J23-122

A REVISION OF THE GENUS APANTESIS Walker
(Lepidoptera, Arctiidae)

BY

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B. S., Massachusetts State College, 1935
M. S., Massachusetts State College, 1936

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENTOMOLOGY
IN THE GRADUATE SCHOOL OF THE
UNIVERSITY OF ILLINOIS, 1938

URBANA, ILLINOIS

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UNIVERSITY OF ILLINOIS

THE GRADUATE SCHOOL

May 20, 1938

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ENTITLED A Revision of the Genus Apantesis (Lepidoptera, Arctiidae)

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF Doctor of Philosophy in Entomology

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A REVISION OF THE GENUS APANTESIS

I. INTRODUCTION

Members of the family Arctiidae have long been favorites among collectors and students of Lepidoptera, partly because of their brilliant markings, which place them among the most highly colored and conspicuous of all moths, and partly because of the innumerable variations exhibited by many of the species. In the genus Apantesis, the largest and one of the most variable of the North American genera, there are 26 species listed by Barnes and Benjamin in their 1927 checklist, with 48 named varieties and an additional list of 36 synonyms and homonyms, making a total of over a hundred specific names applied to approximately 30 species. However, the same tendency toward variation which makes them attractive to students of the group results in endless confusion when an attempt is made to relegate each variety to its proper place in the scheme of classification. Even in several of the largest museums of the country, material from this genus has been found unidentified or incorrectly determined.

With the exception of a few articles which have appeared in recent years concerning the male genitalia of the nais-group of Apantesis, the relationships of the species of this genus have been based entirely on color pattern, correlated with what rearing has been done. Saunders in 1863 and Stretch in 1872 described a number of the species and attempted to key them out. In 1887 Smith discussed the extreme variability within the genus, and although his separation of the species according to the markings of the primaries was fundamentally sound, it was not complete or accurate for all individuals. The same author in 1889 made a noteworthy contribution in listing complete bibliographies for each

species.

By far the most valuable work yet published was Neumoegen and Dyar's "Preliminary Revision of the Bombyces" in 1893 and 1894. These authors not only presented descriptions of the species, their synonymy, and a key, but subdivided the genus into five groups or subgenera. Although these groupings were apparently based entirely on color pattern, they correspond surprisingly well to the groups proposed in this paper. Important contributions since the beginning of the century have been Dyar's (1900) paper on the larvae; Gibson's (1903, 1905) papers on the Canadian species and their early stages; Learned's (1927) article on the genitalia of the nais-group; and the check lists of Barnes and McDunnough (1918), Barnes and Benjamin (1927), and McDunnough (1938), which present the authors' conceptions of the relationships of the species through studies of long series of adults.

The excellent genitalic characters found in the males of the nais-group by Learned suggested that a careful study of the genitalia of the whole group might lead to a better understanding of its relationships, and provide a more solid foundation on which to establish the species.

II. ACKNOWLEDGEMENTS

This study was made possible through a fellowship appointment at the University of Illinois and the cooperation and assistance of a large number of individuals who have loaned material for study.

To Mr. C. F. W. Muesebeck and Mr. J. F. Gates Clarke of the United States National Museum the author is greatly indebted for the loan of specimens and assistance in the preparation of the material; to Mr. W. H. T. Tams of the Brit-

ish Museum of Natural History, for the examination of the types in the British Museum and for photographsof the type specimens and their genitalia; to Dr. H. T. Learned of Fall River, Mass., for the loan of complete series of reared larvae, named pupae, and detailed information on early instars; to Mr. Frank Watson of the American Museum of Natural History for the loan of specimens and an examination of type material; to Dr. James McDunnough of the Canadian Department of Agriculture for the loan of specimens of adults and pupae, and for courtesies extended while at Ottawa; to Dr. Richard Dow of the New England Museum of Natural History, Mr. W. J. Gerhard of the Field Museum, Dr. Hugo Kahl of the Carnegie Museum, Dr. E. T. Cresson of the Philadelphia Academy of Sciences, and Dr. Nathan Banks of the Museum of Comparative Zoology for permission to examine types at these institutions and for material which has been received from them for examination.

In addition to those listed above, many individuals and institutions have sent material for examination and study, and to the following the author expresses sincere appreciation and grateful acknowledgement:

S. W. Bilsing, Texas A. & M. College, College Station

T. L. Bissell, Georgia Experiment Station, Experiment

C. S. Brimley, N. C. Department of Agriculture, Raleigh

M. L. Bristol, Elgin, Illinois.

J. J. Davis, Purdue University, Lafayette, Indiana

R. M. DeCoursey, Connecticut State College, Storrs

R. R. Dreisbach, Midland, Michigan

C. L. Fluke, University of Wisconsin, Madison

H. B. Hungerford, University of Kansas, Lawrence

M. T. James, Colorado State College, Ft. Collins

H. M. Jaques, Iowa Wesleyan College, Mt. Pleasant

C. H. Kennedy, Ohio State University, Columbus

C. P. Kimball, Nantucket, Mass.

H. H. Knight, Iowa State College, Iowa

G. F. Knowlton, Utah Agricultural Experiment Station, Logan

H. E. McClure, Iowa State College, Ames

E. P. Meiners, St. Louis, Missouri

A. P. Metcalf, N. C. State College, Raleigh

C. E. Mickel, University of Minnesota, St. Paul

H. B. Mills, Montana Agricultural Experiment Station, Bozeman

R. H. Painter, Kansas State College, Manhattan

W. A. Price, University of Kentucky, Lexington

H. H. Ross, State Nautral History Survey, Urbana, Illinois

C. W. Sabrosky, Michigan State College, E. Lansing

H. A. Scullen, Oregon State Agricultural College, Corvallis

Wm. Sieker, Madison, Wisconsin

John Standish, Oklahoma A. & M. College, Stillwater

W. C. Stehr, Ohio Iniversity, Athens

D. B. Whelan, University of Nebraska, Lincoln

Finally, the author takes this opportunity for extending -- to Dr. W. V. Balduf of the Department of Entomology at the University of Illinois grateful appreciation for his patient supervision and helpful criticism during the period of research and in the preparation of the manuscript.

