Some orange or piceous also on epistoma, mandibles, antennal segment I, midline of mesothorax and metathorax, coxae, and trochanters; often with some orange or piceous on scutellum and sixth abdominal sternum. Wings colorless except that apex is a little clouded. Length: 16.5 mm.-33.0 mm.; generally more than 20 mm.

Head slightly wider than long; sides rounded, divergent above eyes; head widest below tempora; dorsal margin nearly straight; vertex tumid. Pronotum as in Figure 183, one-fifth wider than long; disk flat, frequently with a shallow, irregular impression on each side between lateral angles; center of disk frequently impunctate. Elytra strongly, coarsely reticulate. Outer hind tibial spur not much thicker than inner spur, very obliquely truncate; truncature elongate. Tarsal pads completely lacking; tarsal segments glabrous between ventral fringes.

Male. Antennae (Fig. 89) reaching at least two segments beyond base of pronotum; segments V–VII strongly incrassate. Emargination of sixth abdominal sternum (Fig. 247) deeply semicircular, densely lined with short, coarse setae; lateral lobes of sternum produced, heavy, broadly

rounded. Pygidium (Fig. 216) broadly truncate at apex. Genitalia as in Figure 322.

Female. Pygidium truncate, not so strongly produced as in male.

Type locality. Owens Valley, California.

Geographic distribution. Lower elevations in southern California, southern Arizona, and northwestern Sonora, ranging north along the Colorado River and its tributaries to the Grand Canyon and the southwestern corner of Utah (Washington County). (See Fig. 33.)

Seasonal distribution. February 28—October 28.

Records. UNITED STATES: *Arizona:* State label only, 2; Bright Angel [Creek], 3700 ft., 1; Dripping Springs, Organ Pipe National Monument, March, 6; Gila Bend, April, 4; mountain near Gila Bend, February, 3; 8 mi. south of Hoover Dam, June, 1; Oracle, June, 2; Patagonia, August, 3; Phoenix, March, April, June, 29; Quartzite, March, 1; Rillito, May, 1; Tinajas Altas [Mountains], April, 5; Tucson, April, May, 10; 10 mi. south of Tucson, 2000 ft., March, 1; Tucson Mountains, May, 8; Wellton, April, 1; Winkleman, April, 1; Yuma, 9 (8 in April). *California:* State label

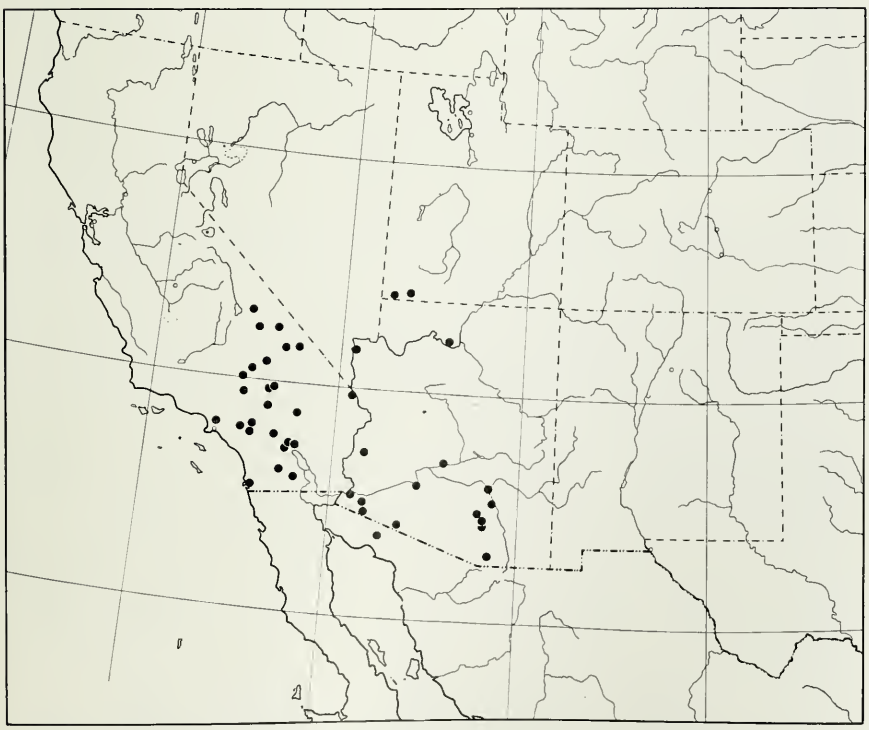


Fig. 33. Distribution of *Lytta magister.*

only, 10; Bagdad, 2; 30 mi. south of Barstow, June, 15; Big Pine, June, 1; Borego [Springs], April, 10; Borego State Park, March, 3; Borego Valley, April, 4; Carrizo [Creek], March, 2; Death Valley, March, 1; Cronise Lake, April, 7; Daggett, April, May, June, October, 11; Furnace Creek, Death Valley, April, 1; Hopkins Well, Riverside County, April, 16; Imperial County, March, 16; Independence, May, 2; Indian Wells, Owens Valley, May, 8; Indio, April (MacSwain, 1956); 20 mi. east of Indio, April, 12; Inyo County, 2; Inyo Mountains, May, 30; Mojave Desert, 2 (1 in May); Mud Hills, San Diego County, March, 1; Muroc Dry Lake, April, 14; Needles, April, 3; Ocotillo, San Diego County, April, 1; Palm Canyon, April, 1; Palm Springs, March, April, 33; Panamint Valley, April, 22; Recordo, June, 1; Rialto, August, 1; Riverside, March, 1; Saltdale, May, 1; San Bernardino County, 1; San Diego, 2; Searles Canyon, Lake, and Station, April, 78; Witch Creek, 1; Yermo, May, 4. *Nevada*: State label only, 1. *Utah*: U[tah] T[erritory], 1; St. George, 10 (1 in May); Zion National Park (Tanner, 1928).

MÉXICO: *Sonora*: Cerro Colorado, ± 35 mi. west-northwest of Sonoyta, April, 20.

Remarks. In all specimens of *magister* from the United States the head, pronotum, femora, and tibiae are orange in color. However, in the series from the Cerro Colorado crater, Sonora, these areas are darkened to a piceous or nearly pure black. Presumably this melanistic variation reflects selection for dark coloration against the black background of the Pinacate lava cap of which the Cerro Colorado is a part. Further details are given in a separate paper (Selander, 1958).

The first instar larva of *magister* has been figured and described by MacSwain (1943 and 1956). The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. The following host plant associations have been recorded: *Chrysothamnus paniculatus* (Compositae) at Zion National Park, Utah (Tanner, 1928); *Coldenia palmeri* (Boraginaceae) (determined by R. McVaugh) at Cerro Colorado crater, Sonora; *Geraea canescens* (Compositae) at Hopkins Well, California; *Lupinus* (Leguminosae) and unspecified Compositae at Muroc Dry Lake, California; lupine, 30 mi. south of Barstow, California; and yucca (Liliaceae) at Oracle, Arizona.

According to the account given by Jaeger (1938), *magister* at times occurs in such numbers in the deserts of California that the scraping of the beetles' elytra against stones and dead vegetation fills the air with a rasping sound.

Lytta (*Paralytta*) *vulnerata* (LeConte)

Cantharis vulnerata LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 159. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 106. Saunders, 1876,

Canad. Ent., vol. 8, p. 224, fig. 10. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 437. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296; 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185.

Lytta vulnerata, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 331. Horn, 1867, Proc. Ent. Soc. Philadelphia, p. 292; 1870, Trans. Amer. Ent. Soc., vol. 3, p. 90; 1872, *in* Rept. U.S. Geol. Surv. 1871, 1872, p. 390. Ulke, 1875, *in* Report upon the geographical and geological explorations and surveys west of the 100th meridian, vol. 5, p. 825. Knowlton, 1930, Florida Ent., vol. 14, p. 53. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 81, pl. 14.

Lytta cooperi LeConte, 1854, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 18; 1857, *in* Reports of explorations and surveys . . . from the Mississippi River to the Pacific Ocean, vol. 12, book 2, pt. 3, p. 51, pl. 2, fig. 6. Horn, 1870, Trans. Amer. Ent. Soc., vol. 3, p. 90; 1872, *in* Rept. U.S. Geol. Surv. 1871, 1872, p. 390. Knowlton, 1939, Utah Agr. Exp. Sta. Mimeo. Ser. 200 (Tech.), pt. 3, p. 5. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 82.

Cantharis vulnerata var. *cooperi,* Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 106. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296.

Cantharis anguicollis Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 105.

Cantharis cooperi, Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 304.

Lytta vulnerata cooperi, Knowlton and Taylor, 1952, Utah Agr. Exp. Sta. Mimeo. Ser. 389, p. 15. Woodbury, 1956, Ecological check lists. The Great Salt Lake Desert series, p. 37.

Black. Vertex orange, often with a median black stripe or fine line; head rarely all black except for a small orange frontal spot. Pronotum orange with a black or piceous anterior marginal area, or with black area extending posteriad as a median stripe. Wings colorless except that apex is clouded. Length: 9 mm.-27 mm.

Head strongly triangular, as wide as to one-fifth wider than long; tempora prominent; dorsal margin varying from nearly straight to deeply concave. Pronotum as in Figure 184, one-fifth to one-fourth wider than long; disk flat at center, becoming rather sharply declivous at sides before and behind lateral angles, almost always with a shallow fovea or irregular impression on each side between lateral angles; center of disk frequently impunctate. Elytra varying from coarsely reticulate to rugose. Outer hind tibial spur at most twice as wide as inner spur, obliquely truncate. Fore and middle tarsal pads poorly developed, those of at least some segments divided on midline; hind tarsal pads represented only by some pale pubescence along ventral edges of second to fourth segments.

Male. Antennae (Fig. 90) reaching base of pronotum; segments IV–VII moderately incrassate; VIII slightly so, not compressed. Emargination of sixth abdominal sternum (Fig. 248) deep, rounded; lateral lobes of sternum strongly produced, rounded and densely pubescent at apex. Pygidium (Fig. 217) subacute at apex. Genitalia as in Figure 323.

Female. Antennae as in Figure 135. First segment of middle tarsi lacking pad (pale pubescence). Pygidium obtuse at apex.

Type locality. Of *vulnerata*, San Diego, California; of *cooperi*, "Wenass River to Fort Colville" [Wenas Creek to Colville, Washington]; of *anguicollis*, Baja California.

Geographic distribution. Intermontane plateaus of western North America from southern British Columbia south through the Columbia Plateau, the Great Basin, and the Colorado Plateau region of Utah to the Mojave Desert; thence southwest to the coastal ranges of California, extending north (west of the Sierra Nevada) to Sacramento County, California, and south onto the peninsula of Baja California. (See Fig. 34.)

Cockerell's (1898) record (also listed by Fall and Cockerell, 1907) of *vulnerata* from the Mesilla Valley, New Mexico, and Gibson's (1912) record of *cooperi* from Indian Head, Saskatchewan, are unacceptable on geographic grounds. The latter is based on a series of seven specimens in the Canadian National Collection labeled "Indian Head, A. P. Saunders."

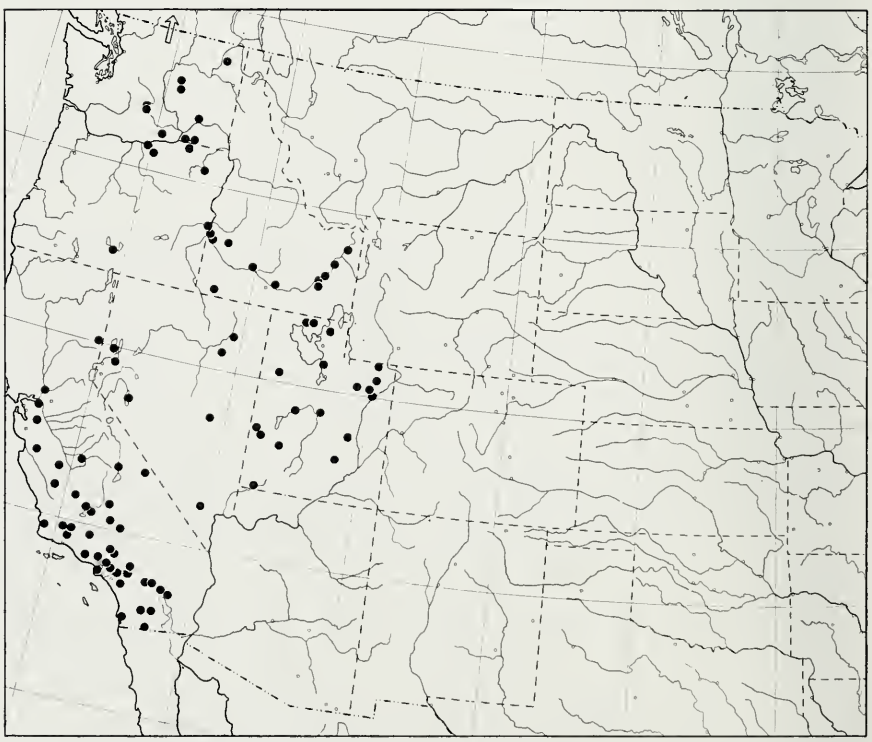


Fig. 34. Distribution of *Lytta vulnerata.*

Seasonal distribution. April 21—December 30 (also one record in February). Collected most commonly from August to October.

Records. CANADA: *British Columbia*: Vernon, 1.

UNITED STATES: *Arizona*: State label only, 1. *California*: State label only, 12; Antioch, August, September, 55; Azuza, 3 (2 in July); Bakersfield, September, 6; Bodfish, 3; 2 mi. east of Caliente Mountain, October, 7; Campo, San Diego County, September, 2; Cantua Creek, November, 1; Castaic, February, 3; Claremont, September, 15; Claremont, mountains near, 4; Coachella Valley, November, 1; Coalinga, 9 (4 in September); Colton, September, October, 14; Corona, 3 (2 in September); Cuyama Valley, Ventura County, October, 2; Desert Spring, 7 mi. north of San Bernardino, August, 40; Fillmore, September, 5; Fort Tejon (Horn, 1873); Fresno, 2; Garnet, December, 1; Hallelujah Junction, Lassen County, July, August, 47; Hollister, August, 2; Indio, August, 1; Kings County, September, 6; Lake Elsinore, September, 1; Lebec, September, 5; Littlerock, October, 15; Los Angeles County, 1; Mill Creek Canyon, San Bernardino County, September, 7; Mojave, 9 (7 in October); Mount Jupiter, 3100 ft. (not located), August, 3; Ontario, September, 1; Owens Valley (Horn, 1873); Palmdale, October, 51; Palm Springs, April, July, October, 3; Panamint Mountains, October, 1; Pasadena, August, September, 5; Playa del Ray, Los Angeles County, October, 11; Pomona (Fall, 1901, p. 185); Sacramento, August, 1; San Bernardino, August, October, 7; San Bernardino County, September, October, 4; San Diego, 2; San Diego County, 1; San Felipe Valley, San Diego County, October, 3; S[anta] Maria River, September, 3; Shafter, October, 1; Tehachapi, August, 7; Tesla, September, 1; Warners Hot Springs, August, 3; White Water, September, October, 4. *Idaho*: Blackfoot, August, 6; Bliss, September, 1; Boise, 1; Camas Creek (ambiguous, not mapped), 6; 4 mi. north of Hazelton, September, 2; Hunt Project, 2 mi. north of Hazelton, July, 1; Idaho Falls, September, 1; Indian Massacre Rock (not located), August, 1; Jordan River, Owyhee County (not located), 1; Juniper Creek, Owyhee County, August, 1; Notus, August, 1; Parma, 2224 ft., September, 2; Pocotello, 16 (5 in August); Ross' Fork, August, 3; St. Anthony, 4956 ft., August, 8. *Nevada*: State label only, 12; Currant Creek, Nye County, July, 7; Deeth, July, 3; Las Vegas, September, October, 11; Pyramid Lake, August, 16; Ruby Mountains, 1; Volma (not located), July, 1; Wadsworth, September, 21; Walker Lake, September, 56. *Oregon*: State label only, 5; Arlington, September, 9; Freewater, September, 1; Ione, September, 2; Island City, 1; Ontario, September, 3; Paisley, August, 1. *Utah*: 2 mi. east of Arlington Drive, [Salt Lake City], September, 2; Blue Creek, Box Elder County, August, 2; Cache Junction, Cache County, August, 27; Delta, August, 2; Desert Range Experiment Station, 50 mi. west of Milford, 5; Duchesne, July, August, 15; Dugway Proving Grounds, Tooele

County, August, September, 36; Emery County, October, 2; F[or]t Duchesne, Uintah County (Knowlton, 1939); Hanksville, September, 1; Hansel Mountains, August, 1; Howell, August, 8; Lampo, Box Elder County (Knowlton, 1930); Lapoint, 5500 ft., August, 1; Little Granite Mountain, Tooele County, August, 6; Logan (Knowlton, 1930); Manila (Knowlton and Taylor, 1952); Manti, August, 1; Milford, August, 3; Millard [County], August, 5; Myton, August, 2; Roosevelt, June, August, 3; St. George, 1; 2 mi. north of San Rafael [River] bridge, Emery County, October, 7; Watson, Uintah County, June, 1; Waw Waw Springs, Beaver County, September, 1. *Washington*: Coulee City, August, 1; Fort Colville [Colville] (LeConte, 1857); Kahlotus, August, 6; 5 mi. south of Lowden, August, 2; Prosser, June, August, October, 3; Selah, 1150 ft., September, 4; Stratford, September, 22; Walla Walla, September, 10; Wenass River [Wenas Creek] (LeConte, 1857); Yakima, August, 10.

MÉXICO: *Baja California Norte?*: Baja (or Lower) California, 5.

Remarks. Adults of this species vary geographically in characters of elytral sculpturing, color, body size, and shape of the pronotum. This variation is described in the following paragraphs.

In all specimens from Baja California, the coastal ranges of California, and the northern and central parts of the Central Valley of California both the head and pronotum have a rather broad black stripe medianly. The pronotal stripe tends to be weakened or broken in the basal half in some of these specimens but is complete in the majority. The series from Playa del Ray, California, has particularly heavy markings: the vertex is entirely black, and the stripe on the pronotum is broadened to cover all but the lateral angles. On and near the western and northern limits of the Mojave Desert in California there is a well-marked tendency for the head stripe to be narrowed to a fine median line and the pronotal stripe to be broken in the basal half. In occasional specimens from this area the head stripe is absent, and the pronotal stripe is limited to the anterior half (or less) of the pronotum. Eastward, through the rest of the range of the species, the vertex of the head is entirely orange, except in very rare instances in which a fine median line is present. In this same region the median pronotal stripe is invariably reduced to a small anterior marginal area.

Although additional records are needed to precisely establish the geographic pattern of the color variation, it now appears that the reduction of the black stripe of the head and pronotum takes the form of a true cline, beginning on the western edge of the Mojave Desert and extending along its northern edge as far east as Las Vegas, Nevada.

Variation in the sculpturing of the elytra shows excellent concordance with the variation in color just discussed. Thus in Baja California and western California the elytra are invariably rugose. Along the edges

of the Mojave Desert there is a slight tendency for development of reticulations. In the specimen from the Panamint Mountains, California, and in the series of six specimens from Las Vegas, Nevada, a regular system of weak reticulations is evident. Finally, in all specimens from the Great Basin and areas to the north and east the elytra are as strongly reticulate as in *magister*.

Geographic variation in body size is shown by the fact that the average length of 73 specimens from California and Baja California is 18.6 (10-27) mm., as compared with an average of 15.3 (9-22) mm. for a series of 133 specimens from Nevada, Utah, Idaho, and Washington. I have not attempted to pursue the study of size variation any further.

With respect to variation in the shape of the pronotum, there seems to be a tendency for the lateral angles to be somewhat less acute in specimens from California and Baja California than in those from other areas. Again, I have not studied this particular variation in detail.

Geographic variation in the larvae of *vulnerata* has been described by MacSwain (1956), who found minor differences between specimens from coastal California (Antioch, Contra Costa County) and specimens from the western edge of the Great Basin (Hallelujah Junction, Lassen County, California). MacSwain treated the two series under the names *vulnerata* and *cooperi*, respectively, but indicated that he did not consider the larval differences to be of a specific nature.

In view of the above discussion, and in particular the high degree of concordance shown between variation in color and elytral sculpturing, it seems convenient to continue the practice of making a distinction between the Baja California and California population (typical *vulnerata*) and the population occurring east of the Cascade-Sierra Nevada range (*cooperi*). As names for these populations I suggest "California race" and "interior race," respectively.

In one of the interior race males from Pyramid Lake, Nevada, the lateral margins of the pronotal disk are strongly spinose. Four spines are present on the left side, two of these at the lateral angle and two along the posterolateral margin. These spines increase in length posteriorly, the fourth or last one being longer than antennal segment II. The right side of the pronotum is similarly modified except that there is no spine corresponding to the first spine of the left side and that the anterior two spines present are subequal in length. In addition to this male, there is a female from the same locality and two females from nearby Hallelujah Junction, California, in which rudiments of two spines are present on each of the lateral angles of the pronotum. Under the circumstances it seems reasonable to consider this anomaly as genetically controlled.

In calling attention to this pronotal anomaly in *vulnerata*, it is worth noting that Fall's description of the pronotum of the species *margarita*,

which was based on a unique male from Isla Santa Margarita, off the coast of the peninsula of Baja California, seems to agree very closely with the condition of the Pyramid Lake male. This similarity is possibly a fortuitous one, but inasmuch as *vulnerata* appears to be closely related to *margarita,* it is tempting to speculate that the spinose condition is genetically homologous in the two species.

The types of *vulnerata* and *cooperi* are in the Museum of Comparative Zoology. The type of *anguicollis* has been lost. There is, however, a specimen from "Baja California" in the Dugès collection at the Instituto de Biología in Mexico City that probably belonged to the series from which Dugès described *anguicollis;* I have designated this specimen as neotype.

Bionomics. Specimens have been collected on the following Compositae: *Artemesia* (California), *Baccharis* (California; LeConte, 1853), *Chrysothamnus* (California and Nevada), *C. nauseosus* and *C. stenophyllus* (Utah), *Gutierrezia* (California and Idaho), and *Solidago* (Washington).

Lytta (*Paralytta*) *margarita* (Fall)

Cantharis margarita Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 300.

According to Fall's description, *margarita* closely resembles the interior race of *vulnerata.* The main differences between the two are that in *margarita* the color of the head and prothorax is red (rather than orange), the lower frontal area of the head is not black, the intermediate segments of the male antennae are "scarcely perceptibly thickened," the tibiae are "much stouter" and "less compressed," and the emargination of the male sixth abdominal sternum is shallow, with the apex very obtusely angulate. The pronotum was described as having "three acute tubercles along the side margin posteriorly." This was evidently a bilaterally symmetrical condition as in his key to species Fall described the pronotum as "trituberculate each side behind the lateral angles." A similar condition occurs as a rare anomaly in the interior race of *vulnerata,* as I have already noted.

Type locality. Isla Santa Margarita, Baja California Sur.

Geographic distribution. Known only from the type locality. (See Fig. 36.)

Seasonal distribution. Unknown.

Records. MÉXICO: *Baja California Sur*: Isla Santa Margarita (Fall, 1901).

Remarks. There are apparently no specimens of this species in collections at the present time. The original description was based on a unique male in the collection of Charles Fuchs. If this specimen were still in existence, it would probably be in the collection of the California Acad-

emy of Sciences, but Hugh B. Leech has informed me (*in litt.*) that it is not there. In all probability it was lost in the San Francisco fire, which destroyed the greater part of the Fuchs collection.

Subgenus ADICOLYTTA, new subgenus

Moderately large, elongate beetles. Colors nonmetallic; head when black with a pale frontal spot. Upper surface essentially glabrous. Head (at least vertex) and pronotum finely granular, micropunctate, finely, sparsely, or very sparsely punctate. Eyes rather narrow, not prominent. Male antennae slightly longer than in female, just short of base of pronotum or extending one or two segments beyond; male intermediate antennal segments (at least IV and V) incrassate, wider than following segments; except in *erebea*, two or more of the intermediate segments with conspicuous, asymmetrical distortion (antennae serrate in *peninsularis*). Female antennae clavate. Pronotum with sides rounded and gradually convergent from middle to base, more abruptly convergent to apex; disk lacking calluses. Elytral surface rugose or rugose punctate, granular. Except in *peninsularis*, male trochanters with modified pubescence, male middle tibiae and either fore tibiae or middle femora variously modified, and first segment of male middle tarsi distorted. Each tibia with two spurs. Hind tibial spurs strongly dissimilar; outer hind tibial spur two to three times as wide as inner spur, obliquely truncate; inner spur only slightly thickened, excavate. Tarsal claws rather heavy, moderately curved. Pygidium not produced. Male genitalia with gonostyli lacking mesal hooks, either slender, tapered, and evenly rounded at apex or somewhat heavier and weakly lobed laterally before apex; minute, sparse setae present on gonostyli; aedeagus with two well-developed ventral hooks.

Type species. Cantharis mutilata Horn.

Remarks. This subgenus contains seven well-marked species, divided into three groups. It is limited in distribution to the North American Continent and within this region occurs primarily in México, one species (*mutilata*) ranging north into the southwestern United States and another (*eucera*) south into western Panamá (Fig. 6). It most closely resembles the subgenus *Paralytta*, and, as pointed out above, it seems to be most closely related to that subgenus. Although it is readily diagnosed by a combination of characters, there seems to be no single character that will distinguish all members of the subgenus from those of all other subgenera of *Lytta*. With some experience, however, it is easily separable on the basis of the general facies of the adults.

In at least *eucera*, *sanguinea*, *erythrothorax*, and *mutilata*, and probably in the other species of the subgenus as well, the abdomen in life

is swollen to the extent that the membranous areas of the third to sixth terga are partially exposed at the sides of the elytra. These areas are bright red or orange in color and as a result are very conspicuous in those species in which the elytra and abdomen are black. Possibly they are aposematic in function. This does not hold for *sanguinea*, where the membranous areas are about the same color as the rest of the beetle.

Very little is known of the bionomics of the species of the subgenus. There is, however, enough data available to suggest that the Eucera and Mutilata groups may be separable on the basis of host plant differences, the former being perhaps restricted to Cucurbitaceae and the latter to Convolvulaceae. There are no host plant records for the Peninsularis Group.

The relationships of the species of the subgenus *Adicolytta* seem reasonably clear. The postulated phylogeny is shown in the diagram in Figure 35. The same arrangement has been followed in constructing the keys to groups and species.

In arriving at the arrangement indicated, I have assumed that the following characters are primitive for the subgenus: antennae moniliform, with segments V and VI incrassate in male but not distorted; male legs lacking obvious sexual modification (as in *peninsularis*); tarsal pads only moderately developed in both sexes (as in *peninsularis*); and male genitalia with gonostyli slender, tapered, and evenly rounded at apex (as in the Peninsularis and Eucera groups). This combination of characters presumably once existed in an ancestral form.

From such an ancestral type the species *peninsularis* may be derived separately as a line in which the antennae became serrate in the male (subserrate in the female). At present *peninsularis* seems to be restricted in range to the southern tip of the peninsula of Baja California. However, it seems likely that at one time the line to which it belongs was more widely distributed, probably extending onto the Mexican mainland, and that subsequently it was eliminated over most of its range.

The Eucera and Mutilata groups apparently arose from an ancestor in which antennal segments V and VI were weakly expanded on the dorsal side (as in *erebea*), the tarsal pads were enlarged and dense, and the male legs had developed specializations, at least to the extent that the pubescence of the trochanters was somewhat modified and the middle femora and the first segment of the middle tarsi were distorted. The Eucera Group is more primitive than the Mutilata Group in having male genitalia essentially like those of *peninsularis*. Presumed specializations in the former group include the asymmetrical distortion of the hind tarsi and the peculiar compression and distortion of the male fore and middle tibiae. In all characters except possibly color *erebea* seems to be the more primitive of the two species constituting the group. For example,

in *erebea* male antennal segments IV–VI are only weakly expanded dorsally, while in *eucera* segment IV is strongly expanded and V and VI are very strongly produced. Again, in *erebea* the male middle tibiae, while contorted and excavate much as in *eucera*, lack the modification of the pubescence found in that species. Interestingly, *erebea* has a small geographic range and seems to be rare, while *eucera* has the largest range of any species of the subgenus and would appear to be the most successful.

It is presumed that from a common ancestor with the Eucera Group a second line developed which gave rise to the Mutilata Group. In this line male antennal segments V and VI were more markedly produced dorsally, the male middle femora developed a concavity on the anterior

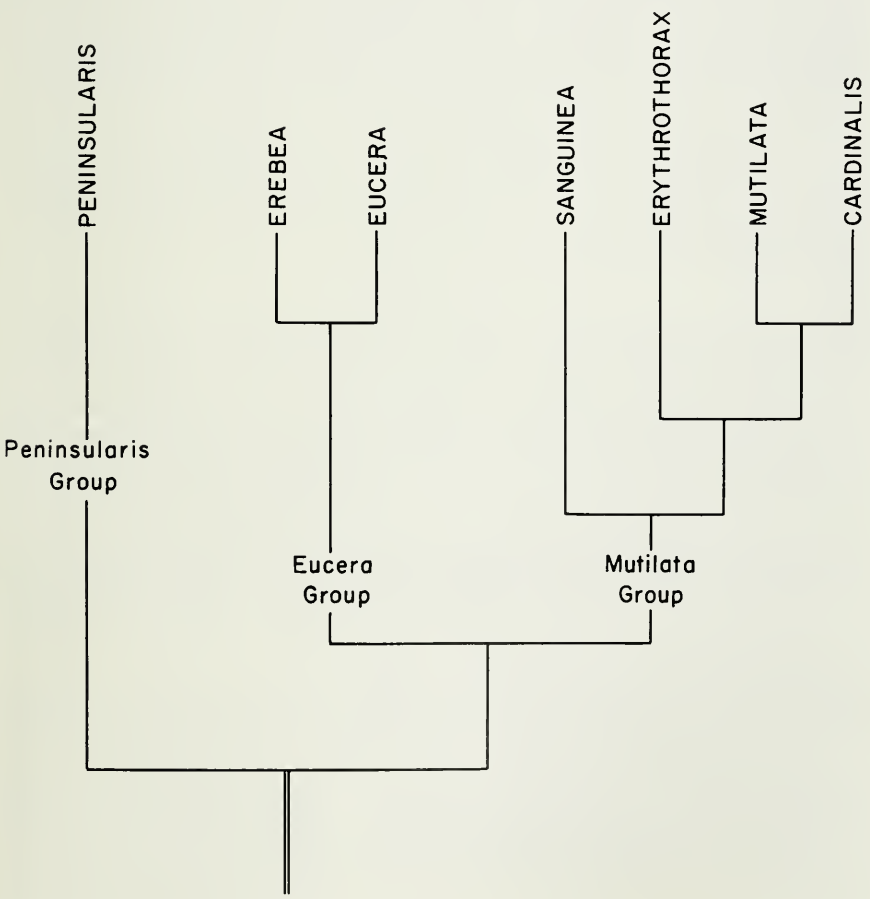


Fig. 35. Phylogeny of the subgenus *Adicolytta*.

side, the distortion of the first segment of the male middle tarsi was intensified, and the gonostyli of the male genitalia became heavier and developed a weak lobe laterally. Within the Mutilata Group *sanguinea* appears to be the most primitive species structurally. However, its entirely pale color is atypical of the subgenus, and I believe on this account that it is to be regarded as a specialized character. In the branch of the line leading to *erythrothorax*, *mutilata*, and *cardinalis* male antennal segment V became strongly produced, and the male middle femora became more highly modified than in the common ancestor with *sanguinea*. The species *erythrothorax* apparently evolved without further major change, while *mutilata* and *cardinalis* were derived from a separate offshoot in which male antennal segment V became even more strongly distorted than in *erythrothorax*. There is a difficulty with this hypothesis in that *sanguinea* and *erythrothorax* have the male fore femora modified on the ventral side, while *mutilata* and *cardinalis* do not. It is therefore necessary to assume that either the modification existed at the beginning of the Mutilata Group line and was subsequently lost in the common ancestor of *mutilata* and *cardinalis* or, perhaps equally likely, that it is of independent origin in *sanguinea* and *erythrothorax*. Attempts to resolve this difficulty by arranging the species differently in the phylogenetic tree only lead to greater difficulty in accounting for the distribution of other characters within the group.

Key to Groups

1. Antennal segments IV–X triangular (males, Fig. 91) or subtriangular (females), produced on ventral side apically; under surface of thorax densely clothed with long, shaggy pubescence; tarsal pads only moderately developed, tending to be divided on midline; male legs unmodified; black with reddish head and pronotum. Cabo San Lucas, Baja California Sur.....Peninsularis Group (p. 141)

   At least distal antennal segments moniliform, nearly symmetrical (IV and following one to three segments expanded or produced on dorsal side in male); under surface of thorax sparsely clothed with short pubescence; tarsal pads well developed, very dense, cushion-like, undivided; male legs variously modified.....2

2. Pronotum and elytra black; male middle tibiae contorted, excavate; first segment of male middle tarsi normally, sparsely pubescent; first three hind tarsal segments clothed laterally with long, hairlike setae; pads of these segments asymmetrical.....Eucera Group (p. 143)

   Color not as above; male middle tibiae modified but not contorted or excavate; hind tarsal segments unmodified.....
   .....Mutilata Group (p. 147)

PENINSULARIS GROUP

Black with red head and pronotum. Male antennae serrate; segments IV–X triangular, produced on ventral side apically. Female antennae subserrate; segments IV–X subtriangular. Scutellum with fine punctures and setae. Under surface of thorax, coxae, trochanters, and base of femora densely clothed with long, shaggy, erect pubescence; many of the setae curved. Male legs unmodified. Tarsal pads only moderately developed, not cushion-like, those of all but first segment of each tarsus divided or parted on midline; hind tarsal pads smaller and more widely divided than rest. Male fifth abdominal sternum evenly, moderately deeply emarginate. Female sixth sternum shallowly, subtriangularly emarginate. Genitalia with gonostyli slender, tapered, evenly rounded at apex, as in Eucera Group except that setae are shorter and sparser; apex of aedeagus drawn out to a blunt peak; dorsal hook slender, not strongly recurved.

Remarks. This group contains only *peninsularis*, which is known from a single locality on the southern tip of the peninsula of Baja California.

Lytta (*Adicolytta*) *peninsularis* (Fall)

Cantharis peninsularis Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 300.

Black. Vertex and upper frontal area of head reddish orange. Prothorax reddish orange; pronotum margined with black, very finely so on anterior half. Wings colorless, except for a yellow cast at apex; veins of costal margin brown, rest yellow. Length: 18 mm.-20 mm. (Fall, 1901).

Head a little longer than wide; sides subparallel above eyes; tempora smoothly rounded; dorsal margin weakly rounded; vertex finely alutaceous, moderately shiny, sparsely punctate; frontal area similar but moderately densely punctate, three shallow impressions between eyes, lateral impressions deeply, longitudinally alutaceous. Maxillary and labial palpi slender. Pronotum with distinct lateral angles, as wide as long, widest at middle; disk flattened before middle, a wide, shallow impression on each side behind middle; surface smoother than on vertex, finely, very sparsely punctate at center, a little more densely punctate at sides. Elytra rugose, subimpunctate. Tarsi moderately slender.

Male. Antennae (Fig. 91) serrate, compressed, reaching two segments beyond base of pronotum; segments III–X progressively shorter, except that V and VI are equal in length; IV–X triangular, distinctly arcuate on ventral side, produced on ventral side at apex. Middle tibiae bowed. Pad of first segment of hind tarsi absent. Emargination of sixth abdominal sternum (Fig. 249) very deeply, acutely triangular; sternum with a pair of obtuse ridges diverging from apex of emargination. Genitalia as in Figure 324.

Female. Antennae stouter; segments IV–VII subtriangular. Sixth abdominal sternum shallowly, subtriangularly emarginate. (Female characters from Fall, 1901.)

Type locality. Cabo San Lucas, Baja California Sur.

Geographic distribution. Known only from the type locality. (See Fig. 36.)

Seasonal distribution. Unknown.

Records. MÉXICO: *Baja California Sur*: Cape [Cabo] San Lucas, 1.

Remarks. The unusual antennae, hairy under surface, uniquely modified sixth abdominal sternum of the male, and absence of sexual modification of the legs of the male are among the more obvious diagnostic characters of this distinct species. Superficially it resembles *mutilata,* which has essentially the same color pattern.

The type of *peninsularis* is in the Museum of Comparative Zoology. The specimen I have studied is a male from the Van Dyke collection in the California Academy of Sciences. It is probably a eutopotype, although it does not bear Fall's label.

FIG. 36. Distribution of *Lytta peninsularis* (circle), *Lytta erebea* (squares), and *Lytta margarita* (triangle).

EUCERA GROUP

Pronotum and elytra black. Male antennal segments IV–VII enlarged, either expanded or produced on dorsal side. Female antennae slender, more strongly clavate than in Mutilata Group. Scutellum impunctate, glabrous. Under surface sparsely clothed with short pubescence. Legs slender. Setae of male fore and middle trochanters long, dense, erect ventrally. Male fore tibiae moderately compressed, enlarged apically, slightly twisted. Male middle tibiae strongly compressed, enlarged apically, strongly contorted; mesal surface excavate. Male fore and middle tarsi slightly expanded in relation to those of female. First segment of male middle tarsi weakly distorted, sparsely pubescent. Tarsal pads well developed, very dense, cushion-like; clothing setae on outer side of first three hind tarsal segments long, hairlike, encroaching to a greater or lesser extent on pads of these segments, which are asymmetrical. Male fifth abdominal sternum entire or nearly so. Male sixth sternum impunctate, glabrous, and flat at middle posteriorly, moderately deeply emarginate. Female sixth sternum subtruncate. Male genitalia with gonostyli as in Peninsularis Group; apex of aedeagus bluntly rounded; dorsal hook strongly recurved.

Remarks. This group contains the species *erebea* and *eucera.*

Key to Species

1. Head black with a small orange frontal spot; elytra distinctly rugose; segments V and VI of male antennae not strongly produced on one side (Fig. 92) ..... *erebea* (p. 143)

   Head with at least tempora and a large frontal spot orange; elytra obsolescently rugose; segments V and VI of male antennae very strongly produced on one side (Fig. 93) ..... *eucera* (p. 144)

Lytta (*Adicolytta*) *erebea* (Champion)

Cantharis erebea Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 442, pl. 20, fig. 20.

Black. Head with a small orange frontal spot. Wings dark brown. Length: 20 mm.-23 mm.

Differs structurally from *eucera* as follows.

Head as wide as long, not at all, or not nearly as distinctly, triangular in form; tempora more evenly rounded. Surface of head and pronotum more strongly granular, more densely, strongly micropunctate, less shiny (only as shiny as in *erythrothorax*), a little less finely punctate. Pronotum not as definitely hexagonal, as long as wide; disk more convex, a wide shallow fovea on each side behind middle. Elytra more coarsely, strongly rugose (as in *erythrothorax*).

Male. Antennae (Fig. 92) shorter, reaching base of pronotum; segment I short, bulbous; IV–VI moderately incrassate, weakly expanded on dorsal side and therefore a little more strongly bulged on that side than on ventral side; V largest; VII very slightly enlarged, intermediate in size and shape between VI and distal segments. Middle tibiae with excavate apical area normally pubescent. Genitalia as in Figure 325.

Female. Antennae a little more gradually clavate than in *eucera.*

Type locality. Huetamo, Michoacán.

Geographic distribution. Southeastern Michoacán and southern México (state). Both localities recorded for the species are within the drainage system of the Río Balsas. (See Fig. 36.)

Seasonal distribution. Unknown.

Records. No data, 1. MÉXICO: *México*: State label only, 1 (paratype); Temescaltepec, 2. *Michoacán*: Huetamo, 1 (paratype).

Remarks. Judged by its representation in collections, *erebea* is one of the rarest Mexican species of *Lytta.* It was described originally from a male and three females, now in the British Museum (Natural History). I have studied two of the females from the type series; a male without data in the Dugès collection in the Instituto de Biología, México, D. F.; and a male and female collected at Temescaltepec in 1931 by G. B. Hinton.

Figures of the genitalia and the antennae of the type male were kindly furnished me by C. M. F. von Hayek. The specimen figured differs from the type in that the anterior end of the aedeagus is more strongly bent.

Lytta (*Adicolytta*) *eucera* (Chevrolat)

Cantharis eucera Chevrolat, 1834, Coléoptères du Mexique, fasc. 3, p. [19]. Herrera and Mendoza, 1866, Gaceta Méd. México, vol. 2, p. 265. Dugès, 1869, La Naturaleza, vol. 1, p. 100, pl. 1, fig. 9. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 104. Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 101. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 438. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296.

Cantharis spectabilis Castelnau, 1840, Histoire naturelle des insectes Coléoptères, vol. 2, p. 273. Lacordaire, 1859, Genera des Coléoptères, vol. 5, p. 676. Haag-Rutenberg, 1879, Deutsche Ent. Zeitschr., vol. 23, p. 412.

Cantharis encera [*sic*], Horn, 1883, Trans. Amer. Ent. Soc., vol. 10, p. 310 (*lapsus calami*).

Lytta eucera, Denier, 1940, Rev. Ent., vol. 11, p. 802. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 348. Selander, 1959, Proc. Ent. Soc. Washington, vol. 61, p. 205, fig. 1.

Black. Vertex and upper frontal area dark orange or red except for a wide longitudinal median band, or only tempora and a heart-shaped frontal spot red or orange. Wings dark brown. Length: 14 mm.-32 mm.

Head wider than long; sides strongly divergent above eyes; tempora

strongly rounded, prominent; dorsal margin straight, a shallow notch on midline; surface smooth, very shiny, only faintly granular, very sparsely punctate. Pronotum distinctly hexagonal, a little wider than long, widest before middle; disk shallowly impressed before middle; occasionally there are one or two shallow foveate impressions on each side of disk, but they are never so large or so deep as in *erebea;* surface as on vertex but more distinctly granular. Elytra obsolescently rugose, subimpunctate. Hind tibiae with a dense apical fringe of long setae.