III. PREPARATION OF MATERIAL

Several different methods were found useful in the preparation of the gen-

italia for examination.

1) In cases in which it was not important to retain the abdomen intact, the tip was snipped off with a pair of scissors, soaked overnight in diluted KOH to which a few drops of alcohol had been added, washed and cleaned in alcohol, the genitalia cleared and hardened in clove oil for an hour or more, rinsed in xylol, and mounted on a slide in Canada balsam in a bakelite ring cell.

2) In some cases the entire abdomen was removed and treated in the same manner, cleaned of the scales, and mounted beside the genitalia.

3) When the abdomen showed important specific characters or in the case of rare specimens, the entire insect was placed in a relaxing jar for a few days to a week, until the abdomen became sufficiently soft to permit the removal of the genitalia without tearing the abdominal wall. The dissected genitalia were then treated exactly as in the first method.

4) If a more rapid method was desired, the entire abdomen was carefully removed, boiled in water until just soft enough to allow the removal of the genitalia, placed in alcohol for a few minutes, and then dried. The dried abdomen was glued back on the specimen and the genitalia treated as above. While this method caused some discoloration and shrinkage, careful timing reduced these to a minimum.

5) The same results were accomplished by soaking the abdomen in a weak solution of alcohol overnight or until the genitalia could be removed.

6) When immediate examination was desired, the dissected genitalia, instead of being soaked overnight in cold KOH, were boiled for a few minutes in concentrated KOH, with examination at frequent intervals in order to remove them as soon as the desired stage of clearing was reached.

In preparing the mounts of the genitalia, it was found necessary to remove one of the claspers, so that its inneraspect and general shape could be compared

from one slide to another. The aedeagus was likewise dissected out and mounted beside the whole preparation. Although the genitalia of the male were satisfactory without staining, the female genitalia required a stain and those of the male were frequently improved by one. Mercurochrome was found thoroughly satisfactory and was applied by the simple method of adding a few drops to the clove oil. Experimentation determined the amount necessary for best results. A bakelite ring cell provided depth sufficient to allow the dissected parts to lie in a normal position without distortion and also added materially to the appearance of the finished slide.

All drawings of the genitalia were made on the same scale and with the aid of a camera lucida.

IV. FACTORS CONSIDERED IN DETERMINING SPECIES RELATIONSHIPS

A collection of approximately 2000 specimens was accumulated from various sources all over the country. The larger eastern museums, including the Field Museum, the American Museum of Natural History, the Carnegie Museum, the Museum of Comparative Zoology at Cambridge, the New England Museum of Natural History, and the collections of the Entomological Society of Philadelphia, the Canadian Department of Agriculture at Ottawa, and Cornell University were visited and studied, and approximately two weeks were spent in Washington working with the Barnes collection and that of the United States National Museum. With records and data from all of these collections available, the following aspects of the problem were studied:

Types. All available types were examined, not only those of species and varieties in good standing, but also those of all synonyms. Although the types served to give an understanding of the species concerned, relatively few changes

from the accepted synonymy were found necessary, and these changes occurred for the most part among the synonyms themselves.

Color pattern. The limits of variation in the color pattern, as well as the most typical form, were studied for each species. Although seeming to intergrade hopelessly at first glance, the species, for the most part, can be distinguished by color characters alone. Once they have been firmly based upon structural characters such as the genitalia, and the color pattern has been correlated with such characters, the species determination may depend upon color and appearance alone. Reference to genitalic structures will be necessary in only a few instances.

Genitalia. The study of the male and female genitalia showed that the genus should be divided into two very distinct genera, the divisions substantiated by two different types of color pattern. Within the smaller genus Apantesis, as thus restricted, both male and female genitalia showed constant specific characters, but in the larger genus Callarctia the study of the male genitalia was somewhat disappointing. The female genitalia of the latter made advisable the division of the genus into four distinct groups of species or subgenera, but within these subgenera further differentiation occurred in only one instance. The male genitalia supplemented those of the female in the subgeneric divisions. However, within the largest subgenus Callarctia even these species possessing a most distinctive color pattern could not always be separated by genitalic structures alone, and in several instances similarity in genitalia did not correspond to similarity in color pattern. In the genus Callarctia, two species, ornata and quenseli, were found in which so-called subspecies and forms possessed genitalia strikingly different from the typical form, and this condition, supplemented by corresponding differences in the color pattern, necessitated their elevation to specific rank.

As a whole, the study of the genitalia with a view to determining species limitations and specific characters merely substantiated the divisions made by

color pattern alone. In the few instances in which an examination of the genitalia is necessary in order to identify a specimen correctly, the decisive characters can be seen without dissection.

Distribution. The data gathered from specimens and from references in the literature concerning distribution were chiefly of value in determining the validity of the subspecies or geographic races. Records cited were taken from specimens actually examined, excepting in only a few cases where they are supplemented by dependable citations from the literature.

Larvae. The study of the larvae substantiated the division of the adults into two genera, the larvae showing very constant and distinct differences. Larval characters likewise supported the subgeneric divisions. The larvae of the twenty species that have been examined have been carefully considered in species differentiation; in a few instances they have influenced the concept of the species and in other cases have indicated close relationships.

Pupae. Since no attempt had ever been made to find specific characters in the pupae, it was extremely gratifying to find them falling into the same distinct generic and subgeneric groups indicated by the adults and by the larvae. Pupal characters have been considered in determining the relationships of certain varieties and species; if those examined are constant for the forms concerned, then certain forms heretofore placed together must be regarded as distinct.

Bibliography. Although a complete bibliography has been prepared for each species, and has been found invaluable in the understanding of the species, it is impractical to reproduce it in this paper. Accordingly, under each species or variety are listed only those references which deal with synonymy, or contain complete descriptions or important work on biology. An indication of the contents of the article follows the citation.

V. ECONOMIC IMPORTANCE OF THE GROUP

Members of the group rarely occur in such abundance as to cause severe damage to crops, although the omnivorous habits of the larvae and their preference for low-growing herbs lead to occasional minor outbreaks among various field crops.

Smith and Abbot, in 1797 (Lep. Ins. Ga. II: 127), first reported that Callarctia arge (Phalaena dione) sometimes proved serious on Indian corn. Packard (Hayden's Surv. Territ. for 1875, p. 720, 1877) reported infestation of corn by this species, and Forbes listed it in his "Monograph on the Insects Injurious to Indian Corn" (23rd Rept. State Entom. Ill., p. 75, 1905). In 1892 Bruner (5th Ann. Rept. St. Bd. Agr. Nebraska, p. 241, 244) stated that arge was one of the common corn insects of Nebraska, "frequently being quite destructive to young corn in the southern states".

Arge has also been found injurious to apple, grape, and cotton. Baldwin (Indiana Entom. Rept. 6, p. 30, 1914) reported finding numerous egg-masses on small apple twigs during the winter, and from the number of egg-masses collected judged that "it must be included among the lesser pests of the fruit". Somes (Bienn. Rept. Missouri Fruit Bull. 24, p. 5, 14, 1914) called the moth the "grape tiger-moth" and recorded it as causing severe losses to grape-growers at several points in Missouri. Sanderson (U.S.F.B. 223, p. 14, 1905, and U.S.D.A. Bull. 57, p. 35, 1906) listed the species as common on cotton in Texas, but never very injurious, and in 1917 Pierce (U.S.F.B. 890, p. 15) stated that it causes occasional injury to cotton, "but will not be serious if attention is given to surrounding vegetation on which it feeds normally".

Forbes (1905) listed one other species Apantesis phalerata, as injurious to corn, but evidently the injury was not considered extensive.

Callarctia phyllira was also listed by Smith and Abbot (1797) as feeding on corn, peas, and wheat, but no reference to damage was made. C. phyllira rectilinea was reported in 1891 by French (Prairie Farmer, May 2, p. 284) as a clover insect which was usually held in check and was not likely to become numerous enough to be very injurious. Reed, however, (Insect Life, V, p. 111, 1892) reported phyllira a serious pest of cotton in a limited area in Mississippi, entirely stripping the plants of leaves over several acres. He predicted that any extensive increase in the species might cause it to become a more serious pest to cotton than either the leaf-worm or the boll-worm.

VI. ADULTS

The members of this group are stout-bodied broad-winged moths with the shaggy vestiture and brilliant colors characteristic of so many of the Arctiidae. The adults are entirely nocturnal, except for Callarctia quenseli, which in the Alps is said to fly only during the brightest noon hours. They are attracted strongly to light, and may readily be captured in light traps. In fact, the use of light is the most widely-used method of attracting them, since they do not come to sugar. Because females are seldom obtained in the traps, the great majority of individuals in any collection are males.

Soon after emergence, the adult emits a few drops of an unpleasant smelling yellowish liquid from beneath the prothoracic patagia. In all probability this fluid can be discharged whenever the insect is disturbed. Harris applied the name "stinking tiger moth" to Callarctia virgo because of the distinct odor produced by the liquid. Presumably it protects the insect from attack, for spiders have been observed to leave untouched other moths of the family Arctiidae which produce the same type of ill-smelling liquid.

In common with many other Arctiidae, at least some of the adults are capable of producing a slight crackling noise on being picked up, and the same type of stridulation is sometimes observed during flight. It is not yet understood how the noise is produced, but the large lateral tympana of the mesothorax, which are provided with chordotonal organs, are believed to be resonators of auditory organs corresponding to those in certain Hemiptera.

Apantesis belongs strictly to the New World. Three of the five species are widely distributed through southern Canada and the United States east of the Rockies. One species, A. radians, is apparently restricted to the southern states, and A. bicolor is known only from the Bahamas. Its nearest relative, A. phalerata, however, extends from the United States south into Mexico.

The genus Callaretia includes one holarctic species: C. quenseli, which inhabits the high mountains of Europe and North America and the arctic regions of North America and Eurasia. All other species are restricted to the New World, and of these only two are known to extend south into Central America. C. arge has been taken in Guatemala, and C. proxima occurs rather commonly in the mountains through Mexico and Central America and occasionally in northwestern South America. Probably other species occurring in the southern United States will eventually be found in Mexico.

With the exception of the Bahaman Apantesis bicolor, all species of the two genera are represented in the United States, although several which have a northern range are more abundant in Canada. As a whole, however, the Canadian fauna is less rich in number of species and in individuals than that of the United States. The group clearly belongs to the north temperate zone of the New World. Its occurrence north of the zone is sporadic, while its distribution southward is limited to mountain ranges.

Morphology

Head. Two ocelli are present and the compound eyes are smooth, not hairy. The proboscis or tongue is rudimentary, shorter than the thorax, and when rolled up is concealed by the labial palpi. The maxillary palpi are minute, one-segmented. The labial palpi are strongly developed, porrect, extending straight out from the head capsule and not upturned over the frons, and are densely clothed with long hairs. The three segments are usually subequal, but the third is sometimes much shorter. In the male the antennae are distinctly bipectinate; in the female nearly filiform, weakly biserrate.