Male. Antennae (Fig. 93) reaching one or two segments beyond base of pronotum; segments IV–VI greatly incrassate; IV strongly expanded on dorsal side; V and VI each very strongly produced on dorsal side in the form of a heavy, blunt process which curves mesad; VII enlarged but only slightly distorted; VIII–X much longer than wide. Posterolateral surface of middle tibiae deeply impressed and densely pubescent apically (Fig. 192). Sixth abdominal sternum as in Figure 250; emargination often weakly humped at middle. Genitalia as in Figure 326; ventral hooks of aedeagus unusually variable.

Female. Antennae as in Figure 136, a little more strongly clavate than in *erebea;* segments IV–VII about as wide as III; IX and X at least slightly longer than wide. Middle tibiae moderately bowed.

Type locality. Of *eucera,* México or Guatemala; of *spectabilis,* México.

Geographic distribution. Mountains and high plateaus of Central America and México from western Panamá to Durango and central eastern Coahuila. (See Fig. 37.)

The northernmost record of this species that I can accept without reservation is Ciudad de Valles, San Luis Potosí. A record from Monclova, Coahuila, based on a female collected by E. Palmer (F. G. Werner collection), has been accepted, but as an extension of range of nearly 400 miles is involved, verification is desirable. Published records of *eucera* from Texas (Horn, 1873; Dillon, 1952) are at best doubtful. Dillon's record was based on an old specimen from the C. V. Riley collection bearing the label "Tex." Horn recorded the species from "Texas near the Mexican border."

Seasonal distribution. This species has been collected in every month from May to December, inclusive, with two records in February (states of México and San Luis Potosí).

Records. No data, 4. MÉXICO: Country label only, 15. *Chiapas*: Finca La Isla (not located), 1. *Coahuila*: Monclova, 1. *Colima*: Zapotlán (not located) (Champion, 1892). *Distrito Federal*: District label only, 1; Coapa, May, July, August, 5; Ciudad Madera, September, 1; Mexico City, 3 (1 in August); San Ángel, 1; San "P." de los Pinos (not located), August, 1; Tacuba, 1; Tacubaya, September, 1; Valley of Mexico, August,

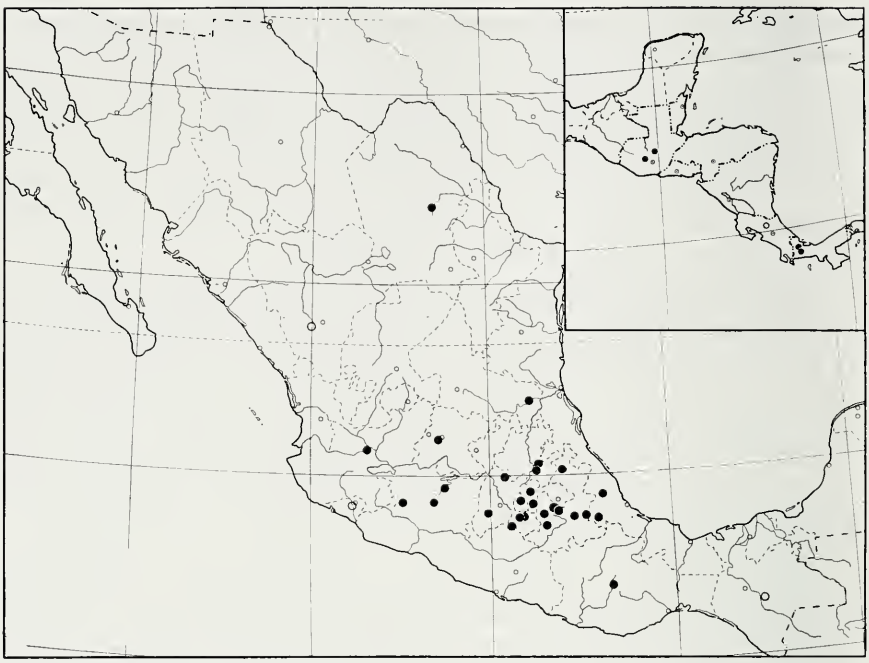


FIG. 37. Distribution of *Lytta eucera*.

3. *Durango*: Sierra de Durango, 1. *Guanajuato*: State label only, 1; Silao (Dugès, 1869). *Hidalgo*: Atotonilco el Grande (Dugès, 1869); Pachuca, July, 1. *Jalisco*: Tlaquepaque, August, 5. *México*: Chapingo, September, 1; Jilotepec (Herrera and Mendoza, 1866); San Rafael, August, 2; Temescaltepec, 3 (2 in February); Texcoco, August, 2. *Michoacán*: Morelia, 1; Tacámbaro [de Codallos] (Champion, 1892); Tancítaro, 6000 ft. and 6600 ft., July, 14. *Morelos*: Cuernavaca (Champion, 1892); Puente de Ixtla, September, 1; Tepoztlán, June, October, 2. *Oaxaca*: [La] Parada (Champion, 1892); Oaxaca [de Juárez], September, 13. *Puebla*: Atl[ixco], October, 1; Cholula (Champion, 1892); Esperanza (Champion, 1892); Huauchinango (Herrera and Mendoza, 1866); [Izúcar de] Mat[amoros], November, 1; Puebla, May, July, 50; Techamachalco, June, August, 2. *San Luis Potosí*: C[iudad de] Valles, February, 1; Huasteca Potosina (Dugès, 1889). *Veracruz*: Jalapa (Champion, 1892); Orizaba (Champion, 1892). *State unknown*: Finca Gibralter, September, 1.

GUATEMALA: Country label only, 7; Cerro [Volcán] Zunil, 4000 ft.-5000 ft., 3; Chicazoa, Finca El Naraujo, 5000 ft., July, 1; Chimaltenango, 2; San Jerónimo, 1.

COSTA RICA: Country label only, 8.

PANAMÁ: Country label only, 1; Boquete, December, 3; Volcán de Chiriquí, 4000 ft.-6000 ft., 1.

Remarks. From my present study it appears that the variation in this species is nongeographic in nature, but much additional data are required before this point can be decided with any degree of certainty. In a group where color pattern is otherwise stable intraspecifically, variation in the color of the head of *eucera* is noteworthy. Variation in the form of the aedeagus is considerably greater in *eucera* than in any of the other species of *Lytta* I have seen with the exception of *quadrimaculata.*

The first instar larva of *eucera* has been described by me in a separate publication (Selander, 1959).

The present location of the types of *eucera* and *spectabilis* is unknown to me. *Spectabilis* has long been regarded as a synonym of *eucera,* and on the basis of its description, this synonymy seems valid.

Bionomics. Herrera and Mendoza (1866) recorded *eucera* from the following three species of Cucurbitaceae: *Sicyos angulata* (as *Scicyos angularis* [*sic*]), *Sechium edule* (as *Sc. edulis* [*sic*]), and *Cucurbita moschata* (as *Pepo macrocarpa*). A specimen from Tacuba and one from Coapa, both localities in the Distrito Federal of México, are from unspecified cucurbits. A specimen from Chapingo, state of México, is recorded (probably accidentally) from clover (*trebol*) (Leguminosae).

Near the city of Puebla, Puebla, in 1957 I collected a series of adults of *eucera* from an unidentified species of Cucurbitaceae. I failed to find any specimens feeding on other species of plants in the area. Most of the adults were subsequently confined in an attempt to obtain eggs. Over a period of a week they fed solely on the cucurbit, although on several occasions I offered them specimens of *Argemone platyceras* (Papaveraceae) and several species of Compositae. Both flowers and leaves of the cucurbit were eaten.

MUTILATA GROUP

Male antennal segments IV and V or IV–VI incrassate, either expanded or produced on dorsal side. Female antennae heavier than in Eucera Group and less strongly clavate. Scutellum impunctate, glabrous. Under surface sparsely clothed with short pubescence. Setae of male trochanters short, erect, bristle-like ventrally. Male middle femora flat or concave on anterior side. Male middle tibiae enlarged apically, variously modified but not contorted or excavate. Male fore and middle tarsi slightly expanded in relation to those of female. First segment of male middle tarsi strongly distorted, very densely pubescent. Tarsal pads well developed, very dense, cushion-like. Abdominal sterna as in Eucera Group. Male genitalia with gonostyli comparatively heavy, lobed laterally before

apex, as in Figure 329; apex of aedeagus bluntly rounded; dorsal hook strongly recurved.

Remarks. This group contains the species *sanguinea, erythrothorax, mutilata,* and *cardinalis.*

Key to Species

1. Entirely orange; segments IV and V of male antennae enlarged but not strongly distorted (Fig. 94).....*sanguinea* (p. 148)
   Color not as above; segment IV of male antennae strongly expanded, V very strongly, subacutely produced on dorsal side apically.....2
2. Pronotum red with a pair of large black discal spots; male fore femora with a notch and tuft of setae on ventral side near middle; segment VI of male antennae never distorted. Southern Sonora southward.....*erythrothorax* (p. 150)
   Pronotum immaculate red or black; male fore femora unmodified; segment VI of male antennae often distorted.....3
3. Head and pronotum red, elytra black.....*mutilata* (p. 152)
   Black with red elytra.....*cardinalis* (p. 155)

Lytta (*Adicolytta*) *sanguinea* Haag-Rutenberg

Lytta sanguinea Haag-Rutenberg, 1880, Deutsche Ent. Zeitschr., vol. 24, p. 35.

Cantharis sanguinea, Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 442, pl. 20, fig. 19.

Orange. Elytra paler than head and pronotum. Antennal segments VI–XI (females) or VII–XI (males) black. Wings yellow. Under surface sometimes suffused with piceous. Pubescence pale except for some black setae on tarsi. Length: 16 mm.-27 mm.

Head slightly longer than wide; sides parallel or slightly divergent above eyes; tempora broadly rounded; vertex tumid; surface smooth, moderately shiny, very sparsely punctate. Pronotum lacking definite lateral angles, a little longer than wide, widest at anterior third or fourth; disk usually broadly, distinctly impressed before middle; surface coarsely but not strongly alutaceous, more coarsely punctate than head. Elytra rugose punctate; nervules very clearly marked.

Male. Antennae (Fig. 94) reaching base of pronotum; segments IV–VI moderately incrassate, weakly expanded on dorsal side, smooth on mesal surface, with some distortion evident in that V and VI are shallowly excavate for basal half dorsomedially; VII-X distinctly longer than wide. Modified setae of fore trochanters forming a small tuft on ventral margin near base. Fore femora excavate on ventral side for apical two-fifths. Middle femora flat or shallowly concave on anterior side, anteroventral

edge well defined. Middle tibiae sinuate, a little enlarged apically. Pale pubescence (pad) of first segment of hind tarsi limited to apex. Sixth abdominal sternum as in Figure 251. Genitalia as in Figure 327.

Female. Antennae as in Figure 137; segments VIII–X about one-fifth wider than III. Middle tibiae weakly bowed. First segment of middle and hind tarsi entirely black pubescent beneath.

Type locality. México.

Geographic distribution. Valley system of the Río Balsas and its tributaries from western Michoacán to Morelos and eastern Guerrero. (See Fig. 38.)

Seasonal distribution. July 6—September.

Records. MÉXICO: Country label only, 1 (type). *Guerrero*: State label only, 1; Iguala, September, 1; Mochitlán (Champion, 1892); Río Balsas [Balsas], 9. *Michoacán*: Apatzingan [de la Constitución], 1200 ft., July, August, 9. *Morelos*: 16 mi. south of Cuernavaca, ±1600 ft., July, 20; Jojutla, August, 3.

Remarks. The immaculate orange color easily distinguishes this species from all other species of *Lytta*. It is the only species of its group in which antennal segment V is not strongly produced in the male.

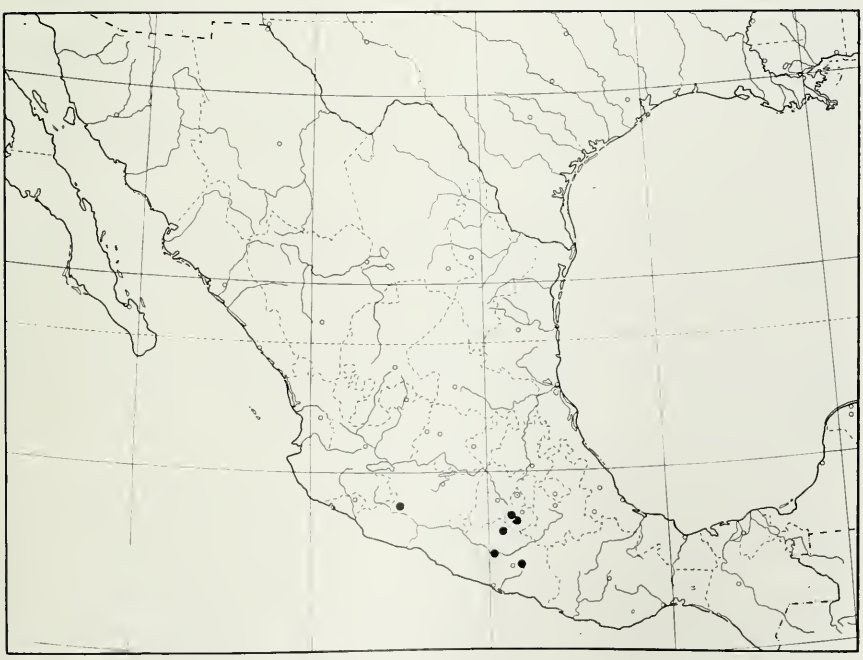


Fig. 38. Distribution of *Lytta sanguinea*.

The type of *sanguinea* is in the Zoologische Staatssammlung in Munich (examined).

Bionomics. The series of specimens from 16 mi. south of Cuernavaca, Morelos, was collected in 1955 from two species of Convolvulaceae growing in an area of disturbed ground at roadside. Eighteen of the specimens were found on an undetermined, purple-flowered species of *Ipomoea.* Feeding on this plant seemed to be confined to the corolla, mainly along the lip. Care was necessary in collecting the beetles as they tended to select deeply shaded flowers near the ground where they were easily overlooked. Two individuals were found on the flowers of *Operculina ornithopoda,* but feeding was not observed. Plant identifications were made by F. Miranda.

Lytta (*Adicolytta*) *erythrothorax* (Herrera and Mendoza)

Cantharis erytrotora Herrera and Mendoza, 1867, Gaceta Méd. México, vol. 3, p. 14.

Cantharis erytrotorax, Dugès, 1869, La Naturaleza, vol. 1, p. 166 (emendation).

Cantharis stigmata Dugès, 1881, Gaceta Méd. México, vol. 5, pl. 4, fig. 10. Not Dugès, 1869, La Naturaleza, vol. 1, p. 159.

Cantharis erythrothorax, Horn, 1885, Trans. Amer. Ent. Soc., vol. 12, p. 108 (emendation). Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 102. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 439, pl. 20, fig. 13.

Black. Head, except for neck and epistoma, red or orange. Pronotum red or orange, finely margined with black and with a large black spot on each side of disk at middle (very rarely absent); spots variable in size and shape. Scutellum and midline area of metasternum occasionally reddish. Wings brown. Length: 17 mm.-23 mm.

Head as wide as to one-tenth wider than long; sides nearly parallel above eyes; tempora broadly rounded; vertex tumid; frontal area possessing a broad, oblique impression on each side extending from tip of midline impression to mesal margin of eye; surface smooth, shiny, very sparsely punctate. Pronotum generally without distinct lateral angles, as wide as or slightly wider than long, widest anteriorly; disk broadly, deeply, transversely impressed before middle, weakly impressed on midline basally; surface as on vertex but a little more densely punctate at sides. Elytra rugose, subimpunctate.

Male. Antennae (Fig. 95) reaching base of pronotum; segments IV and V incrassate; IV strongly expanded on dorsal side, smooth on mesal side, two-fifths longer than wide; V very strongly, subacutely produced on dorsal side apically, smooth and excavate on dorsomesal side basad of apex of process (but not so strongly excavate as in *mutilata* and *cardinalis*); smooth areas of IV and V generally reddish; VI not modified; VI–X obviously longer than wide. Modified setae of fore trochanters

forming a well-marked tuft on ventral margin near base. Fore femora with a notchlike groove and a tuft of coarse setae on ventral side near middle. Middle femora compressed; anterior side excavate from near base to apex, with an elevated area along basal margin and part of ventral margin which is very densely clothed with long pubescence. Middle tibiae enlarged apically, flat and subglabrous apically on mesal side, densely padded with moderately long, semierect pubescence apically on anterior side. Pale pubescence (pad) of first segment of hind tarsi limited to apex. Sixth abdominal sternum as in Figure 252; emargination sometimes weakly humped at middle. Genitalia as in Figure 328.

Female. Antennae as in Figure 138; segments V–X at least slightly longer than wide. Middle tibiae weakly bowed. Pale pubescence (pad) of first segment of hind tarsi limited to apex or absent.

Type locality. Of *erythrothorax,* Taxco [de Alarcón], Guerrero; of *stigmata,* probably Tupátaro, Guanajuato.

Geographic distribution. Southern Sonora to central Jalisco and Colima; thence southeast to Veracruz and eastern Guerrero. (See Fig. 39.)

A label notation of "Vera Cruz" for a specimen of *erythrothorax* in the Dugès collection has been interpreted as referring to the state rather

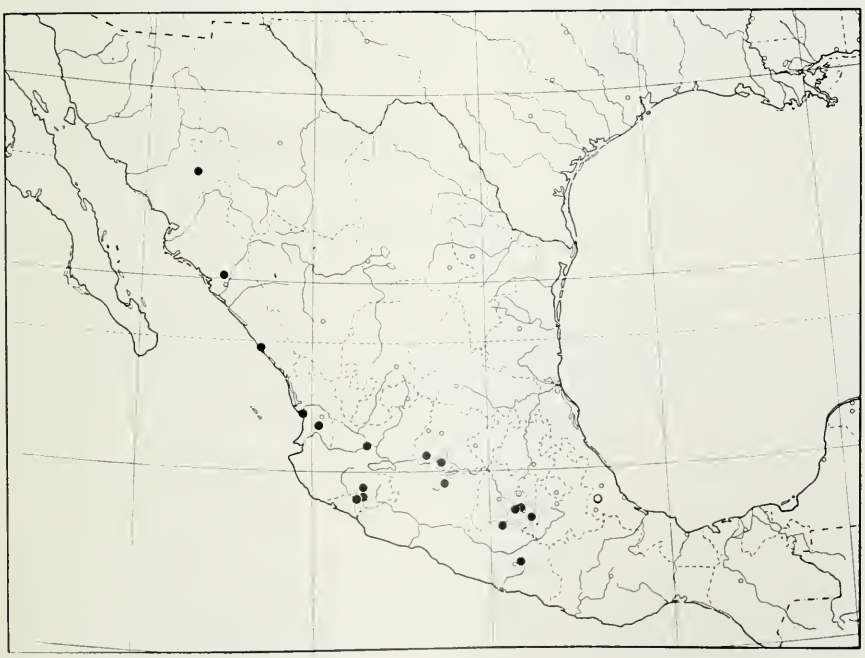


Fig. 39. Distribution of *Lytta erythrothorax.*

than the city of Veracruz. A specimen in the United States National Museum is mislabeled Texas (H. Ulke collector).

Seasonal distribution. July 10—October 16; also one record for March 4.

Records. No data, 10. MÉXICO: Country label only, 13. *Colima*: State label only, 1; Colima, September, 2; Tonila, 1. *Guanajuato*: Tupátaro (Dugès, 1889); 6 mi. northwest of Yuriria, July, 1. *Guerrero*: Amula, 6000 ft., August, 1; Michapa (not located; possibly refers to Los Reyes Michapa, Oaxaca), September, 1; Taxco [de Alarcón], August, 1. *Jalisco*: Guadalajara, March, 2; Vulcano [Volcán de] Colima, 6. *Michoacán*: Morelia, 1. *Morelos*: Cuernavaca, 8; Jalastoc [Jaloxtoc], October, 1; Tepoztlán, August, 5. *Nayarit*: Vicinity of Compostela, August, 1; San Blas, September, 1. *Sinaloa*: Mazatlán, September, 4; Pericos, August, 30; Venodio (not located; possibly an error for Venadillo), August, 1. *Sonora*: San Bernardo, July, 2. *Veracruz*: State label only, 1.

Remarks. The only species with which *erythrothorax* might be confused is *mutilata*, which differs from it most conspicuously by the characters given in the key. The pronotal spots are absent in one specimen of *erythrothorax* examined, and Champion (1892) noted the same condition in one of his specimens.

The types of both *erythrothorax* and *stigmata* have been lost. As neotype of *erythrothorax* I have designated a male in the British Museum (Natural History) from Amula, Guerrero. As neotype of *stigmata* I have designated a male in the United States National Museum labeled México (Dugès collection).

Bionomics. The series of specimens from Pericos, Sinaloa, and the single specimen from near Yururia, Guanajuato, were collected on unidentified grasses.

Lytta (*Adicolytta*) *mutilata* (Horn)

Cantharis mutilata Horn, 1875, Trans. Amer. Ent. Soc., vol. 5, p. 155; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 310. Snow, 1883, Trans. Kansas Acad. Sci., vol. 8, p. 43. Champion, 1892-93, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, pp. 439, 463, pl. 21, fig. 21. Horn, 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 356. Cockerell, 1898, New Mexico Agr. Exp. Sta. Bull. 28, p. 173. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 296. Fall and Cockerell, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 210.

Lytta mutilata, Vaurie, 1950, Amer. Mus. Novitates, no. 1477, p. 40. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 349. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 86, pl. 15.

Black. Head, except epistoma, lower margin of frontal area, antennal callosities, and often a narrow area along dorsomesal margin of eyes, red or orange. Pronotum red or orange, generally finely margined with black and with a black blotch on each of the inflexed sides above coxae.

Scutellum generally orange. Wings colorless, with pale brown veins. Midline area of metasternum usually reddish. Length: 12 mm.-24 mm.

Head as wide as long; sides weakly divergent above eyes; tempora broadly rounded; vertex and upper frontal area smooth, shiny, very sparsely punctate. Pronotum with obtuse lateral angles or none, slightly wider than long to slightly longer than wide, widest before middle; disk flattened or transversely impressed before middle, frequently with a fovea on each side just behind middle; surface as on vertex but less finely micropunctate and a little less shiny. Elytra rugose, impunctate.

Male. Antennae (Fig. 96) reaching base of pronotum; segments IV and V incrassate; IV strongly expanded on dorsal side, smooth on mesal side, one-fifth to one-third longer than wide; V very strongly, subacutely produced on dorsal side apically, smooth and excavate on dorsomesal side basad of apex of process; VI often weakly distorted, not enlarged; smooth areas of IV and V generally dark orange or reddish; VII–X nearly as wide as long. Fore trochanters with ventral margin strongly angulate basally; modified setae forming a definite row on ventral margin. Fore femora unmodified. Middle femora compressed; anterior side excavate for apical two-thirds, with an elevated area basally which is very densely clothed with long pubescence (area less extensive than in *erythrothorax*). Middle tibiae enlarged apically, nearly straight, flat and glabrous apically on mesal side, densely padded apically on anterior side with moderately long, semierect pubescence. Pale pubescence (pad) of first segment of hind tarsi limited to apex or absent. Sixth abdominal sternum as in Figure 253, or with a definite apex indicated at middle of emargination. Genitalia as in Figure 329.

Female. Antennae as in *cardinalis* (see Fig. 139) but segments V–X progressively slightly wider and VI–X as wide as long. Middle tibiae strongly bowed. Pale pubescence (pad) absent on first segment of hind tarsi.

Type locality. Arizona.

Geographic distribution. Northeastern Durango and central eastern Coahuila to southern Arizona and southern New Mexico, extending west to the Pacific Coast of California near the Mexican border and thence south to southern Baja California Norte. (See Fig. 40).

Seasonal distribution. June 28—October 5.

Records. UNITED STATES: *Arizona*: Douglas, August, 4; Marana, August, 1; Nogales, August, 1; Patagonia, August, 1; Phoenix, 10 (7 in September); Postvale, August, 2; Redrock, September, 2; Thatcher, August, 84; Tumacacori Mission, 3200 ft., August, 8; Tucson, July–October, 22; Willcox, August, 1. *California*: La Jolla, 1. *New Mexico*: State label

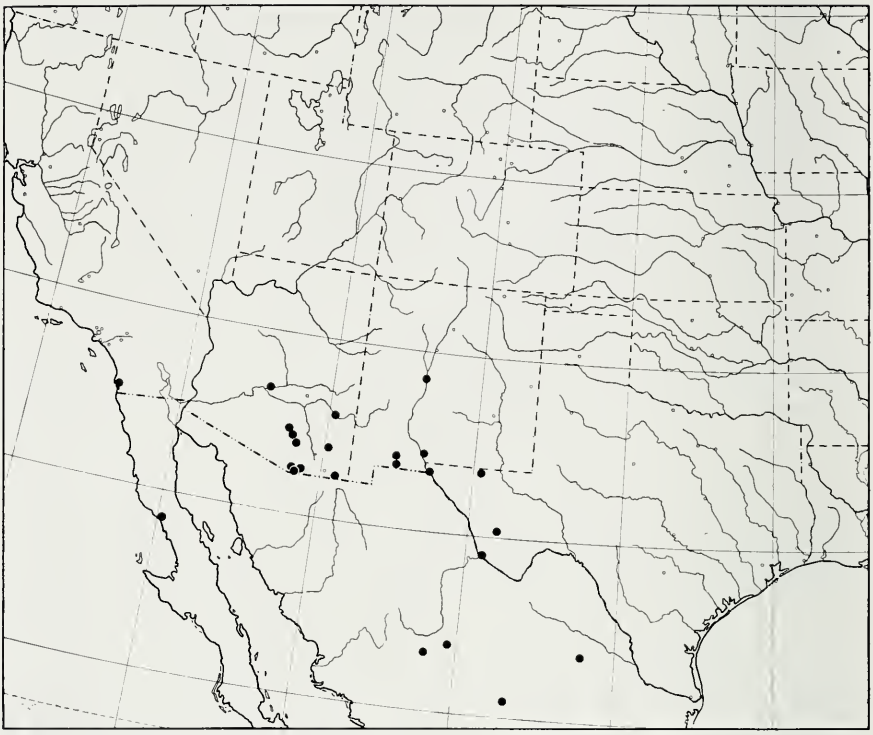


FIG. 40. Distribution of *Lytta mutilata*.

only, 2; 10 mi. north of Columbus, 4100 ft., September, 1; Deming, September, 1; Mesilla (Fall and Cockerell, 1907); Mesilla Park, August, 1; Socorro (Snow, 1883). *Texas*: State label only, 4; Alpine, June, August, 10; El Paso, 4000 ft., September, 1; Pine Springs, August, 47; Presidio, August, 44.

MÉXICO: *Baja California Norte*: San Julio (Horn, 1894). *Chihuahua*: 9 mi. north of Camargo, September, 1; Salaices, 5200 ft., September, October, 2; Kilometer 36, [between] Santa Bárbara [and] Ojito [in Durango], 6900 ft., August, 17. *Coahuila*: Monclova (Champion, 1892). *Durango*: Villa [Ciudad] Lerdo (Champion, 1892).

Remarks. Lytta mutilata is the only representative of *Adicolytta* definitely known to occur in the United States. Although apparently most closely related to *cardinalis*, it more nearly resembles *peninsularis* and *erythrothorax* in color. From *peninsularis* it is readily separated by the characters of the Mutilata Group and from *erythrothorax* by the characters given in the key to the species of the Mutilata Group.

The first instar larva of *mutilata* has been described by MacSwain

(1956). The type of the species is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. Specimens have been collected on *Cuscuta* (Convolvulaceae) at Pine Springs, Texas, by J. W. MacSwain and at Redrock, Pinal County, Arizona, by F. F. Bibby and J. W. Warren.

Lytta (*Adicolytta*) *cardinalis* Chevrolat

Lytta cardinalis Chevrolat, 1834, Coléoptères du Mexique, fasc. 1, p. [25]. *Cantharis cardinalis*, Chevrolat, 1834, Coléoptères du Mexique, fasc. 3, p. [19]. Dugès, 1869, La Naturaleza, vol. 1, p. 111, pl. 1, fig. 12. Horn, 1885, Trans. Amer. Ent. Soc., vol. 12, p. 111. Dugès, 1889, An. Mus. Michoacano, vol. 2, p. 102. Champion, 1892, Biol. Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 438, pl. 20, fig. 12.

Black. Head with a diamond-shaped orange frontal spot. Elytra a rich dark red. Wings yellow. Length: 13 mm.-25 mm.

Head barely longer than wide; sides parallel above eyes; tempora broadly rounded; dorsal margin weakly rounded; surface smooth, moderately shiny, very sparsely punctate; center of frontal spot elevated. Pronotum with obtuse lateral angles, as wide as long, widest just before middle; disk transversely impressed before middle, moderately shiny, finely, weakly, irregularly alutaceous, center before middle subimpunctate, glabrous. Elytra rugose, subimpunctate.

Male. Antennae (Fig. 97) nearly reaching base of pronotum; segments IV and V incrassate; IV strongly expanded on dorsal side, smooth on mesal side, about one-third longer than wide; V very strongly, subacutely produced on dorsal side apically, smooth and excavate on dorsomesal side basad of apex of process; VI often weakly distorted, not enlarged; VII–X distinctly longer than wide. Fore trochanters not strongly angulate on ventral margin; modified setae forming a definite row on ventral margin, setae increasing in length toward base of trochanter. Fore femora unmodified. Middle legs modified as in *mutilata*. Pale pubescence (pad) of first segment of hind tarsi limited to apex. Sixth abdominal sternum shallowly emarginate. Genitalia as in Figure 330.

Female. Antennae as in Figure 139; segments V–X not becoming perceptibly wider, each longer than wide. Middle tibiae strongly bowed. Pale pubescence (pad) absent on first segment of hind tarsi. Sixth abdominal sternum as in Figure 281.

Type locality. Tehuacán, Puebla.

Geographic distribution. Southern Puebla, northwestern Oaxaca, and eastern Guerrero to central Jalisco, extending east into Veracruz, probably in the region adjacent to southern Puebla. (See Fig. 41.)

Extension of the range of this species to Jalisco is based on a specimen in the Dugès collection. Labels of "Vera Cruz" for three additional

FIG. 41. Distribution of *Lytta cardinalis*.

specimens in the Dugès collection have been interpreted as referring to the state rather than the city of that name.

Seasonal distribution. September 16—November.

Records. No data, 2. MÉXICO: Country label only, 2. *Guerrero*: Mochitlán (Champion, 1892). *Jalisco*: Guadalajara, 1. *Morelos*: Alpuyeca, 1100 m., October, 9; Cuautla [Morelos], 1; Xochicalco (not located), October, 1; Yautepec, 9. *Oaxaca*: Huajuápan de León, September, 4; Tamazulapan, September, 1. *Puebla*: Chiantla [error for Chiautla], 1; Matamoros Izúcar [Izúcar de Matamoros], 9 (5 in November); Puebla, 1; Techamachalco, October, 2; Tehuacán (Chevrolat, 1834). *Veracruz*: State label only, 3.

Remarks. This attractive species is easily distinguished from all other New World species of *Lytta* by its distinctive color pattern. Morphologically it is most like *mutilata*.

The location of the type of *cardinalis* is unknown to me.

Bionomics. According to Chevrolat (1834), adults were found in Puebla on "une plante grimpante." Dr. C. Bolívar y Pieltain has informed me that he has seen adults on a species of white-flowered Convolvulaceae in Morelos.

Subgenus POREOSPASTA Horn, new status

Poreospasta Horn, 1868, Trans. Amer. Ent. Soc., vol. 2, p. 139. MacSwain, 1943, Ann. Ent. Soc. America, vol. 36, p. 360.

Small to moderately large beetles. Colors black or metallic (often brilliant) green, blue, or purple; head and/or pronotum sometimes partially or entirely orange. Male antennae usually long, longer than in female, reaching or extending beyond base of pronotum (except in *sublaevis*); intermediate segments incrassate or not, never excavate or produced; if intermediate segments incrassate, male hind trochanters spined or angulate, or gonostyli of male genitalia hairy, or both. Female antennae clavate. Elytra rugose or (*sublaevis*) smooth. Male fore tibiae each with two spurs, or if posterior spur absent (*nigrocyanea* and some *moerens*), then hind trochanters spined. Pygidium not produced. Male genitalia with each gonostylus bearing a mesal (or mesoventral) hook, or if hooks absent, gonostyli clothed ventrally with long setae; aedeagus with one or two ventral hooks (both absent in *childi*).

Type species. Nomaspis sublaevis Horn, by subjective synonymy with *Poreospasta polita* Horn (preoccupied); fixed by monotypy.

Remarks. In North America this subgenus contains 21 species, divided into two groups. Its range includes most of the western United States and adjacent areas in southwestern Canada and northwestern México (Figs. 7-8). In addition to the North American representatives, there are at least four Palearctic species (*luteovittata* Kraatz, *clematidis* Pallas, *poeciloptera* Semenov, and *fairmairei* Borchmann) that fall within the limits of the subgenus as presently defined. Phylogenetically *Poresospasta* seems to be nearer to the subgenera *Lytta* and *Pomphopoea* than to either *Paralytta* or *Adicolytta*.

Adults of *Poreospasta* feed on a wide variety of herbaceous plants. Larval hosts have been recorded for three species (Table I).

Five groups of *Poreospasta* may be recognized: the Luteovittata, Fairmairei, and Clematidis groups in the Palearctic region and the Stygica and Moerens groups in the Nearctic region.

The Luteovittata Group (*luteovittata*) may be defined as follows: Frontal spot present. Head subtriangular. Antennae moniliform clavate in both sexes. Male legs unmodified; all tibiae with two spurs each. Male sixth abdominal sternum with a lightly sclerotized area. Male genitalia with each gonostylus bearing a rather poorly developed hook mesoventrally at apex, clothed ventrally with long setae; aedeagus with a single ventral hook. *Luteovittata* closely approaches the species *moerens* in most characters.

The Fairmairei Group (*fairmairei*) has the following combination of

characters: Frontal spot present. Head subquadrate. Antennae filiform; segments closely articulated; male intermediate segments not incrassate. Male legs unmodified; all tibiae with two spurs each; hind tibial spurs both slender, flattened, sticklike. Male sixth abdominal sternum without a lightly sclerotized area. Male genitalia with each gonostylus bearing a mesal hook, clothed ventrally with long setae; aedeagus without ventral hooks.

The Clematidis Group (*clematidis* and *poeciloptera*) has these characters: Frontal spot absent. Head quadrate. Antennae moniliform; male intermediate segments not incrassate. Male first fore tarsal segment modified (*poeciloptera*) or not; legs otherwise unmodified; all tibiae with two spurs each. Male sixth abdominal sternum without a lightly sclerotized area. Male genitalia with gonostyli each bearing a mesal hook, clothed ventrally with long setae; aedeagus with two ventral hooks, the subapical one small.

The two North American groups of *Poreospasta* I have recognized were recently delimited by MacSwain (1956) in his classification of the first instar larvae of the Meloidae. According to MacSwain, first instar larvae of the Moerens and Stygica (= Polita) groups are separable on the basis of characters of the mandibles (distinct teeth present in the Moerens Group) and maxillae (third segment with lateral margins usually converging in the Moerens Group, never so in the Stygica Group). MacSwain's diagnosis of the adults of the Moerens Group is inaccurate, it should be noted, in that it fails to recognize the presence of mesal hooks on the male gonostyli of some of the included species.

Of the two North American groups, the Stygica Group is taxonomically the more difficult and at the same time the more interesting. In the course of the present study I have spent a disproportionately large amount of time in the analysis of this group, without arriving at wholly satisfactory results as to species limits or species relationships. The group is confined largely to California and is remarkable for the high degree of sympatry shown by its species. In both the larval stage and the adult stage the species exhibit a general uniformity of structure that makes it impossible to arrange them in a phylogenetic system with any great degree of confidence. In short, the group has undergone considerable speciation with relatively little differentiation. MacSwain, who also remarked at the difficulty of determining relationships among the species, has suggested some groupings on the base of larval morphology, but I fail to find support for these in characters of the adults. The relationships suggested in Figure 42 are static ones based entirely on adult morphology and are to be regarded as highly tentative. The morphological basis for the arrangement is largely outlined in the key to species (below).

The species *rathvoni, chloris, comans,* and *stygica* form a complex

that apparently cannot be understood without intensive field studies. The present treatment of this complex is therefore provisional, serving mainly to outline some of the evolutionary and taxonomic problems awaiting study.

The Moerens Group, which constitutes the second North American line of *Poreospasta,* seems to have undergone much of its early evolution on the Pacific Coast, where its more primitive species are now found. In the course of its development it has spread eastward and northward into the Rocky Mountains. Adults of the group are specialized with respect to other members of the subgenus in having the male hind trochanters generally angulate or spined, the male first fore tarsal segment distinctly cultriform, the male fifth abdominal sternum deeply emarginate, and the male sixth abdominal sternum with a lightly sclerotized median area. In six of the nine species of the group the intermediate segments of the male antennae are swollen to the extent that they are in part as wide as or wider than the distal segments. This character suggests the possibility of a relationship with the subgenus *Paralytta,* but the weight of evidence favors the conclusion that the similarity between the two is convergent. Whether the incrassate condition of the antennae is a primitive or specialized character within the Moerens Group itself is questionable. If it is primitive, then according to my interpretation of the phylogeny (Fig. 42), *moerens* and *navajo* on the one hand and *morosa* on the other must

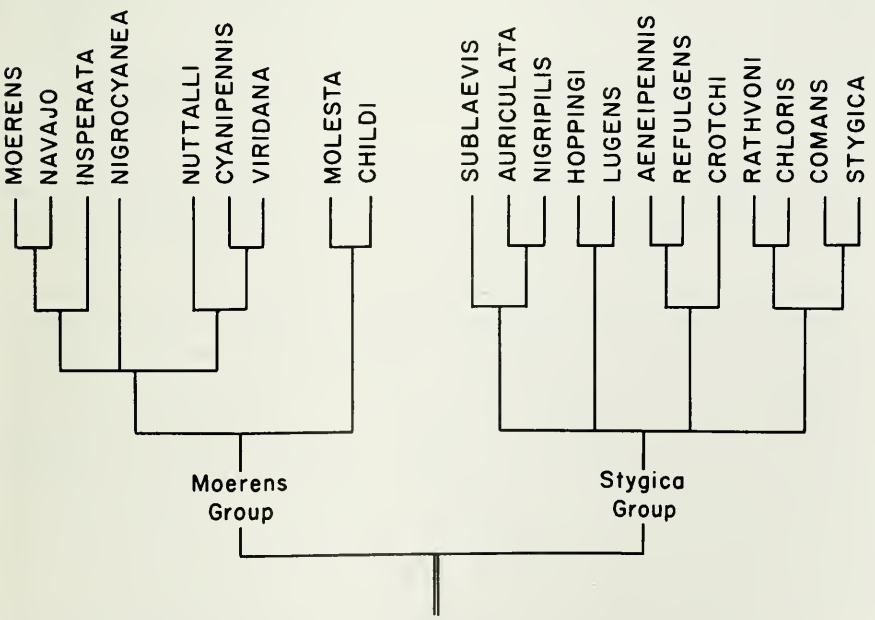


Fig. 42. Phylogeny of the North American species of *Poreospasta.*

have lost it independently. Conversely, if it is a specialized character, it presumably arose independently on two or even three occasions.

First instar larvae has been described by MacSwain (1956) for one of the four species of the Moerens Subgroup, two of the three species of the Cyanipennis Subgroup, and both species of the Childi Subgroup. Evidence from the larval morphology fully supports the division of the group into three subgroups suggested by adult morphology.

The Moerens Subgroup contains all those species of the group which retain the mesal hooks on the male gonostyli. It seems likely that the most primitive of these is *moerens*. The species *navajo* is similar to *moerens* in most characters and is apparently a derivative of it. *Insperata* differs from *moerens* and *navajo* mainly in its incrassate male antennae, distinctly spined male hind trochanters, and elongate male sixth abdominal sternum and genitalia. With respect to the first two characters it is like *nigrocyanea*, but both characters are very likely primitive for the subgroup, and I feel more inclined to regard *insperata* as a separate offshoot of the original ancestor of the subgroup than as a close relative of *nigrocyanea*.

The species *nigrocyanea* is itself a "missing link" connecting *moerens* and *navajo* with the species of the Cyanipennis Subgroup. It resembles *moerens* and *navajo* in having the male first fore tarsal segment unmodified and in retaining mesal hooks on the male gonostyli, while at the same time it has the general facies of the Cyanipennis Subgroup and almost precisely the same incrassate antennal type. It is not, however, a direct ancestor of the Cyanipennis Subgroup as the male is more specialized than any species of that subgroup in having only a single fore tibial spur.

The Cyanipennis Subgroup includes three similar, bright metallic species in which the mesal hooks of the male gonostyli have been lost and in which the first segment of the male fore tarsi is strongly distorted. Within the subgroup the species may be arranged on the basis of static relationships in the order shown in Figure 42.

In the present state of our knowledge, the Childi Subgroup is most logically regarded as a separate derivative of the ancestor of the Moerens Group. It resembles the Cyanipennis Subgroup in characters of the male genitalia (gonostyli lacking mesal hooks and clothed with long setae). However, there is little else to suggest a special relationship between the two subgroups, and I regard the genitalic similarity as probably convergent.