Thorax. Two broadly expanded lateral lobes or patagia of the prothorax lie back over the mesothorax and form the so-called "collar". An elongate lateral lobe or tegula lies over the base of each mesothoracic wing and extends back to the scutellum. A conspicuous rounded lobe on the caudal margin of the metapleuron is the hood or bulla of the tympanum. The prothoracic tibia lacks apical spurs but is provided with a membranous leaf-like epiphysis on its inner surface; the mesothoracic tibia has one pair of apical spurs; the metathoracic tibia a pair of apical and a pair of subapical spurs, subequal in length. The vestiture of the thorax is dense, shaggy in the male but smooth in the female; the thorax beneath is clothed with long hairs.

Normal venation (pl. I, f. 1). Forewing or mesothoracic wing: R_1 is free, rising from the discal cell a short distance before the upper angle; R_2 rises from the cell at the upper angle or slightly basad; R_3, R_4, and R_5 are stalked, rising from the upper angle. The base of media is lost; M_1 rises from the upper angle or just below the angle, M_2 from just above the lower angle, and M_3 from the angle. Cu_1 rises from the lower angle of the cell or just below it, Cu_2 from the discal cell slightly beyond the middle. 1st A has been lost, 2nd A is free, and 3rd A is represented only by a short spur at the base of the wing.

Hind wing or metathoracic wing: Sc+R_1 rises from the discal cell at a point slightly more than half the distance from the base; Rs and M_1 spring from the upper angle of the cell, M_2 from just above the lower angle, and M_3 and Cu_1 from the lower angle. Cu_2 rises from the discal cell slightly beyond the middle. 1st A is lost, 2nd and 3rd A are free and extend to the margin of the wing.

Aberrations in the venation. Because of the relatively small variation in body structure throughout the order Lepidoptera and particularly in such closely related groups as families, the dense vestiture of hair and scales which obscures structural characters, and the extreme development of the wings in comparison with the rest of the body, systematists have placed great reliance upon venation in the separation of families and of genera within the families. The student who must rely upon keys comes to consider such venational characters as fixed and constant for the particular genus or family under consideration, and since in most cases no additional characters are given, an occasional specimen with abnormal venation may key out perfectly to a distantly removed group.

Dyar (Psyche VI, p. 511-512, 1893) called attention to the fact that four of seventeen specimens, or nearly 25%, of Isia isabella, an Arctiid, showed four different variations from the normal type of venation, a sufficient range of variation on which to found four genera.

In an examination of a series of 143 specimens of Callarctia arge, it was found that 26 of these, or 22%, showed distinctly abnormal venation. In many cases in which an aberration occurred, the venation in one wing was normal or showed an entirely different type of variation. Aberrational venation is not restricted to arge, for the same or additional types of abnormal venation were found in C. virgo, C. parthenice, C. phyllira, C. proxima, C. doris, and C. virgunculs, and doubtless occur in other species of the genus not examined for this character.

The majority of the variations occurred in the radial field of the forewing, while a few included the first branch of media. No abnormalities were observed in the hind wing.

As shown in plate I, figs. 1 and 2, R_1 and R_2 usually arise free from the discal cell and R_3, R_4, and R_5 are normally stalked and rise with M_1 from the upper angle of the cell. Fig. 3 shows R_2 stalked with R_{3+4+5}, a type of venation characteristic of many Arctiidae, which would place this individual in the genus Diacrisia. A common aberration is shown in figs. 4 - 8, in which R_2 anastomoses with R_{3+4+5} to form an areole or accessory cell, as in the closely related genus Arctia. Fig. 9 shows a comparatively rare type of venation, with R_3 stalked with R_2. In fig. 10 radius is only four-branched and either R_3 or R_4 has dropped out or is anastomosed for its entire length with one of theother veins. In the normal venation R_3 and R_4 are stalked together, but occasionally, as shown in fig. 11, it is R_4 and R_5 that have a common stalk. R_1 rarely enters into the aberration, but in fig. 12 an areole is formed between R_1 and Rs, and in fig. 13, R_2 is stalked with R_1 rather than rising free from the cell. M rarely anastomoses with R to form an areole as in fig. 14, but quite commonly migrates out onto the stalk of R_3, R_4, and R_5. Fig. 15shows not only this latter condition, but also the loss of one of the branches of radius.

The occurrence of so many types of abnormal venation in such a large percentage of individuals of a species indicates the necessity of using morphological characters other than, or in addition to, venation for the determination of genera in this extremely variable family.

Male genitalia (pl. II, f. 1). The ninth and tenth abdominal segments are modified for mating. Normally they are retracted within the eighth segment and concealed by a long anal tuft of hairs. The ninth segment is a narrow ring composed of a ventral vinculum (vin)and a dorsal tegumen (teg), articulated later-

ally, with the edges of the tegumen heavily sclerotized. A beak-like uncus (un) representing the tenth segment or an appendage of that segment is attached to the tegumen and extends downward over the body opening. The apical portion of the uncus is usually slender and cylindrical, the proximal portion expanded into broad shoulders and containing a median membranous area which is often specific in shape. The anal opening is just ventrad of the uncus. Prominent lateral valves or claspers (cl), roughly diamond-shaped, are articulated midway along the dorsal margins at the juncture of the tegumen and vinculum, and attached by a membrane to the vinculum along their dorsal margins proximad of the articulatory point. The proximal ends are narrow, nearly meeting at the mid-ventral line, the distal ends usually rounded or pointed. The inner surface of the clasper is strongly concave, lined with a sheet of chitin which is free from the outer surface, and heavily sclerotized distad of the articulatory point, membranous and easily ruptured proximad. The free margin of the heavy portion of the inner sheet is produced into a more or less prominently raised ridge, the harpe (h), which extends obliquely across the inner surface of the clasper from the point of articulation to near the ventral margin, and extends beyond the dorsal margin of the clasper as a slender arm or ampulla (amp). The ventral margin of the clasper is sparsely clothed with setae; the outer surface bears a deep transverse groove in the region of the harpe, with a dense tuft of setae from the groove. Between the claspers and projecting through the tegumen and vinculum below the uncus lies the heavily-sclerotized aedeagus or sheath of the ductus ejaculatoris. The aedeagus may be evenly sclerotized throughout, or provided with minute file-like teeth around the orifice, or a small serrate plate distad of the orifice, or the entire ventral aspect may be heavily sclerotized and produced into one or more stout apical spines. From the orifice at the apex of the aedeagus may be everted a membranous vesica (ves) representing the distal end of the ejaculatory duct and

bearing numerous rows of small file-like teeth or cornuti. The proximal end of the ejaculatory duct passes from the aedeagus through an irregular opening on the ventral aspect near the base. The aedeagus is supported by a membranous sheath, the ring-wall or anellus, attached to the bases of the claspers, to the ampullae, and to mesal margins of the vinculum. Mesad of the proximal ends of the claspers the anellus bears a mid-ventral sclerotized plate or juxta (jx).

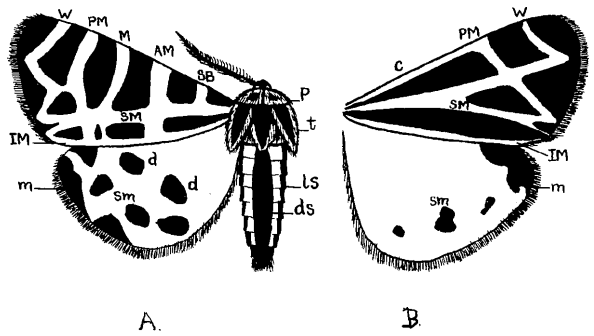
Female genitalia (pl. II, f. 2). The eighth and ninth abdominal segments are modified for mating, and are partially retractile into the abdominal cavity. The ninth segment consists of two lateral hairy lobes, the ovipositor lobes (op). Between these are the anal opening and the oviporus or opening of the egg passage. A slender apodeme or tendon (ten) extends cephalad from each lobe into the eighth segment for muscle attachment. The eighth tergite is a narrow band. The eighth sternite is modified into a genital plate, bearing the ostium bursae of the vagina, the true genital opening. The genital plate caudad of the ostium bears a median genital groove (gg) and a blind pocket-like pouch (p). The lateral portions of the genital plate cephalad of the ostium are often expanded into broad crenulated lips. The ostium bursae opens into a narrow tube-like ductus bursae which may be armed with one or more sclerotized plates characteristic of the subgenera. The ductus bursae expands into a large bulb-like bursa copulatrix (bc). The inner surface of the bursa is provided with four signa, or patches of small spines arranged concentrically, believed to assist in retaining the spermatophore of the male. The signa are occasionally greatly reduced in size, and one or more may become lost. The wall of the bursa in virgin females is heavily ridged and folded to allow expansion during and following copulation. The spermatophores deposited during copulation are frequently observed within the bursa of prepared specimens, usually in pairs, but never more than four in number. The spermatophore consists of a circular or oval bulb which lies against the wall of

the bursa, but which is easily broken and is not usually observed. The tube or neck of the spermatophore is a greatly elongated, coiled structure, usually extending from the bursa into the ductus seminalis (ds); the spermatozoa pass from the spermatophore through the ductus seminalis and thence to the receptaculum seminalis.

Color Pattern

Except in species and individuals in which the markings of the primaries are greatly reduced, the members of these two genera can usually be distinguished from other Arctiidae by the color pattern alone, which consists of a striped thorax, black primaries marked with a distinct longitudinal submedian band, subterminal W-shaped band, and a maximum of four transverse bands, and secondaries variously spotted with black.

In order to facilitate comparisons and the use of the key, the names which have been applied to the various stripes and spots by workers such as Hampson are shown in figure 1. On the primaries, or fore-wings, these consist of a costal stripe (C), a stripe along the inner margin (IM), a submedian longitudinal stripe (SM), a subterminal W-shaped mark, and one or more transverse bands extending, when complete, from C to IM. In the genus Callarctia (figure 1, A) there may be four transverse bands, a subbasal half-band (SB) which never extends below SM, an antemedian or anterior median transverse band (AM), a median transverse band (M), and a post-median or posterior median transverse band (PM) which lies across the top of the W. These bands may be complete, broken, or wanting. In the genus Apantesis the only transverse band usually present is the upper branch of PM, which forms with W an X-shaped mark. In addition to the stripes shown in the figure, the veins of the primaries may, in the genus Callarctia, be narrowly



A. B.

Figure 1. Color pattern.

A. Genus Callarctia B. Genus Apantesis

SB - Subbasal half-band

AM - antemedian transverse band

M - median transverse band

PM - postmedian transverse band

W - subterminal W-shaped band

SM - submedian longitudinal band

C - costal stripe

IM - inner marginal stripe

p - patagium

t - tegula

ds - dorsal stripe

ls - lateral stripe

m - marginal spot

sm - submarginal spot

d - discal spot

lined with pale scales. In the genus Apantesis the so-called median vein (actually the stem of Cu, not media) bears a distinct stripe fully as wide as SM, but none of the other veins are ever lined. In Callaretia the median vein in a few species is very narrowly lined, but is never widely lined unless all the other veins are lined.