Key to North American Groups

1. Male intermediate antennal segments not incrassate, never wider than distal segments; male hind trochanters unmodified; male first

tarsal segment not cultriform; male fifth abdominal sternum not deeply emarginate; male sixth sternum not modified as below; gonostyli each bearing a mesal hook; aedeagus with one or two ventral hooks.....
.....Stygica Group (p. 161)

Male intermediate antennal segments incrassate or not; male hind trochanters usually spined or angulate on ventral margin (always so if antennae not incrassate); male first tarsal segment cultriform; male fifth abdominal sternum deeply emarginate; male sixth sternum elongate, very deeply, narrowly, triangularly emarginate, with a lightly sclerotized area medianly, clothed with long setae; gonostyli with or without mesal hooks; aedeagus with one ventral hook or none.....
.....Moerens Group (p. 193)

STYGICA GROUP

Head usually with a pale (orange) frontal spot. Head sparsely micropunctate, finely to moderately coarsely, usually rather sparsely punctate. Male antennae slender, except in *sublaevis* reaching at least base of pronotum; segments much more elongate than in female; intermediate segments relatively wider than in female but not wider than distal segments and not appearing incrassate. Legs slender, unmodified. Male hind trochanters neither spined nor angulate on ventral margin. Male middle tibial spurs both spiniform. Outer hind tibial spurs usually thickened, at least slightly, obliquely or very obliquely truncate; inner spur spiniform, flattened or very obliquely truncate. Male fore and middle tarsi very slightly heavier than in female. Tarsal claws slender. Male fifth abdominal sternum not deeply emarginate. Male sixth sternum not elongate, lacking a median lightly sclerotized, long-pubescent area, not clothed with long pubescence on lateral lobes; emargination triangular or shallowly obtuse. Male genitalia with each gonostylus bearing a mesal hook, glabrous or essentially so; aedeagus with one or two ventral hooks, the apical one small when present.

Remarks. This group contains the species *sublaevis, auriculata, nigripilis, hoppingi, lugens, aeneipennis, refulgens, crotchi, chloris, rathvoni, stygica,* and *comans.* It is largely confined to California, with only two species (*auriculata* and *stygica*) ranging outside the limits of the state (Fig. 7). All 12 species included in it are very similar to one another in both adult and larval characters, and on this account no formal division of the group above the species level has been made.

The adult beetles are found most commonly on flowers of *Eschscholtzia* (Papaveraceae) and *Ceanothus* (Rhamnaceae), although a great variety of other plants also serve as hosts, including particularly species of Leguminosae and Compositae. The principal, if not the only, food material utilized by the adults is pollen.

Key to Species

1. Wingless, with shortened elytra ..... *sublaevis* (p. 163)
   Wings and elytra fully developed 2
2. Black, with dark metallic blue or green elytra; conspicously clothed throughout with rather long, more or less erect pubescence; male and female sixth abdominal sterna as in Figures 255 and 282, respectively; male genitalia with ventral hooks of aedeagus rudimentary (Figs. 332c and 333c) and mesal hooks of gonostyli located nearer to middle than to apex 3
   Not as above 4
3. Pubescence colorless apically or entirely colorless, at least on under surface of body; vertex often marked with orange; male antennae (Fig. 255) nearly filiform, with more cylindrical segments; male genitalia as in Figure 332 ..... *auriculata* (p. 165)
   Pubescence piceous; vertex entirely black; male antennae (Fig. 100) more clavate, with more moniliform segments; male genitalia as in Figure 333. Sierra Nevada, and coastal California north of San Francisco Bay ..... *nigripilis* (p. 169)
4. Pronotum distinctly elongate, one-tenth to nearly one-third longer than wide; slender, black beetles, without metallic luster; pronotum with sides orange or not; outer hind tibial spur not or only slightly wider than inner spur 5
   Not as above 6
5. Pronotum orange with a wide black median stripe. *hoppingi* (p. 171)
   Pronotum entirely black ..... *lugens* (p. 172)
6. Pronotum orange, at least in part 7
   Pronotum black, green, blue, or metallic 9
7. Vertex orange ..... *aeneipennis* (p. 174)
   Head green except for usual small pronotal spot 8
8. Pronotum with a large green median spot; elytra with long pubescence confined to base ..... *refulgens* (p. 175)
   Pronotum entirely orange; elytra clothed throughout with long, erect pubescence ..... *crotchi* (p. 177)
9. Elytra violet or green with a violet (not brassy) luster; rest of body green or brass-colored; pubescence colorless; head and pronotum distinctly microreticulate; male sixth abdominal sternum medianly impressed, moderately deeply, triangularly emarginate; female sixth sternum emarginate. Sacramento and Calaveras counties, California, south to Tulare County, California ..... *rathvoni* (p 178)
   Not as above 10

10. Head and pronotum distinctly microreticulate, more or less satiny in texture; male sixth abdominal sternum (Fig. 262) relatively flat, shallowly, evenly emarginate; male antennal segments elongate, more cylindrical (Fig. 106); brilliant brassy green; pubescence colorless (Kern and Tulare counties, California) or piceous (central western California) ..... *chloris* (p. 179)

    Head and pronotum smooth or relatively so; male sixth abdominal sternum medianly impressed, moderately deeply, triangularly emarginate; male antennal segments more moniliform; pubescence piceous 11

11. Hairy, conspicuously clothed throughout with long, straight, erect pubescence; green. Central western California..... *comans* (p. 192)

    Pubescence shorter, less erect, especially on upper surface; elytral pubescence very short, subrecumbent, and inconspicuous, or if longer, erect setae present these confined to immediate base; green, blue, or black..... *stygica* (p. 185)

Lytta (*Poreospasta*) *sublaevis* (Horn)

Nomaspis sublaevis Horn, 1868, Trans. Amer. Ent. Soc., vol. 2, p. 140.

Poreospasta polita Horn, 1868, Trans. Amer. Ent. Soc., vol. 2, p. 139. Van Dyke, 1928, Univ. California Publ. Ent., vol. 4, p. 415, pl. 15, fig. 4. MacSwain, 1943, Ann. Ent. Soc. America, vol. 36, p. 361, fig. 2. Edwards, 1951, Pan-Pacific Ent., vol. 27, p. 44. Not *Lytta polita* Say, 1824, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 302. *New synonymy.*

Poreospasta sublaevis, Van Dyke, 1928, Univ. California Publ. Ent., vol. 4, p. 416, pl. 15, fig. 3.

Lytta polita, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 95.

Black. Head with a large orange spot at center above eyes, occasionally with occiput orange also. Pronotum often orange at sides, rarely with disk orange except for a pair of black spots. Length: 11 mm.-20 mm.

Wingless, with elytra shortened and abdomen somewhat swollen. Head with sides straight, generally divergent; tempora well marked; dorsal margin weakly curved; surface finely granular to smooth, finely, sparsely, deeply punctate; pubescence short, scattered. Eyes very small, oval. Pronotum subhexagonal, wider than long; disk even, flattened, sometimes with a fovea on each side at middle; surface glabrous, impunctate or very sparsely punctate at center of disk. Scutellum large, broad, bluntly rounded or truncate, generally foveate. Elytra shortened, somewhat inflated, covering mesothoracic epimera at sides, exposing last two abdominal terga when abdomen is not badly shrunken; sutural margins touching or overlapping for basal two-thirds to three-fourths, then strongly divergent; surface smooth (not rugose), very finely punctate, subglabrous. Hind wings entirely absent. Mesothorax shortened, the

middle coxae almost reaching metasternum, not overlapping hind coxae. Middle tibiae bowed. Outer hind tibial spur twice as wide as inner spur, expanded apically, very obliquely truncate; inner spur very obliquely truncate. Tarsal pads moderately well developed, undivided; first segment of middle tarsi and all segments of hind tarsi entirely dark pubescent. Abdomen somewhat swollen; terga and sterna fully developed, normal.

Male. Antennae (Fig. 98) short, reaching about middle of pronotum, segment III fully twice as long as wide; IV–X shorter, subequal in length, becoming progressively more moniliform and slightly wider. Fifth abdominal sternum feebly emarginate. Emargination of sixth sternum (Fig. 254) moderately deep, triangular; a shallow median sulcus from apex of emargination. Genitalia as in Figure 331; apical ventral hook of aedeagus obsolescent.

Female. Tending to be larger than male and with more strongly swollen abdomen. Antennae shorter (Fig. 140). Sixth abdominal sternum shallowly, triangularly emarginate.

Type locality. Of *polita*, "Southern Coast Range of California" (Horn, 1868); of *sublaevis*, Fort Tejon, California.

Geographic distribution. Western side of the Central Valley of California and adjacent hills from Alameda and San Joaquin counties south; thence east along the Tehachapi Mountains and north along the eastern edge of the Central Valley to Tulare County. (See Fig. 45.)

Seasonal distribution. February 21—July 25.

Records. UNITED STATES: *California*: Alamont Pass, Alameda County, April, 1; Arvin, February–April, 48; 20 mi. east of Bakersfield, April, 7; 10 mi. north of Blackswells Corner, April, 4; Coalinga and 10 mi. east of Coalinga, March, April, 3; Corral Hollow, San Joaquin County, March, 2; Cottonwood Creek, Kern County (ambiguous; not mapped), March, April, 5; 5 mi. south of Democrat Springs, Kern County, April, 3; Ducor, March, 4; Fort Tejon (Horn, 1868); Gorman (Van Dyke, 1928); Hospital Canyon, San Joaquin County, March, April, 6; Ingram Canyon, 8 mi. west of Westley, April, 3; Kettleman Hills, March, 1; Kings County, June, 7; Livermore, March, 4; Llanada, February, 41; Los Banos, Merced County, 2; Lost Hills, Kern County, March, April, 5; 30 mi. southwest of Mendota, April, 1; ½ mi. north of Midway, April, 38; Oro Lona, February, 2; Panoche and Panoche Creek, Fresno County, March, April, 2; Porterville, July, 1; Posey Creek (Van Dyke, 1928); Simmler, March, April, 29; Tipton, March, 8; Tracy and vicinity, March, 27; Tulare Lake, March, 19; Visalia, March, June, 3; Warthan Canyon, Fresno County, March, 4; Woody, March, 1.

Remarks. This is the only wingless species of *Lytta.* Superficially, the adults are very similar to those of the genus *Meloe,* but they are easily distinguished by the presence of the pale frontal spot on the head, as well as by the presence of mesal hooks on the gonostyli of the male genitalia.

Despite extensive modification of the body form accompanying the loss of wings, there is no question but that *sublaevis* belongs in the present group. Credit for first recognizing its true relationships belongs to MacSwain (1956).

In most specimens from the western side of the Central Valley the head and pronotum are quite finely sculptured, the disk of the pronotum is relatively flat, and the sides of the pronotum are distinctly angulate. The head is black except for the pale frontal spot. There is some orange on the pronotum in approximately half the specimens examined; generally, this color is limited to the sides, but in a few specimens it covers nearly all the pronotum. Color variation does not appear to follow any regular geographic pattern within the limits of this western race. Along the southern and eastern edge of the Central Valley *sublaevis* is represented by a race which differs from the western form in having the head and pronotum more coarsely sculptured, the disk of the pronotum more convex, the sides of the pronotum less strongly or not at all angulate, and the pronotum consistently entirely black. In two of the specimens (Ducor and Visalia) the top of the vertex (as well as the usual frontal spot) is orange.

Typical representatives of the two races are shown in Van Dyke's work (1928, pl. 15, figs. 3-4). Approximately 90 per cent of the specimens examined can be sorted to race with ease. However, variation in both races, and especially in the western one, makes a consistent separation of specimens impossible. Interestingly, within the range of the western race specimens structurally resembling the southeastern race occur more commonly in the north than in the south.

The larva of *sublaevis* has been described (as *polita*) by MacSwain (1943 and 1956). The types of *polita* and *sublaevis* are in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. There are two records of *sublaevis* feeding on grass, two from *Eschscholtzia* (Papaveraceae), one from *Amsinckia* (Boraginaceae), and one from Compositae.

Lytta (*Poreospasta*) *auriculata* Horn

Lytta auriculata Horn, 1870, Trans. Amer. Ent. Soc., vol. 3, p. 91. Van Dyke, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 131. Edwards, 1951, Pan-Pacific Ent., vol. 27, p. 44. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 90.

Cantharis auriculata, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 113; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.

Black, sometimes with a faint metallic blue or green luster. Head with a small orange frontal spot; vertex typically orange with a black stripe on midline but varying from entirely orange to entirely black. Elytra generally metallic green or bluish green, varying to nearly black. Wings brown, the anal region pale. Pubescence entirely colorless or colorless with base piceous, that on upper surface of body varying very rarely to entirely piceous; pubescence erect, producing a hairy appearance. Length: 6 mm.-19 mm.

Head quadrate; tempora not prominent; dorsal margin truncate; vertex smooth, shiny, rather finely, deeply, moderately densely to sparsely punctate; punctures separated by an average distance greater than diameter of a single puncture; frontal area more densely punctate and usually a little alutaceous; pubescence long, fine, erect, conspicuous, varying in different specimens from half to fully as long as fourth segment of middle tarsus. Pronotum (Fig. 185) as wide as or slightly wider than long, not transverse, generally subhexagonal, with obtuse lateral angles, but varying to nearly circular; surface before middle like that of vertex, behind middle more densely punctate and sometimes weakly alutaceous; pubescence as on vertex; basal margin not strongly reflexed. Scutellum rounded. Elytra rugose, impunctate, sparsely, regularly clothed with semierect setae which are usually a little shorter than those on head. Outer hind tibial spur two to three times as wide as inner spur, rather acute at apex; inner spur obtuse. Tarsal pads well developed, undivided on fore and middle tarsi and on first segment of hind tarsi, tending to be divided on midline on second to fourth segments of hind tarsi; pale pubescence (pad) of first segment of hind tarsi limited to apical half to two-thirds. Tarsal claws (Fig. 201) heavier and more strongly curved than in related species except *nigripilis.*

Male. Antennae (Fig. 99) extending two segments beyond base of pronotum; distal segments at most one and one-fourth longer than wide, only slightly wider than intermediate segments; XI about as wide as X, shorter than IX and X combined. Fifth abdominal sternum shallowly, broadly emarginate. Emargination of sixth sternum (Fig. 255) deep, triangular; sternum lacking fine median groove, impressed between lateral lobes, which are rather densely pubescent. Genitalia as in Figure 332; gonoforceps more elongate than in *nigripilis;* gonostyli slender, the mesal hook on each located distad of midpoint between base and apex; dorsal margin of aedeagus abruptly emarginate near apex, which is slender; ventral aedeagal hooks rudimentary, the apical hook often obsolete; dorsal hook strongly recurved.

Female. Antennae (Fig. 141) not reaching base of pronotum. Tarsal pads smaller and often in part divided; pale pubescence (pad) of first segment of middle tarsi limited to apex. Sixth abdominal sternum not impressed, either emarginate (Fig. 282) or with apex entire.

Type locality. Kern River region, California.

Geographic distribution. Southern California and the Sonoran Desert of Arizona, extending north along the Colorado River system to southern Utah and south onto the peninsula of Baja California. (See Fig. 43.)

Seasonal distribution. March—July.

Records. UNITED STATES: *Arizona*: Cortaro, March, 5; Florence Junction, April, 1; Fredonia, June, 5; Gila Bend, April, 2; Oatman, April, 1; Oracle Junction, April, 1; Peach Springs, June, 1; Phoenix, March–June, 7; Pichacho, April, 1; Sabino Canyon, March, 1; Sentinel, March, 19; Tucson, March–May, 19; Willton, April, 1. *California*: Andreas Canyon, April, 3; Argus Mountains, May, 10; Arvin, April, 9; Baker, March, 11; Banning, March–June, 12; Barrett Springs, April, 6; 10 mi. north of Blackwells Corner, Kern County, April, 10; Borrego [Springs], March, April, 28; Buckmans Springs, San Diego County, May, 10; Cajon Pass, June, 7; Camarillo, March, April, 12; Carmel, May, 44; Chilao, June, 8; Chino

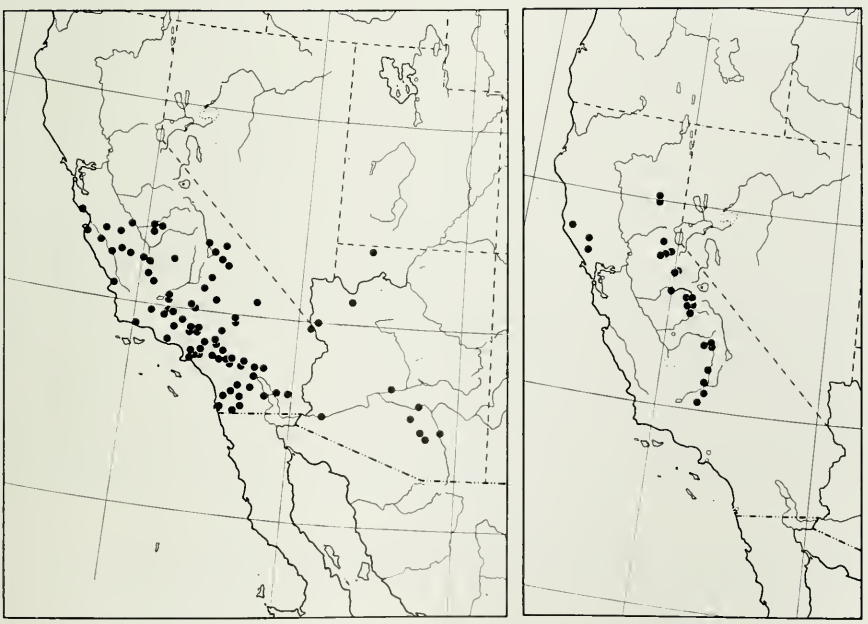


Fig. 43 (left). Distribution of *Lytta auriculata.*

Fig. 44 (right). Distribution of *Lytta nigripilis.*

Canyon, March, 1; Chocolate Mountains, Imperial County, April, 3; Claremont, 4; Clovis, May, 3; Coachella Valley, 1; Coalinga (and Warthan Canyon), March–May, 13; Cronise Lake, April, 2; Crystal Lake, Los Angeles County, June, 1; Cuyama Valley, Kern County, May, 1; Daggett, April, 3; Darwin, May, 21; Deep Creek, San Bernardino County, May, 2; Doble, June, 1; Edison, April, 2; Elizabeth Lake, Los Angeles County, June, 1; El Mirador, April, May, 12; El Paso Mountains, April, 1; Frazier Park, May, June, 65; Frenchmans Flat, Los Angeles County, April, 1; Fresno, June, 7; Gavilan, April, May, 3; Gilman Hot Springs, May, June, 5; south of Gorgonia Pass, May, 1; Griffith Park, April, 6; Indio, March, 1; 5 mi. west of Indio, March, 1; 20 mi. east of Indio, April, 13; Joshua Tree National Monument, April, 3; Kane Springs, March, 1; Keeler, May, 8; Kings County, April, 5; Lancaster, April, May, 8; Lanes Bridge, Fresno County, April, 27; Lebec, 4000 ft., May, June, 12; Little Lake, Inyo County, May, 2; Lone Pine, May, June, 2; Los Angeles, April, 3; Lost Hills and 6 mi. south of Lost Hills, April, 14; Lytle Creek, San Bernardino County, May, 1; Maricopa Pass, July, 2; Mendota and 30 mi. southwest of Mendota, April, 4; Milham City (MacSwain, 1956); Mint Canyon, April, 12; Mojave, April–June, 7; Morongo Valley, May, 1; Morro Bay, San Luis Obispo County, June, 1; Mount Pinos, Kern County, June, 5; The Narrows, San Diego County, March, April, 3; Neenach, May, 1; Needles, March, 4; Niland, April, 1; Owens Valley, May, 3; Palm Canyon, April, 3; Palmdale, May, 1; Palm Springs, March, April, 61; Panamint Mountains, May, 13; Panoche Hills and Panoche Valley, April, May, 14; Paraiso Springs, May, June, 3; Pasadena, 1; 6 mi. east of Pearblossom, May, 31; Pine Mountains, San Luis Obispo County, April, 1; Pinnacles, May, 10; Poway, 2; Priest Valley, Monterey County, May, 1; Ramona, April, 1; Randsburg, May, 1; Riverside, April, 4; Saboba Springs, Riverside County, June, 1; San Bernardino, 1; San Carlos Canyon, May, 1; San Diego, April, May, 10; San Jacinto Mountains (Cranston Ranger Station, Herkey Creek, Idyllwild, 8 mi.-9 mi. west of Keen Camp, Pinon Flat, Ribbonwood, San Jacinto River, 3000 ft., Vandevanter Flat), May, June, 55; San Lucas, April, 4; San Marcus Pass, June, 2; Santa Cruz, June, 2; Santa Monica, April, 3; Santa Rosa Mountains, 5800 ft. and 6200 ft., May, June, 15; 2 mi. north of Shavers Well, Riverside County, April, 3; Tanbark Flat and 4 mi. west of Tanbark Flat, Los Angeles County, June, 7; Tehachapi, May, 14; Tejon Pass, May, 2; Tulare Lake, March, 4; Ventucopa, April, 3; Victorville, April, May, 3; 7 mi. east of Walker Pass, April, 5; Yermo, April, May, 5. *Utah*: State label only, 1.

MÉXICO: *Baja California* [*Norte*?]: Metero Beach, April, 3.

Remarks. The color of the head in *auriculata* varies geographically. In Arizona, Baja California, and most of southern California the vertex is orange, usually with a black stripe on the midline. In western Fresno

County, eastern Kern County, and eastern Los Angeles County there is an evident reduction in the average size of the orange area. West of these areas the trend continues into the Coastal Range, where the orange area is commonly reduced to an inconspicuous spot on each of the tempora or is obliterated entirely. Individuals without orange on the vertex occur in western Los Angeles County at Griffith Park, Mint Canyon, and Neenach. In Ventura County the vertex is entirely black in 11 of 14 specimens examined. At Frazier Park and nearby Lebec, in extreme southern Kern County, it is black in 61 (79 per cent) of 77 specimens. From Santa Barbara County five specimens are available (San Marcus Pass and Ventucopa), all with the orange area reduced to a small spot at the tempora. The single specimen from San Luis Obispo County (Morro Bay) is similar. Northward, in San Benito County, two of ten specimens from Pinnacles have the vertex entirely black. At San Lucas, Monterey County, it is entirely black in 3 of 4 specimens examined; at Carmel, Monterey County, in 33 (75 per cent) of 44 specimens; and at Santa Cruz, Santa Cruz County, in 1 of 2 specimens.

Correlated with the reduction of the orange area of the vertex in *auriculata* from the Coastal Range area of California there is a tendency for the color of the elytra to be darker and less metallic than is usual elsewhere in the range of the species. As far as I can tell, however, there is no comparable tendency for darkening of the pubescence.

Included among the material studied in the collection of the San Jose State College is a male of *auriculata* found mated with a female of *sublaevis* at Coalinga, California. This apparently unique case of interspecific mating of Meloidae was previously reported by Edwards (1951).

The first instar larva of *auriculata* has been described by MacSwain (1956). The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. The following food plants have been recorded, primarily in California: African daisy, *Encclia,* and *Geraca canescens* (Compositae); *Argemone* and *Eschscholtzia* (Papaveraceae); *Cuscuta umbellata* (Convolvulaceae); *Dicentra* (Fumariaceae); *Eriodictyon* and *Phacelia* (Hydrophyllaceae); *Lupinus* (Leguminosae); *Pentstemon spectabilis* (Scrophulariaceae); *Salvia* (Labiatae); *Sambucus* (Caprifoliaceae); *Sphaeralcea* and S. *ambigua* (Malvaceae); and *Verbena* (Verbenaceae).

Lytta (*Poreospasta*) *nigripilis* (Fall)

Cantharis nigripilis Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 303.
Lytta nigripilis, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 91, pl. 14.

Differs from *auriculata* as follows.

Head usually black with a small orange frontal spot; in one female

from Potwisha, Tulare County, California, top of vertex dark orange. Elytra dark metallic blue or blue-black, only rarely with a tinge of green. Pubescence uniformly piceous, or at most with the tips of the pubescence of the under surface of the thorax colorless.

Male. Antennae (Fig. 100) with distal segments as a rule a little more moniliform and more noticeably wide than preceding segments. Pale pubescence (pad) of first segment of hind tarsi frequently limited to less than apical half of segment, never to more than half. Genitalia as in Figure 333; gonoforceps less elongate; gonostyli more robust, the mesal hooks located at or basad of midpoint between apex and base of gonostyli; aedeagus with dorsal margin more or less evenly rounded apically and with dorsal hook more massive, not strongly recurved.

Type locality. Sierra Nevada of California, from Tulare County to Tuolumne County.

Geographic distribution. Sierra Nevada and northern coastal region of California. (See Fig. 44.)

Seasonal distribution. March—July 10.

Records. UNITED STATES: *California*: State label only, 2; Ash Mountain, April, June, 3; Bass Lake, June, 10; Big Trees, Sequoia National Park, June, 1; 3 mi. south of Camino, June, 2; Camp Nelson, Tulare County, July, 1; Clear Lake, May, 2; Clearlake Oaks, May, 9; Colfax, May, 11; Colony Mill Road, Tulare County, June, 4; Comfort, Mendocino County, 1; Coulterville, April, 7; Glennville, April, 1; Havilah, June, 1; Hobergs, May, 2; Kern County, March, 3; Kaweah, 4; Malpitas, 3; Mariposa County, May, June, 3; Meadow Valley, Plumas County, June, 1; Mendocino County, June, 11; Miami Ranger Station, Madera County, June, 5; Oakhurst, June, 1; Placerville, April, 2; Potwisha, Tulare County, June, 40; Riverton, July, 4; Seneca, June, 2; Sequoia National Park, 2000 ft.-3000 ft., April, May, 60; Shut Eye Mountain, Madera County, June, 7; Snowline Camp, Eldorado County, June, July, 49; Springville, June, 5; Strawberry, June, 2; Sugar Pine, 4; Tuolumne County, May, 6; Wawona, June, 3.

Remarks. The species appears to have a disjunct distribution, with a small population in the northern Coastal Range of California isolated by the Central Valley from the main population in the Sierra Nevada. There seems to be no morphological difference between the two populations.

The range of *nigripilis* is strictly allopatric with respect to that of *auriculata.* Along the coast of California there is apparently a sizable gap between the ranges of the two forms. In southern California the main *nigripilis* population extends to the southern end of the Sierra Nevada, which cuts deeply into the range of *auriculata.* Apparently in this region

nigripilis cannot exist in the dry lowlands, while *auriculata* is not successful in the higher, more mesic habitat of *nigripilis*.

Since *nigripilis* and *auriculata* are very closely related, their allopatric distributional relationship suggests that they may ultimately prove to be only racially distinct. However, I have not found any definite indication that they are capable of interbreeding. On the basis of the characters of the male genitalia they are 100 per cent separable. Some overlap between them occurs in all other characters, but the variation producing this overlap tends in the main to be sporadic and nongeographic in nature, with no discernible tendency for the two species to converge morphologically where they approach each other geographically. Variation in head color in *auriculata* constitutes an exception in that it is clearly geographical. However, here again there is no indication of intergradation between *auriculata* and *nigripilis* in a geographically intermediate area. It would therefore seem that the relatively poor differentiation of the two forms in most characters is a reflection of their close phylogenetic relationship rather than the result of introgression at the present time. Field investigations centered in the area of close geographic approximation of the two species in Kern County will undoubtedly contribute greatly to a further clarification of the situation.

The first instar larva of *nigripilis* has been described by MacSwain (1956) from specimens obtained from adults collected in Eldorado County, California. As to be expected, the larva differs from that of *auriculata* in only minor points.

The type of *nigripilis* is in the Museum of Comparative Zoology. I have examined two cotypes, labeled southern California, in the United States National Museum.

Bionomics. The following food plants have been recorded: *Ceanothus* (Rhamnaceae), *Eriogonum* (Polygonaceae), *Lupinus* and *Vicia* (Leguminosae), and Ranunculaceae.

Lytta (*Poreospasta*) *hoppingi* Wellman

Lytta hoppingi Wellman, 1912, Ent. News, vol. 23, p. 35. Van Dyke, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 131.

Black. Head with an elongate orange or piceous frontal spot between eyes; tempora frequently orange or piceous also. Pronotum orange with a wide median stripe and anterior margin black; stripe scalloped at sides, sometimes narrowed toward base. Wings light brown, the anal region paler. Length: 11 mm.-13 mm.

Head quadrate; vertex smooth, shiny, rather finely, moderately densely punctate; frontal area a little more densely punctate, irregularly, shallowly impressed above and below frontal spot, rarely slightly alutaceous; pubes-

cence rather long, erect. Eyes moderately wide, scarcely emarginate. Pronotum elongate, slender, one-tenth to three-tenths longer than wide; sides rather evenly arcuate from base to apex, without indication of lateral angles; disk weakly convex; surface and pubescence as on vertex. Scutellum subtruncate. Elytra noticeably broadened apically; surface weakly alutaceous, subimpunctate; pubescence in basal region long, as on head and pronotum, becoming shorter but not sparser toward apex. Outer hind tibial spur not or only slightly wider than inner spur, very obliquely truncate; inner spur obtuse. Tarsal pads weakly developed, similar to those of *lugens*. Tarsal claws weakly curved.

Male. Antennae (Fig. 101) reaching base of pronotum or surpassing it by one segment; segments elongate moniliform, III–X subequal in width or with distal segments very slightly wider; X noticeably shorter than rest. Fifth abdominal sternum entire. Emargination of sixth sternum (Fig. 256) triangular. Genitalia as in Figure 334.

Female. Antennae (Fig. 142) reaching one segment beyond middle of pronotum; segments III–VI subequal in width; VII–X becoming progressively wider. Sixth abdominal sternum truncate.

Type locality. Coalinga, California.

Geographic distribution. Foothills at the southern end of the Central Valley of California. (See Fig. 46.)

Seasonal distribution. March 21—June.

Records. UNITED STATES: *California*: Coalinga, May, 10 (including holotype and one paratype); Delano, March, 2; Tulare County, April, 2; Visalia, March, June, 17.

Remarks. Morphologically *hoppingi* is quite similar to *lugens*. Its color pattern is unique for the genus *Lytta*.

The type of *hoppingi* is in the United States National Museum (examined).

Lytta (*Poreospasta*) *lugens* (LeConte)

Cantharis lugens LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 161. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 112; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.

Lytta lugens, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 355.

Black, with or without a tiny piceous or orange frontal spot between eyes. Wings light brown with colorless anal region. Length: 11 mm.-17 mm.

Head subquadrate; vertex smooth, shiny, moderately coarsely, moderately densely punctate, with a few very fine punctures interspersed with

larger ones; frontal area more densely punctate, alutaceous, irregularly, shallowly impressed; pubescence moderately long, erect. Eyes moderately wide, scarcely emarginate. Pronotum (Fig. 186) elongate, slender, one-fifth longer than wide; sides straight and rather weakly divergent from base to before middle, then convergent; disk weakly convex; surface shiny, more coarsely and for the most part more densely punctate than vertex, generally distinctly alutaceous; pubescence as on vertex. Scutellum rounded. Elytra rugose, subimpunctate; pubescence very short, erect, sparse, with some longer setae at base and along margins. Outer hind tibial spur (Fig. 196) not or only very slightly wider than inner spur, distinctly shorter, flattened or very obliquely truncate; inner spur obtuse. Tarsal pads weakly developed, divided on fore and middle tarsi; pale pubescence (pad) completely absent on first segment of middle tarsi and all segments of hind tarsi. Tarsal claws moderately curved.

Male. Antennae (Fig. 102) reaching base of pronotum; segments elongate moniliform; III–VI subequal in width; VII–X slightly wider; III and X shorter than rest (except II); XI about three-fourths as long as IX and X combined. Fifth abdominal sternum very shallowly, broadly emarginate. Emargination of sixth sternum (Fig. 257) triangular. Genitalia as in Figure 335; aedeagus with a single ventral hook.

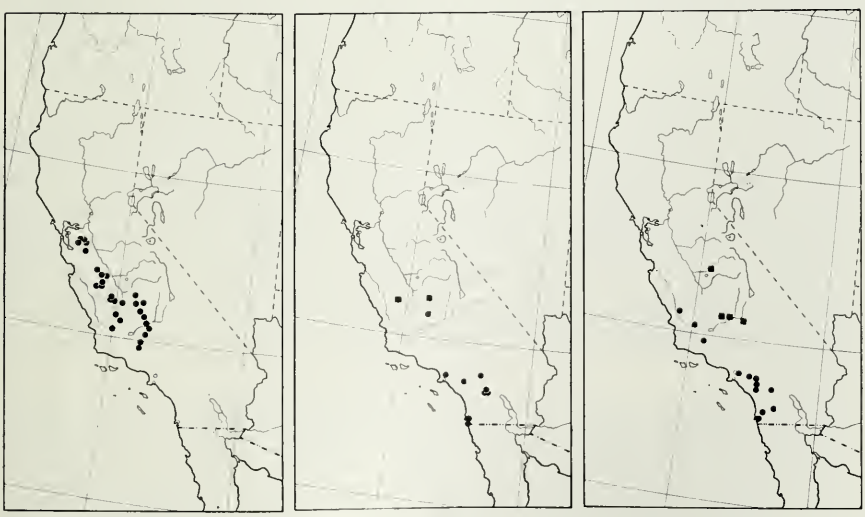


Fig. 45 (left). Distribution of *Lytta sublaevis.*

Fig. 46 (center). Distribution of *Lytta lugens* (circles) and *Lytta hoppingi* (squares).

Fig. 47 (right). Distribution of *Lytta aeneipennis* (circles) and *Lytta refulgens* (squares).

Female. Antennae (Fig. 143) reaching middle of pronotum; segments III–V subequal in width; VII–X becoming progressively wider. Sixth abdominal sternum truncate or weakly notched.

Type locality. San Diego, California.

Geographic distribution. Southwestern California, from Los Angeles and San Bernardino counties to San Diego County. (See Fig. 46.)

Seasonal distribution. May 27—July.

Records. UNITED STATES: *California*: State label only, 2; Barton Flats, San Bernardino County, July, 2; Corona, 1; Coronado, May, 1; Los Angeles, 1; Pinon Flat, San Jacinto Mountains, May, June, 7; Ribbonwood, 1; San Diego, 1; Vandevanter Flat, San Jacinto Mountains, June, 1.

Remarks. This species may be immediately separated from other all-black species of *Lytta* by its elongate pronotum and slender outer hind tibial spurs. It is most similar structurally to *hoppingi.*

The type of *lugens* is in the Museum of Comparative Zoology.

Bionomics. Specimens have been collected in the San Jacinto Mountains on *Argemone* (Papaveraceae), *Eriogonum* (Polygonaceae), and *Lupinus* (Leguminosae).

Lytta (*Poreospasta*) *aeneipennis* (LeConte)

Cantharis aeneipennis LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 160. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 113; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.

Lytta aeneipennis, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 334. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 91.

Vertex and median part of frontal area orange; rest of head black. Pronotum orange, finely margined with black; a short, brownish streak often present on midline before middle. Elytra metallic blue-green, green, or blue. Under surface and femora dark metallic blue or blue-black. Scutellum, tibiae, and tarsi black. Wings pale brown, the base nearly colorless. Pubescence piceous, with a sericeous luster; setae long and erect except on elytra, giving beetle a hairy appearance. Length: 5 mm.-12 mm.

Head quadrate or nearly so; tempora not prominent; dorsal margin weakly rounded; vertex moderately shiny, finely granular, finely, sparsely to moderately densely punctate; where densest, punctures separated by an average distance greater than the diameter of a single puncture; frontal area more densely punctate, finely, weakly alutaceous, with a smooth, impunctate area at center; pubescence fine, about two-thirds as long as fourth segment of middle tarsus. Eyes small. Pronotum transverse, one-tenth to (rarely) one-fourth wider than long; outline varying between

the extremes shown in Figures 187 and 188; disk almost always with a shallow impression on each side behind middle; surface a little alutaceous, otherwise as on vertex and with similar pubescence; basal impressed line weak; basal margin not strongly inflexed. Scutellum truncate. Elytra rugose, impunctate; some long, erect setae at base, but surface otherwise with only scattered, short, subrecumbent setae. Pubescence on under surface, coxae, trochanters, and femora fine, long, as on head. Outer hind tibial spur moderately slender, not more than twice as wide as inner spur, acute at apex; inner spur acute (Fig. 198). Tarsal pads weakly developed, undivided; first segment of middle and hind tarsi entirely piceous pubescent. Tarsal claws slender.

Male. Antennae (Fig. 103) reaching or slightly surpassing base of pronotum; distal segments about twice as long as wide; IV–X subequal in length and width; XI shorter than IX and X combined. Fifth abdominal sternum very shallowly emarginate. Sixth sternum variable in shape (Figs. 258-59), shallowly emarginate; a fine median groove running from posterior margin to base of sternum. Genitalia as in Figure 336; aedeagus with a single ventral hook.

Female. Antennae (Fig. 144) not reaching base of pronotum. Fifth abdominal sternum entire. Sixth sternum truncate or feebly emarginate, lacking a distinct median groove.

Type locality. Santa Ysabel, California.

Geographic distribution. Southwestern California, from San Luis Obispo County to San Diego County. (See Fig. 47.)

Seasonal distribution. March 18—May.

Records. UNITED STATES: *California*: State label only, 21; near Cariso [Carrizo] Creek (Horn, 1873) (not mapped); 4 mi. west of Coahuila [Coachella], April, 89; 10 mi. southeast of Creston, March, 1; Elsinore, 3; The Gavilan, Riverside County, April, 1; Pomona, 4; Poway, 1; Riverside, April, 4; San Diego, 1; Santa Isabel [Ysabel] (LeConte, 1851); Simmler, March, April, 29; Ventucopa, April, 6.

Remarks. This species most closely resembles *refulgens* structurally. It is easily distinguished from all related species in having both the vertex and the pronotum orange in color.

The larva has been described by MacSwain (1956). The type is in the Museum of Comparative Zoology.

Bionomics. The series from near Coahuila was collected on *Eschscholtzia* (Papaveraceae), as previously reported by MacSwain (1956).

Lytta (*Poreospasta*) *refulgens* Horn

Lytta refulgens Horn, 1870, Trans. Amer. Ent. Soc., vol. 3, p. 91. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 93.

Cantharis refulgens, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 114; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.

Brilliant metallic green or bluish green. Head with a moderately large orange frontal spot. Pronotum orange, finely margined with green or black and with a large metallic green or bluish green median spot which is connected either to anterior margin or (rarely) basal margin. Elytra with a brassy luster. Tibiae brassy or black. Tarsi black. Wings darker than in either *aeneipennis* or *crotchi*. Pubescence either piceous or pale; setae long and erect except on elytra, giving beetle a hairy appearance. Length: 7.0 mm.-11.5 mm.

Head quadrate or nearly so; tempora not prominent; dorsal margin weakly rounded; vertex smooth, shiny, moderately coarsely, sparsely punctate; punctures separated by an average distance twice or nearly twice as great as the diameter of a single puncture; frontal area weakly alutaceous, more densely punctate, with an impunctate area at center; pubescence fine, varying in different specimens from less than half as long to fully as long as fourth segment of middle tarsus; as a rule the pubescence is distinctly shorter than in *aeneipennis* and *crotchi*. Eyes small, straight on margin facing antennal insertion. Pronotum transverse, one-tenth to one-fourth wider than long, more or less suboval in outline; sides not strongly curved; disk usually with a shallow impression on each side behind middle; surface weakly alutaceous, not granular, rather finely, weakly, very sparsely punctate, the center of disk nearly impunctate; pubescence as on vertex; green discal spot one-third width of pronotum; basal impressed line deep; basal margin strongly reflexed. Scutellum rounded. Elytra rugose, impunctate; some long, erect setae at base, but surface otherwise with only scattered, short, subrecumbent setae. Pubescence on under surface, coxae, trochanters, and femora fine, sparse, as long as on head, not as hairy as in *aeneipennis* and *crotchi*. Middle tibiae weakly bowed. Outer hind tibial spur slender, slightly wider than to (rarely) nearly twice as wide as inner spur, very obliquely excavate, acute at apex; inner spur acute. Tarsal pads weakly developed, undivided on at least fore and middle tarsi. Tarsal claws slender.

Male. Antennae as in Figure 104, reaching or extending one or two segments beyond base of pronotum. Fifth abdominal sternum entire. Emargination of sixth sternum shallow, as in typical *chloris* and some *aeneipennis;* sternum flattened at center but without a median groove. Genitalia as in Figure 337; aedeagus with a single ventral hook.

Female. Antennae (Fig. 145) a little longer than in *aeneipennis*, reaching base of pronotum. Middle tibiae more strongly bowed than in male. Sixth abdominal sternum truncate, not flattened.

Type locality. Millerton, California. Millerton was formerly a community in northern Fresno County, near Friant. Its site is now covered by Millerton Lake.

Geographic distribution. Western Sierran foothills from Fresno County to northern Kern County, California. (See Fig. 47.)

Seasonal distribution. March 30—April 24.

Records. UNITED STATES: *California*: State label only, 2; Glennville, March, 1; 6 mi. west of Kernville, April, 4; Millerton (Horn, 1870); Walker Pass, Kern County, April, 12.

Remarks. The first instar larva of this species has been described by MacSwain (1956). The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. Adults have been recorded from *Ceanothus* (Rhamnaceae) and *Lupinus* (Leguminosae) (MacSwain, 1956).

Lytta (*Poreospasta*) *crotchi* (Horn)

Cantharis Crotchii Horn, 1874, Trans. Amer. Ent. Soc., vol. 5, p. 38; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.
Lytta crotchi, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 95.

Dark metallic green or greenish blue, often slightly brassy. Head with a small, round orange frontal spot. Pronotum orange, finely margined with black. Antennae, tibiae, and tarsi black. Pubescence piceous, without conspicuous silver reflection, in greater part very long, erect, giving beetle a very hairy appearance. Length: 6 mm.-10 mm.