In both genera the markings of the primaries may be greatly reduced, especially in the females, consisting of only a few short dashes and small spots indicating the position of some of the stripes.

The secondaries, or hind-wings, are usually yellow or red marked with a number of black spots, which may be distinguished as marginals (m), submarginals (sm), and discals (d); in many cases the spots become fused into a border, or the discal spots coalesce to form a black basal area; rarely are the wings entirely black.

The thorax is usually lined with three black stripes, one on each tegula (t) and one on the mesoscutum; the patagia (p) are typically spotted with black. In certain species the head and thorax are entirely black. The abdomen typically bears a black dorsal stripe (ds) or series of spots, and two lateral stripes (ls) or series of small spots; the ventral surface may be entirely black, as it is in most females, or it may be marked with two rows of black spots, or the segments may be black with the edges narrowly margined with pale scales.

Sexual Dimorphism

Sexual dimorphism is characteristic of many of the species, such as Callaretia placentia, C. f-pallida, C. proxima, and Apantesis phalerata and vittata, in which the colors and markings of the females are distinctly different from those of the males. In fact, the female of C. f-pallida has until now been

called a distinct species, C. quadranotata. In the majority of the species, however, sexual dimorphism consists only of a smoother vestiture and usually an intensifying of the colors in the female.

The males can usually be readily distinguished by the distinctly bipectinate antennae. In the females, the antennae are nearly filiform, only weakly biserrate. The apex of the abdomen of the male is clothed with an anal tuft of long setae which hides the tips of the genitalia; in the female the apex is broadly rounded and devoid of any setae. The frenulum of the male consists of a single stout bristle rising from the anal angle of the hind wing and held in a membranous frenulum hook which rises from the membrane of the fore wing between C and Sc. The frenulum of the female is composed of a small number of more slender bristles which are held in a retinaculum or cluster of strong hairs and scales on the cubital vein of the fore wing.

Key to Genera

1a. Veins concolorous with rest of primaries, or entirely or partially marked with pale scales; primaries of some females entirely black except for a few white spots; ductus bursae of female genitalia unarmed (pl. IV, f. 3) or with one or two small plates (pl. II, f. 2; pl. IV, ff. 5, 7); aedeagus of male unarmed and evenly sclerotized throughout (pl. IV, f. 4d), or with small cornuti surrounding orifice (pl. IV, f. 4d), or with a small serrated plate (pl. IV, f. 6b) - - - - - Genus CALLARCTIA - - - - - - - - - - - - 2

1b. Veins except median vein concolorous with rest of primaries; median vein always lined with a stripe as wide as costal and submedian bands except in male of A. bicolor which has head, thorax, and primaries entirely black, sometimes with a few white spots; ductus bursae of female genitalia with a

single heavily sclerotized dorsal plate as wide as eighth segment or wider (pl. IV, ff. 4, 5); aedeagus of male with apex heavily sclerotized ventrally and bearing one or more prominent spines (pl. V, ff. b, c) - Genus APANTESIS - - - - - - - - - - 46

Key to Subgenera of Callarctia

2a. Veins of primaries always completely lined with pale scales; costal stripe of primaries wide, extending to R; costa below salmon-pink to flame; antennae of male narrowly pectinate; ductus bursae of female and aedeagus of male unarmed (pl. IV, ff. 1, 3) - - - - subgenus MIMARCTIA - - - - - - - - 5

2b. Veins of primaries completely, partially, or not at all lined with pale scales; ductus bursae of female armed with one or two plates; costal stripe of primaries never extending to R - - - - - - - - - - - - - - - - - - - 3

3a. Veins of primaries concolorous with rest of wing, except for median vein which is narrowly lined, lining sometimes obscured by coalescence with transverse bands; last two or three abdominal segments entirely black; vertex and patagia immaculate; ductus bursae of female with a single triangular dorsal plate (pl. IV, f. 7); aedeagus of male with a small serrated plate (pl. IV, f. 4) - subgenus NOTARCTIA

(One species, Callarctia proxima)

3b. Median vein seldom lined except when other veins are also lined; last two or three abdominal segments never entirely black; both patagia and vertex never immaculate - 4

4a. Veins fully lined but linings obsolescent towards outer margin; transverse stripes rarely extending below cell; secondaries clear yellow; vertex spotted; ductus bursae of female with a sclerotized ring completely surrounding ductus (pl. IV, f. 5); aedeagus of male with cornuti on lateral margins of orifice (pl. IV, fig.4d) - - - - - - - - - - - - - - - - - subgenus HOLARCTIA

(One species, Callarctia turbans)

4b. Veins fully, partially, or not at all lined; primaries of some females entirely black, markings reduced to small spots; ductus bursae of female with two small curved lateral plates (pl. II, f. 2); aedeagus of male unarmed, evenly sclerotized throughout (pl. II, f. 1) - subgenus CALLARCTIA - - - 6

Key to Species of the Subgenus Mimarctia

5a. Pale stripe wide, black markings usually reduced to small triangles or dashes; M a triangular spot at end of cell; stripe on median vein approximately as wide as 3M; color white or faintly suffused with pink - - arge

5b. Pale stripes seldom reducing black areas to small triangles or dashes; M a definitely oblique band, not triangular; stripe on median vein much narrower than 3M; color usually pink, salmon, or reddish, seldom white - doris

Key to Species of the Subgenus Callarctia

6a. Veins of primaries, excluding bases of median and anal veins, entirely or partially lined with pale scales - 7

6b. Veins of primaries, not including bases of median and anal veins, not lined with pale scales - 24

7a. Median vein more broadly lined than A, with pale scales on each side of vein - 8

7b. Median vein narrowly lined, with pale scales only on vein - - - - - - - - 12

8a. Secondaries red, with a black spot at origin of Cu2 of secondaries - *virgo*

8b. Secondaries yellow, black, or whitish - 9

9a. No transverse stripes; secondaries yellow - - - - - - - - - - - - *virguncula*

9b. At least one transverse band - 10

10a. Vertex spotted; secondaries blackish - - - - - - - - - - - - - - - *quenseli*

10b. Vertex immaculate; secondaries yellow - - - - - - - - - - - - - - - - - - 11

11a. PM present - *virgo* f. *citrinaria*

11b. PM absent, only M present - - - - - - - - - - - - - - - *virguncula* f. *otiosa*

12a. Only median vein lined; vertex spotted - - - - - - - - - - - - - - - - - - 13

12b. Other veins, in addition to median, lined - - - - - - - - - - - - - - - - 14

13a. Bases of anal vein and of antennae marked with pale scales; size small, 33 mm. or less - *blakei*

13b. Not so marked with pale scales; larger, over 33 mm.- - *williamsii elongata*

14a. PM oblique, straight, not angled or curved - - - - - - - - *phyllira oithona*

14b. PM angled, curved, irregular, broken, or absent - - - - - - - - - - - - 15

15a. Secondaries entirely black, or blackish with obscure pale markings - - - 16

15b. Secondaries red or yellow with black markings - - - - - - - - - - - - - - - 18

16a. Vertex immaculate; primaries with one or two transverse bands; secondaries entirely black; size more than 35 mm. - *anna*

16b. Vertex usually spotted; secondaries grayish, often with indistinct white or yellow markings; size less than 35 mm. - - - - - - - - - - - - - - - - - 17

17a. Marks of primaries yellowish; usually only M and PM present and not extending below cell; veins sometimes only partially lined - - - - - - - *quenseli*

17b. Markings of primaries whitish; AM, M, and PM usually present and extending to SM or below, often coalescent - - - - - - - - - - - - - - - - *cervinoides*

18a. Secondaries red with only one discal spot - - - - - - - - - - - - *parthenice*

18b. Secondaries yellow or orange, if reddish then with more than one discal spot - 19

19a. Abdomen black below; vertex immaculate; primaries with at most two transverse stripes never extending below SM; secondaries yellow with black markings; more than 35 mm. - - - - - - - - - - - - - - - - *anna* f. *persephone*

19b. Abdomen of male spotted below, female black; AM and SB often present and bands often extending below SM - 20

20a. SB present; transverse bands complete; spots on reddish or yellow secondaries small, not fusing; veins often only partially lined - - - - *hewletti*

20b. SB not often present; spots of secondaries usually fused - - - - - - - - 21

21a. Vertex usually spotted; antennae with pale scales on basal third; SB some-

times present; small, rarely over 30 mm. - - - - - - - - - - - - edwardsii

21b. Vertex rarely spotted; antennae never with pale scales; SB almost never present; usually over 30 mm. - 22

22a. Ventral margin of clasper of male with a prominent thumb-like projection (pl. II, f. 1); AM usually present; markings usually extending below SM; veins often only partially lined - - - - - - - - - - - - - - - - - - - ornata

22b. Ventral margin of clasper of male without thumb-like projection; AM rarely present; markings seldom extending below SM - - - - - - - - - - - - - - 23

23a. Size small, 33 mm. or less; transverse bands often lacking; vertex immaculate; rare - celia lineata

23b. Larger, 35 mm. or more; at least one transverse band always present; vertex sometimes spotted - complicata

24a. Head and thorax entirely black - 25

24b. Not so - 29

25a. Markings of primaries not reduced to short dashes and small spots; both males and females - 26

25b. Markings of primaries reduced to short dashes and small spots; only females - 27

26a. SB present; transverse bands extending below SM - - - - - - - - nevadensis

26b. No SB; transverse bands seldom extending below SM - williamsii tooele f. ophir

27a. Secondaries all black except for a discal yellow or red spot - - -

34a. Abdomen spotted below; males only - 35

34b. Abdomen black below; both males and females - - - - - - - - - - - - - - - - 36

35a. C entirely pale; secondaries red with a narrow border, several submarginals, and a discal spot; usually more than 34 mm. - - - - - - - - - - - - phyllira

35b. C usually pale at base only; secondaries brownish, yellow, or orange with a broad irregular border and several discal spots; 34 mm. or less - - celia

36a. Costa pale; secondaries red with a narrow border, submarginal spots, and a discal spot - 37

36b. Costa black or pale only at base; secondaries with a wide border, the spots not distinct - 38

37a. M and PM three times as far apart on C as on SM; last abdominal segment entirely black - placentia

37b. M and PM only twice as far apart on C as on SM; last abdominal segment striped - phyllira

38a. Costa pale at base; less than 34 mm.; only females - - - - - - - - - - celia

38b. Costa black its entire length; usually more than 34 mm. - - - - - - figurata

39a. SB present - 40

39b. SB absent - 42

40a. Vertex immaculate; secondaries deep yellow or orange-red; size large, 40 mm. or more - hewletti

40b. Vertex spotted; usually smaller - 41

41a. Antennae and base of anal vein with pale scales; secondaries yellow or reddish; not over 33 mm. - blakei

41b. Antennae and base of anal vein rarely marked with pale scales; usually larger, 35 mm. or more - nevadensis

42a. Vertex spotted; ventral margin of harpe of male without thumb-like projection - 43

42b. Vertex usually immaculate; ventral margin of harpe with thumb-like projection (pl. II, f. 1) - ornata