Head shape as in *aeneipennis;* vertex more distinctly microreticulate than in that species, rough, coarsely, deeply, densely punctate; punctures separated by an average distance less than the diameter of a single puncture; frontal area more densely punctate, some of the punctures confluent; entire head conspicuously clothed with fine pubescence which is about as long as fourth segment of middle tarsus. Pronotum transverse, one-tenth to one-half longer than wide, oval, with sides more strongly convergent at apex than at base; disk finely granular, like vertex, but less coarsely, less densely, and much more shallowly punctate, most of the punctures confined to sides, the center of disk very sparsely punctate; pubescence like that of head; basal impressed line deep; basal margin strongly reflexed. Elytra rugose, impunctate, sparsely, regularly, conspicuously clothed with long, fine, erect setae which are fully as long as or even longer than those of head. Wings similar to those of *aeneipennis* but darker brown. Pubescence on under surface of coxae, trochanters, and femora long, fine, like that of elytra. Abdomen less densely punctate and pubescent than in *aeneipennis.* Tarsal pads weakly developed, distinctly

divided on all segments, the midline glabrous; pale pubescence of first segment of hind tarsi limited to apex. Tarsal claws weakly curved.

Male. Antennae (Fig. 105) surpassing base of pronotum by two or three segments; segments elongate, not so closely articulated or so filiform as in *aeneipennis;* distal segments at most twice as long as wide. Fifth and sixth abdominal sterna as in *aeneipennis* except that sixth sternum sometimes lacks an impression and fine groove on midline. Genitalia as in Figure 338; aedeagus with two ventral hooks.

Female. Antennae reaching base of pronotum. Middle tibiae more strongly curved than in male. Sixth abdominal sternum truncate, not impressed or grooved.

Type locality. San Diego, California.

Geographic distribution. Southwestern California, from Los Angeles County to San Diego County. (See Fig. 48.)

Seasonal distribution. March 8—April 18.

Records. UNITED STATES: *California*: State label only, 2; 4 mi. west of Coahuila, April, 3; Pine Valley, San Diego County, April, 95; San Diego (Horn, 1874); San Dimas, Dalton Canyon, Los Angeles County, April, 3; Tanbark Flat, Los Angeles County, April, 8.

Remarks. This is an unusually hairy species resembling *refulgens* in color. It differs most conspicuously from *refulgens* and the related but differently colored *aeneipennis* by the presence of long pubescence over the entire surface of the elytra; in this respect it is like *comans.* It also differs from these two species in having two (rather than one) ventral hooks on the aedeagus. Structurally, *crotchi* is most similar to *aeneipennis.*

The first instar larva of *crotchi* has been described by MacSwain (1956). The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. Adults have been collected on *Ceanothus* (Rhamnaceae) at Tanbark Flat and on *Eschscholtzia* (Papaveraceae) near Coahuila. An interesting ecological relationship between *crotchi* and *aeneipennis* is suggested by the fact that these species occur sympatrically, are active as adults at the same time, and share at least one food plant (*Eschscholtzia*) in common.

Lytta (*Poreospasta*) *rathvoni* LeConte

Lytta rathvoni LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 335; 1857, *in* Reports of explorations and surveys . . . Mississippi River to the Pacific Ocean, vol. 12, book 2, pt. 3, p. 21. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 96.

Cantharis rathvoni, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 112; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 299.

Brilliant metallic green, brassy green, or brass-colored, with the usual orange frontal spot. Elytra metallic violet or greenish violet, varying occasionally to a nearly pure green. Pubescence colorless. Length: 8 mm.-17 mm.; average with standard error (50 specimens), 12.1 mm. ± .3 mm.

Differs structurally from the Sierran foothills race of *chloris* as follows. Pubescence longer, denser, and comparatively conspicuous on under surface. Microreticulation of elytra less distinct. Male antennal segments slightly more elongate (Fig. 107); segment V 2.4-3.2 (average, 25 specimens, 2.73) times as long as wide. Male sixth abdominal sternum (Fig. 261) rather deeply impressed medianly and more deeply triangularly emarginate. Female sixth sternum (Fig. 283) emarginate medianly.

Type locality. Near Sacramento, California.

Geographic distribution. California, from the Sierran foothills in Tulare County north to Calaveras and Sacramento counties. (See Fig. 48.)

Seasonal distribution. March 17—June 14.

Records. UNITED STATES: *California*: El Mirador, April, 1; El Portal, May, 1; Fresno, May, June, 10; Kaweah, 3; Lemoncove, March, 66; Millerton (Horn, 1873); Mokelumne Hill, 1; Potwisha, March, May, 4; near Sacramento (LeConte, 1853); Salt Creek, Tulare County, April, 1; Sequoia National Park, April, May, 43; Springville, June, 2; Squaw Valley, Fresno County, April, 6.

Remarks. The only species with which *rathvoni* is likely to be confused is *chloris*, which occurs with it in Tulare County; see remarks for *chloris*.

The first instar larva of *rathvoni* has been described by MacSwain (1956). The type is in the Museum of Comparative Zoology.

Bionomics. Most of the specimens I have seen from Lemoncove were collected by J. W. MacSwain, who has recorded them (MacSwain, 1956) from *Lupinus* (Leguminosae) and *Eschscholtzia* (Papaveraceae).

Lytta (*Poreospasta*) *chloris* (Fall)

Cantharis chloris Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 303.

Lytta chloris, Linsley and MacSwain, 1942, Amer. Midland Nat., vol. 27, p. 406.

Lytta chloris ?, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 92.

Brilliant brassy green; the development of the brassy quality varies considerably but as a rule is strongest on the head and pronotum. Head with a moderate-sized, oval or diamond-shaped orange frontal spot. Pubescence entirely colorless (Sierran foothills) or entirely piceous, or (rarely) with individual setae piceous basally and colorless apically; length of pubescence variable. Length: 7 mm.-14 mm.; average with standard error (75 specimens), 10.1 mm. ± .2 mm.

Head quadrate to triangular; surface micropunctate, usually distinctly microreticulate and satiny in texture, not glistening, moderately coarsely, rather sparsely punctate; pubescence sparse, short to moderately long. Pronotum subhexagonal, as wide as to nearly one-fifth wider than long; disk uneven; midline finely impressed, at least at center; surface usually even more distinctly micropunctate than head, usually transversely alutaceous, moderately coarsely, rather sparsely, irregularly punctate; pubescence as on vertex. Elytra rugose, very distinctly microreticulate, impunctate; pubescence consisting of some very short setae inconspicuously scattered over surface except at immediate base (rarely as much as basal third) and margins, where the setae are as long as those on pronotum. Pubescence on under surface sparse, variable in length. Legs slender, unmodified. Outer hind tibial spur twice as wide as inner spur, acute; inner spur acute. Tarsal pads moderately well developed, undivided on fore and middle tarsi; ventral pale pubescence of first segment of hind tarsi limited to apex when clothing setae of tarsi are piceous. Tarsal claws weakly curved.

Male. Antennae (Fig. 106) very slender, reaching three or four segments beyond base of pronotum; segments more nearly cylindrical than in *stygica* and *comans;* segment V 2.1-3.1 (average, 28 specimens, 2.49) times as long as wide. Fifth abdominal sternum very shallowly emarginate. Sixth sternum typically only slightly impressed and very shallowly, obtusely emarginate, as in Figure 262. Genitalia as in Figure 339; aedeagus with only a single ventral hook (Sierran foothills) or with a small second hook also developed.

Female. Antennae (Fig. 146) not reaching base of pronotum. Sixth abdominal sternum either entire or weakly emarginate medianly.

Type locality. Kern County or Tulare County, California.

Geographic distribution. California. There appear to be two separate populations. One of these ranges through the valleys and foothills of the Coastal Range from Mount Diablo, Alameda County, south to the Cuyama Valley and western Kern County (vicinity of Wasco). The other occupies the lower slopes and foothills of the Sierra Nevada in Tulare and Kern counties. (See Fig. 49.)

Seasonal distribution. March 14—May 16.

Records. UNITED STATES: *California:* Adobe Creek, Stanislaus County, April, 4; Arvin, March, 12; 20 mi. east of Bakersfield, March, 1; 2 mi. northeast of Caliente Mountain, San Luis Obispo County, March, 2; Coalinga, March, 4; Cottonwood Creek, Kern County, (ambiguous; not mapped) March, 5; Cuyama Valley, Kern and Santa Barbara counties, 6; Glennville, April, 55; Havilah, May, 1; Hospital Canyon, San Joaquin County, March, 22; Kaweah, 6; Kern County, March, 1; La

Panza, April, 3; Lemoncove, March, 57; Monterey County, March, 1; Mount Diablo, April, 1; Mount Hamilton, April, 3; North Fork Kaweah River, April, 1; San Antonio Valley, 35 mi. south of Livermore, April, 54; San Jose, April, 9; Santa Clara County, April, 1; Sequoia National Park, 3000 ft.-5000 ft., April, May, 9; Silver Creek, Santa Clara County, April, 8; Simmler, March, 21; Tulare County, 4; Visalia, March, 1; 14 mi. west of Wasco, April, 3; Woody, April, 8.

Remarks. Throughout the range of *chloris*, the head, pronotum, and elytra are usually very distinctly microreticulate and the male sixth abdominal sternum is usually relatively flat and very shallowly, evenly emarginate. These two characters are of great assistance in separating *chloris* from *stygica* and *comans*, and the second one is very useful in separating *chloris* and *rathvoni*. However, there is sufficient variation in *chloris*, as well as in the other species, that these characters must be used in conjunction with others.

Typical *chloris*, as described by Fall, seems to be confined to the Sierran foothills in Tulare and Kern counties. If we exclude for the moment two short series of specimens from Arvin and Cottonwood Creek, this population may be characterized as having the pubescence colorless, the aedeagus with a single ventral hook, and the female sixth abdominal sternum almost always entire (exceptions in two specimens from Glennville and one from Lemoncove). In the Coastal Range area to the west,

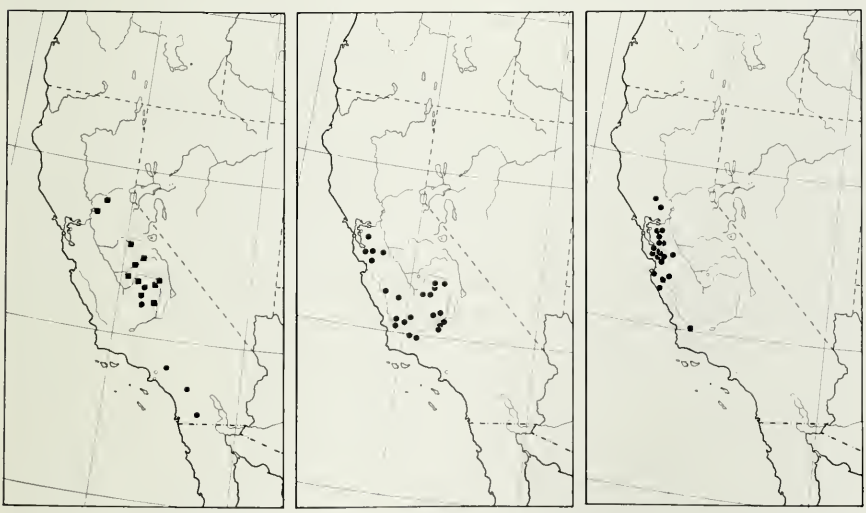


Fig. 48 (left). Distribution of *Lytta crotchi* (circles) and *Lytta rathvoni* (squares).

Fig. 49 (center). Distribution of *Lytta chloris*.

Fig. 50 (right). Distribution of *Lytta comans*.

and including the Cuyama Valley and western Kern County, *chloris* is represented by a population which differs from the typical population in having the pubescence piceous, the aedeagus almost always with two ventral hooks (exceptions in one specimen each from Coalinga and Simmler), and the female sixth sternum entire in only 55 per cent of the specimens.

In view of the generally low level of morphological differentiation among species in the Stygica Group, the Sierran foothills and Coastal Range populations of *chloris* might reasonably be treated as separate species on the basis of the characters given above. However, in the absence of information as to whether they can exist in sympatry, I prefer at present to regard them as races of a single species; this is the interpretation suggested by MacSwain (1956) in first calling attention to the Coastal Range population in connection with his description of its first instar larva. It is to be hoped that with further field work the apparent distributional gap between the two populations will be filled, thus permitting an objective determination of whether intrinsic isolating mechanisms between them exist.

The species with which *chloris* is likely to be confused are *rathvoni, stygica,* and *comans.* The Sierran foothills race of *chloris* occurs sympatrically with *rathvoni* in Tulare County and with *stygica* in Kern County. In the southern part of its range the Coastal Range race of *chloris* is sympatric with southern *stygica* in the Cuyama Valley; to the north it occurs just inland of the coastal population of *stygica.* It occurs in broad sympatry with *comans.* In distinguishing between *chloris* and these species, it is convenient to treat the two races separately.

From *rathvoni,* the Sierran foothills race of *chloris* differs by the following combination of characters: average size smaller; elytra brassy green (not purple); microreticulation of elytra slightly more distinct; pubescence on under surface shorter and sparser, that on abdomen generally very short and inconspicuous; male antennal segments a little less elongate; male sixth abdominal sternum flatter (not as deeply impressed) and more shallowly, evenly emarginate; female sixth sternum usually entire. Since *chloris* and *rathvoni* maintain their separate identities in their area of sympatry, they fall within the usual definition of species. There is, however, a tendency for them to vary toward each other in a large series of both species from Lemoncove. In this series the vast majority of specimens are typical of either *chloris* or of *rathvoni,* but a few are difficult to assign to either one or the other species. The nature and extent of the differences separating typical *chloris* and *rathvoni* are such that the intergradation at Lemoncove is quite likely the result of individual intraspecific variation, but the possibility of some introgression between them should not be completely discounted.

From sympatric *stygica,* the Sierran foothills race of *chloris* differs as follows: color brassy green (green, blue, or black in *stygica*); pubescence colorless; head and pronotum usually distinctly microreticulate (smooth or nearly so in most *stygica*); microreticulation of elytra slightly more distinct; male sixth abdominal sternum usually flatter and more shallowly and evenly emarginate; female sixth sternum usually entire. In a male from Arvin the pubescence is entirely piceous, while in 13 other specimens from this locality and in a series of 4 specimens from Cottonwood Creek (Kern County; exact location not known) at least part of the pubescence is piceous with only the tip colorless. The entirely piceous-pubescent Arvin male is also atypical of *chloris* in having a small second hook indicated on the ventral side of the aedeagus. In addition, three (of a total of ten) of the females represented in the two series have the sixth abdominal sternum definitely emarginate medianly. On the basis of these characters, these series might be regarded as intergrades with the Coastal Range race of *chloris,* but an equally likely hypothesis is that their atypical features are the result of introgression from *stygica,* which has been taken at these same localities. In support of this second hypothesis there is the fact that the microreticulation of the head and pronotum is weak in both series. It must be admitted, however, that this evidence is tenuous in view of the wide range of normal variation in this character in *chloris.* Here again, as in the case of sympatric *chloris* and *rathvoni* in Tulare County, field studies of the populations involved seem to be essential for a real understanding of what appears to be a very complex variational problem.

The Coastal Range race of *chloris* differs from *stygica* by the same characters as does the Sierran foothills race except that the color of the pubescence is the same (entirely piceous) in both and the value of the form of the female sixth abdominal sternum as a basis for separation is much lessened inasmuch as it is emarginate (as in *stygica*) in about half the females of *chloris* in the Coastal Range area. Additional characters for separation are the presence of a second ventral hook on the aedeagus of Coastal Range *chloris* and a rather distinct difference in male antennal length (segments more elongate in *chloris*) between *chloris* and the northern coastal population of *stygica.*

From *comans,* Coastal Range *chloris* differs in the same characters that distinguish it from northern coastal *stygica* except that there is no perceptible difference in the color of the integument (green in both species). There is one additional and very useful difference, however, and that is the presence in *comans* of long, erect setae on the entire sutural half of the elytral surface. *Chloris* usually has some moderately long or long setae at the immediate base of the elytra and along the margin. In occasional specimens these are present as far back as the basal third of the

Table V. Comparison of Six Populations of the Stygica Complex

	COASTAL RANGE *chloris*	SIERRAN FOOTHILLS *chloris*	NORTHERN COASTAL RANGE *stygica*	SIERRAN FOOTHILLS *stygica*	*rathvoni*	*comans*
Head	Usually distinctly microreticulate	Usually distinctly microreticulate	Usually smooth	Usually smooth	Distinctly microreticulate	Usually smooth
Color	Brassy green	Brassy green	Green, brassy green, or black	Green, brassy green, or black	Brassy green with purple elytra	Brassy green
Antennal size	Long	Long	Short	Long	Long	Moderately short
Pubescence on elytra	Short	Short, at least on apical two-thirds	Short	Short	Short	Long throughout
Male sixth abdominal sternum	Usually shallowly, obtusely emarginate	Usually shallowly, obtusely emarginate	Moderately deeply, triangularly emarginate	Moderately deeply, triangularly emarginate	Moderately deeply, triangularly emarginate; lateral lobes well rounded	Moderately deeply, triangularly emarginate
Female sixth abdominal sternum	Frequently emarginate	Usually entire	Emarginate	Emarginate	Emarginate	Emarginate
Number of ventral aedeagal hooks	Normally two	Usually one	Usually one	One	One	One
Average body size	Small	Small	Large	Large	Large	Small
Pubescence	Typically colorless	Piceous	Piceous	Piceous	Colorless	Piceous

elytra, but I have seen no specimens of *chloris* that could be confused with *comans* on the basis of this character.

For a more concise comparison of the characters of *chloris, stygica, comans,* and *rathvoni* than that provided by the above discussion, the reader is referred to Table V.

The type of *chloris* is in the Museum of Comparative Zoology.

Bionomics. Linsley and MacSwain (1942) found *chloris* present in 7 (.92 per cent) of 759 cells examined at a nesting site of *Anthophora linsleyi* Timberlake 20 mi. east of Bakersfield, Kern County. Food plants recorded for the adult beetles (one or two records each) are *Baeria, B. chrysostoma,* and *Layia* (Compositae).

Lytta (*Poreospasta*) *stygica* (LeConte)

Cantharis stygica LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 161. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 113; 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, pp. 293-94, 299.

Cantharis smaragdula LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 160. *New synonymy.*

Lytta stygica, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 335; 1857, *in* Reports of explorations and surveys . . . Mississippi River to the Pacific Ocean, vol. 12, book 2, pt. 3, p. 21.

Lytta smaragdula, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 334; 1857, *in* Reports of explorations and surveys . . . Mississippi River to the Pacific Ocean, vol. 12, book 2, pt. 3, p. 21. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 93.

Lytta dolosa LeConte, 1861, Proc. Acad. Nat. Sci. Philadelphia, p. 354.

Cantharis stolida Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 302. *New synonymy.*

Cantharis purpurescens Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 302. *New synonymy.*

Cantharis smaragdina [*sic*], Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 294 (*lapsus calami*).

Cantharis difficilis Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 303. *New synonymy.*

Lytta arborea Wellman, 1912, Ent. News, vol. 23, p. 34. *New synonymy.*

Lytta purpurescens, Linsley and MacSwain, 1942, Amer. Midland Nat., vol. 27, p. 406, fig. 7.

Lytta nevadensis Van Dyke, 1947, Pan-Pacific Ent., vol. 23, p. 155. *New synonymy.*

Lytta stolida, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 94.

Varying from bright metallic green or blue to a pure black. Head with a small orange frontal spot. Pubescence piceous. Length: 7 mm.-15 mm.

Head usually quadrate, rarely triangular; surface usually smooth, rarely microreticulate; surface sparsely, finely punctate; pubescence sparse, moderately long. Pronotum varying from quadrate to subhexagonal; surface and pubescence as on head. Elytra rugose, distinctly microreticulate,

impunctate; pubescence short. Outer hind tibial spur twice as wide as inner spur, acute; inner spur acute. Tarsal pads moderately well developed, undivided on fore and middle tarsi; ventral pale pubescence of first segment of hind tarsi limited to apex. Tarsal claws as in Figure 202.

Male. Antennae varying in length between extremes shown in Figures 108 and 109; see also Table VI. Fifth abdominal sternum very shallowly emarginate or entire. Emargination of sixth sternum shallowly triangular (Fig. 263). Genitalia as in Figure 340; aedeagus almost always with only a single ventral hook, rarely with a weak second hook.

Female. Antennae as in Figure 147 (northern California) or with segments more elongate than shown. Sixth abdominal sternum shallowly emarginate.

Type locality. Of *stygica,* Oregon; of *smaragdula,* mountains around Santa Ysabel, California; of *dolosa,* Mendocino, California; of *stolida,* San Francisco, California; of *purpurescens,* Pasadena or Riverside, California; of *difficilis,* San Diego, California; of *arborea,* near Hamburg, Siskiyou County, California (see remarks, below).

Geographic distribution. (See Fig. 51.) Beginning in southern Idaho the range of this species extends northwest (probably discontinuously) to the Cascade Mountains in Washington and thence south along these mountains and the Coastal Range to northern California, where it is divided into two arms by the Central Valley of California. One arm continues south along the humid coast, passes through the San Francisco Bay region, and terminates in the Santa Cruz Mountains. The other arm extends south through the Sierra Nevada to Tuolumne County. South of the Santa Cruz Mountains and south of Tuolumne County there is hiatus of range of considerably more than 100 miles. In eastern California the range commences again in the Inyo, Panamint, and Argus mountains, Inyo County; crosses the southern end of the Sierra Nevada and the Tehachapi mountains; and continues south, mainly along the San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountains and associated foothills, to the Coastal Range of San Diego County. To the east populations are known from the Spring Mountains in southwestern Nevada and from an area in southeastern Arizona extending from the Tucson region to the White Mountains.

Notwithstanding the fact that it occurs at some low, arid localities in the southern half of its range, *stygica* is clearly unable to make a deep penetration into true desert habitat as shown by its avoidance of the Great Basin, the more arid portions of the Central Valley of California, and all but the western margins of the Mojave and Colorado deserts. The populations in the Argus Mountains and the Spring Moun-

tains seem to be isolated from each other and from other populations. The same may be true of the populations in the Panamint Mountains and Inyo Mountains, and its probably true for the population in southeastern Arizona. Presumably these populations are relicts surviving from a time (most likely the last Pluvial Period) when less severe climatic conditions permitted the range of the species to extend more or less continuously east from the southern Sierras of California into Arizona. If this is true, then we can expect to find additional isolated populations in southern Nevada and northern Arizona.

The distributional gap between the northern and southern segments of the range of *stygica* is discussed below.

Seasonal distribution. March 8—July 21. There are relatively few March records in the northern half of the range and relatively few June records in the southern half. July records are rare throughout the range.

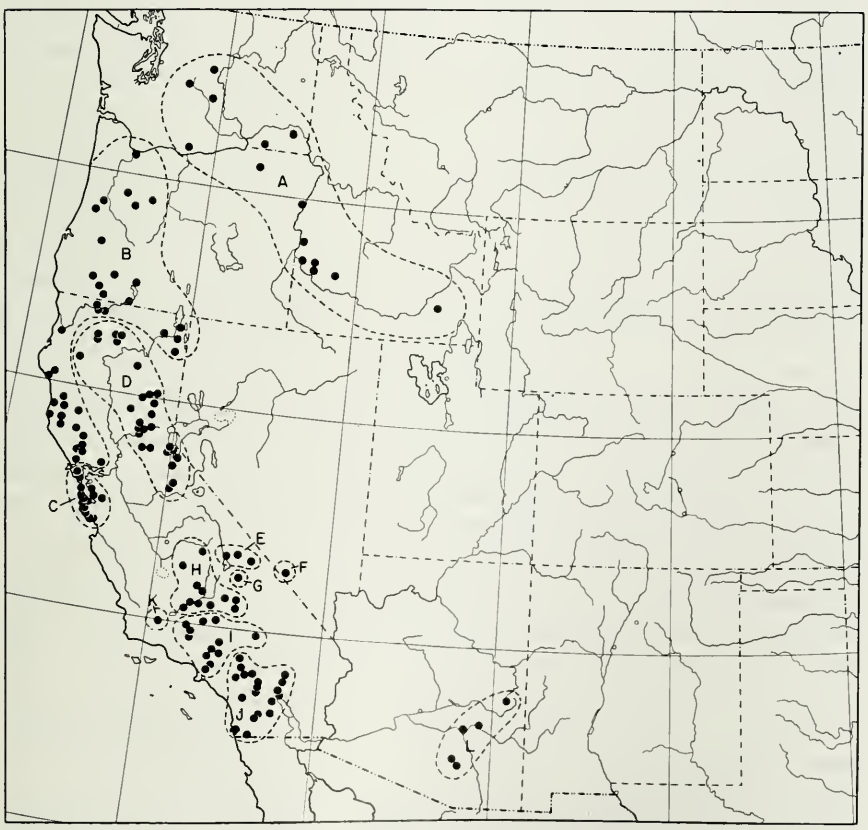


FIG. 51. Distribution of *Lytta stygica*. Letters are used to identify samples in Table VI.

Records.[3] UNITED STATES: *Arizona*: State label only, 2; Cortaro, 14; Globe, 1; San Carlos, Gila River, 2; Tucson, 32; White Mountains, 1. *California*: Alameda County: Arroyo Mocho, 5 mi. south of Livermore, 14; Berkeley, 1; Leona Hills, 1; hills back of Oakland, 25; Oakland, 2. Alpine County: Hope Valley, 20; Lake Alpine, 4. Amador County: Ten Rise [?] (not located), 1. Butte County: Jarboe Pass, 11. Eldorado County: County label only, 1; Echo Lake, 2; Glen Alpine Creek, 1; Meyers, 6300 ft., 12; Placerville, 1; Pollock Pines, 2. Humboldt County: County label only (Nunenmacher material, probably from Weitchpec), 9; Garberville, 1; Fort Seward, 1. Inyo County: Argus Mountains, 38; Lone Pine, 1; Mazurka Canyon, Inyo Mountains, 2; Mountain Spring Canyon, Argus Mountains, 6; Panamint Mountains, 4; Westgard Pass Plateau, 3. Kern County: 20 mi. east of Bakersfield, 9; 18 mi. south of Bakersfield, 7; Fort Tejon, 1; Glennville, 3; Kernville and 5 mi. north of Kernville, 24; Havilah, 9; Lebec, 4000 ft., 4; Piute Mountains, 5; Rand, 3; Searles Station, 4; "South. Cala.," 5 (including coptype of *purpurescens*); Tehachapi, 45; Walker Pass and 3 mi. east of Walker Pass, 97; Willow Springs, 2. Lake County: Hullville, 1; Kelseyville, 1; Middletown, 5. Los Angeles County: County label only, 6 (including cotype of *purpurescens*); Chicago, 1; Fairmont, 3; Gorman, 1; Lancaster, 5; Little Rock, 1; Los Angeles, 2; Mint Canyon, 1; Palmdale and 2 mi. east of Palmdale, 11; Pasadena (Fall, 1901, p. 185); Pearblossom and 6 mi. east of Pearblossom, 13. Marin County: County label only, 4; Fairfax, 12; Kentfield, 1; Mill Valley, 1; Muir Woods, 5; Ross, 1; San Francisco (including Mission Hills, Point Lobos, and Twin Peaks), 21; Sausalito, 1. Mendocino County: County label only, 1; Baechtel Creek, 3 mi. west of Willits, 1; Eagle's Nest, (not located) 1; Mendocino (LeConte, 1861); Pygmy Forest, Fort Bragg, 16; Rancheria Creek, near Boonville, 3; Ryan Creek, 57; 2 mi. north of Willits, 1. Modoc County: Badger Well, 3; Davis Creek, 4800 ft., 1; Hackamore, 1. Napa County: Calistoga, 25; Mount Saint Helena, 54; Pope Valley, 5. Nevada County: County label only, 1; Chicago Park, 2; Nevada City, 7. Placer County: County label only, 2; Colfax, 10; Dutch Flat, 1; Emigrant Gap, 6. Plumas County: County label only, 2; Johnsville, 2; Meadow Valley, 4000 ft.-5000 ft., 2; Onion Valley, 2; 4 mi. west of Quincy, 2. Riverside County: 4 mi. west of Coahuila [= Coachella], 20; Idyllwild, 4; Indio, 2; Marion Mountain Camp, San Jacinto Mountains, 1; Palm Springs, 1; Riverside (Fall, 1901, p. 185); Santa Rosa Mountains, 5; 10 mi. southeast of Temecula, 1. San Bernardino County: County label only, 7; Barstow, 1; Barton Flats, 1; Deep Creek, 17; Forest Home, 4; Joshua Tree National Monument (Bell Picnic Area), 2; Twenty-nine Palms, 3;

[3] In order to save space, months in which specimens have been collected are omitted. In the case of California I have departed from the system used elsewhere in this paper in listing the localities by counties.

Victorville, 3. San Diego County: County label only, 1; Borego, 3; Borego State Park, 1; Dulzura, 2800 ft., 1; Mason Valley, 1; San Diego, 1; mountains near Santa Ysabel (LeConte, 1853). San Mateo: Brisbane, 6; Half Moon Bay, 2; Kings Mountain Road, 3; Pescadero, 6; Portola State Park, 1; San Andreas Lake, 2; San Mateo, 2. Santa Barbara: Cuyama River, 6. Santa Cruz County: Ben Lomand, 4; Big Basin, 6; Boulder Creek, 6; between Boulder Creek and Big Basin, 1; Santa Cruz, 2. Shasta County: Black Mountain, 1; 5 mi. east of Burney, 1; Castella, 34; Lassen National Park (Kelley's Resort and Manzanita Lake), 4. Sierra County: Gold Lake, 7. Siskiyou County: County label only (Nunenmacher material, including type of *arborea*, presumably from near Hamburg), 5; Dunsmuir, 31; Hamburg, 1; McCloud, 7; Scott Bar, 4; Yreka, 1. Solano County: 5 mi. south of Dixon, 4. Sonoma County: Trinity, 8. Trinity County: County label only, 1; Big Flat, 1; Carrville, 2400 ft.-2500 ft., 11; Coffee Creek, 1; Eagle Creek, 1; Hayfork, 3000 ft., 3; Plummer Springs Ranger Station (not located), 1; Trinity River Camp (not located), 1. Tulare County: Lemoncove, 5; Sequoia National Park, 5000 ft.-7000 ft., 2. Tuolumne County: Long Barn, 2; Strawberry, 1. *Idaho*: Boise, 2692 ft., 4; Caldwell, 2375 ft., 2; Emmett, 2373 ft., 2; Payette, 7; Pine, 12; Pocatello, 3. *Nevada*: Kyle Canyon, Charleston Mountains [Spring Mountains], 17 (including type of *nevadensis*). *Oregon*: Alsea, 3; Ashland, 7; 20 mi. east of Cascadia, 1; Corvallis, 16; Giles Lake, Portland, 1; Gold Hill, 1; Homestead, 1; Jacksonville, 1; Kane Creek (not located), 2; Keno, 4; Klamath County, 5; 10 mi. northwest of Klamath Falls, 1; Langden Lake, 2; Mount Jefferson, 2; North Santiam River, 10 mi. north of highway 20, Linn County, 2; Prospect, 7; Warner Mountains, 4; Yoncalla, 1. *Washington*: Dryden, 1; Easton, 1; Ellensburg, 1; Lake Wanna, 1; Rebels Ridge, Pomeroy, 1; Walla Walla, 10.

Remarks. As presently defined, *stygica* includes a highly variable complex of populations. In the past authors have attempted to distinguish a number of species within the complex, but I do not believe that this procedure is justified on the basis of the data now available.

Stygica varies in color from bright metallic green or blue through shades of deep blue to a pure, nonmetallic black. Pure black specimens seem to be relatively scarce, although in many of the dark specimens the metallic luster is visible only in the proper light or under magnification. The metallic coloration seems to be entirely structural in origin. When "black" specimens are immersed in a liquid, their luster is considerably enhanced.

North of California and east of the Cascade Mountains all specimens examined are either bright green or blue-green. In the Cascades of Washington they are darkened to a deep blue or blue-black. To the south, in an area encompassing the Coastal Range and Cascades of Oregon and

extending south into California through northern Siskiyou County and along the Coastal Range, the metallic coloration is, as a general rule, either poorly developed or absent. This does not apply, however, to specimens from the less humid, inland side of the Coastal Range of California. Thus in Lake and Napa counties there is a pronounced tendency for the development of green coloration, and even the darkest specimens have some metallic luster. Specimens from near Dixon Springs, in Sonoma County, well within the Central Valley, are bright green. In San Mateo County, south of San Francisco, specimens from Brisbane, Half Moon Bay, and Pescadero are black, while those from localities farther inland (San Andreas Lake, Portola State Park, and Kings Mountain) are bright green. Finally, in Santa Cruz County 5 specimens examined are entirely black, 12 are greenish black, and 3 are green.

Returning to northern California, the material from Modoc County is either black or dark blue. In the northern Sierras, the Mount Shasta region, and Trinity County the color is consistently a bright metallic green or blue-green. This same bright coloration is characteristic also of all specimens of *stygica* from Arizona and southern Nevada and all those from southeastern California as far west as Tulare County, extreme eastern Kern County (Walker Pass), the San Bernardino and San Jacinto mountains, and the Coastal Range in San Diego County. In the southern Sierran foothills of central Kern County, on the Tehachapi Mountains, and in extreme northern Los Angeles County (Fairmont and Lancaster) the great majority of specimens available are black with a brassy or purplish luster developed to a very high degree, while the green specimens tend to be quite dark. In the Tehachapi series, which is the only large one from the general area, there is complete intergradation from essentially pure black to bright metallic green. To the south, all specimens from Pearblossom and Palmdale, Los Angeles County, are bright green, as are six specimens from the Cuyama Valley, Santa Barbara County. Further south, 2 of 4 specimens from Forest Home, San Bernardino County, are black; the single specimen from near Temecula, western Riverside County, is metallic black; and, finally, the two specimens from southwestern San Diego County (San Diego and Dulzura) are pure black.

There is marked geographic variation in antennal length in *stygica*. In general the antennae are relatively elongate in the southern part of the range of the species and short in the northern part. This variation is expressed graphically in Table VI, using the proportion of length to width of the male fifth segment as an index of relative antennal length.

Along the northern part of the coast of California and particularly in the San Francisco Bay region, there is a tendency for the head to be more triangular in shape than usual. The pronotum varies considerably

in proportion of length to width and in shape but without clear-cut geographic pattern. The aedeagus is also notably variable. As a general rule, only a single hook is present, but occasional specimens from Alpine and Kern counties, California, have a weakly developed second hook.

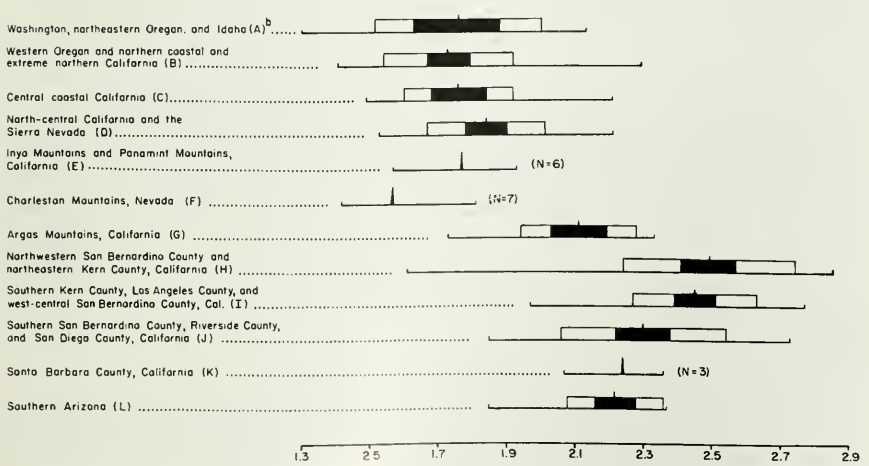
Morphological differences between first instar larvae of *stygica* from eastern Kern County (= *smaragdula*) and the San Francisco Bay region (= *stolida*) have been described by MacSwain (1956).

For a summary of the principal differences between adults of *stygica* and the closely related species *chloris, rathvoni,* and *comans,* see Table V.

The types of *stygica, smaragdula, dolosa, stolida, purpurescens,* and *difficilis* are in the Museum of Comparative Zoology. The type of *nevadensis* is in the collection of the California Academy of Sciences (Type no. 5866, examined); the type series is labeled as collected in June, not July as stated by Van Dyke (1947).

Wellman's (1912) description of *arborea* was based on an unspecified number of specimens collected at Weitchpec, Humboldt County, California, and near Hamburg, Siskiyou County, California, May 20, 1911 and June 2, 1911, respectively, by F. W. Nunenmacher. The type locality was given as Humboldt County, and it was stated that the type was in the Wellman collection. There is, however, no specimen labeled as the type in the Wellman collection in the United States National Museum. On the contrary, one of several Siskiyou County specimens in the Nunen-

TABLE VI. VARIATION IN THE PROPORTIONS (LENGTH/WIDTH) OF THE MALE FIFTH ANTENNAL SEGMENT IN *Lytta stygica*[a]



[a] Observed limits of variation shown by length of horizontal lines; means marked by narrow vertical triangles; bars represent one standard deviation on each side of mean; black portions of bars represent two standard errors of the mean on each side of the mean.

[b] Letters are used to identify samples on the map shown in Figure 51.

macher collection in the Chicago Natural History Museum bears a hand-printed label that is unquestionably Wellman's, designating it as the "type" of "*Lytta aborea* [*sic*] Wellm." Another of the Siskiyou County specimens in the same collection has Wellman's cotype label (with the specific name again misspelled). Whatever the cause of this gross inconsistency on Wellman's part, his labeling of the Siskiyou County specimen as the type of *arborea* must surely take precedence over his published statement.

Bionomics. Linsley and MacSwain (1942) found *stygica* (as *purpurescens*) infesting 29 (3.82 per cent) of 759 cells of *Anthophora linsleyi* Timberlake examined from a nesting site 20 mi. east of Bakersfield, Kern County, California. This same nesting site was also parasitized by the closely related *chloris* and by *tenebrosa.*

In the adult stage *stygica* feeds on the pollen of a variety of spring flowers, including some domesticated ones. At present there is no indication of food plant differences between the various geographic segments of the species population. The food plants recorded are as follows: African daisy [*Arctotis?*], *Layia,* and *Rafinesquia neomexicana* (Compositae); *Lesquerella gordani* (Cruciferae); *Arctostaphylos* and *Rhododendron* (Ericaceae); *Eriodictyon californicum* and *Phacelia* (Hydrophyllaceae); *Iris* (Irideaceae); *Salvia* (Linsley and MacSwain, 1942) (Labiatae); *Astragalus* and *Lupinus* (several records) (Leguminosae); *Eschscholtzia* and *E. californica* (several records) (Papaveraceae); *Ceanothus* (Rhamnaceae); *Cercocarpus, Cowania stansburiana,* and *Prunus* (Rosaceae); *Orthocarpus* (Scrophulariaceae); and *Lycium* (Solanaceae).

Lytta (*Poreospasta*) *comans,* new species

Brilliant green or brassy green. Pubescence piceous. Length: 7 mm.-13 mm.; average with standard error (79 specimens), 10.1 mm. ± .2 mm.

Structurally like the northern Coastal Range population of *stygica* except as follows: Clothed throughout with long, erect pubescence. Male antennal segments somewhat more elongate and cylindrical in shape; segment V 1.8-2.5 (average, 50 specimens, 2.26) times as long as wide.

Geographic distribution. Coastal Range and western side of the Central Valley, California, from Yolo County south to the Cuyama Valley. (See Fig. 50.)

Seasonal distribution. February 27—June 25.

Type material. Holotype male and allotype female from Los Altos, Santa Clara County, California, March 1937, E. S. Ross, in the collection of the California Academy of Sciences.

Additional records. UNITED STATES: *California*: Adobe Creek, Stanislaus County, March, 46; Alma, 2; Alum Rock Park, Santa Clara County,

April, 1; Arroyo Bayo, Mount Hamilton, April, 4; Big Sur, Monterey County, April, 1; Cache Creek Canyon, Yolo County, April, 1; Cedar Ridge, Alameda County, May, 1; Clayton, April, 1; Clear Creek, Cuyama Canyon, March, 1; Contra Costa County, May, 2; Del Puerto Canyon, March, 1; Guadalupe Lake, Santa Clara County, April, 2; Los Altos, March, April, 55; Monterey, March, 4; Mount Hamilton, May, 2; Niles Canyon, Alameda County, March, 2; Paraiso Springs, April, May, 10; Pine Canyon, Monterey County, March, 5; Pine Mountains, San Luis Obispo County, April, 1; Pinnacles National Monument, April, 9; Putah Canyon, Yolo County, March, April, 62; San Antonio Valley, Santa Clara County, April, 6; San Jose, April, 1; Somersville, March, 9; Stevens Creek, Santa Clara County, April, 1.

Remarks. This species is a derivative of *stygica*, from which it is only weakly differentiated morphologically. In the northern half of its range the available data seem to indicate that it is an inland replacement of the northern Coastal Range population of *stygica*. In Alameda County, in the Livermore region, the two populations have been recorded only a few miles from each other. To the south, in the absence of *stygica*, *comans* is able to extend its range all the way to the coast. The southern limit of known range is at Clear Creek, a tributary of the Cuyama River. Very probably it enters the Cuyama Valley itself, and in that event it is probably in contact with the southern population of *stygica*, which enters the valley from the east. It is unfortunate, but the relationship between *comans* and *stygica* in this southern region cannot be determined accurately at the present time due to the lack of critical material.

Throughout its range *comans* maintains its distinctiveness, and despite its obviously close phylogenetic relationship with *stygica*, it seems to represent a separate species.

See remarks for *chloris*.

Bionomics. There are one or two records each of adults collected on *Ceanothus cuneatus* (Rhamnaceae), *Cryptantha* (Boraginaceae), *Eriodictyon* (Hydrophyllaceae), and *Eschscholtzia californica* (Papaveraceae).

MOERENS GROUP

Head with a pale (orange) frontal spot. Head sparsely micropunctate, minutely granular, finely punctate. Eyes narrow. Male antennae reaching one to three segments beyond base of pronotum; intermediate segments often incrassate, so that they are as wide as or wider than distal segments. Male hind trochanters spined or angulate on ventral margin in most species (always so if intermediate antennal segments not incrassate). Middle tibiae strongly bowed. One or both spurs of male middle tibiae

usually thickened and sticklike. Outer hind tibial spur thickened, obliquely truncate; inner spur slender, spiniform. Male fore and middle tarsi at least slightly heavier than in female. Tarsal pads well developed, dense, undivided; female with pale pubescence (pad) of first segment of fore and middle tarsi limited to apical half or less. Male fifth abdominal sternum deeply emarginate. Male sixth sternum elongate; emargination very deeply, narrowly triangular; a lightly sclerotized area medianly (rarely absent in *moerens*), this area and lateral lobes of sternum clothed with long pubescence. Male genitalia with each gonostylus bearing a mesal hook and clothed ventrally with short but conspicuous setae, or if mesal hooks absent, then gonostyli clothed ventrally with long setae; aedeagus with a single ventral hook or (*childi*) none.

Remarks. This group contains nine species, divided into three subgroups. It is widely distributed in western North America north of México, with two of the species (*moerens* and *childi*) ranging south onto the peninsula of Baja California and another (*nuttalli*) as far east as Minnesota (Fig. 8).

Food plants have been recorded for six of the nine species of the group. These records suggest that the preferred, if not the only, food plants are species of Leguminosae. So far as known the beetles feed on both flowers and leaves.

Key to Subgroups

1. Black or very dark blue; first segment of male fore tarsi straight, not excavate at base; male fore tibiae sometimes with only a single spur each 2

   Bright metallic green, blue, purple, or violaceous; first segment of male fore tarsi bent, with a deep, socket-like excavation at base; male fore tibiae always with two well-developed spurs each; gonostyli of male genitalia lacking mesal hooks... Cyanipennis Subgroup (p. 204)

2. Gonostyli of male genitalia each with a mesal hook at apex; male antennal segment I not densely punctulate on ventral side; pronotum never marked with orange; male fore tibiae sometimes with posterior spur obsolete or very small..... Moerens Subgroup (p. 194)

   Gonostyli of male genitalia lacking mesal hooks; male antennal segment I densely punctulate on ventral side; pronotum frequently in part orange; male fore tibiae with posterior spur always well developed..... Childi Subgroup (p. 215)

Moerens Subgroup

Entirely black or very dark blue; body sometimes with a metallic blue luster. Frontal spot one-fifth to one-fourth as wide as frontal area between

eyes. Male antennae with intermediate segments incrassate (*insperata* and *nigrocyanea*) or not; all segments but II longer than wide. Pronotum hexagonal or nearly so, wider than long; lateral lobes obtusely rounded; disk flattened, granular, rather dull. Male hind trochanters each angulate on ventral margin or armed with a sharp spine. Male middle tibiae each with one or both spurs somewhat modified. First segment of male fore tarsi cultriform but not distorted. Emargination of male fifth abdominal sternum triangular. Male genitalia with each gonostylus bearing a mesal hook at apex; gonostyli very sparsely clothed ventrally with fine, short setae; aedeagus with a single ventral hook (rudiment of a second hook sometimes present in *moerens*).

Remarks. This subgroup includes the species *moerens, navajo, insperata,* and *nigrocyanea.* The first of these appears to be fairly common, ranging from Oregon south through California. The species *insperata* has been found only in southern California. *Navajo* is known from a single collection in northern Arizona, while *nigrocyanea* has been collected in western Colorado, eastern Utah, and Wyoming.

Key to Species

1. Male antennae clavate, with intermediate segments much narrower than distal segments; male hind trochanters angulate on ventral margin, not spined.....2

   Male antennae with intermediate segments incrassate, at least in part as wide as or wider than distal segments; male hind trochanters each armed with a distinct spine on ventral margin.....3

2. Head and pronotum (especially latter) sparsely punctate; elytra finely, weakly rugose, moderately shiny; male abdominal sterna relatively smooth, shiny; lateral lobes of male sixth abdominal sternum not divergent (Fig. 264); male genitalia as in Figure 341; male posterior fore tibial spur often much reduced in size or absent.....
   .....*moerens* (p. 196)

   Head and pronotum densely punctate; elytra coarsely, strongly rugose (subreticulate), dull; male abdominal sterna finely rugose, dull; lateral lobes of male sixth abdominal sternum strongly divergent (Fig. 265); male genitalia as in Figure 342; male posterior fore tibial spur well developed.....*navajo* (p. 200)

3. Entirely black; head sparsely short-pubescent; pronotum subglabrous; male fore tibiae each with two spurs; male middle tibiae not modified as below; male sixth abdominal sternum (Fig. 266) extremely elongate, with lateral lobes not divergent.....*insperata* (p. 201)

   At least elytra very dark blue; head and pronotum clothed with long, erect pubescence, hairy; male fore tibiae each with a single spur;

male middle tibiae acutely produced at apex and with posterior spur projecting at a wide angle; male sixth abdominal sternum (Fig. 267) shorter, with lateral lobes strongly divergent. . . . *nigrocyanea* (p. 202)

Lytta (*Poreospasta*) *moerens* (LeConte)

Cantharis moerens LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 216. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 110; 1874, Trans. Amer. Ent. Soc., vol. 5, p. 39; Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298.

Lytta moerens, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 332; 1857, *in* Reports of explorations and surveys . . . from the Mississippi River to the Pacific Ocean, vol. 12, book 2, pt. 3, p. 21. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 88, pl. 14.

Cantharis incommoda Horn, 1883, Trans. Amer. Ent. Soc., vol. 10, p. 312. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298. *New synonymy.*

Lytta nunenmacheri Wellman, 1912, Ent. News, vol. 23, p. 36.

Lytta incommoda, Linsley and MacSwain, 1942, Univ. California Publ. Ent., vol. 7, p. 195, tbl.

Black, with or without a metallic bluish luster. Wings variable in color, generally nearly colorless with light brown apex, sometimes colorless only in anal region. Pubescence piceous on upper surface of body, either piceous or nearly white on under surface. Length: 11 mm.-21 mm.

Head as wide as or slightly wider than long, subtriangular to quadrate; surface moderately shiny, never particularly rough, sparsely to moderately densely punctate; pubescence long on sides and frontal area, shorter on vertex. Pronotum subhexagonal; disk irregularly impressed; surface more granular than on vertex, sparsely punctate before middle, somewhat more densely so and often finely alutaceous behind; pubescence as on vertex. Scutellum subtruncate or rounded. Elytra finely, weakly rugose, moderately shiny, impunctate, essentially glabrous. Outer hind tibial spur twice as wide as inner spur; truncature oval, almost always laminate. Tarsal claws (Fig. 203) heavy, strongly curved.

Male. Antennae (Fig. 110) clavate; segments IV–X subequal in length to III, becoming progressively much wider and more moniliform; X globular. Hind trochanters weakly angulate to almost spined along ventral margin distad of middle, the margin rather sharp. Anterior fore tibial spur sinuate, longer and heavier than posterior spur, which is often rudimentary or absent on one or both fore tibiae. Middle tibial spurs heavy, either both spiniform or posterior one flattened, sticklike. Abdominal sterna clothed with short setae, these much shorter and less conspicuous than in female; surface finely punctate, finely granular but shiny. Emargination of fifth abdominal sternum broad, ridged or notched at apex. Emargination of sixth sternum as in Figure 264; sternum usually with a

lightly sclerotized median area; lateral lobes of sternum not divergent, less densely pubescent than in related species. Genitalia as in Figure 341; gonoforceps robust; gonostyli not bowed in ventral view; setae longer and less sparse than in *navajo;* aedeagus as shown or with a rudiment of a second hook basad of apical one.

Female. Antennae (Fig. 148) reaching a little beyond middle of pronotum, more strongly clavate than in *insperata,* with segment IV three-fifths as wide as IX; intermediate segments more moniliform than in male. Sixth abdominal sternum (Fig. 284) broadly, shallowly emarginate.

Type locality. Of *moerens,* Sacramento, California; of *incommoda,* southern California; of *nunenmacheri,* Orleans Bar, Humboldt County, California.

Geographic distribution. Widespread in California, extending north into western Oregon. (See Fig. 52.) Occurs in both mountains and lowlands.

Seasonal distribution. March 4—July 10.

Records. UNITED STATES: *California*: State label only, 21; Antioch, April, May, 7; Arvin, March, April, 33; Bairs Ranch, Redwood Creek, Humboldt County, June, 1; 18 mi. north of Bakersfield, April, 1; Berkeley, April, 4; Bass Lake, 2500 ft., June, 2; 10 mi. north of Blackwells Corner,

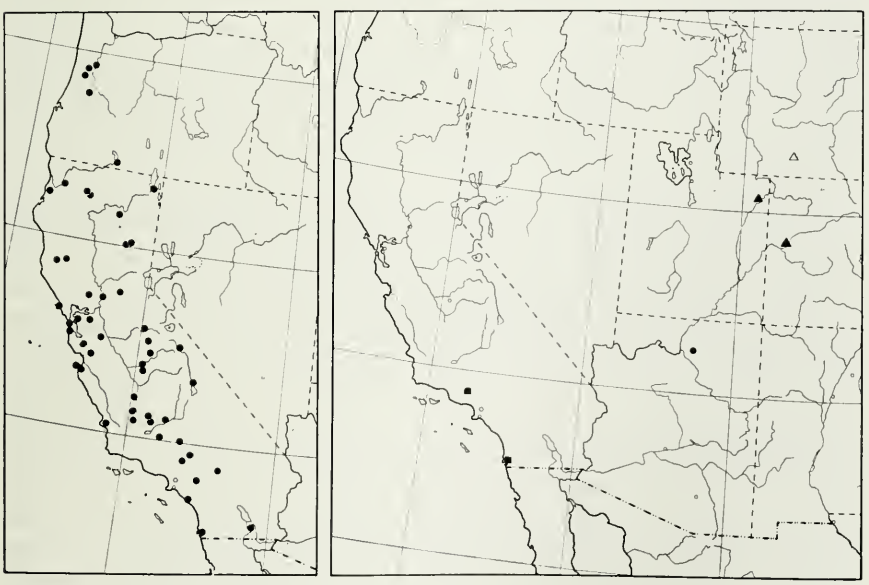


Fig. 52 (left). Distribution of *Lytta moerens.*

Fig. 53 (right). Distribution of *Lytta navajo* (circle), *Lytta insperata* (squares), and *Lytta nigrocyanea* (triangles).

April, 82; 5 mi. east of Carmel, May, 1; Carrville, 2400 ft.-2500 ft., May, June, 9; Coffee Creek, Trinity County, May, 4; Coloma, May, 2; Coronado, 8; Cypress Point, June, 1; Davis Creek, 4800 ft., Modoc County, June, 3; Delano, March, 9; El Portal, May, 1; Fresno, June, 2; Glennville, May, 1; Hullville, June, 4; Imperial County, April, 5; Indian Flat, [Guard Station], Mariposa County, June, 1; Indian Wells, Owens Valley (not located), May, 1; Kern County, March, 6; Kettleman City, May, 4; Lancaster, May, 4; Lanes Bridge, Fresno County, April, 43; Lone Pine, Inyo County, April–June, 29; Los Angeles County, April, July, 10; Lucerne Valley, 30 mi. south of Barstow, May, 62; McGee Creek, Mono County, June, 5; 20 mi. northwest of McKittrick, April, 2; near Mather, July, 70; Meadow Valley, 3500 ft.-4000 ft., Plumas County, June, 1; Milham City (not located), April, 112; Mojave, June, 2; Montara (Linsley and MacSwain, 1942); Muroc Dry Lake, San Bernardino County, April, 3; Newport Bay, May, 1; [Orleans Bar], Humboldt County, May, 12 (lectotype and paratypes of *nunenmacheri*); Owens Valley, 4 (3 in May); Plumas County, June, 12; Point Reyes, May, 18; Putah Canyon [Creek], April, 1; Quincy and 4 mi. west of Quincy, May–June, 75; Rancho de Oso, Santa Cruz County, July, 3; Sacramento (LeConte, 1851); Salida, March, 10; San Bernardino, May, 7; San Diego, 5; San Diego County, 3; San Francisco, March, 3; San Jose, March, 2; San Luis Obispo, 3; Shasta County, July, 1; Snow Line Camp, El Dorado County (not located), June, 1; Tuolumne County, 4 (2 in July); near Whitmore Hot Springs, Mono County, June, 1; Willits and 2 mi. north of Willits, May, 15. *Nevada*: State label only, 1. *Oregon*: State label only, 5; Coburg, July, 49; Corvallis, May–July, 6; Independence, July, 1; Klamath Falls, June, 10; Marys Peak, May, 1; Monmouth, June, 2; Monroe, June, 2; Salem, June, 3.

Remarks. The population of *moerens* south of the Central Valley of California and along the Owens River Valley east of the Sierra Nevada is clearly differentiated from the rest of the species population in consistently lacking the posterior spur on both fore tibiae of the male. In one of the specimens from Los Angeles County and in another from San Diego a small socket is present at the point where the missing spur should arise. In these specimens the socket has a continuous membranous covering, indicating that the absence of the spur is not the result of breakage. In all other males from the southern area there is no indication of such a spur socket. Elsewhere within the range of *moerens* the posterior spur is absent from both fore tibiae only in two of a long series of males from Lanes Bridge, Fresno County, California. In a few additional males from Fresno County and a few from Plumas County, California, it is lacking on one fore tibia only. In all other males it is present on both fore tibiae although varying greatly in size. On the average, the spur is about half the length of the anterior fore tibial spur.

At its smallest it is reduced to a short peg which does not extend beyond the base of the tibia and is therefore difficult to see unless the tibia is properly oriented under the microscope and examined rather closely. Variation in the size of the spur does not seem to be correlated with geographic distribution within the northern segment of the *moerens* population.

Color in *moerens* varies clinally in a north-south direction. In Oregon and northern California almost all specimens are a pure black in color, the few exceptional ones being faintly metallic. Progressing southward, through central California, the metallic coloration occurs more frequently and becomes more obvious, the elytra tending to develop a purplish tone and the rest of the body a blue or green luster. South of the Central Valley of California and along the Owens River Valley the metallic luster is very conspicuously developed in all specimens.

For the most part the outer hind tibial spur of *moerens* is quite constant in size and shape. However, in nearly a third of the specimens examined from Arvin, Kern County, California, as well as in four specimens from Oregon, it is much more strongly expanded than usual, much less obliquely truncate, and not at all laminate.

LeConte based his original description and subsequent redescription (1853) of *moerens* on a unique type. This specimen is now in the LeConte collection at the Museum of Comparative Zoology (no. 5125), where it was examined at my request by F. G. Werner. According to Dr. Werner (*in litt.*), the specimen is a female lacking any metallic luster. It is labeled with a gold disc, which indicates California, and another label with the abbreviation "Sac." [Sacramento] and Rathvon's name.

Horn (1873 and subsequently), who based his definition of *moerens* on specimens from the southern part of the range, wrongly assumed that the metallic coloration and absence of the male posterior fore tibial spur characteristic of *moerens* in the southern area were constant features of the entire species. Subsequently, he encountered specimens of more northern *moerens* which he failed to recognize as conspecific with his "*moerens*" and which he described under the name *incommoda*. The type of *incommoda* is in the Horn collection at the Academy of Natural Sciences of Philadelphia.

Lytta nunenmacheri has long been recognized as a synonym of *incommoda*. I have examined 15 specimens from the type series of *nunenmacheri*, including a male and female of *moerens* (mounted *in copulo*) marked "Type." These last specimens, in the Chicago Natural History Museum (Nunenmacher collection), are labeled Humboldt County, California, May 22, 1911, collected by F. W. Nunenmacher. As it is not evident which of the two Wellman considered to be the type of *nunenmacheri*, selection of a lectotype is required, and I hereby designate the

male of the pair as such. It should be pointed out that three of the specimens of Wellman's type series are representatives of *blaisdelli* rather than *moerens*, which accounts for some of the discrepancy between his description of *nunenmacheri* and the actual characters of *moerens*. In particular, his description of the antennae of *nunenmacheri* seems to apply more closely to *blaisdelli* than to *moerens*.

Bionomics. The known larval hosts of *moerens* are *Anthophora stanfordiana* Cresson (Linsley and MacSwain, 1942) and *Colletes fulgidus* Swenk (MacSwain, 1956). The former record is from a nesting site at Montara, California; the latter is from an unspecified locality.

Adults of *moerens* have been collected on the following Leguminosae: lima beans at Independence, Oregon; *Lupinus* at Arvin, 5 mi. east of Burney, Indian Well, Lone Pine, Milham City (MacSwain, 1956), Muroc Dry Lake, and 4 mi. west of Quincy, all in California; and *Vicia* at Willits and 4 mi. north of Willits, California (MacSwain, 1956). In addition, there is a questionable record of radishes (Cruciferae) at Coburg, Oregon.

Lytta (*Poreospasta*) *navajo* Werner

Lytta navajo Werner, 1951, Psyche, vol. 57, p. 134, figs. 2, 4.

Black with a metallic bluish luster. Wings nearly colorless. Pubescence piceous. Length: 16 mm.-23 mm. (Werner, 1951).

Head strongly triangular, one-fifth wider than long; tempora well marked; surface moderately shiny, rough, densely, deeply punctate; pubescence long on sides and frontal area, shorter on vertex. Pronotum subhexagonal, one-seventh wider than long; disk irregularly impressed, uneven; surface as on vertex but finely alutaceous except for a smooth median area, much more densely punctate than in *moerens*, the sides very densely punctate; pubescence as on vertex. Scutellum subtruncate. Elytra coarsely, strongly rugose (subreticulate), dull, impunctate, essentially glabrous. Outer hind tibial spur twice as wide as inner spur; truncature broadly oval, laminate. Tarsal claws heavy, strongly curved.

Male. Antennae as in *moerens*. Hind trochanters subangulate along ventral margin distad of middle, the margin rather sharp. Anterior fore tibial spur sinuate, a little longer than posterior spur, which is well developed. Middle tibial spurs heavy, flattened, sticklike. Abdominal sterna clothed with short setae; surface finely punctate, rugose, dull. Emargination of fifth abdominal sternum as in *moerens*. Emargination of sixth sternum as in Figure 265; lateral lobes of sternum divergent, more densely, coarsely pubescent than in *moerens*. Genitalia as in Figure 342; gonoforceps more elongate than in *moerens;* setae of gonostyli extremely

short; mesal hook of each gonostylus not turned mesad; ventral hook of aedeagus obsolescent.

Female. Not seen. Probably with sexual characters very similar to those of *moerens.*

Type locality. 22 mi. north of Cameron, Coconino County, Arizona.

Geographic distribution. Known only from the type locality, in north central Arizona. (See Fig. 53.)

Seasonal distribution. The type series was collected May 19.

Records. UNITED STATES: *Arizona*: 22 mi. north of Cameron, May, 1 (paratype).

Remarks. Werner (1951) described this species from a series of two males and three females, all bearing the same data. The type, a male, is in the Museum of Comparative Zoology (no. 28501), as is the allotype. The specimen I have seen is a male paratype in the collection of F. G. Werner.

Bionomics. The type series was found feeding on *Astragalus* (Leguminosae).

Lytta (*Poreospasta*) *insperata* (Horn)

Cantharis insperatus Horn, 1874, Trans. Amer. Ent. Soc., vol. 5, p. 39.
Cantharis insperata, Horn, 1883, Trans. Amer. Ent. Soc., vol. 10, p. 311. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298.

Black. Wings light brown, with anal region almost colorless. Pubescence silvery on under surface of thorax, piceous elsewhere. Length: 18 mm.-23 mm.

Head as wide as long; sides rounded, moderately divergent above eyes; tempora rather prominent; surface moderately shiny, smooth, sparsely punctate; pubescence short, the setae on lower frontal area longer than rest. Pronotum subhexagonal, barely wider than long; disk deeply, broadly impressed at middle, shallowly impressed at sides behind middle; midline distinctly impressed for basal two-thirds; surface not alutaceous, rather dull, more sparsely, irregularly punctate than head, subglabrous. Scutellum rounded, distinctly foveo-sulcate. Elytra finely, weakly rugose, impunctate, essentially glabrous. Outer hind tibial spur (Fig. 197) four times as wide as inner spur; truncature nearly circular, not at all laminate. Tarsal claws rather weakly curved.

Male. Antennae (Fig. 111) with segments elongate filiform, slightly compressed, becoming somewhat moniliform, more rounded on lateral side than on mesal, subequal in width; IV–IX equal in length, nearly one-fifth longer than III; X as long as III, XI not quite two-thirds as long as IX and X combined, cylindrical for basal two-thirds, then tapered. Hind

trochanters (Fig. 162) truncate at apex, armed with a spine on ventral margin near apex; ventral margin otherwise nearly straight. Anterior fore tibial spur straight, longer than posterior spur, which is well developed. Posterior margin of middle tibiae produced at apex into a pointed plate which is short of middle of posterior spur; posterior middle tibial spur sticklike, twice as wide as anterior spur, projecting at a wide angle, truncate at apex. Emargination of fifth abdominal sternum (Fig. 218) moderately narrow, not notched at apex, lined with long, silky pubescence. Sixth sternum (Fig. 266) extremely elongate, cleft medianly for apical two-thirds; lightly sclerotized median area narrow, extending from basal fifth to apical fifth of sternum. Genitalia as in Figure 343; gonoforceps elongate, slender, tapered; aedeagus slender, with ventral hook well developed.

Female. Antennae (Fig. 149) less strongly clavate than in *moerens*, with segment IV four-fifths as wide as IX. Sixth abdominal sternum entire, not at all emarginate.

Type locality. Mojave Desert, California.

Geographic distribution. Southern California from Ventura County to San Diego. (See Fig. 53.)

Seasonal distribution. Specimens examined were collected May 26. Recorded by Fall at San Diego in April.

Records. UNITED STATES: *California*: San Diego (Fall, 1901); Mojave Desert (Horn, 1874); Ventura County, May, 3.

Remarks. Two of the specimens I have studied are in the collection of the California Academy of Sciences; the other specimen is in the collection of the University of California. The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. Essig's (1926) record of *insperata* as a pest of beets is highly doubtful in view of the evident rarity of the species. Essig mistakenly figured specimens of *Linsleya sphaericollis* (Say) as *Lytta insperata*, but this can hardly be the species in question either. Possibly the record refers to *moerens*.

Lytta (*Poreospasta*) *nigrocyanea* Van Dyke

Lytta nigrocyanea Van Dyke, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 129.

Black, with or without a dark blue luster. Elytra very dark blue or indigo, somewhat metallic. Wings nearly colorless. Pubescence piceous. Length: 19 mm.-20 mm.

Head wider than long, strongly triangular; tempora prominent; dorsal margin straight; vertex, especially at tempora, distinctly tumid; surface rather dull, very densely punctate, the punctures becoming coarser and less dense on frontal area; surface extremely hairy, being densely clothed

with long, erect, silky pubescence. Pronotum hexagonal, wider than long; disk transversely impressed before middle, with a broad, somewhat foveate impression on each side at middle; surface rather dull, very densely punctate behind middle, more sparsely so before; pubescence as on vertex. Elytra finely rugose or rugose punctate, dull; pubescence sparse and very short except for some long setae at base. Outer hind tibial spur less than twice as wide as inner spur; truncature oval. Tarsal claws heavy, strongly curved.

Male. Antennae with segments more elongate than in *cyanipennis;* IV–VIII subequal in length, incrassate, bulged apically on lateral side, triangular in shape; VII and VIII more strongly bulged and slightly wider than rest; IX and X shorter than preceding segments, as wide as VI. Hind trochanters truncate at apex, armed with a spine on ventral margin at distal third. Anterior fore tibial spur long, heavy, excavate basally; posterior spur obsolete. Apex of fore and middle tibiae acutely produced on posterior side. Posterior middle tibial spur sticklike, heavier than anterior spur, somewhat contorted. Emargination of fifth abdominal sternum broad, notched at apex; lateral lobes of sternum broadly rounded. Emargination of sixth sternum as in Figure 267; lateral lobes of sternum strongly divergent, curved ventrad at apex; lightly sclerotized median area triangular. Genitalia as in Figure 344; gonoforceps robust; gonostyli bowed in ventral view; aedeagus with ventral hook well developed.

Female. Antennae clavate. Hind trochanters distinctly angulate on ventral margin at distal third. Fore tibiae each with two spurs. Apex of fore and middle tibiae less acutely produced than in male. Fifth abdominal sternum shallowly emarginate. Sixth sternum with a narrow, U-shaped emargination medianly, much as in *childi.*

Type locality. Palisade, Colorado.

Geographic distribution. Western Colorado, eastern Utah, and Wyoming. (See Fig. 53.)

Seasonal distribution. The type series was collected May 7; the specimens from Utah were collected May 21.

Records. UNITED STATES: *Colorado*: Palisade, May, 3 (holotype and paratypes). *Utah*: Dinosaur National Monument, May, 2. *Wyoming*: State label only, 1.

Remarks. One of the paratypes has a pair of small, blunt tubercles on each side of the pronotum just before the basal impressed line.

The presence of only a single spur on each fore tibia in the male distinguishes *nigrocyanea* from all other North American species of *Lytta* except *moerens.* The evident affinity of *nigrocyanea* with the species of the Cyanipennis Subgroup has been mentioned above.

The type of *nigrocyanea* is in the collection of the California Academy

of Sciences (no. 2601, examined). The paratypes examined are in the collections of the Brigham Young University and the California Academy of Sciences. According to the original description of *nigrocyanea*, there should be additional paratypes in the collection of the Colorado Agricultural and Mechanical College at Fort Collins. I have written twice to this institution requesting information about these, but neither of my letters has been answered.

Cyanipennis Subgroup

Bright metallic green, blue, purple, or violaceous. Frontal spot one-sixth or less as wide as frontal area between eyes. Head wider than long, strongly triangular; tempora prominent; dorsal margin nearly straight; vertex somewhat tumid; surface smooth, shiny, moderately densely to sparsely punctate; pubescence long, erect. Male antennae with segments IV–VII incrassate, subequal in length, bulged on lateral side, triangular; VI and VII obviously thicker than rest; VIII–X progressively shorter and narrower; VIII similar in shape to VII, about as wide as V. Pronotum hexagonal, wider than long; lateral angles well marked; disk flattened or impressed before middle, usually foveate on each side at middle; base strongly impressed along margin, which is reflexed, the impression broadened medianly; surface more finely punctate than on head; punctures usually denser behind middle than before; pubescence as on head. Elytra impunctate; pubescence sparse; female with pubescence shorter and sparser than in male and with long setae never present basally. Apex of fore and middle tibiae acutely produced on posterior side in male; apex of fore-tibiae flared in this position in female. Male fore tibiae each with two spurs; anterior spur long, heavy, distorted, excavate at base. Male posterior middle tibial spur sticklike, somewhat contorted. Outer hind tibial spur at most twice as wide as inner spur; truncature oval; inner spur flattened. First segment of male fore tarsi strongly modified, bent in dorsal view, with a deep, socket-like excavation anteroventrally at base; first segment of female fore tarsi strongly cultriform, straight, not excavate. Tarsal claws moderately curved. Emargination of male fifth abdominal sternum broad, notched at apex. Female fifth abdominal sternum shallowly emarginate. Male sixth sternum with mesal margin of lateral lobes as well as an elongate, rectangular median area lightly sclerotized; median area with two more or less distinct, parallel rows of long setae, these rows extending onto lateral lobes of sternum as fringes; long setae usually bent at apex. Emargination of female sixth sternum moderately deep, circular or oval. Male genitalia as in Figure 345; gonostyli lacking mesal hooks, very conspicuously clothed ventrally with long setae; aedeagus with a single ventral hook, this hook strongly recurved.

Remarks. This subgroup contains three very similar forms: *nuttalli, cyanipennis,* and *viridana.* The last two of these are especially close morphologically and, in view of their allopatric distribution, may be conspecific.

The range of the Cyanipennis Subgroup encompasses the main mountain masses of western North America as far north as the Peace River region of Canada and south to the southern limits of the Rocky Mountains, in New Mexico and Arizona. The range of *nuttalli,* which includes the greater part of the combined ranges of *cyanipennis* and *viridana,* is one of the largest in the genus. Its range is also notable in that it extends farther east than that of any other North American species of *Lytta* exclusive of the species of the subgenus *Pomphopoea.*

Key to Species

1. Elytra generally violet, at least on margins, rarely entirely green; male fifth abdominal sternum with lateral lobes angulate (Fig. 219) ..... *nuttalli* (p. 205)

   Elytra lacking violet color; male fifth abdominal sternum with lateral lobes rounded 2

2. Male antennal segments IV–VIII incrassate but not otherwise modified; hind trochanters spined or angulate on ventral margin in male, angulate or smooth in female; individual setae on under surface of thorax entirely piceous ..... *cyanipennis* (p. 209)

   Male antennal segments IV–VIII flattened and clothed with long, erect setae on lateral surface; hind trochanters not spined or angulate; individual setae on under surface of thorax colorless apically, piceous basally ..... *viridana* (p. 213)

Lytta (*Poreospasta*) *nuttalli* Say

Lytta nuttallii Say, 1824, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 300.

Lytta nuttalli,[4] Say, 1824, American entomology, vol. 1, p. 5, pl. 3, fig. 1. LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 334. Horn, 1872, Rept. U.S. Geol. Surv., 1871, p. 390. Cockerell and Harris, 1925, Proc. Biol. Soc. Washington, vol. 38, p. 30, fig. 9. Carruth, 1931, Ent. News, vol. 42, p. 54. Knowlton, 1930, Florida Ent., vol. 14, p. 53; 1939, Utah Agr. Exp. Sta. Mimeo. Ser. 200, pt. 3, p. 5. Fox, 1943, Canadian Ent., vol. 75, p. 206. Peterson, 1951, Larvae of insects, vol. 2, p. 198, fig. C57, A. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 87.

Cantharis fulgifer LeConte, 1847, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 1, p. 90.

Lytta fulgifer, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 334.

Cantharis nuttalli, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 106;

[4] The specific name *nuttalli* has been frequently misspelled as *nuttali* or *nutalli,* but it does not seem necessary to segregate these variants in listing the synonymy.

1873, Rept. U.S. Geol. Surv., 1872, 1873, p. 717. Saunders, 1876, Canadian Ent., vol. 8, p. 224, fig. 11. Wickham, 1896, Canadian Ent., vol. 28, p. 34. Chittenden, 1899, Yearbook U.S. Dept. Agr., 1898, p. 250. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297. Wickham, 1901, Psyche, vol. 9, p. 151. Chittenden, 1903, U.S. Dept. Agr. Div. Ent. Bull. 40, p. 116; 1903, U.S. Dept. Agr. Div. Ent. Bull. 43, p. 27, fig. 22. Fall and Cockerell, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 210. Gibson, 1912, 42nd Ann. Rept. Ent. Soc. Ontario, p. 2, fig. 4.

Lytta nuttalli var. *fulgifera,* Ulke, 1875, *in* Report upon the geographical and geological explorations and surveys west of the 100th meridian, vol. 5, p. 825.

Cantharis nuttali [*sic*] var. *fulgifera,* Putnam, 1876, Proc. Davenport Acad. Nat. Sci., vol. 1, p. 91.

Cantharis fulgifera, LeConte, 1878, Bull. U.S. Geol. Surv., vol. 4, pt. 2, p. 472.

Head and pronotum brassy green, usually edged with purple, varying rarely to brassy violet. Elytra somewhat iridescent, usually metallic dark violet, becoming lighter and distinctly brassy toward base and margins, the immediate base and margins brassy green; elytra varying occasionally through brassy violet to brassy green, in which case the margins and base are almost always violet. Under surface metallic dark green or blue-green, usually grading to purple along edges of sclerites. Femora and tibiae metallic green, blue, or purple. Wings nearly colorless. Pubescence on under surface of thorax distinctly pale, silvery, the individual setae entirely colorless or colorless with base piceous; rest of pubescence piceous. Length: 7 mm.-21 mm.

Pronotum (Fig. 189) with lateral angles generally a little more prominent and acute than in *cyanipennis* and *viridana.* Elytra sparsely clothed with short pubescence, with some long setae usually present at immediate base.

Male. Antennae as in Figure 112; intermediate segments incrassate but not otherwise modified. Hind trochanters (Fig. 163) armed with a well-developed spine on ventral margin just basad of middle. Fifth abdominal sternum (Fig. 219) with lateral lobes angulate. Sixth sternum as in Figure 268. Genitalia as in Figure 345.

Female. Antennae as in Figure 150. Hind trochanters angulate on ventral margin near middle. Sixth abdominal sternum as in Figure 285.

Type locality. Of *nuttalli,* Missouri Territory; of *fulgifera,* near Longs Peak, Colorado.

Geographic distribution. Central Alberta and northern Minnesota south to California, Arizona, and New Mexico. (See Fig. 54.) Limited to higher elevations in the southern half of its range. The Sierra Nevada population appears to be disjunct from the main range of the species.

Saunders' (1876) report that *nuttalli* is "extremely abundant" in Kansas

is evidently erroneous as I have seen no specimens from that state and it is unlikely that the species occurs so far south east of the Rocky Mountains. There is a specimen in the Chicago Natural History Museum labeled Toronto, Ontario (September 4, 1930, F. H. Daniels), which I have disregarded pending verification in the form of additional material from that locality.

Seasonal distribution. May 31—September 21. Collected most frequently in June and July. As in the other two species of the subgroup, the seasonal distribution does not seem to be affected by latitude.

Records. CANADA: *Alberta*: Cardston, 1; Chin, June, 1; Edmonton, 3 (2 in July); Iron Springs, June, 1; Laggen, June, 1; Lethbridge, June, 2; Medicine Hat, June, July, 16; Scandia, June, 57; Stavely, July, 1. *Manitoba*: Aweme, June, July, 8; McCreary, June, 5; Melita, July, 1; Sandilands, September, 1; Winnipeg, 3. *Saskatchewan*: Attons Lake, Cut Knife, June, 3; Indian Head, July, 2; Lloydminster, June, July, 4; Moose Jaw, 1; North Portal, 3; Oxbow, June, 3; Penzance, 2; Roche Percee, July, 2; Saskatoon, June, 5; Weyburn, June, 2.

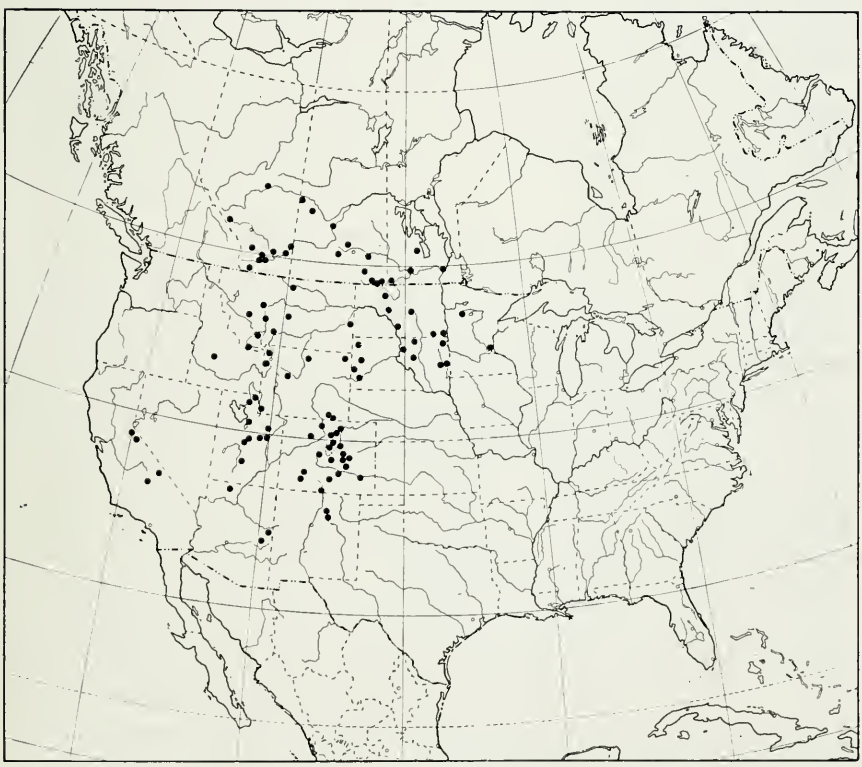


Fig. 54. Distribution of *Lytta nuttalli*.

UNITED STATES: *Arizona*: Kaibab National Forest, June, 1; Springerville, July, August, 9; White Mountains, 10,000 ft., July, 3. *California*: State label only, 2; Inyo County, July, 1; Monache Mountain, Tulare County, July, 4; Sardine Creek, 8500 ft., Mono County, June, 1; Sonora Pass, 9000 ft.-11,000 ft., Alpine County, June, July, 282; Twin Lake, Mono County, July, 1. *Colorado*: State label only, 45; Antonito, July, 13; Bent's Fork (LeConte, 1853); Cochetopa National Forest, September, 1; Colorado Springs, July, 1; Creede, 1844 ft., August, 4; Denver, 8; Eastonville, August, 2; Fort Collins, June, 15; Georgetown, 2; Gilpin County, 9500 ft., July, 2; Great Sand Dunes, Alamosa County, July, 1; Larkspur, July, 10; near Leadville, August, 6; near Longs Peak (LeConte, 1847); North Park, June, 4; Palmer Lake, June, 2; Pingree Park, August, 3; Pinnacle, 1; San Isabel National Forest, August, 3; South Park (Ulke, 1875); Wellington, July, 1; Willow Park (not located), 3. *Idaho*: Atlanta, 7800 ft. (LeConte, 1878); Snake River (Horn, 1873, p. 717). *Minnesota*: State label only, 2; Itasca [State] Park, 12 (8 in June, July); St. Anthony Park, August, 1. *Montana*: State label only, 20; Bozeman, August, 10; Carlyle, July, 1; Havre, June, 1; Helena, July, 2; Lewis and Clark County, July, 2; Lima, June, 1; Moccasin, July, 1; Rock Creek Lake, Powell County, July, 2; Sheridan, June, July, 6. *Nebraska*: (Chittenden, 1903, p. 27). *New Mexico*: State label only, 9; Beulah, August, 2; near Hot Springs, Las Vegas, 7000 ft., July, 1. *North Dakota*: State label only, 1; Custer, 2; Fessenden, June, 5; Forman, July, 1; Glenburn, July, 1; Hankinson, August, 2; Mandan, June, 6. *South Dakota*: State label only, 1; Black Hills, 1; Brookings, 13 (1 in July); Buffalo (Carruth, 1931); Custer, July, 2; Faulkton, Leola, Newell, Selby, and Sisseton Indian Reservation (Carruth, 1931); Volga, 1. *Utah*: State label only, 2; Bear Lake, 1; Duchesne, July, 1; Fish Lake, June, July, 28; Fruitland, July, 1; Lambs Canyon, Salt Lake County, August, 14; Logan, July, 1; Lost Lake, August, 2; Mill Creek Canyon, Salt Lake County, July, 2; Payson Canyon summit, 1; Timothy Creek, 7500 ft., 10 mi. north of Altonah, Duchesne County, June, 1; Valley View, Mount Nebo, Juab County, July, 1. *Wyoming*: State label only, 2; Bamforth Lakes, 10 mi. northwest of Laramie, July, 13; Big Horn Mountains, July, 1; Evanston, June, 1; Grand Teton National Park, July, August, 7; Hulett, July, 2; Laramie, 2; Wind River Basin (Putnam, 1876); Yellowstone National Park, 27 (21 in July).

Remarks. The violet color of the elytra will distinguish *nuttalli* from *cyanipennis* and *viridana* in almost all cases. In the absence of this color, males of *nuttalli* can be distinguished from those of *cyanipennis* by the form of the fifth abdominal sternum and from those of *viridana* by this same character as well as by the absence of long pubescence on the antennae. Atypically colored females of *nuttalli* are best separated from specimens of *cyanipennis* by the pale pubescence of the under surface

of the thorax and from specimens of *viridana* by the distinctly angulate hind trochanters.

Aside from the variation in elytral color, which is not geographic, *nuttalli* is remarkably stable throughout its range. No structural variation worthy of note has been observed other than that involving two specimens from Edmonton, Alberta, which appear to be hybrids between *nuttalli* and *viridana* (see discussion of *viridana*).

The first instar larva of *nuttalli* has been described by MacSwain (1956). The type has been lost. As neotype I have designated a male from Brookings, South Dakota, in the collection of Cornell University.

Bionomics. Except for reports of occasional injury to oats and barley in western Canada (Gibson, 1912) and North Dakota (Chittenden, 1903, p. 116), *nuttalli* has been recorded only from species of Leguminosae. Among the records which have come to my attention are the following: *Astragalus* in western Canada (Gibson, 1912) and California, *Caragana arborescens* in Utah, *Caragana* sp. in North Dakota and Saskatchewan (Penzance), *Cnemidophacos pectinatus* and *Diholcos bisulcatus* in Saskatchewan (Fox, 1943), *Thermopsis montanus* in Utah, and *Vicia americana* in western Canada (Gibson, 1912). There have also been some reports of feeding on cultivated beans and beets (Chittenden, 1899; 1903, p. 116; 1903, p. 27; and Gibson, 1912).

Fox (1943) has reported that adults of *nuttalli* feeding on *Cnemidophacos* and *Diholcos* in Saskatchewan are attacked by the mirid bug *Hadronema militaris* Uhler.

Lytta (*Poreospasta*) *cyanipennis* (LeConte)

Cantharis cyanipennis LeConte, 1851, Ann. Lyc. Nat. Hist. New York, vol. 5, p. 160. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 107; 1873, Rept. U.S. Geol. Surv., 1872, 1873, p. 717. LeConte, 1878, Bull. U.S. Geol. Surv., vol. 4, p. 472. Wickham, 1896, Canadian Ent., vol. 28, p. 34. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297. Wickham, 1902, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 5, p. 301. Gibson, 1912, 42nd Ann. Rept. Ent. Soc. Ontario, p. 4.

Lytta salicis LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 333; 1866, Smithsonian Misc. Coll., vol. 6, no. 167, p. 162.

Lytta cyanipennis, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 333. Horn, 1872, Rept. U.S. Geol. Surv., 1871, p. 390. Knowlton, 1930, Florida Ent., vol. 14, p. 53; 1939, Utah Agr. Exp. Sta. Mimeo. Ser. 200, pt. 3, p. 5. Knowlton and Taylor, 1952, Utah Agr. Exp. Sta. Mimeo. Ser. 389, p. 15. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 86. Hicks, 1959, Check-list and bibliography on the occurrence of insects in birds' nests, p. 72.

Differs from *nuttalli* as follows.

Elytra metallic dark purple, blue, or green, never violet. Brassy, iridescent quality almost always lacking. Under surface the same color as

elytra or the same color with an admixture of green, rarely at all brassy. Pubescence entirely dark. Length: 8 mm.-20 mm.

Male. Fifth abdominal sternum (Fig. 220) with lateral lobes broadly rounded, not angulate. Elytra frequently with long, erect setae on basal half to two-thirds. Hind trochanters with a well-developed spine on ventral margin at or basad of middle (Fig. 164) or with spine reduced to a tooth or acute angulation (rarely obsolete) and located distad of middle of ventral margin (Fig. 165).

Female. Hind trochanters with ventral margin varying from distinctly angulate (Fig. 166) to smoothly rounded (Fig. 167).

Type locality. Of *cyanipennis,* Oregon; of *salicis,* Salt Lake City, Utah.

Geographic distribution. Southern British Columbia south to northern California, southern Utah, and southern Wyoming. (See Fig. 55.) Limited to higher elevations in the southern part of its range.

Seasonal distribution. March 24—August 18.

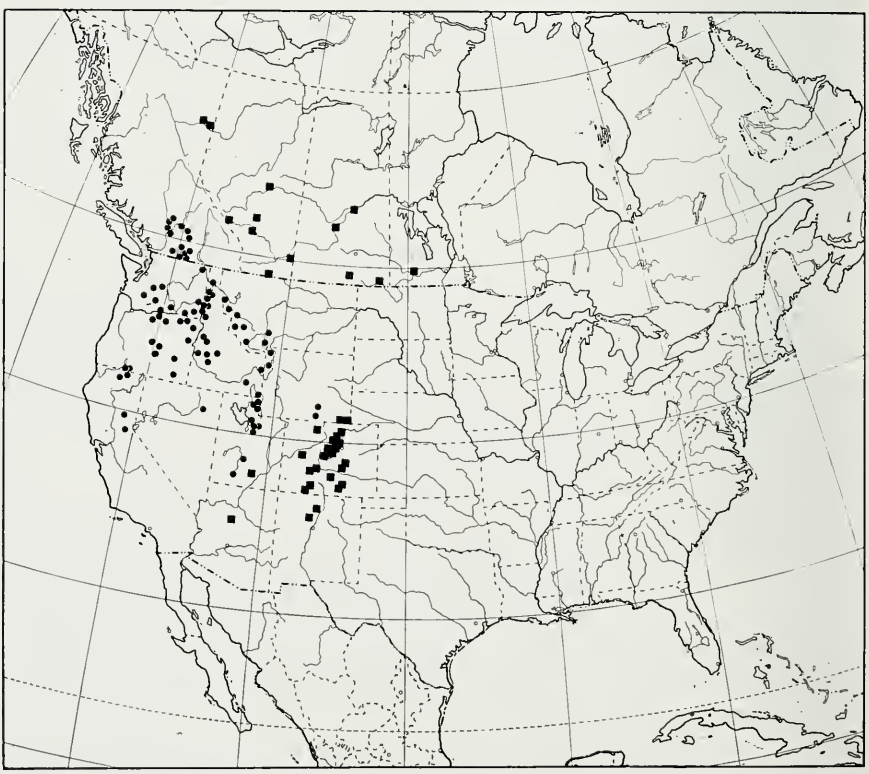


Fig. 55. Distribution of *Lytta cyanipennis* (circles) and *Lytta viridana* (squares).

Records. CANADA: *British Columbia*: Clinton, June, 1; Crown Lake, June, 8; Douglas Lake, June, 5; Ducks (Gibson, 1912); Hulcar, May, 2; Lac du Bois, Kamloops, 3700 ft., July, 3; Lytton, June, 1; Midday Valley, June, July, 12; Okanagan Landing, May, 1; Oliver, June, 14; Pavilion Lake, June, 14; Penticton, June, 1; Princeton, May, 1; Similkameen, May, 3; Seton Lake, June, 1; Six Mile Creek, May, 3; Spious Creek (not located), June, 1; Summerland, June, 1; Vernon, May, 8; Westbank, June, 1.

UNITED STATES: *California*: Bucks Lake, Plumas County, June, July, 5; Dunsmuir, 1; MacDoel, May, 1; Middle Fork, American River, Placer County, August, 1; Sierra Nevada, 2. *Idaho*: Atlanta, 4; Avon, June, 1; Bannock Pass, Lemhi County, July, 23; Bloomington Lake, Wasatch Mountains, 8200 ft., July, 4; Brundage Lookout, Payette National Forest, August, 1; Caldwell, 2375 ft., May, 1; Deary, 2775 ft., May, 25; Fort Sherman, June. 1; Granite, July, 4; Joel, May, 3; Lakefork, Valley County, July, 2; Lewiston, 5000 ft., March–May, 5; McCall, June, 1; Moscow, May, June, 9; Moscow Mountain, 3000 ft., May, 1; St. Maries, June, 1; Sandpoint, 2086 ft., June, 4; Stanley, June, 1; Teton, June, 1; Warm Lake, June, 3; Winchester, June, 1. *Montana*: Beaverhead County, May, 1; Bitter Root Valley, 1; Bozeman, June, 2; Butte, 1; Gallatin County, June, July, 8; Glacier National Park, June, July, 9; Madison County, July, 11; Missoula, 5; Rock Creek Lake, Powell County, July, 1; 5 mi. east of Saint Regis, June, 16; Thompson Falls, June, 1. *Nevada*: Elko, June, 3. *Oregon*: Arlington, May, 2; Burns, June, 2; Durkee, June, 4; Enterprise, July, 1; Fish Lake, Steens Mountains, 7000 ft., July, 1; Klamath Falls and 17 mi. east of Klamath Falls, June, July, 2; Langden Lake, Umatilla County, June, 1; Lexington, May, 1; Milton, 1500 ft., May, 1; Moro, April, 7; Ochoco National Forest, June, 2; Princeville, June, 1; Silver Creek, July, 6. *Utah*: Alta, Little Cottonwood Canyon, 9000 ft.-10,000 ft., July, August, 200; Aspen Grove, Mount Timpanogas, July, 13; Bell Canyon, Salt Lake County, July, 1; Brighton, 9000 ft.-10,000 ft., July, 45; Cedar Breaks, July, 4; Chalk Creek, Summit County, July, 1; Fish Lake, 8600 ft., June, July, 48; Logan Canyon, June, August, 17; Mill Creek Canyon, Salt Lake County, July, 5; Mueller Park, Davis County, June, 1; Provo and Provo Canyon, May, July, 19; Spanish Fork, 1; Strawberry Valley, June, 1; Tony Grove Ranger Station, Cache County, July, 1; west of Woodruff Mountains, 8000 ft., Rich County, June, 1. *Washington*: Alderdale, May, 1; Dayton, May, 4; Dryden, May, 3; Easton, 9; Kiona, May, 2; Mount Rainier National Forest, June, 1; Northport, June, 6; Pullman, 3; Tieton, May, 2; Walla Walla, May, 28; Yakima County, July, 2.

Remarks. The length of the elytral pubescence is extremely variable in the male. In the southern half of the range (except in California) the elytral pubescence is short throughout, or if long setae are present, they are restricted to the immediate base of the elytra. In a few specimens

from this area long setae are present as far apicad as the basal fourth of the elytra. In northern Idaho about two-thirds, and elsewhere within the northern half of the range (and in California) about half, of the specimens have distinctly hairy elytra, with long setae along the sutural third of each elytron from the base to the middle or apical third. Other specimens from the northern area have entirely short pubescence, and all degrees of intermediacy between the extremes is represented in still others.

Throughout the greater part of the range of *cyanipennis* the male hind trochanters have a well-developed spine located at or basad of the middle of the ventral margin (Fig. 164). In Utah, southeastern Idaho, and southern Wyoming it is reduced to a short tooth (Fig. 165) located distad of the middle of the ventral margin or (rarely) is absent. Modification of the female hind trochanters is correlated geographically with that of the male: where the male trochanters have a well-developed spine, the ventral margin of the female trochanters is distinctly angulate; where the male spine is reduced, the ventral margin of the female trochanters is rounded. Series of specimens from Nevada (Elko), southwestern Idaho (Atlanta and Stanley), northwestern Wyoming (Yellowstone and Grand Teton national parks), and the Gallatin Mountain region of Montana show, to a greater or lesser extent, intermediate development of the trochanteral modification.

The first instar larva of this species has been described by MacSwain (1956). The type of *cyanipennis*, as well as that of *salicis*, is in the Museum of Comparative Zoology.

Bionomics. The type material of the synonym *salicis* was reportedly taken on willow, but this record has never been verified and is probably wrong. All other food plants recorded for *cyanipennis* belong to the family Leguminosae. One specimen examined from Idaho was collected on *Vicia*, and there are several records of *Lupinus* from British Columbia, Idaho, Montana, and Utah. In addition, Gibson (1912) reported injury to peavine [*Lathyrus* ?], beans, and peas in British Columbia.

In the Wasatch Range of Utah I have frequently found *cyanipennis* feeding on a species of *Lupinus* growing at elevations between 8000 ft. and 10,000 ft. The beetles feed on the petals of the flowers in preference to the leaves, although they readily accept leaves if flowers are not available. In captivity they feed more or less continuously, day and night. Their fecal material, which is emitted in large quantity, contains great amounts of undigested plant tissue; it is presumably this inefficient utilization of food that accounts for the unusually ravenous habits of the beetles. Efforts to maintain the beetles on plants other than the species of *Lupinus* upon which they feed in nature were uniformly unsuccessful, although in one instance some individuals fed sparingly on the leaves of

a different species of *Lupinus* and on the leaves of fresh lettuce. Alfalfa and several species of Compositae were offered on various occasions and were always refused.

Hicks (1959), citing the unpublished doctoral dissertation of W. L. Jellison, records *cyanipennis* from the nest of the magpie *Pica pica hudsonica.*

Lytta (*Poreospasta*) *viridana* LeConte

Lytta viridana LeConte, 1866, Smithsonian Misc. Coll., vol. 6, no. 167, p. 162. Horn, 1872, Rept. U.S. Geol. Surv., 1871, p. 390. Fox, 1943, Canadian Ent., vol. 75, p. 206.

Cantharis viridana, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 107. LeConte, 1879, Bull. U.S. Geol. Surv., vol. 5, pt. 3, p. 506. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297. Wickham, 1902, Bull. Lab. Nat. Hist. State Univ. Iowa, vol. 5, p. 301. Fall and Cockerell, 1907, Trans. Amer. Ent. Soc., vol. 33, p. 210. Gibson, 1912, 42nd Ann. Rept. Ent. Soc. Ontario, p. 15.

Differs from *cyanipennis* as follows.

Individual setae on under surface of thorax colorless apically, piceous basally (entirely piceous in *cyanipennis*).

Male. Antennal segments IV–VIII flat and conspicuously clothed with long, erect setae on outer surface. Hind trochanters almost invariably smooth on ventral margin, without an indication of a spine. Elytra with pubescence usually slightly longer at base than in female but only very rarely with any long, erect setae.

Female. Hind trochanters with ventral margin never angulate.

Type locality. "Rocky Mountains, from the Black Hills northward into the Hudson Bay Territory" (LeConte, 1866).

Geographic distribution. Peace River region of British Columbia and southern Manitoba south through eastern Wyoming, Colorado, and southeastern Utah to northern Arizona and New Mexico. (See Fig. 55.) Limited to higher elevations in the southern part of its range. Consistently allopatric with *cyanipennis.*

I have seen a few specimens supposedly from Kansas, but I doubt that they are correctly labeled. Tanner and Hayward's (1934) record of *viridana* from Utah was based on misidentified specimens of *Linsleya sphaericollis* (Say).

Seasonal distribution. May 20—August 14.

Records. CANADA: *Alberta*: Bilby, June, 1; Calgary, May, 25; Coutts, June, 2; Edmonton, June, July, 14 (including 2 *viridana* x *nuttalli* hybrids); Laggan, May, 1; Medicine Hat, May, June, 38. *British Columbia*: Fort St. John, June, 1; Taylor, June, 20. *Manitoba*: Aweme, June, 2. *Saskatchewan*: Asquith, May, 1; Christopher Lake, May–July, 21; Ogema, June, 1; Oxbow, June, 3; Penzance, June, 2; Prince Albert National

Park, June, 3; Rivercourse Post Office, May, 2; Rudy (Gibson, 1912); Saskatoon, June, 1.

UNITED STATES: *Arizona*: San Francisco Mountains, June, July, 20 (9 at Snow Bowl). *Colorado*: State label only, 170; Creede, 8844 ft., August, 34; Dumont, June, 1; Estes Park, July, 1; Fort Collins (Wickham, 1902); Georgetown, 8300 ft.-8600 ft., June, 6; Grand Lake, August, 4; Green Mountain Falls, August, 1; Gunnison, 7500 ft., June, 2; Jefferson, July, 5; 18 mi. north of Leadville, June, 3; Little Beaver (Wickham, 1902); southwest of Montrose (Wickham, 1902); near Nederland, June, 8; North Park, June, 1; Ohio, July, 2; Ouray (Wickham, 1902); Palmer Lake, June, 7; Ragged Mountain, Gunnison County, June, 1; Rico (Wickham, 1902); Rio Grande, 10 mi. southwest of Creede, July, 1; Rocky Mountain National Park (Fall River Entrance and Hidden Valley), June, 4; Russel, June, 1; Sheep Lake, Rocky Mountain National Forest, June, 1; [La] Veta Pass, 1; Ward, July, 6; West Cliff (Wickham, 1902); Willow Park (not located), 15. *New Mexico*: Abiquiu, 1; Harveys Ranch, Las Vegas Range (Fall and Cockerell, 1907); Jemez Mountains, May, 11. *Utah*: Miners Peak [Mountain], Wayne County, July, 3. *Wyoming*: State label only, July 1; 25 mi. west of Cheyenne, June, 1; Laramie, July, 2.

Remarks. The only consistent basis for separation of females of *viridana* and *cyanipennis* is the difference in the color of the pubescence of the under surface of the thorax. This difference is best observed when the pubescence is viewed in profile against back lighting. Males of the two species are easily separated by use of the antennal and trochanteral characters indicated in the key. The character of elytral pubescence is of no real value in making determinations because of the great variability in *cyanipennis*. An occasional green female of *nuttalli* may be confused with *viridana* but can be distinguished by its definitely angulate hind trochanters.

In view of the great similarity between *viridana* and *cyanipennis*, the allopatry of the two forms suggests that they may represent geographical races of the same species. Such a hypothesis is supported by the fact that the population of *cyanipennis* in southern Idaho, Wyoming, and Utah approaches *viridana* with respect to reduction of the modification of the hind trochanters. However, there is no evidence of intergradation between *viridana* and *cyanipennis* in characters of the male antennae and color of the thoracic pubescence. The problem of the relationship of the two forms requires a great deal of additional study, pending which it seems most reasonable to consider them as separate species. This decision is in line with the knowledge that *nuttalli*, which is sympatric with both *viridana* and *cyanipennis* and is unquestionably specifically distinct from both, shows only slight structural differentiation from either of them.

Hybridization of *viridana* and *nuttalli* is indicated by two males from Edmonton, Alberta, collected July 12, 1917, by F. S. Carr. These specimens have the violet elytra of *nuttalli* and the unmodified hind trochanters and rounded lateral lobes of the fifth abdominal sternum of *viridana.* One has the antennae of *nuttalli,* while the other has antennae like those of *viridana* but with the intermediate segments less flattened laterally and with the erect setae shorter and sparser than usual. In addition to these specimens, I have seen from Edmonton 12 specimens of typical *viridana* (including 1 specimen with collection data identical to those of the hybrids) and 3 specimens of typical *nuttalli.* Inasmuch as the two species occur sympatrically over a large area and apparently do not have food plant differences, the occurrence of occasional hybrids is not particularly surprising.

Bionomics. Apparently restricted to Leguminosae. Fox (1943) has reported that in Saskatchewan *viridana* occurs with *nuttalli* on *Cnemidophacos pectinatus* and *Diholcos bisulcatus.* Other food plants are *Caragana* at Penzance (again with *nuttalli*) and peavine [*Lathyrus* ?] at Prince Albert National Park, both localities in Saskatchewan.

Childi Subgroup

Black, without metallic luster. Frontal spot diamond-shaped. Pronotum frequently in part orange. Head quadrate, as long as wide; surface subglabrous, irregularly punctate, with some very fine punctures intermixed with larger ones. Male antennae with segment I densely punctulate on ventral side; intermediate segments incrassate or not. Pronotum hexagonal (*molesta*) or subquadrate (*childi*); surface more irregularly, sparsely punctate than head, subglabrous. Scutellum rounded. Elytra impunctate, essentially glabrous. Outer hind tibial spur cylindrical or nearly so, four times as wide as inner spur; truncature broadly oval. Emargination of male fifth abdominal sternum broadly triangular. Male genitalia with gonostyli lacking mesal hooks, clothed ventrally with long setae; aedeagus with a single ventral hook or none.

Remarks. This subgroup contains the species *molesta* and *childi.* Its range extends from central California south to the Cape Region of the peninsula of Baja California.

Key to Species

1. Pronotum hexagonal (Fig. 190); male antennae (Fig. 113) clavate; male hind trochanters each armed with a ventral spine near apex; female sixth abdominal sternum (Fig. 286) with a broadly rounded emargination ..... *molesta* (p. 216)

Pronotum subquadrate (Fig. 191); male antennae not clavate, the intermediate segments incrassate; male hind trochanters not spined; female sixth abdominal sternum (Fig. 287) with a narrow, U-shaped emargination ..... *childi* (p. 218)

Lytta (*Poreospasta*) *molesta* (Horn)

Cantharis molesta Horn, 1885, Trans. Amer. Ent. Soc., vol. 12, p. 111. Fall, 1901, Trans. Amer. Ent. Soc., vol. 27, p. 298.

Lytta molesta, Van Dyke, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 131. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 89, pl. 15.

Black. Frontal spot nearly always more than half as wide as frontal area between eyes, rarely half as wide. Pronotum orange or reddish orange with anterior margin of disk broadly black and with a large black discal blotch extending from basal margin to before middle, as in Figure 190, or with orange arch so formed narrowly or broadly broken medianly; very rarely with pronotum entirely black. Wings light brown with area basad of 1A nearly colorless. Pubescence silvery on under surface of thorax, piceous elsewhere. Length: 11 mm.-22 mm.

Head with sides a little more divergent above eyes than in *childi* and with tempora therefore more prominent; surface smooth, sparsely punctate. Pronotum (Fig. 190) hexagonal, one-fifth to one-fourth wider than long; basal margin more strongly emarginate medianly than in *childi;* surface smooth or with some fine alutaceous markings, especially basally. Tarsal claws moderately curved.

Male. Antennae (Fig. 113) reaching one segment beyond base of pronotum; form nearly as in female, the intermediate segments not incrassate; segments III-VIII subequal in length; III as wide as VI, IV and V a little narrower; VI–X becoming progressively slightly wider; IX and X a little shorter than VIII; XI at most four-fifths as long as IX and X combined. Hind trochanters each armed with a spine on ventral margin near apex; ventral margin nearly straight; apex of trochanter truncate. Posterior margin of middle tibiae produced as a broad lamella reaching beyond middle of posterior tibial spur. Posterior middle tibial spur heavy, contorted, projecting at a wide angle, truncate at apex. Sixth abdominal sternum as in Figure 269. Genitalia as in Figure 346; aedeagus with ventral hook well developed.

Female. Antennae (Fig. 151) reaching about middle of pronotum; segments III–X becoming progressively slightly wider. Sixth abdominal sternum (Fig. 286) with a broadly rounded emargination. Genitalia with gonostyli very short.

Type locality. "California . . . probably near Visalia" (Horn, 1885).

Geographic distribution. Central Valley of California from Contra Costa County to Kern and Tulare counties. (See Fig. 56.) Recorded from Washington by Fall (1901, p. 298) but undoubtedly in error.

Seasonal distribution. April 3—July 1.

Records. UNITED STATES: *California*: State label only, 11; Auberry, April, 1; 10 mi. north of Blackwells Corner, Kern County, April, 64; Brentwood and 3 mi. southwest of Brentwood, April, 18; El Mirador, Tulare County, April, 2; Fresno, June, July, 6; Kern County, 7; Kings County, June, 5; Lanes Bridge, 5 mi. north of Fresno, April, 3; Madera, April, 1; 6 mi. north of Merced, April, 3; Panoche Canyon, Fresno County, April, 1; Springville, April, 2; 14 mi. north of Wasco, April, 52.

Remarks. The pronotum is entirely black in one of the specimens from 6 mi. north of Merced. In all other specimens of the species that I have seen it is extensively marked with orange.

The first instar larva of *molesta* has been described by MacSwain (1956). The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. There are records from *Lupinus* (Leguminosae) in Contra Costa, Kern, and Fresno counties. The specimen from Auberry, Fresno County, was collected on filaree [*Erodium cicutarium* (Geraneaceae)].

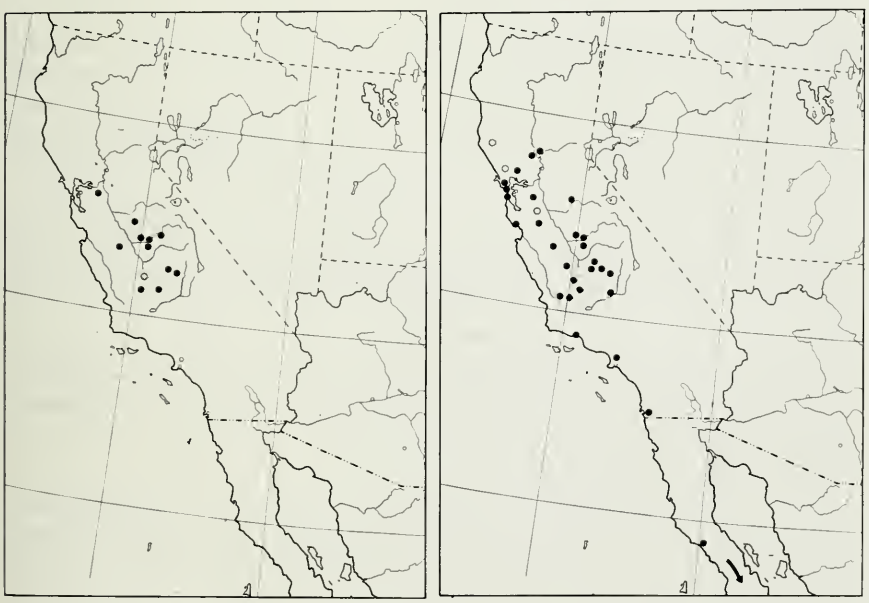


Fig. 56 (left). Distribution of *Lytta molesta.*

Fig. 57 (right). Distribution of *Lytta childi.*

Lytta (*Poreospasta*) *childi* LeConte

Lytta childii LeConte, 1857, *in* Reports of explorations and surveys . . . from the Mississippi River to the Pacific Ocean, vol. 12, book 2, pt. 3, p. 52.

Cantharis childii, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 108; 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 356. Fall, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 185; 1901, Trans. Amer. Ent. Soc., vol. 27, p. 297.

Lytta maculicollis Van Dyke, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 130. Not Klug, 1825, Verh. Kaiserlichen Leopoldinsch-Carolinischen Akad. Naturforsch., vol. 12, p. 445. *New synonymy.*

Lytta childi, MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 89.

Black. Frontal spot varying from less than one-third to nearly half as wide as frontal area between eyes. Pronotum varying from entirely black to largely reddish orange (Fig. 58). Antennae, prosternum, and tarsi often reddish when pronotum is extensively marked with orange. Metasternum with midline rarely reddish. Wings light brown, with area basad of 1A nearly colorless. Pubescence piceous. Length: 10 mm.-20 mm.

Head surface sometimes weakly alutaceous or canaliculate, especially frontal area, sparsely to rather densely punctate. Pronotum (Fig. 191) subquadrate, varying from slightly wider than long to slightly longer than wide; surface varying from almost smooth to strongly, transversely alutaceous. Tarsal claws weakly curved.

Male. Antennae reaching one to three segments beyond base of pronotum; segments III–VII incrassate, bulged on lateral side; IV and V largest; VIII–X narrower than preceding segments, becoming progressively shorter; XI at least as long as IX and X combined, longer than first segment of middle tarsus. Hind trochanters not angulate or spined on ventral margin, subtruncate at apex. Mesal surface of fore tibiae lined with dense, golden pubescence. Middle tibial spurs spiniform, not modified. Fifth abdominal sternum as in Figure 221. Sixth sternum as in Figure 270; lateral lobes of sternum curving ventrad at apex. Genitalia as in Figure 347; aedeagus with ventral hook represented by an apical knob.

Female. Antennae reaching base or basal third of pronotum; segments III–VIII subequal in width; IX and X slightly wider. Sixth abdominal sternum (Fig. 287) with a narrow, U-shaped emargination medianly. Genitalia with gonostyli elongate.

Type locality. Of *childi*, San Francisco, California; of *maculicollis*, "near Panoche Creek," Fresno County, California (Van Dyke, 1929). The labels of the type series of *maculicollis* read Panoche Canyon rather than Panoche Creek.

Geographic distribution. Santa Cruz, Mendocino, Sacramento, and Tuolumne counties south through the Central Valley to Ventura and Los

Angeles counties, California; thence, based on records of Horn (1894), south along the coast to southern Baja California Sur (Isla Santa Margarita). (See Fig. 57.)

Seasonal distribution. March 8—July 7.

Records. UNITED STATES: *California*: State label only, 15; Antelope, April, 14; 10 mi. north of Blackwells Corner, Kern County, April, 8; Brentwood and 3 mi. southwest of Brentwood, April, 36; By Pass, Yolo County (not located), April, 2; Byron, April, 44; Camp Taylor, Marin County, June, 1; Coalinga, March, 7; Clovis, July, 1; Davis and north of Davis, April–May, 47; 5 mi. south of Democrat Springs, Kern County, April, 11; El Mirador, Tulare County, May, 6; Fresno, June, 11; 9 mi. north of Fresno, April, 13; 15 mi. north of Fresno, April, 36; Friant, April, 1; Jamestown, April, 20; Kern County, March, 1; 11 mi. south of Kettleman City, April, 3; La Panza, San Luis Obispo County, May, 1; Lindsay, May, 2; Los Angeles, 205 ft., March, 1; Los Angeles County, 6 (1 in April); Lost Hills, Kern County, April, 1; McClure Valley, Kings County (not located), March, 1; Madera, May, 35; Mendocino County (Fall, 1901); Mount Tamalpais, Marin County, July, 2; Napa, June, 1; Pacheco Pass, Merced County, June, 1; Panoche area (Panoche, Panoche Creek, Panoche Canyon, and Pinoche [Panoche] Hills, Fresno County; Little Pinoche [Panoche] Creek, San Benito County), March–April, 76; San Diego (Horn, 1894); San Francisco (LeConte, 1857); Santa Cruz, June, 3; Simmler, April, 1; Sonoma County, 1; Springville, April, 7; Stanislaus [County], April, 2; Taylor State Park, Marin County, May, 1; Tulare, April, 2; Ventura, April, 4; Visalia, June, 22; 14 mi. west of Wasco, April, 6; Woodland, May, 1.

MÉXICO: *Baja California Norte*: San Julio (Horn, 1894). *Baja California Sur*: Margarita Island [Isla Santa Margarita] (not mapped) (Horn, 1894).

Remarks. The color of the pronotum varies geographically. The variation is continuous, but for the purpose of analysis it is convenient to recognize a number of arbitrary color classes, to each of which a value is assigned reflecting the strength of development and extensiveness of the orange marking or markings (Fig. 58). In class 1 the pronotum is entirely black. In classes 2 and 3 the lighter areas shown are piceous and are either invisible macroscopically or not particularly conspicuous. In classes 4–6 they are distinctly orange. By assigning each specimen examined to its appropriate color class, an average value has been derived for each sample of specimens which serves as an index of "orangeness" of the pronotum. These averages are arranged geographically in Figure 59. The bar graphs in this figure show the frequency distribution of the color classes in each sample, the distance between base lines being equal

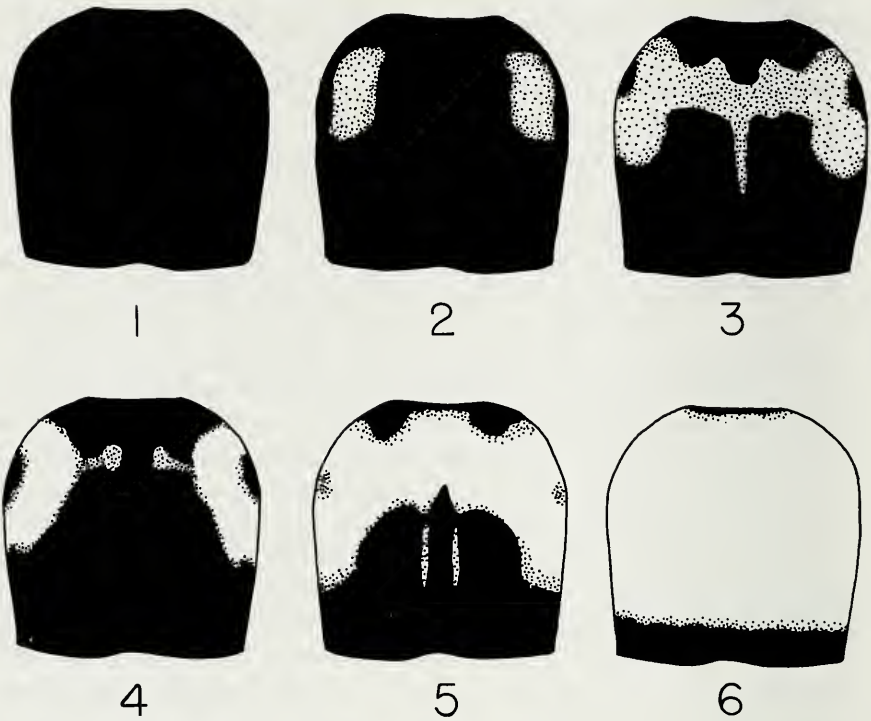


FIG. 58. Pronotal color classes in *Lytta childi*.

to 100 per cent of the sample. The number of specimens in each sample is indicated on the graphs. The shaded area on the map is the range of *molesta*.

As shown in Figure 59, variation in pronotal color in *childi* has the pattern of a centripetal cline for increased development of orange with its center in the Central Valley of California. The most interesting aspect of this variation is that in the Central Valley *childi* occurs sympatrically with *molesta*, which has a pronotal color pattern much like that of class 5 of *childi*. Thus *childi* tends to resemble *molesta* in color where the two species occur together but loses this resemblance where the latter species does not occur.

Similar examples of character convergence have been described in other groups of animals. In the butterflies, particularly the heliconids, numerous examples are known, most of these apparently accountable for on the basis of Müllerian or Batesian mimicry. In a recent review of snake mimicry, Hecht and Marien (1956) have described a particularly clear-cut case of convergence involving a *Lampropeltis* mimic of a coral snake. Sympatric convergence of the frogs *Rana clamitans* and *septen-*

trionalis has been described and discussed by Moore (1952). In this last example the convergence presumably results from the two species of frogs being in the same habitat and thus being subject to the same selection pressures.

Available evidence indicates that the beetles *childi* and *molesta* also share the same habitat. Both species have been collected on *Lupinus* at several points within the area of sympatry. They presumably occur on the same species of *Lupinus* as several mixed series of the two have been examined. Moreover, they have the same seasonal distribution. Under these circumstances it is not difficult to conceive of one or more of the physical factors of the environment producing parallel phenotypic

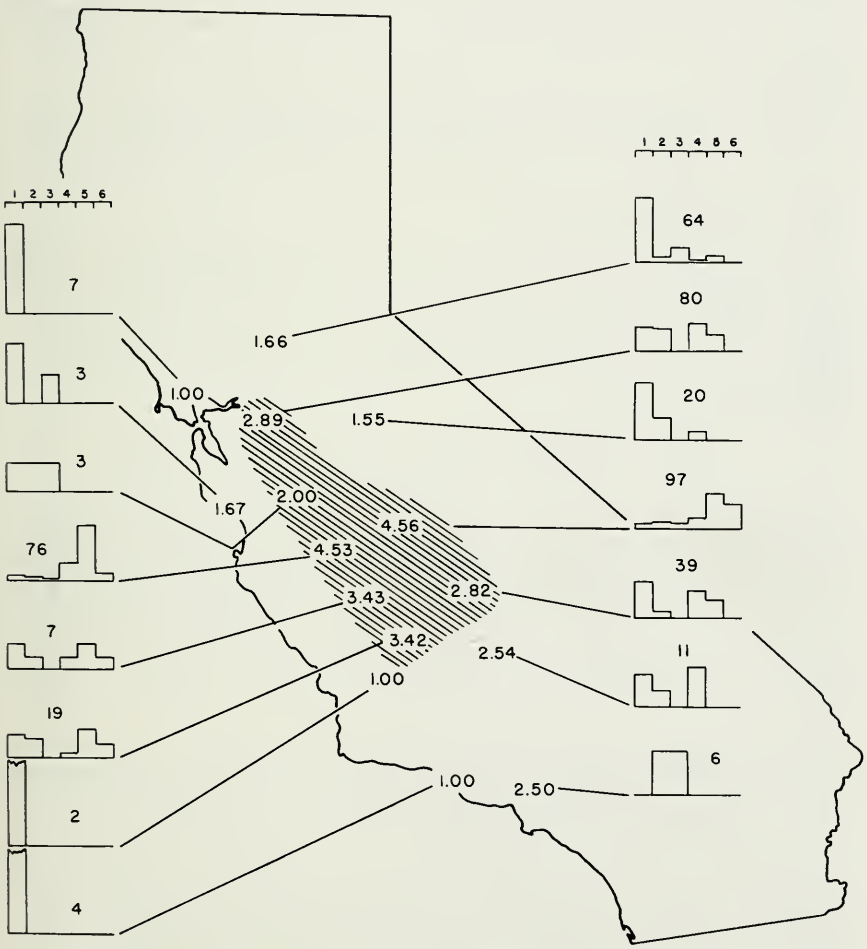


Fig. 59. Geographic variation in *Lytta childi*. For explanation see text.

or (through natural selection) genotypic responses in the two species. The ecological distinctness of the Central Valley from the surrounding areas lends some support to this explanation. However, the possibility that some form of Müllerian mimicry is operating cannot be overlooked. If mimicry is involved, there is presumably a predator exerting a pressure on the two species in the Central Valley but not in the peripheral area. Batesian mimicry seems to be ruled out as it is very unlikely, in view of their close relationship, that one species is more distasteful than the other. In addition, it appears that neither of the species occurs more abundantly than the other, which is in violation of one of the primary conditions under which Batesian mimicry can be operative. Hybridization, another possible explanation of sympatric convergence, does not seem to be involved in the present case as there is no evidence of intergradation between *childi* and *molesta* in any of their numerous structural differences.

The first instar larva of *childi* has been described by MacSwain (1956). The type of *childi* is in the Museum of Comparative Zoology, and the type of *maculicollis* is in the collection of the California Academy of Sciences (no. 2602, examined).

Bionomics. Specimens have been recorded from *Lupinus* (or "lupine") (Leguminosae) at the following localities in California: Panoche Creek, Fresno County (Van Dyke, 1929, as *maculicollis*); 3 mi. southwest of Brentwood; 11 mi. south of Kettleman City; north of Davis, Yolo County; and Ventura. A record of "Compositae" near Los Angeles (Fall, 1901) can probably be discounted.

Subgenus POMPHOPOEA LeConte, new status

Pomphopoea LeConte, 1862, Smithsonian Misc. Coll., vol. 3, art. 136, p. 273; 1866, Smithsonian Misc. Coll., vol. 6, art. 167, p. 161. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 115. Blatchley, 1910, The Coleoptera or beetles of Indiana, p. 1364. Cockerell and Harris, 1925, Proc. Biol. Soc. Washington, vol. 38, p. 32. Cros, 1929, Ann. Soc. Ent. France, vol. 98, pp. 213-14. Denier, 1933, Rev. Chilena Hist. Nat., vol. 37, p. 241. Dillon, 1950, Amer. Midland Nat., vol. 48, p. 353. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 71.

Moderate-sized to large, slender beetles, most similar in general facies to members of the subgenus *Lytta*. Metallic green, blue, or aeneous with femora and tibiae (hind tibiae only in *polita*) orange. Head without a pale frontal spot. Pubescence colorless. At least elytra satiny in texture, not particularly shiny. Head with tempora well defined; surface microgranulate, sparsely, finely punctate. Labrum deeply emarginate (Figs. 155-58). Antennae moniliform clavate or (*polita*) subfiliform. Male antennae longer than in female; intermediate segments not incrassate or

otherwise modified. Pronotum subcampanuliform or subhexagonal. Wings medium brown. Under surface moderately densely pubescent; setae long except on midventral region of male abdomen, where they are much shortened. Fore femora at least slightly concave on anterior side so as to appear bowed, even in female. Male fore and middle legs modified or not. Male fore tibiae each with two spurs or only one (anterior spur absent in *polita*). Male middle tibiae each with posterior spur long, curving strongly posteriad. Tarsal pads well developed and pale on all segments, divided or parted on midline. Outer hind tibial spur expanded, flared; inner spur spiniform or sticklike, excavate behind. Male fifth abdominal sternum distinctly emarginate. Male genitalia with gonostyli elongate, slender, tapered, glabrous, blunt and turned dorsad at apex; aedeagus slender, not much curved; ventral hooks subequal in size and similar in shape, well separated; dorsal hook abruptly recurved.

Type. Lytta sayi LeConte; fixed by subsequent designation by MacSwain (1956, p. 72, footnote). Dillon's (1952) designation of *aenea* as type is invalid because this species was not one of the first included in *Pomphopoea.*

Remarks. Pomphopoea contains a total of four well-marked but superficially similar species, which fall naturally into three species groups. Adults of the species, in the main, are found in the spring on the blossoms of a variety of trees and shrubs, especially of members of the family Rosaceae. The range of the subgenus, which is centered in the Eastern Deciduous Forest, covers almost all of the eastern United States in addition to a narrow, adjacent band in southeastern Canada (Fig. 9). The western limits of distribution are eastern Wyoming (*sayi*) and eastern Texas (*aenea*). As discussed in an earlier section of this paper, *Pomphopoea* seems to have had a history of dispersal quite distinct from that of the other North American members of the genus *Lytta,* which it replaces east of the Great Plains. This geographical replacement cannot be explained entirely on a historical basis, however, for several of the primarily western species of *Lytta* have access to the Eastern Deciduous Forest at present or have undoubtedly had such access in relatively recent times. Rather, I would suggest that a critical deterrent to eastward dispersal of members of the large western fauna of *Lytta* is an inability on their part to compete successfully with species of *Pomphopoea* in the mesic country east of the Great Plains. Similarly, westward movement of *Pomphopoea* is probably blocked by the presence of the western fauna of *Lytta.*

Two of the species of the subgenus have ranges which are divided more or less completely into western and eastern segments. This segmentation of range presumably reflects post-Pleistocene changes of climate which

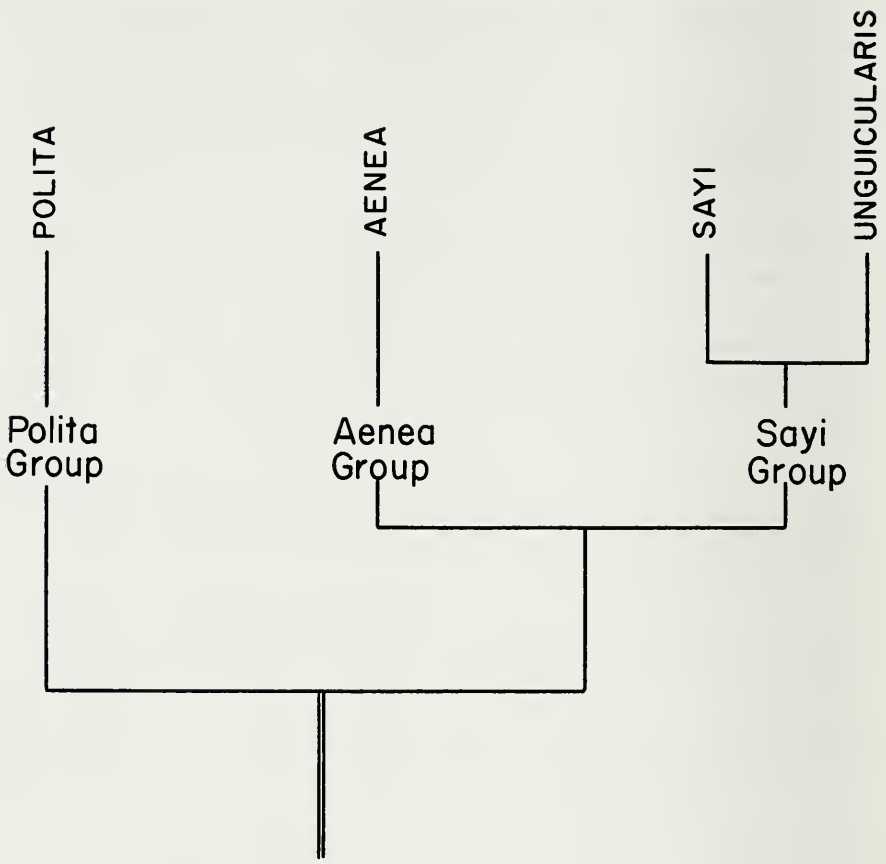


FIG. 60. Phylogeny of the subgenus *Pomphopoea*.

have brought about partial or total extinction of the populations in the intermediate territory. Further study of the distribution and ecology of the members of the subgenus will probably lead to valuable conclusions regarding post-Pleistocene biogeography of the eastern United States.

The phylogeny of the species of *Pomphopoea*, as suggested by the results of the present analysis of adult morphology, may be outlined as follows (see also Fig. 60). The subgenus originally arose from an ancestral species which reached eastern North America from Asia by way of the Bering Strait and which was characterized, in all probability, by having the male fore tibiae not thickened or arcuate and with two spurs each, male hind tibiae not dilated (as in the female), gonostyli of the male genitalia parallel or nearly so, male sixth abdominal sternum simply emarginate, and female sixth sternum entire. All these characters

are now represented in the subgenus, although the above combination of them has not been retained by any single species.

The species *polita* arose as an offshoot from the ancestral type in which in the male the fore tibiae developed a strong groovelike impression, one of the fore tibial spurs was lost, the first fore tarsal segment was asymmetrically dilated, and the gonostyli became divergent. The subfiliform nature of the antennae of this species, although it is unique within the subgenus, is perhaps a primitive rather than specialized character inasmuch as it approaches the condition in some of the Old World species of *Lytta* that I believe are closely related to *Pomphopoea*. *Polita* is apparently the least successful of the species of *Pomphopoea*, being both rare and confined in distribution.

The other species of the subgenus apparently arose as derivatives of a separate evolutionary line, as indicated by the fact that in all of them the male hind tibiae are somewhat dilated and more strongly compressed than in the female and that the female sixth abdominal sternum is at least weakly emarginate. On this line *aenea* has retained an essentially primitive combination of characters, while in both *sayi* and *unguicularis* the male fore tibiae are thickened and arcuate, the male sixth abdominal sternum has become impressed, and the female sixth sternum is relatively deeply grooved. *Unguicularis*, with its strongly dilated and compressed male hind tibiae and strongly modified female sixth sternum, is clearly more highly evolved than *sayi* and is nearly if not fully as highly evolved as *polita*. It is of interest to note that while *sayi* and *unguicularis* replace each other geographically, the more distantly related *aenea*, which is the commonest and most widely distributed species of the subgenus, is able to occur in broad sympatry with both species.

First instar larvae of *sayi* and *aenea* have been described by MacSwain (1956). These larvae show well-marked differences, but until the larva of at least one other species is known, their morphology cannot contribute to the study of phylogenetic relationships within the subgenus.

Key to Groups

1. Antennae subfiliform (Fig. 114); fore and middle tibiae black; male with a broad impression on anterior side of fore tibiae and a weaker one on middle tibiae; male fore tibiae each with only a single spur; first segment of male fore tarsi dilated on one side; male hind tibiae as in female, not dilated; female sixth abdominal sternum entire, not modified.....Polita Group (p. 226)

   Antennae moniliform, clavate (Fig. 115); all tibiae orange, at least at middle; male fore tibiae and fore tarsi not modified as above; male fore tibiae each with two spurs; male hind tibiae at least weakly dilated, more strongly compressed than in female; female sixth ab-

dominal sternum at least weakly emarginate medianly at apex (usually also with a groove).....2

2. Male fore and middle legs not modified as below, as in female; male sixth abdominal sternum (Fig. 272) neither impressed nor concavely folded; female sixth sternum not or only very feebly grooved..... .....Aenea Group (p. 228)

Male fore femora noticeably more strongly impressed on anterior side than in female; male fore tibiae thickened, stouter than middle tibiae, bowed; male sixth abdominal sternum (Figs. 273-74) impressed or concavely folded, at least along emargination; female sixth sternum (Figs. 288-89) deeply grooved medianly at apex..... .....Sayi Group (p. 234)

POLITA GROUP

Head subtriangular; occiput prominent, well defined; surface of head and pronotum only moderately granulate, shiny. Antennae subfiliform. Pronotum subhexagonal, about as wide as long, the lateral angles better marked than in the Sayi and Aenea groups; disk bulged for basal two-thirds. Elytra very finely, obscurely rugose punctate, glabrous. Male fore tibiae each with only a single spur (anterior spur absent); anterior side of tibiae with a broad groovelike impression from before middle to apex, the impression forming a rather deep, impunctate concavity apically. Male middle tibiae with a weak groovelike impression subapically on lower half of anterior surface. Outer hind tibial spur twice as wide as inner spur, with excavation nearly longitudinal. Male fore tarsi with first segment asymmetrical, dilated on anterior side. Male sixth abdominal sternum neither impressed nor concavely folded. Female sixth sternum entire, not grooved. Male genitalia with gonostyli divergent apically. Female genitalia with anteromesal corner of each gonocoxite not protuberant or obscuring notch of mesal margin.

Remarks. This group contains only *polita*, from the southeastern United States.

Lytta (*Pomphopoea*) *polita* Say

Lytta polita Say, 1824, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 302. LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 336.

Lytta femoralis LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 336.

Pomphopoea polita, LeConte, 1866, Smithsonian Misc. Coll., vol. 6, no. 167, p. 161. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 116. Sherman, 1913, Ent. News, vol. 24, p. 247.

Cantharis pedestris Gemminger, 1870, [Harold] Coleopt. Hefte, vol. 6, p. 124. New name for *Lytta femoralis* LeConte, not Klug, 1825, Nova Acta

Phys.-Med. Acad. Caesareae Leopoldino-Carolinae, vol. 12, pt. 2, p. 435.
Pomphopoeca [*sic*] *polita* Hebard, 1903, Ent. News, vol. 14, p. 260.
Pomphopoea femoralis, Blatchley, 1920, Canad. Ent., vol. 52, p. 72.
Pomphopoea polita a. *femoralis*, Löding, 1945, Geol. Surv. Alabama, Mon. 11, p. 55.

Head, pronotum, and under surface aeneous, shiny. Elytra a duller brassy color. Femora orange with black apex. Hind tibiae orange with black base and apex. Fore and middle tibiae, and the tarsi, black. Black areas with a green luster. Length: 13 mm.-22 mm.

Head subtriangular; surface sparsely punctate throughout, with very short, inconspicuous setae. Labral emargination extending to middle (Fig. 155). Pronotum usually with a pair of foveae on disk behind middle; surface of disk smooth, shiny, subimpunctate, glabrous. Tarsi with midline of ventral surface glabrous, impunctate, broadly dividing all tarsal pads.

Male. Antennae as in Figure 114, only slightly longer than in female. Male fore tibiae with anterior, impressed surface very sparsely clothed with fine setae except for glabrous apical concavity; anteroventral margin of male fore tibiae fringed with setae, those at ventral corner of apex very dense, longer than rest, curving out over concavity. Fore tibial spur curving posteriad. Emargination of sixth abdominal sternum (Fig. 271) straight-sided; lateral lobes subacutely triangular. Genitalia as in Figure 348.

Female. Antennae as in Figure 152.

Type locality. Of *polita*, Georgia; of *femoralis*, Louisiana.

Geographic distribution. Coastal Plain and Piedmont of the southeastern United States from North Carolina to Louisiana. (See Fig. 61.)

Seasonal distribution. December 19—June 2.

Records. UNITED STATES: *Alabama*: Auburn, June (Löding, 1945); Mobile County, February, March (Löding, 1945). *Florida*: Archbold Biological Station, Lake Placid, January, 3; Billy Island, Okefenokee Swamp, December, 5; Deland, March, 3; Dunedin, January (Blatchley, 1920); Eau Gallie, March, 2; Hilliard, April, 2; Lake Placid, January, 1; Myakka River State Park, March, 2; Oneco, March, April, 28; Port Sewall, January, March, 3; Punta Gorda, February, March, 2; Tarpon Springs, March, 1. *Georgia*: Augusta, March, 1; Doughtry County, April, 1; Stone Mountain, DeKalb County, April, 1; Thomasville (Hebard, 1903); Waycross, March, 8. *Louisiana*: (LeConte, 1853). *Mississippi*: Lucedale, February, 1. *North Carolina*: New River, April, May, 2; Raleigh, April, May, 2; Southern Pines, April, 1. *South Carolina*: (Horn, 1873).

Remarks. The granulation of the surface of the head is usually more

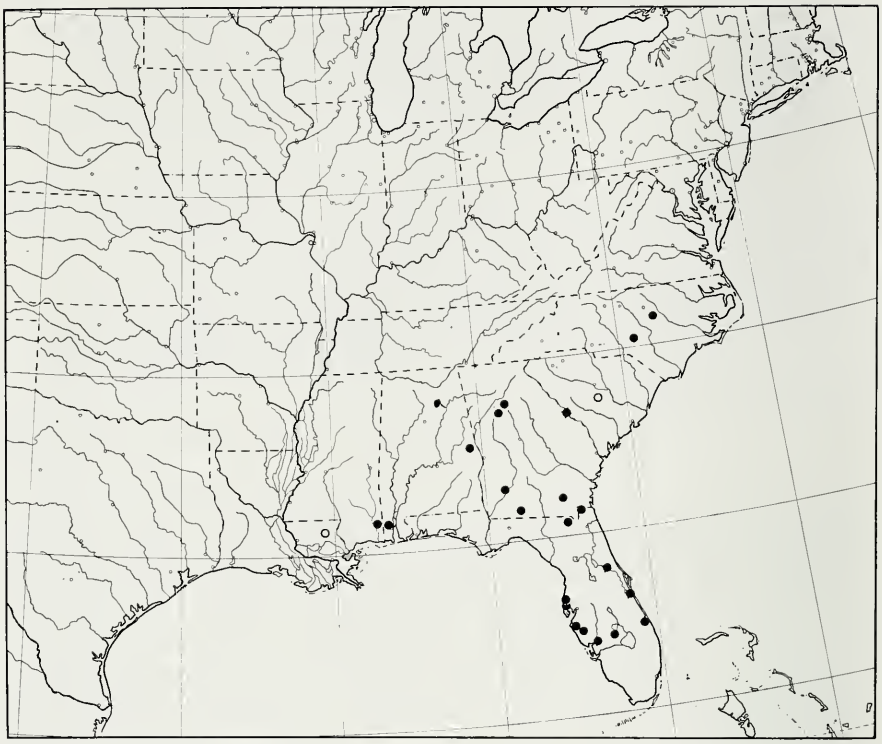


FIG. 61. Distribution of *Lytta polita*.

strongly marked in females than in males. The species is easily recognized by its aeneous color and subfiliform antennae.

The type of *polita* has been lost. As neotype I have designated a male labeled Waycross, Georgia, March 22, 1952, J. R. McGillis, in the Canadian National Collection, at Ottawa. The type of *femoralis* is in Museum of Comparative Zoology.

Bionomics. This species has been collected at light several times. No food plants are recorded.

AENEA GROUP

Head subtriangular; occiput not prominent. Antennae moniliform, clavate. Surface of head and pronotum strongly granulate, satiny. Pronotum campanuliform, as in Sayi Group. Elytra rugose, sparsely pubescent to essentially glabrous. Male fore and middle legs not modified, as in female. Male hind tibiae moderately dilated. Male sixth abdominal sternum neither impressed nor concavely folded. Female sixth sternum weakly emarginate medianly at apex, not or only very feebly grooved.

Male genitalia with gonocoxites parallel. Female genitalia with anteromesal corner of each gonocoxite not protuberant or obscuring notch of mesal margin.

Remarks. The only species included in this group is *aenea*, which ranges through most of the eastern United States, as far west as eastern Texas.

Lytta (*Pomphopoea*) *aenea* Say

Lytta aenea Say, 1824, Jour. Acad. Nat. Sci. Philadelphia, vol. 3, p. 301. LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 337.

Cantharis nigricornis LeConte, 1847, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 1, p. 90.

Cantharis filiformis LeConte, 1847, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 1, p. 91.

Lytta filiformis, LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 337.

Lytta tarsalis Bland, 1864, Proc. Ent. Soc. Philadelphia, vol. 3, p. 71. Borchmann, 1917, *in* Junk and Schenkling, Coleopterorum catalogus, pt. 69, p. 99.

Pomphopoea texana LeConte, 1866, Smithsonian Misc. Coll., vol. 6, no. 167, p. 161. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 117. Tucker, 1906, Trans. Kansas Acad. Sci., vol. 20, pt. 1, p. 88. Dillon, 1952, Amer. Midland Nat., vol. 48, p. 354. *New synonymy.*

Pomphopoea aenea, Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 117. Ulke, 1902, Proc. United States Nat. Mus., vol. 25, pp. 32, 54. Blatchley, 1910, The Coleoptera or beetles of Indiana, p. 1364. Sherman, 1913, Ent. News, vol. 24, p. 247. Britton, 1920, Connecticut State Geol. and Nat. Hist. Surv. Bull. 31, p. 238. Mutchler and Weiss, 1924, New Jersey Dept. Agr. Circ. 76, p. 9. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 73, pls. 13, 15.

Typically metallic aeneous green but varying to a nearly pure metallic green or blue. Elytra typically cupreous or cupreous green, rarely purplish; in the Texas race (see below) and in some specimens from the southeastern United States they are nearly pure green or (rarely) blue. Femora and tibiae orange, the femora often black at apex. Tarsi varying from orange to fuscous. Length: 9 mm.-16 mm.

Head with surface finely, moderately densely punctate on front, sparsely punctate on vertex; punctures coarser than in the Sayi Group; pubescence moderately long, erect, conspicuous. Labral emargination deep, extending to middle (Fig. 156). Pronotum with surface and pubescence as on vertex, the center subimpunctate, nearly glabrous. Legs slender. Tarsal pads clearly, rather broadly divided except on first segment of hind tarsi, where pad is merely parted; midline of tarsi impunctate.

Male. Antennae (Fig. 116) nearly as in *sayi*, reaching base of pronotum, obviously longer than in female; segments a little more elongate

than in the Sayi Group. Hind tibiae weakly dilated. Fifth abdominal sternum with lateral lobes obtusely rounded, not bulged. Sixth sternum as in Figure 272. Genitalia as in Figure 349.

Female. Antennae as in Figure 153. Genitalia much as in *polita.*

Type locality. Of *aenea,* Pennsylvania; of *nigricornis,* St. Louis, Missouri; of *filiformis* and *texana,* Texas; of *tarsalis,* Illinois.

Geographic distribution. The range of this species appears to be divided into two major segments. One extends from New Hampshire south to Alabama and west to Missouri. The other includes central Oklahoma, eastern Texas, and northwestern Louisiana. (See Fig. 62.)

Seasonal distribution. February 27—July 6 (both extremes in Texas). Most records are in April and May.

Records. UNITED STATES: *Alabama*: Cheaka State Park, April, 3; Montgomery, 1. *Connecticut*: Hamden, May, 1; New Haven, May, 9. *District of Columbia*: District label only, 1; Washington and 4.5 mi. southwest of Washington, April, 37. *Georgia*: Atlanta, April, 1; Barnes-

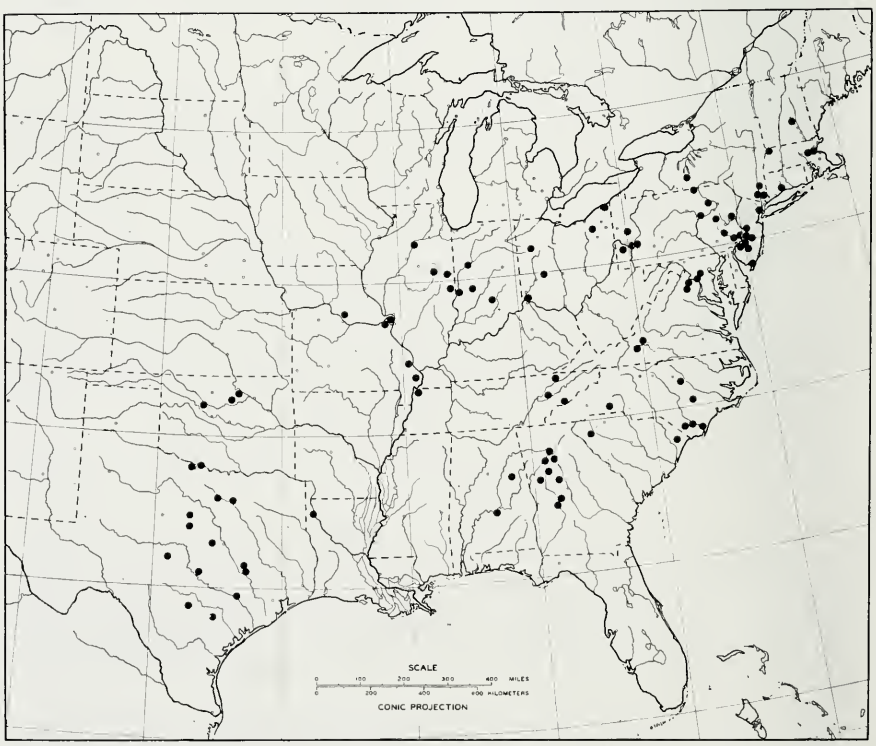


FIG. 62. Distribution of *Lytta aenea.*

ville, March, 2; Camp McClellan, April, 1; Fort Valley, April, 1; Kennesaw, March, 1; Marshalville, 3; Meriwether County, April, 1; Spalding County, 1; Stone Mountain, DeKalb County, March, April, 7. *Illinois*: Kickapoo State Park, April, 1; Mahomet, April, 1; Paris, April, 1; Putnam County, May, 1; Savanna, May, 1. *Indiana*: Brown County, April, 1; Lafayette, April, 1; Putnam County, April, 1; Vigo County, 1. *Kentucky*: State label only, 1; West Point, April, 1. *Louisiana*: State label only, 1; Shreveport, March, 10. *Maryland*: State label only, 1; Alberton, April, 5; Camp Springs, May, 1; Clear Spring, April, 12; College Park, 1; Hyattsville, May, 1; Jenny, April, 1; Linden, April, 1; Plummers Island, April, 7; Takoma Park, May, 2. *Massachusetts*: Charlemont, 1; Cheshire, 1; Hopkinton, May, 1; Milton, May, 2; Natick, May, 2. *Missouri*: State label only, 3; Cape Girardeau, April, 1; Charleston, April, 2; Columbia, April, May, 3; Ranken, April, 1; St. Louis (LeConte, 1847). *New Hampshire*: State label only, 7. *New Jersey*: Anglesea (Mutchler and Weiss, 1924); Fort Dix, May 1; Glassboro, April, 5; Greenwood Lake, May, 1; Merchantville (Mutchler and Weiss, 1924); Trenton, May, 1; Westville and Woodside (Mutchler and Weiss, 1924). *New York*: Brewster, April, 1; Hugenot Woods, Westchester County, May, 1; Ithaca, May, June, 2; Montgomery, May, 2; Mount MacIntyre, June, 1; New Windsor, April, May, 6; New York, May, 1; Rock City, May, 1; West Point, April, 3; Wilmington, June, 1. *North Carolina*: Ellenboro, March, 7; Faison, April, 1; Raleigh, April, 3; Waccamaco Lake, April, 1; Whiteville, April, 1; Wilmington, April, 1. *Ohio*: Chestnut Grove, Ashtabula County, June, 1; Cincinnati, April, May, 4; Springfield, April, 1; Summit County, April, 1. *Oklahoma*: Kingfisher, March, 3; Pawnee, March, 2; Payne County, April, 1. *Pennsylvania*: Allegheny County, April, May, 4; Cabot, April, 2; Danville, May, 1; Darby, April, 1; Germantown, May, 1; Hazleton, 1; Jeannette, 1; Philadelphia, April, May, 4; Reading, April, 2; Washington County, 1; Wilawana, April, June, 3; Windgap, May, 1; Wyoming, April, 1. *South Carolina*: Clemson College, April, 1; Conway, March, 1. *Tennessee*. State label only, 1; Great Smoky Mountains, 1600 ft., April, 3; Knoxville, April, 1; Reelfoot Lake, 1; Tazewell, April, 2. *Texas*: State label only, 41; Austin, May, 1; Bethage, 1; Brazos County, April, 2; Bryan, March, 1; College Station, February, April, 2; Colorado County, March, 1; Comanche County, March, 1; Dallas, March, 3; Dallas County, July, 1; Fedor, 5; Fort Worth, 2; Gatesville, April, 1; Iowa Park, March, 1; Mason, May, 1; Ranger, March, 6; San Antonio, March, 3; Thornberry (Tucker, 1906); Tiger Mills, April, 2. *Virginia*: Falls Church, April, 10; Great Falls, April, 2; Ivy Depot, April, 3; Rosslyn, April, 1; Salem, 1; Vienna, April, 3; West Falls Church (MacSwain, 1956). *West Virginia*: Levels, April, 4.

Remarks. Geographic variation in this species is summarized in Tables VII and VIII. For purposes of analysis of variation the specimens

TABLE VII. COMPARISON OF COLOR CHARACTERS IN SAMPLES OF *Lytta aenea*

	FEMORA BLACK-TIPPED	TARSI BLACK OR FUSCOUS	ELYTRA			NUMBER OF SPECIMENS
			GREEN OR BLUE	CUPREOUS-GREEN	CUPREOUS OR PURPLE	
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	
New England, New York, New Jersey, eastern Pennsylvania	96.2	85.9		50.0	50.0	78
Ohio, Indiana, Illinois, western Pennsylvania, Kentucky	50.0	50.0		4.2	95.8	24
Missouri	100	90.0			100	10
Maryland, District of Columbia	60.0	6.7	1.4	65.3	33.3	75
Virginia, West Virginia	27.3	24.2		42.4	57.6	33
North Carolina, South Carolina, eastern Tennessee		5.9		23.5	76.5	17
Alabama, Georgia	3.7	22.2	18.5	14.8	66.7	27
Texas, Oklahoma, Louisiana		100	92.5	7.5		80

TABLE VIII. DEGREE OF DILATION OF MALE HIND TIBIA OF *Lytta aenea*
Expressed as Average Ratio of Greatest Width of Tibia to Least Width at Base

	AVERAGE RATIO	STANDARD ERROR	STANDARD DEVIATION	NUMBER OF SPECIMENS
New England, New Jersey, eastern Pennsylvania	1.73	.03	.13	24
Ohio, Indiana, Illinois, western Pennsylvania, Kentucky	1.76	.03	.09	8
Missouri	1.77			3
Maryland, District of Columbia	1.86	.02	.12	26
Virginia, West Virginia	1.86	.04	.14	11
North Carolina, South Carolina, eastern Tennessee	2.01	.06	.16	8
Alabama, Georgia	1.98	.04	.16	15
Texas, Oklahoma, Louisiana	2.17	.03	.19	32

examined have been divided into eight geographic samples, as indicated in the tables. The main variational trends are discussed briefly below.

As shown in Table VII, the femora are frequently tipped with black in specimens from northern populations, while they are not or only very rarely so marked in specimens from the southern part of the range. Color of the tarsi varies discordantly. For the most part the frequency of occurrence of black or fuscous coloring of the tarsi is comparable to that of black tipping of the femora, but major exceptions occur in the Maryland–District of Columbia population and even more strikingly in the Texas–Oklahoma–Louisiana population, where all specimens have dark tarsi in the complete absence of black femoral tipping.

The distinctness of the latter population is also apparent with respect to color of the elytra. Although the data are not given in Table VII, the color of the head, pronotum, and under surface varies also. In general these parts are an aeneous or olive green in specimens with at least some cupreous tone in the elytra and a more nearly pure green or blue in specimens with green or blue elytra. It should be noted that color variation in *aenea* is continuous in nature, and that the three classes of elytral color recognized in Table VII are arbitrary.

Density of pubescence varies greatly, with a strong tendency for denser development in northern populations. A subtle but distinct north-south trend for increased dilation of the male hind tibiae is present, as indicated by the data given in Table VIII.

The distributional data (Fig. 62) suggest that the Texas–Oklahoma–Louisiana population of *aenea* may be geographically isolated from more northern and eastern populations. At the same time, the somewhat

intergradational nature of the Alabama–Georgia population would indicate that if isolation is indeed a fact, it is of relatively recent origin. To the west, there is apparently no gene exchange between the southwestern population and the Missouri population.

On the basis of the information now available, I will speculate that during the last glacial epoch the range of *aenea* was broadly continuous through the southeastern United States and that as the species moved northward with the subsequent amelioration of climatic conditions contact with the southwestern population was lost or severely limited. The absence of intergradation between the southwestern population and the Missouri population may be explained on the basis that the latter pushed into Missouri from Illinois and has never reached far enough west to contact the population in Oklahoma.

Separation of the southwestern population of *aenea* as a separate species (*texana*) does not seem justifiable on a morphological basis, although there is ample reason to recognize this population as a separate race. A vernacular name, such as "Texas race," would seem appropriate for it.

The first instar larva of *aenea* has been described by MacSwain (1956).

As neotype of *aenea* I have designated a male in the United States National Museum from Allegheny County, Pennsylvania (Wickham collection). The types of the synonyms *nigricornis*, *filiformis*, and *texana* are in the Museum of Comparative Zoology. The type of *tarsalis* is in the collection of the Academy of Natural Sciences of Philadelphia.

Bionomics. This species appears to be similar to *sayi* in its feeding habits. Genera of Rosaceae on whose flowers it is known to feed include *Amelanchier*, *Crataegus*, *Prunus* (peach, plum), *Pirophorum* (pear) (recorded eating fruit also by Mutchler and Weiss, 1924), and *Malus* (apple). In addition, there are single records each of feeding on flowers of willow (Salicaceae) (Ulke, 1902) and *Carya* (Juglandaceae) and leaves of oak (Fagaceae) (Sherman, 1913).

SAYI GROUP

Head triangular; occiput not very prominent. Surface of head and pronotum strongly granulate, satiny. Antennae moniliform clavate. Pronotum campanuliform, about as wide as long, impressed at base medianly; disk even, rather flat. Elytra distinctly rugose punctate, essentially glabrous. Male fore femora very noticeably more strongly impressed on anterior side than in female; anterior surface smoother and more nearly glabrous (setae minute, erect, very sparse). Male fore tibiae thickened, stouter than middle tibiae, decidedly bowed; anterior surface like that of fore femora. Male hind tibiae at least weakly dilated. Outer hind tibial spur less obliquely excavate than in the Polita Group. Male sixth abdomi-

nal sternum impressed, at least along emargination. Female sixth sternum notched and deeply grooved medianly at apex. Male genitalia with gonostyli parallel. Female genitalia with anteromesal corner of each gonocoxite forming a dark, protuberant tooth which obscures notch of mesal margin in ventral view; notch weak.

Remarks. This group includes the species *sayi* and *unguicularis*. Its range encompasses a large part of the eastern United States and a narrow, adjacent area of Canada.

Key to Species

1. Tibiae narrowly black at base and apex; labral emargination not extending to middle (Fig. 157); male fore femora not contorted; female sixth abdominal sternum with groove not strictly vertical in position (Fig. 288) ..... *sayi* (p. 235)

   Tibiae entirely orange; labral emargination deeper, extending at least to middle (Fig. 158); male fore femora contorted; female sixth abdominal sternum with groove strictly vertical in position ..... *unguicularis* (p. 238)

Lytta (*Pomphopoea*) *sayi* LeConte

Lytta aenea, Say, 1824, *in* Keating, Narrative of an expedition to the source of St. Peters River . . . , vol. 2, p. 288. Misidentification.

Lytta sayi LeConte, 1853, Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 336.

Cantharis pyrivora Fitch, 1859, Third report on the noxious and other insects of the State of New York, p. 36.

Pomphopoea sayi, LeConte, 1866, Smithsonian Misc. Coll., vol. 6, no. 167, pp. 160-61. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 117. Wickham, 1896, Canad. Ent., vol. 28, p. 34. Blatchley, 1910, The Coleoptera or beetles of Indiana, p. 1364, fig. 590. Gibson, 1912, 42nd Ann. Rept. Ent. Soc. Ontario, p. 4, fig. 7. Britton, 1920, Connecticut State Geol. and Nat. Hist. Surv. Bull. 31, p. 238. Mutchler and Weiss, 1924, New Jersey Dept. Agr. Circ. 76, p. 9. Cockerell and Harris, 1925, Proc. Biol. Soc. Washington, vol. 38, p. 31, fig. 10. Houghton, 1947, Bull. Brooklyn Ent. Soc., vol. 42, pp. 103-05. MacSwain, 1956, Univ. California Publ. Ent., vol. 12, p. 72, pl. 14.

Metallic green or blue. Femora orange with black apex. Tibiae orange with black base and apex. Tarsi black. Black areas with a green or blue luster. Length: 13 mm.-22 mm.

Head with surface finely, sparsely punctate; pubescence moderately long, conspicuous. Labral emargination not extending to middle (Fig. 157). Pronotum with surface and pubescence as on vertex, the center subimpunctate, nearly glabrous. Tarsal pads narrowly divided, those of basal segments often only parted; midline of tarsi punctate.

Male. Antennae as in Figure 117, reaching base of pronotum, a little longer than in female. Fore femora not contorted. Hind tibiae weakly

dilated. Fifth abdominal sternum with lateral lobes obtusely rounded, not bulged. Sixth sternum (Fig. 273) impressed along emargination, not folded; lateral lobes prominent, evenly rounded, obtuse. Genitalia as in Figure 350.

Female. Antennae as in Figure 154. Sixth abdominal sternum more deeply notched than in *unguicularis* and with groove less vertical and extending farther basad (Fig. 288).

Type locality. Of *sayi* Illinois; of *pyrivora*, Canajoharie, New York.

Geographic distribution. Southern Quebec and Pennsylvania to northeastern Wyoming and Iowa. (See Fig. 63.) Available distributional data suggest that there are three isolated populations.

Seasonal distribution. May 18—July 27. The vast majority of the records are in May and June. Three specimens examined are labeled as collected in September.

Records. CANADA: *Ontario*: Brittania, May, 4; Hastings, May, 1; Hastings County, May, 1; Kearney, July, 2; Kinburn, June, 7; Marmora, May, 13; Merivale, June, 1; Muskoka (Gibson, 1912); Osgoode [Station], May, June, 3; Renfrew, 1; Smoky Falls, Mattagami River, June, 1; Perkins, May, 1; Sudbury, 2; Toronto (Gibson, 1912); Westboro, June, 9; Wright, May, 2. *Quebec*: Beech Grove, June, 1; Covey Hill, June, 1; Duparquet, May, 14; Harrington Lake, Gatineau Park, June, 1; Hull (Gibson, 1912); Kazubazua, June, 2; Showbridge (Gibson, 1912); Wakefield, June, 1.

UNITED STATES: *Connecticut*: Cornwall, June, 18. *Illinois*: Freeport, May, 3; Morrison, June, 12; Oregon, May, June, 3; Savanna, 1; Urbana, June, 1. *Iowa*: Benton County, June, July, 2; Delaware County, June, 1; Des Moines, June, 2. *Massachusetts*: Hopkinton, June, 1; Montgomery, June, 1; Mount Everett, June, 2; Mount Wachisett, 1; Williamstown, June, 1. *Minnesota*: Itasca State Park, June, 18. *New Jersey*: Greenwood Lake, June, 1. *New York*: Albany, May, 1; Almond, June, 6; Barre, June, 1; Cambridge, June, 1; Canajoharie, June, 1; Canandaigua, 1; Canton, June, 1; Castleton, June, 7; Clinton, June, 2; Connecticut Hill, Tompkins County, June, 2; Cooks Falls, 1; Corinth, June, 1; Elba, 1; Elbridge, May, 2; Ellenberg, June, 11; Elsmere, May, 2; Fonda, June, 2; Genesee County, June, 4; Geneva (MacSwain, 1956); Gloversville, May, June, 14; Hamilton, June, 1; Hartford, May, 15; Hudson, May, 1; Ithaca, May, June, 18; Lockport, June, 1; McLean, 11; Meadowdale, May, 1; Newport, June, 1; Northampton, June, 1; North Elba, July, 3; North Fairhaven, June, 1; North Java, July, 3; Patterson, June, 4; Peru, June, 1; Philmont, June, 1; Portage, 1; Port Jervis, June, 3; Poughkeepsie, June, 1; Putnam, June, 2; Ravena, June, 1; Rochester, June, 1; Schenectady County, June, 1; Schuylerville, June, 1; Slingerland, May, 5; Sonyea, July, 4; Tuscarora, 1;

Varna, May, 1; Voorheesville, June, 4; Waterville, June, 1; Waverly, June, 3; Wellsburg, July, 2; Wilmurt, 2. *Pennsylvania*: Factoryville, June, 1; Hummelstown, 3 (2 labeled September); Mount Pocono, July, 7; Muncy, June, 1; Sylvania, 1; Wilawana, June, 8; Wysox, June, 2. *Vermont*: Middleburg, May, 3. *Wisconsin*: Cedar Lake, June, 1; Dane County, September, 1. *Wyoming*: Crook County, June, 6.

Remarks. Material from Ontario and Quebec is blue or (less frequently) greenish blue in color except for a series from Beech Grove, Quebec, which is a rather pure green. In the United States the blue color is characteristic of samples of *sayi* from New York and eastward, although within this area color varies in series through blue-green to an occasional pure green. The Canadian and eastern United States material presumably represents a single population. In Illinois, Wisconsin, Minnesota, and Iowa there is a second population characterized by a purer, brighter green color, with a tendency for the development of a brassy quality. The Wyoming series, representing a third population, has a dark bluish green color quite distinct from that of either the eastern or the central population. In addition, it is unusual in that the orange of the legs (especially the

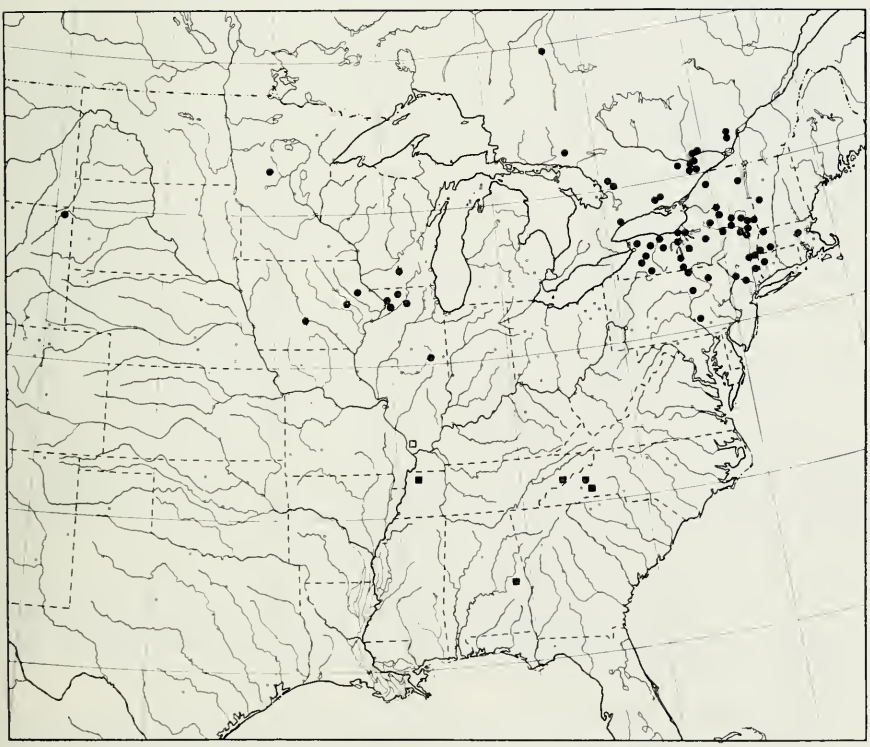


Fig. 63. Distribution of *Lytta sayi* (circles) and *Lytta unguicularis* (squares).

hind ones) is darkened to a rather dull piceous. I have found no significant structural variation in the species.

The first instar larva of *sayi* has been described by MacSwain (1956). The type of *sayi* is in the Museum of Comparative Zoology. The type of *pyrivora* has been lost.

Bionomics. Adults have been recorded in the literature from the following plants: *Prunus* (peach, cherry, plum), *Pirophorum* (pear), and *Rosa* (Roseaceae); *Kolkwitzia*, elder, and *Viburnum lentago* (Caprifoliaceae); *Robinia pseudo-acacia* and beans (Leguminosae); butternut (Juglandaceae); and wheat (Gramineae) (Fitch, 1859; Gibson, 1912; Houghton, 1947; and Mutchler and Weiss, 1924). Some of the specimens examined from Ontario, Canada, are labeled as collected on *Salix discolor* (Salicaceae) and *Cornus* (Cornaceae). The beetles apparently feed largely on flowers; Fitch reported that they also attack young fruit of Rosaceae. Houghton stated that each year over a period of seven years a swarm of hundreds of the beetles arrived at a garden in Springville, New York, just as two large *Robinia* trees were flowering. After stripping these trees of flowers, the swarm began feeding on the flowers of nearby *Kolkwitzia* and *Rosa* shrubs. Two or three days after arrival it moved on.

Lytta (*Pomphopoea*) *unguicularis* (LeConte)

Pomphopoea unguicularis LeConte, 1866, Smithsonian Misc. Coll., vol. 6, no. 167, p. 160. Horn, 1873, Proc. Amer. Philos. Soc., vol. 13, p. 116. Blatchley, 1910, The Coleoptera or beetles of Indiana, p. 1364. Sherman, 1913, Ent. News, vol. 24, p. 247. Britton, 1920, Connecticut State Geol. and Nat. Hist. Surv. Bull. 31, p. 238.

Metallic green. Femora, tibiae, and tarsi orange, the femora narrowly black at apex. Length: 17 mm.-25 mm.

Head and pronotum essentially as in *sayi* except that labral emargination is deeper, extending at least to middle (Fig. 158). Tarsi with midline of ventral surface glabrous, impunctate, broadly dividing all tarsal pads.

Male. Antennae as in *sayi.* Fore femora deeply concave on anterior side, contorted (twisted 45 degrees anteriad). Hind tibiae strongly dilated and compressed, at apex as wide or nearly as wide as middle of femora. Fifth abdominal sternum with lateral lobes conspicuously bulged. Sixth sternum as in Figure 274, very deeply impressed (concavely folded in most dried specimens). Genitalia as in *sayi.*

Female. Antennae and genitalia essentially as in *sayi.* Sixth abdominal sternum with notch shallower than in *sayi;* groove shorter, strictly vertical in position (Fig. 289).

Type locality. Illinois.

Geographic distribution. Eastern Alabama northwest to Illinois and northeast to the Smoky Mountains. (See Fig. 63.)

Except for a record from Connecticut, the range of *unguicularis* is allopatric with that of *sayi*. The species was reported from Connecticut by Britton (1920), who mentioned no specific locality. Although I have seen no specimens on which inclusion of the species in the Connecticut list could have been based, I have examined a series of 23 specimens labeled Cornwall, Connecticut, June 16, 1922 (2 labeled June 20), Chamberlain collection (New York University, Cornell University, and United States National Museum). However, under the circumstances (including the lack of collector's name on the labels), I strongly suspect the validity of the locality data, and I think the occurrence of *unguicularis* in Connecticut needs verification.

Seasonal distribution. May 2—July 4.

Records. UNITED STATES: *Alabama*: Auburn, May, 1. *Illinois*: (LeConte, 1866). *North Carolina*: Black Mountain, May, 1; Blowing Rock (Sherman, 1913); Montreat, July, 3; Mount Graybeard, May, June, 3; Mount Mitchell, 6711 ft., June, 1. *Tennessee*: Great Smoky Mountains, June, 58; Matin, June, 1.

Remarks. The type is in the Museum of Comparative Zoology.

Bionomics. There are records of adults feeding on both Rosaceae and Ericaceae. Sherman (1913) reported that in June 1901 at Blowing Rock, North Carolina, adults swarmed in "untold thousands" on peach, rose, and mountain laurel (*Kalmia*). According to his account, they ate the blossoms of the mountain laurel and the leaves of the peach, "apparently preferring those [leaves] that were affected with leaf curl disease"; the feeding habits on rose were not mentioned. The specimens examined from the Great Smoky Mountains, Tennessee, were collected on azalea (*Rhododendron*).

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Additional Figures

Figs. 64–85. Male antennae of species of *Lytta*: 64, *nitidicollis;* 65, *morrisoni;* 66, *fulvipennis;* 67, *lecontei;* 68, *variabilis;* 69, *scituloides* (allotype); 70, *michoacanae;* 71, *ebenina;* 72, *plumbea;* 73, *koltzei;* 74, *augusti;* 75, *sonorae;* 76, *biguttata;* 77, *scitula;* 78, *quadrimaculata* (Veracruz); 79, *proteus;* 80, *reticulata;* 81, *agrestis;* 82, *mirifica;* 83, *deserticola;* 84, *tenebrosa;* 85, *blaisdelli* (Siskiyou County, California).


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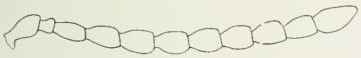
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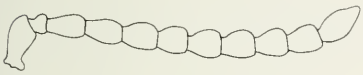
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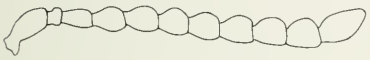
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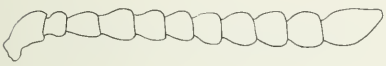
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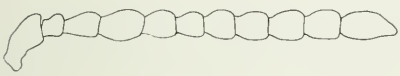
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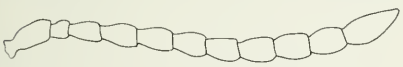
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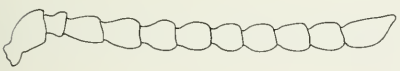
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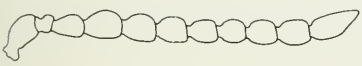
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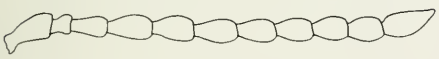
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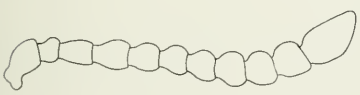
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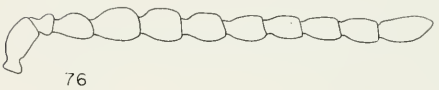
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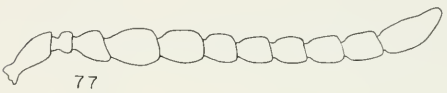
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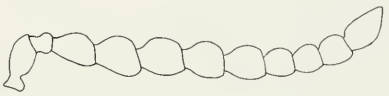
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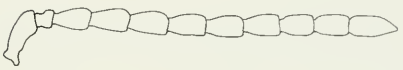
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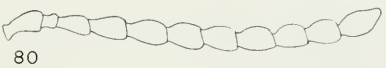
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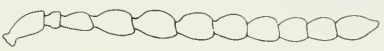
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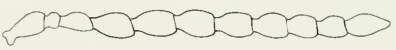
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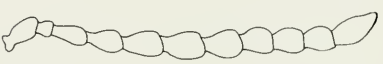
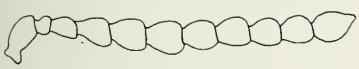

85

Figs. 86–107. Male antennae of species of *Lytta*: 86, *melaena;* 87, *morosa;* 88, *funerea;* 89, *magister;* 90, *vulnerata;* 91, *peninsularis;* 92, *erebea;* 93, *eucera;* 94, *sanguinea;* 95, *erythrothorax;* 96, *mutilata;* 97, *cardinalis;* 98, *sublaevis;* 99, *auriculata;* 100, *nigripilis* (cotype); 101, *hoppingi;* 102, *lugens;* 103, *aeneipennis;* 104, *refulgens;* 105, *crotchi;* 106, *chloris;* 107, *rathvoni.*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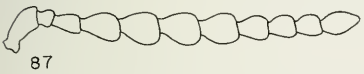
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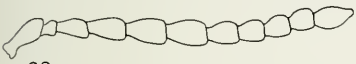
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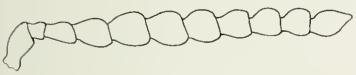
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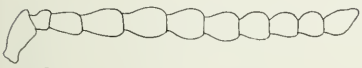
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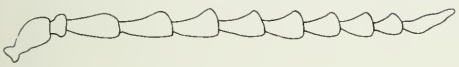
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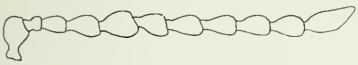
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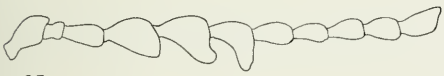
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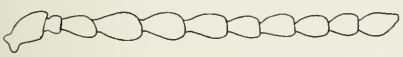
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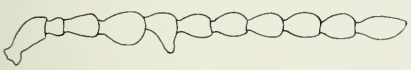
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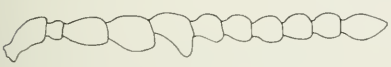
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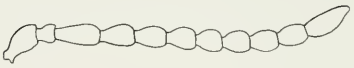
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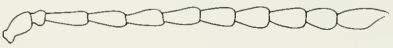
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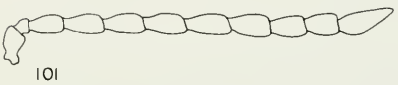
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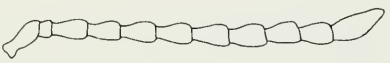
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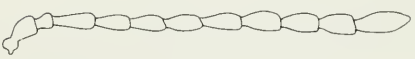
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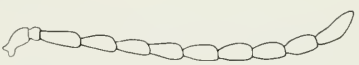
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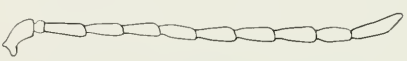
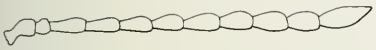

107

Figs. 108–116. Male antennae of species of *Lytta*: 108, *stygica* (northern California); 109, *stygica* (southern California); 110, *moerens;* 111, *insperata;* 112, *nuttalli;* 113, *molesta;* 114, *polita;* 115, *sayi;* 116, *aenea.* Figs. 117–129. Female antennae of species of *Lytta*: 117, *nitidicollis;* 118, *morrisoni;* 119, *fulvipennis;* 120, *lecontei;* 121, *variabilis;* 122, *ebenina;* 123, *plumbea;* 124, *koltzei;* 125, *proteus;* 126, *augusti;* 127, *reticulata;* 128, *agrestis;* 129, *mirifica.*



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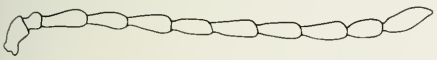

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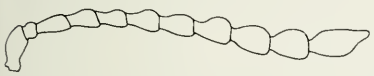

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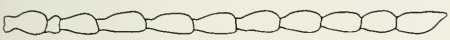

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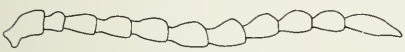

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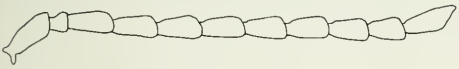

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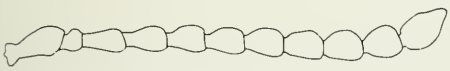

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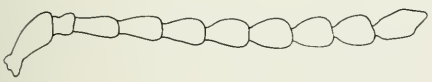

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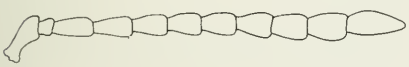

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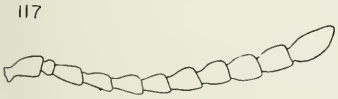

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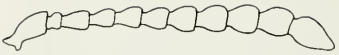

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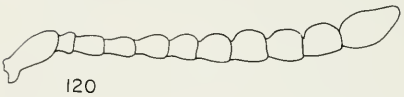

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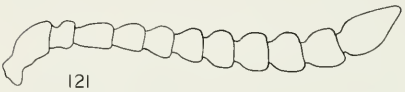

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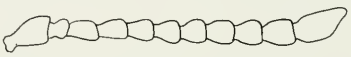

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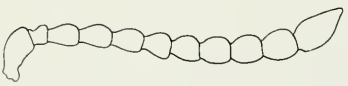

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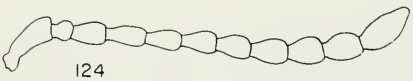

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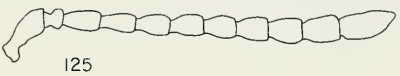

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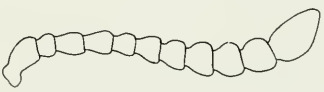

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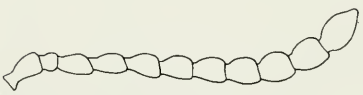

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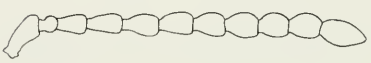

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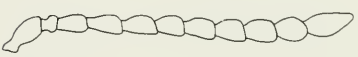
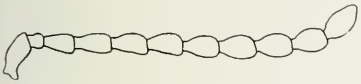


129

Figs. 130–151. Female antennae of species of *Lytta*: 130, *deserticola;* 131, *tenebrosa;* 132, *blaisdelli;* 133, *morosa;* 134, *funerea;* 135, *vulnerata;* 136, *eucera;* 137, *sanguinea;* 138, *erythrothorax;* 139, *cardinalis;* 140, *sublaevis;* 141, *auriculata;* 142, *hoppingi;* 143, *lugens;* 144, *aeneipennis;* 145, *refulgens;* 146, *chloris;* 147, *stygica* (northern California); 148, *moerens;* 149, *insperata;* 150, *nuttalli;* 151, *molesta.*



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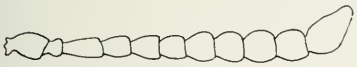

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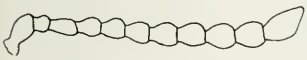

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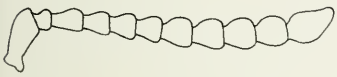

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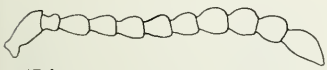

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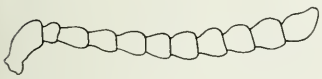

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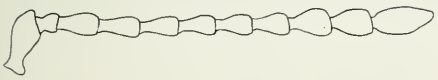

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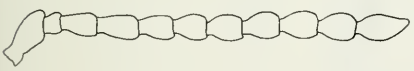

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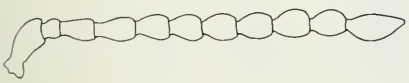

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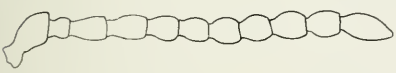

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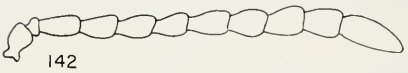

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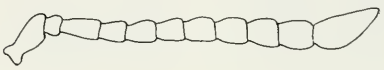

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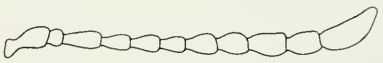

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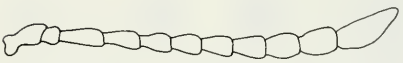

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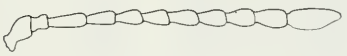

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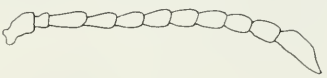

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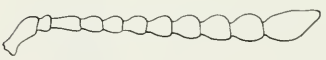

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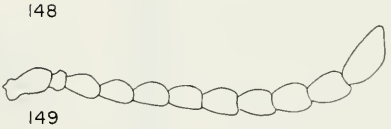

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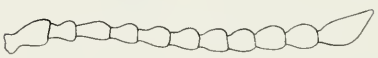

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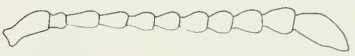

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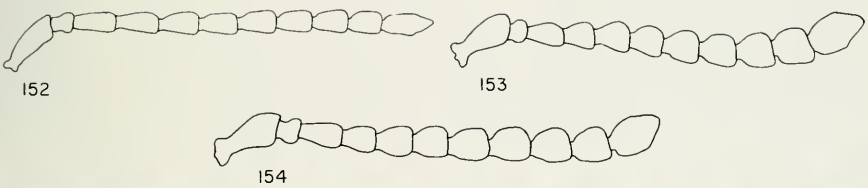
Figs. 152–154. Female antennae of species of *Lytta*: 152, *polita;* 153, *aenea;* 154, *sayi.* Figs. 155–158. Labra of species of *Lytta*: 155, *polita;* 156, *aenea;* 157, *sayi;* 158, *unguicularis.* Figs. 159–167. Right elytra of species of *Lytta*: 159, *quadrimaculata* (showing range of variation); 160, *biguttata* (a, pale race; b–d, typical race; c, southern México race); 161, *scitula.* Figs. 162–167. Hind trochanters of species of *Lytta*: 162, *insperata,* male; 163, *nuttalli,* male; 164, *cyanipennis,* male (typical); 165, *cyanipennis,* male (Utah); 166, *cyanipennis,* female (typical); 167, *cyanipennis,* female (Utah).



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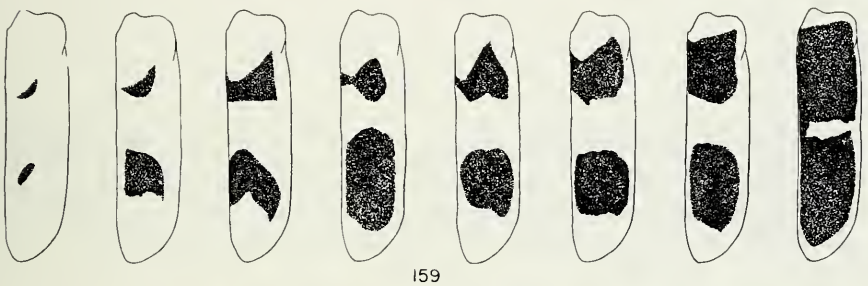

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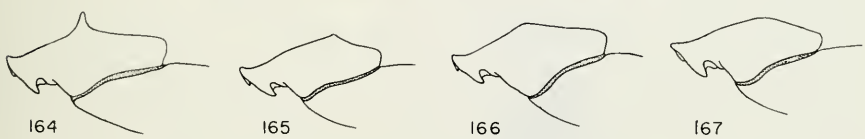

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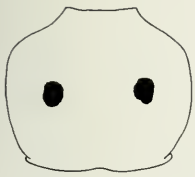
Figs. 168–191. Pronota of species of *Lytta*: 168, *variabilis;* 169, *puberula;* 170, *plumbea;* 171, *koltzei;* 172, *canelas;* 173, *biguttata;* 174, *proteus;* 175, *mirifica;* 176, *arizonica;* 177, *deserticola*; 178, *tenebrosa* 179, *blaisdelli;* 180, *lugubris;* 181, *melaena;* 182, *morosa;* 183, *magister;* 184, *vulnerata;* 185, *auriculata;* 186, *lugens;* 187, *aeneipennis;* 188, *aeneipennis* (variant); 189, *nuttalli;* 190, *molesta;* 191, *childi.*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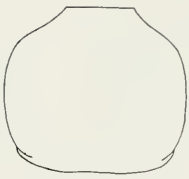
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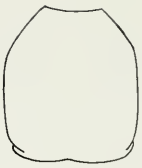
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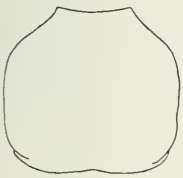
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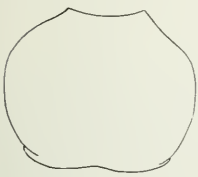
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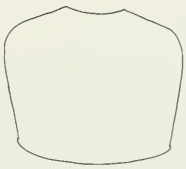
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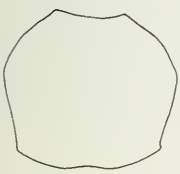
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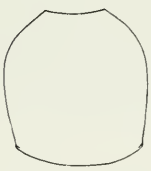
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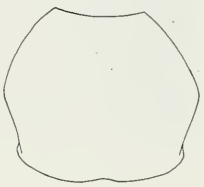
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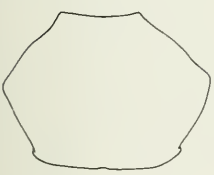
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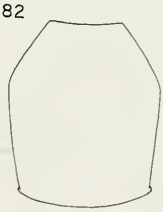
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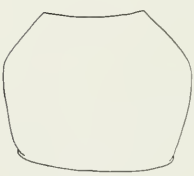
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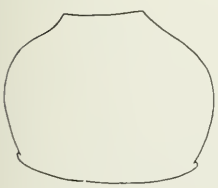
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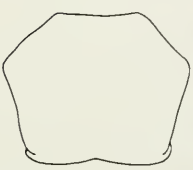
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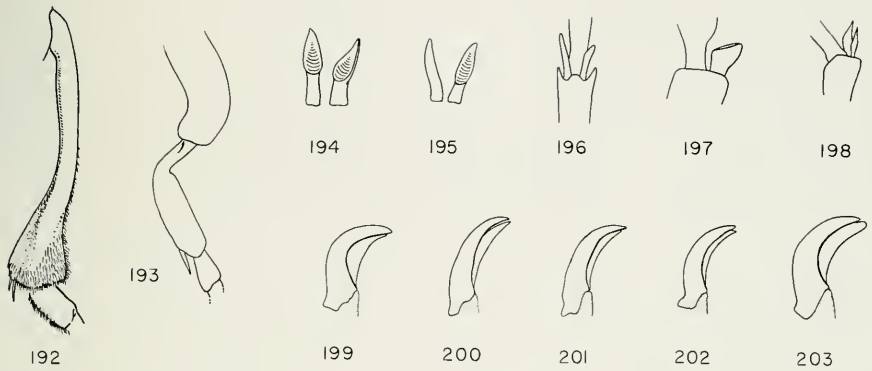
Fig. 192. Anterior view of male middle tibia of *Lytta eucera.* Fig. 193. Deformed femur and tibia of left middle leg of female of *Lytta augusti* from La Parada, Oaxaca. Figs. 194–198. Hind tibial spurs of species of *Lytta*: 194, *lugubris,* posterior view, right hind leg; 195, *blaisdelli,* same; 196, *lugens,* anterior view, right hind leg; 197, *insperata,* outer spur; 198, *aeneipennis,* inner view, right hind leg. Figs. 199–203. Mesal aspect of fore tarsal claws of species of *Lytta*: 199, *variabilis;* 200, *puberula;* 201, *auriculata;* 202, *stygica;* 203, *moerens.* Figs. 204–217. Male pygidia of species of *Lytta*: 204, *moesta;* 205, *variabilis* (variant from Temescaltepec, México); 206, *sonorae;* 207, *biguttata;* 208, *scitula;* 209, *quadrimaculata* (a, Veracruz; b, c, Central Plateau); 210, *proteus;* 211, *tenebrosa;* 212, *blaisdelli;* 213, *melaena;* 214, *morosa;* 215, *funerea;* 216, *magister;* 217, *vulnerata.*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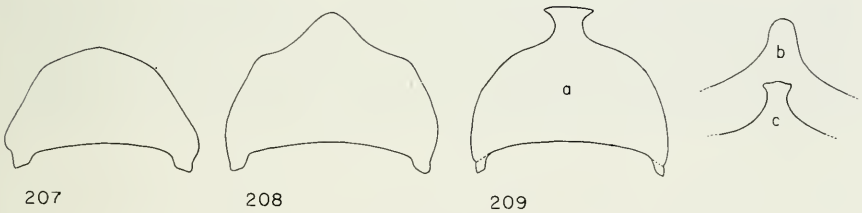
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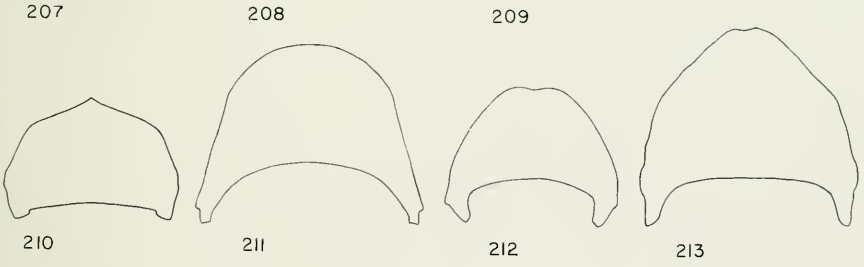
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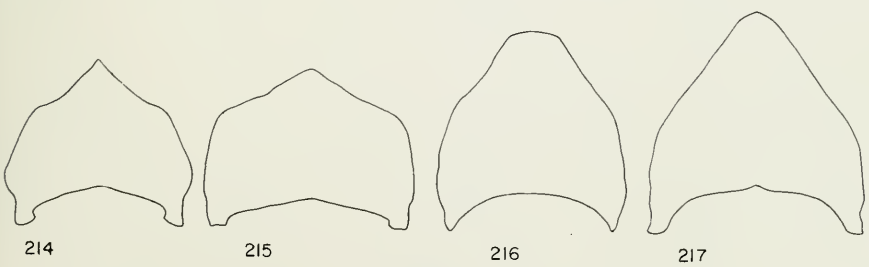
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Figs. 218–221. Male fifth abdominal sterna of species of *Lytta*: 218, *insperata;* 219, *nuttalli;* 220, *cyanipennis;* 221, *childi.* Figs. 222–241. Male sixth abdominal sterna of species of *Lytta*: 222, *morrisoni;* 223, *moesta;* 224, *fulvipennis;* 225, *variabilis;* 226, *michoacanae;* 227, *ebenina;* 228, *plumbea;* 229, *koltzei;* 230, *canelas;* 231, *augusti;* 232, *bipuncticollis;* 233, *sonorae;* 234, *scitula;* 235, *quadrimaculata* (Veracruz); 236, *proteus;* 237, *reticulata;* 238, *agrestis;* 239, *mirifica;* 240, *deserticola;* 241, *corallifera.*


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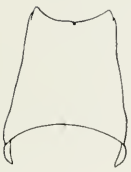
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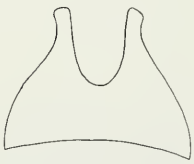
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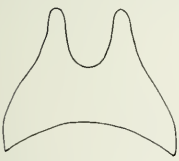
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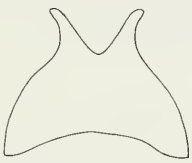
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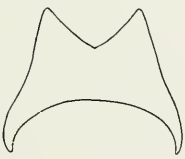
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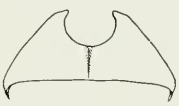
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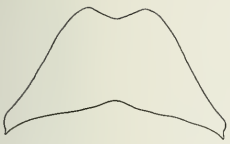
Figs. 242–265. Male sixth abdominal sterna of species of *Lytta*: 242, *tenebrosa;* 243, *lugubris,* 244, *melaena;* 245, *morosa;* 246, *funerea;* 247, *magister;* 248, *vulnerata;* 249, *peninsularis;* 250, *eucera;* 251, *sanguinea;* 252, *erythrothorax;* 253, *mutilata;* 254, *sublaevis;* 255, *auriculata;* 256, *hoppingi;* 257, *lugens;* 258, *aeneipennis;* 259, *aeneipennis* (variant); 260, *refulgens;* 261, *rathvoni;* 262, *chloris;* 263, *stygica* (Argus Mountains, California); 264, *moerens;* 265, *navajo.*



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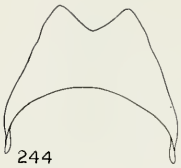

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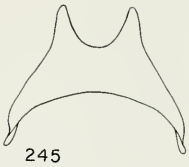

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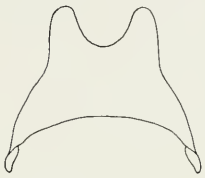

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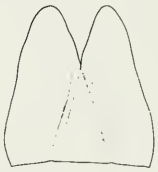

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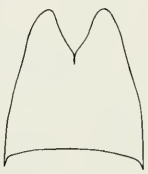

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Figs. 266–274. Male sixth abdominal sterna of species of *Lytta*: 266, *insperata;* 267, *nigrocyanea;* 268, *nuttalli;* 269, *molesta;* 270, *childi;* 271, *polita;* 272, *aenea;* 273, *sayi;* 274, *unguicularis.* Figs. 275–289. Female sixth abdominal sterna of species of *Lytta*: 275, *plumbea;* 276, *koltzei;* 277, *canelas;* 278, *bipuncticollis;* 279, *biguttata;* 280, *scitula* (a, ventral view; b, lateral view); 281, *cardinalis;* 282, *auriculata;* 283, *rathvoni;* 284, *moerens;* 285, *nuttalli;* 286, *molesta;* 287, *childi;* 288, *sayi;* 289, *unguicularis.*

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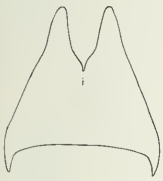

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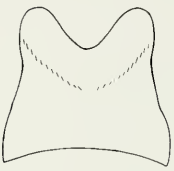

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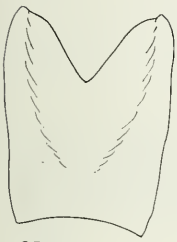

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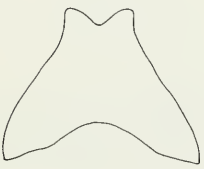

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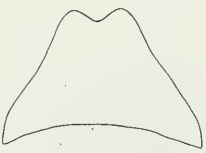

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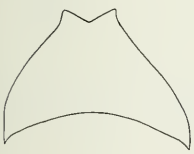

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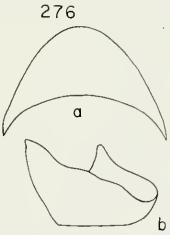

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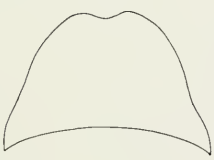

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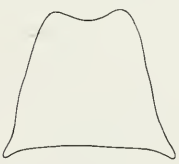

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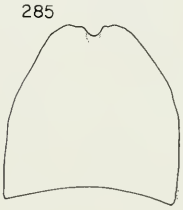

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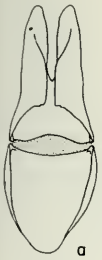
Figs. 290-298. Male genitalia (a, ventral view of gonoforceps; b, lateral view of gonoforceps; c, lateral view of aedeagus) of species of *Lytta*: 290, *nitidicollis;* 291, *morrisoni;* 292, *moesta;* 293, *fulvipennis;* 294, *lecontei;* 295, *variabilis* (2 mi. S Trancoso, Zacatecas); 296, *variabilis* (variant from Temescaltepec, México); 297, *sonorae* (apex of aedeagus); 298, *puberula.*



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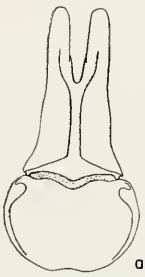

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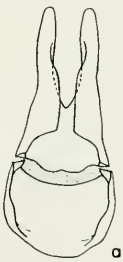

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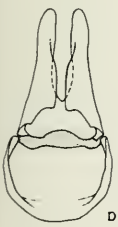

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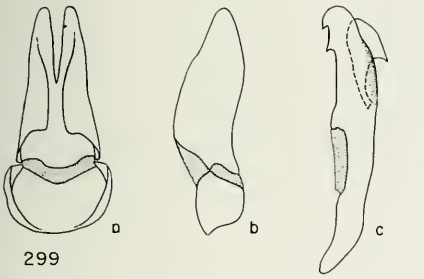

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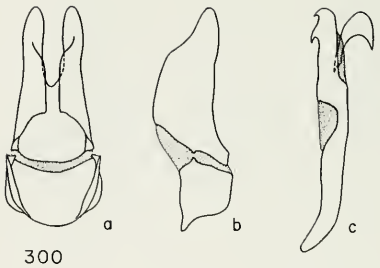

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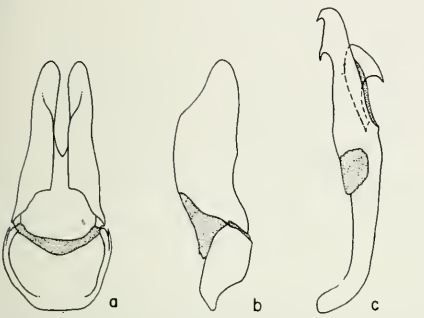

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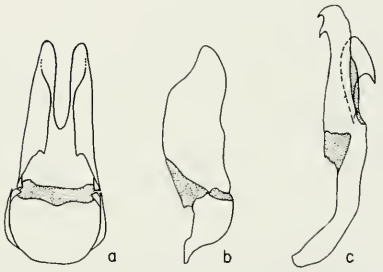

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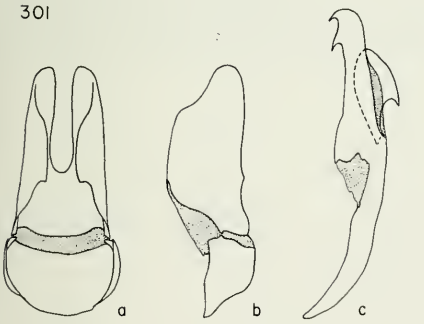

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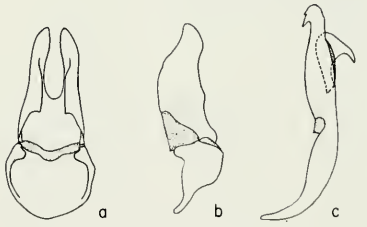

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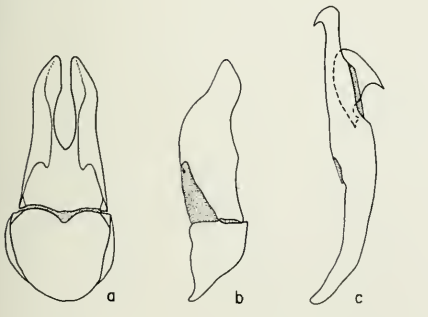

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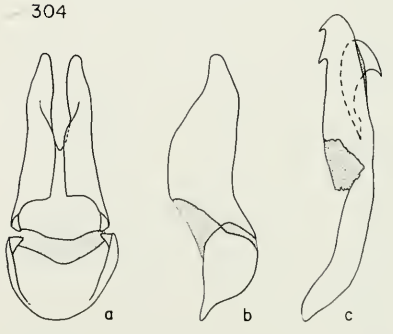

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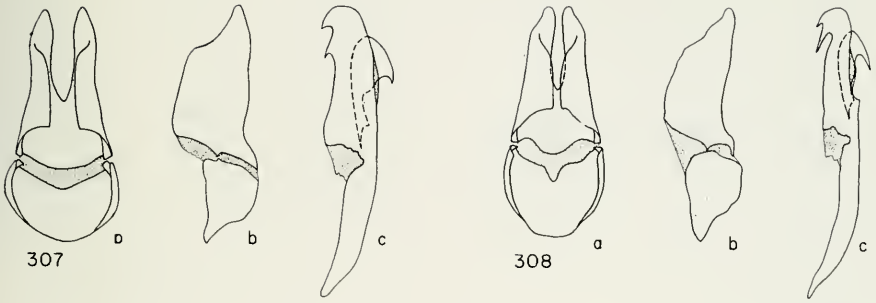
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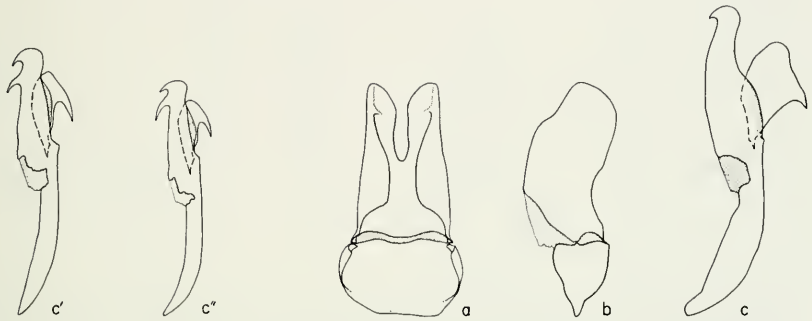
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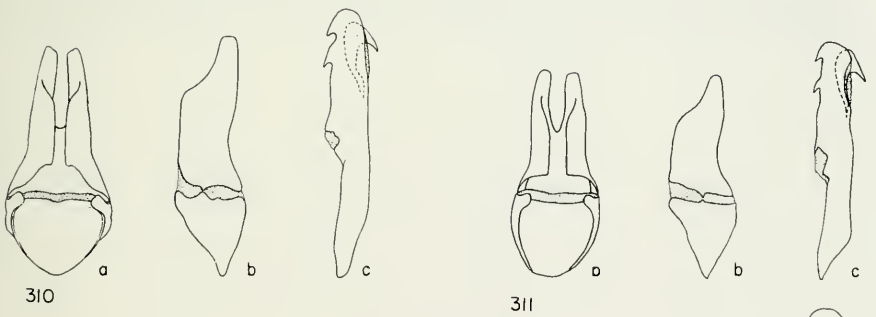
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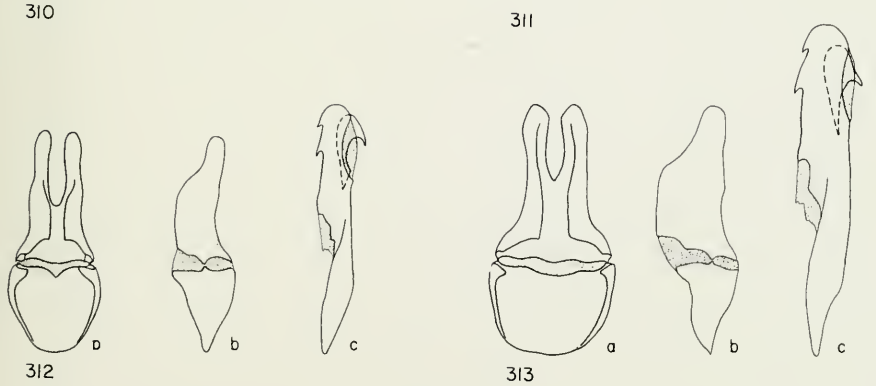
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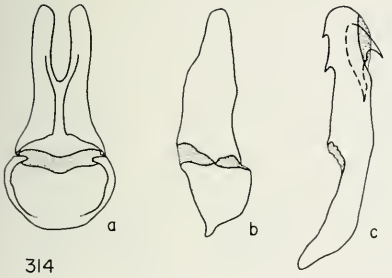

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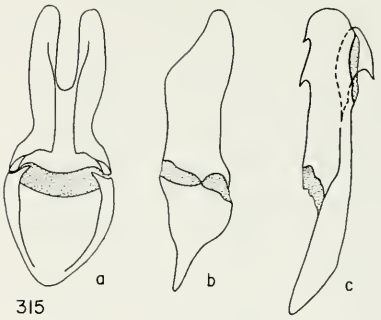

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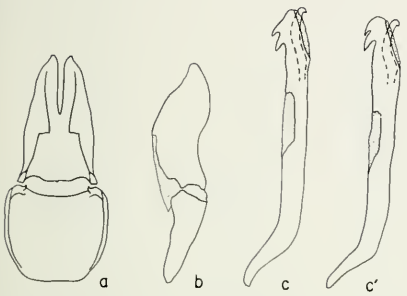

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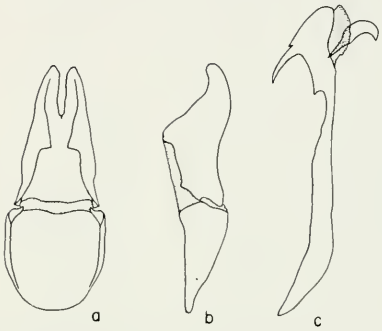

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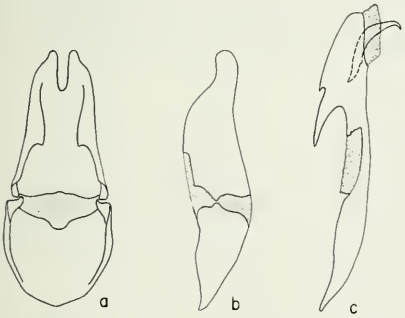

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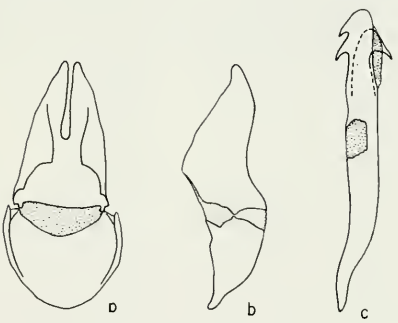

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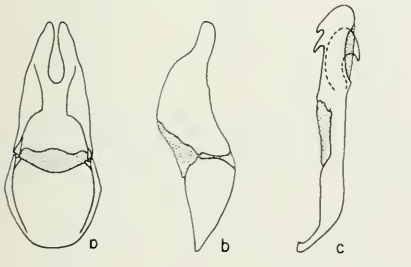

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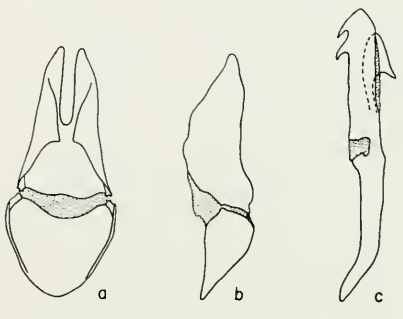

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Figs. 322–329. Male genitalia (a, ventral view of gonoforceps; b, lateral view of gonoforceps; c, lateral view of aedeagus) of species of *Lytta*: 322, *magister;* 323, *vulnerata;* 324, *peninsularis;* 325, *erebea;* 326, *eucera* (c′, variant from Finca Gibralter, México (state unknown); c″, variant from Tancitaro, Michoacán); 327, *sanguinea;* 328, *erythrothorax;* 329, *mutilata.*

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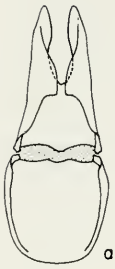

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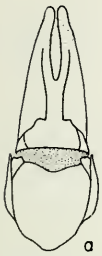

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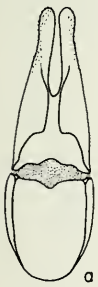

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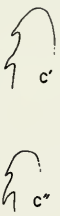

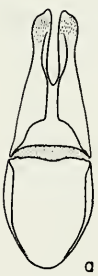

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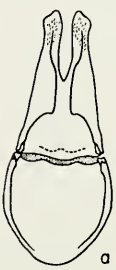

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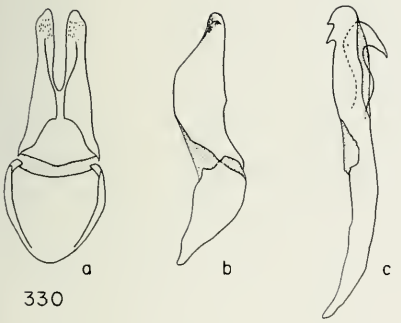
Figs. 330–338. Male genitalia (a, ventral view of gonoforceps; b, lateral view of gonoforceps; c, lateral view of aedeagus) of species of *Lytta*: 330, *cardinalis;* 331, *sublaevis;* 332, *auriculata* (c′, variant); 333, *nigripilis* (cotype) (c′, variant); 334, *hoppingi;* 335, *lugens;* 336, *aeneipennis;* 337, *refulgens;* 338, *crotchi.*



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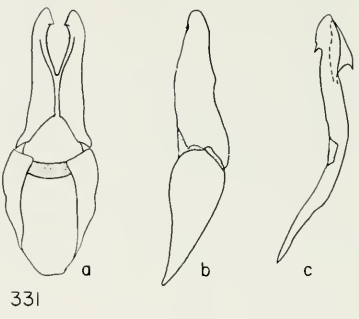

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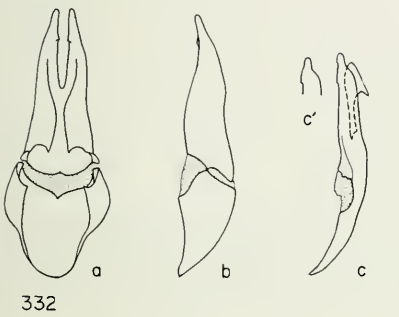

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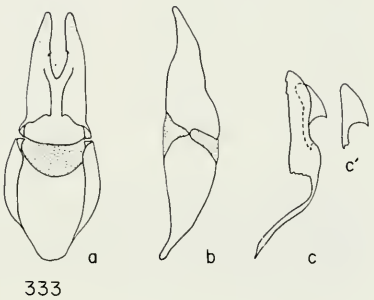

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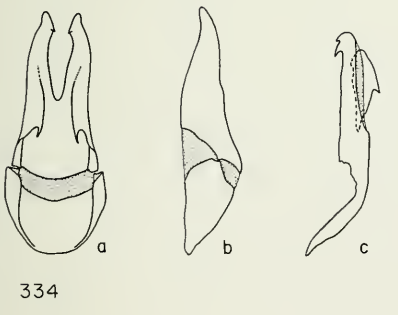

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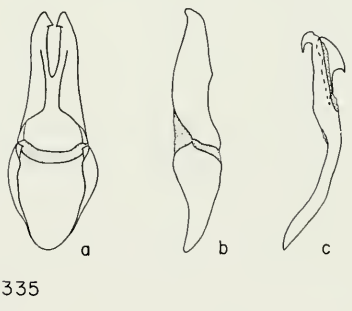

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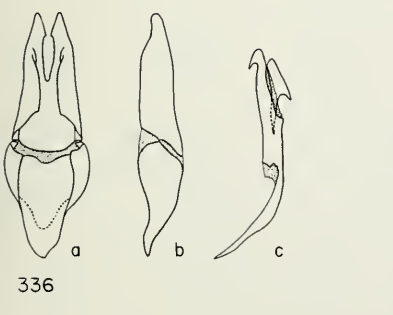

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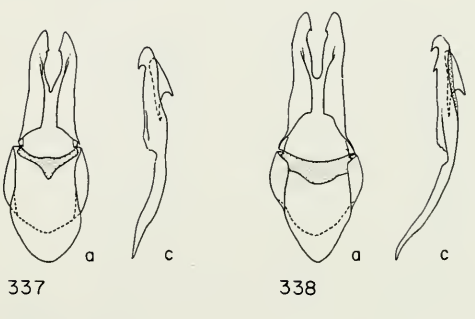

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Figs. 339–346. Male genitalia (a, ventral view of gonoforceps; b, lateral view of gonoforceps; c, lateral view of aedeagus) of species of *Lytta*: 339, *chloris* (Kern County, California); 340, *stygica* (Mendocino County, California); 341, *moerens;* 342, *navajo;* 343, *insperata;* 344, *nigrocyanea;* 345, *nuttalli;* 346, *molesta.*

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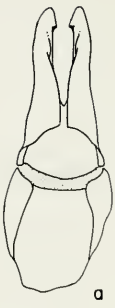

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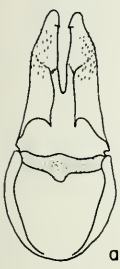

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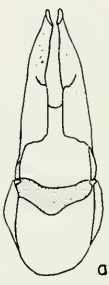

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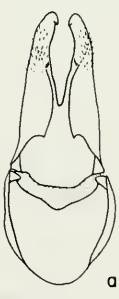

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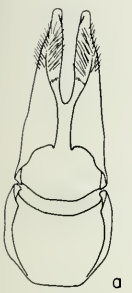
Figs. 347–350. Male genitalia (a, ventral view of gonoforceps; b, lateral view of gonoforceps; c, lateral view of aedeagus) of species of *Lytta*: 347, *childi;* 348, *polita;* 349, *aenea;* 350, *sayi.*



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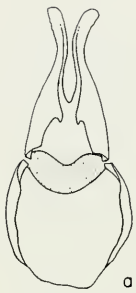

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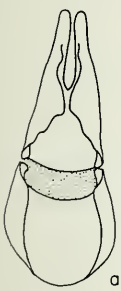

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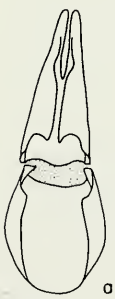

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Index

Specific scientific names are indexed under appropriate generic names, except in the case of species of the genus *Lytta*. Junior synonyms are printed in italics; homonyms are followed by authors' names. For taxa of the genus *Lytta*, page numbers in italics indicate principal references.

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