43a. Small forms, about 25 mm.; secondaries blackish - - - - - - - - cervinoides

43b. Usually larger; secondaries not entirely blackish - - - - - - - - - - - 44

44a. Smaller forms, less than 33 mm.; antennae and base of anal vein with pale scales; secondaries yellow or reddish - - - - - - - - - - - - - - - - blakei

44b. Usually larger, 35 mm. or more; antennae and base of anal vein rarely with pale scales - 45

45a. Secondaries deep coral-red with only one discal spot - - - - - - - favorita

45b. Secondaries paler, or yellow or whitish, with several discal spots and dashes - williamsii f. dieckii

Key to Species of the Genus Apantesis

46a. Males - 47

46b. Females - 51

47a. Aedeagus with one or two stout conical spines at apex, directed nearly

caudad, and no smaller spines at base of larger spine - - - - - - - - - 48

47b. Aedeagus with one or more spines directed laterad or slightly cephalad 49

48a. Aedeagus with two stout equal conical spines; patagia spotted; costa pale or black; secondaries yellow-white flushed with pink; W usually complete - phalerata

48b. Aedeagus with a single stout conical spine at apex and a much smaller spine on opposite side of aedeagus; head and thorax black, primaries entirely black or with a few white spots - - - - - - - - - - - - - - bicolor

49a. Aedeagus with one or more minute spines at base of a single large conical or slender spine; patagia usually spotted; W usually broken or wanting; costa usually pale - radians

49b. Aedeagus without minute spines at base of long spine - - - - - - - - - - 50

50a. Costa always black; W usually complete; secondaries and abdomen yellow; dorsal stripe of abdomen narrowed posteriorly; patagia usually spotted; proximal portion of callum of aedeagus ending in a definite swirl - - nais

50b. Costa always (?) pale; secondaries yellow or orange-red; W usually broken; dorsal stripe of abdomen usually widened posteriorly; proximal portion of callum of aedeagus merging gradually into normally sclerotized aedeagus - vittata

51a. Dorsal plate of ductus bursae at least twice the width of the eighth segment; lips of ostium broadly expanded and crenulated; secondaries red with large black spots which are rarely entirely coalesced - - - - - phalerata

51b. Dorsal plate of ductus bursae less than twice as wide as eighth segment- 52

52a. Dorsal plate only slightly wider than eighth segment; funnel more than half as wide as plate itself; W usually broken; secondaries red with broad terminal border - radians

52b. Dorsal plate about 1 1/2 times the width of the eighth segment, sometimes smaller - 53

53a. Costa always black; secondaries yellow or red, spotted, rarely broadly margined; dorsal stripe of abdomen usually narrowed posteriorly; W usually complete - nais

53b. Costa always (?) pale; secondaries yellow or red, broadly margined with black; dorsal stripe of abdomen usually widened posteriorly; W usually broken - vittata

VII. LARVAE.

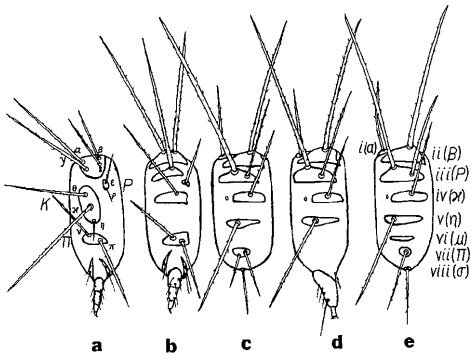
The caterpillars are general feeders on low-growing plants such as Taraxacum, Plantago, and Chenopodium. As a rule they feed at night, sometimes being attracted to lights, and during the day remain hidden beneath stones, boards, crumpled papers, or other rubbish. Upon being disturbed, they run rapidly and seek shelter. They hibernate as half-grown or nearly full-grown larvae and commence feeding in early spring soon after snow and frost have left the ground.

In appearance they are blackish or brownish caterpillars rather sparsely clothed with short, uneven, and usually barbed setae which arise from conspicuous rounded warts or verrucae. The position and size of the warts furnish important characters in the identification of the larvae. In this discussion and in the larval descriptions and keys, Dyar's system of the nomenclature of the warts is

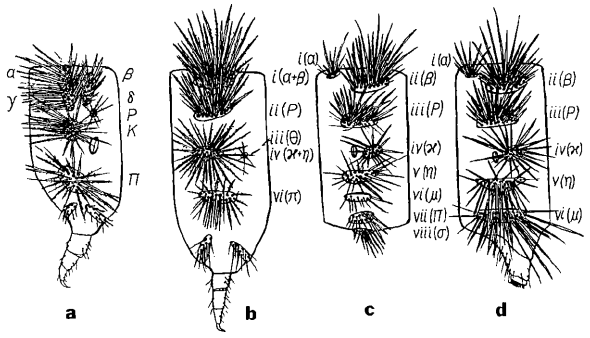
followed, since most descriptions in the literature use his numbers, although in the accompanying figure there is given the equivalent Greek letter designation of Fracker's (1915) system, which homologizes the thoracic with the abdominal setae. The larvae of the genera treated in this discussion can easily be distinguished from other "woolly-bear" caterpillars by the fact that wart i of the abdomen is less than half the size of wart ii, and that iv is partially or entirely above the spiracle.

In contrast to the tufts of setae characteristic of mature or partly-grown caterpillars, as shown in fig. 3, first instar larvae (fig. 2) possess only a small number of very long primary setae, each wart bearing usually one, and never more than three. A primary seta, according to Fracker's definition, is one which occurs in the first instar. This reduced number of setae represents a primitive condition from which little divergence has taken place within the genera under consideration, the first instar larvae of the whole group being so similar that no characters have been found to separate them. In the first instar the warts are large and brown, the body creamy-white with no markings, and the setae all conspicuously spinulose. In figure 2b attention should be called to the presence of the small but distinct wart iii which Fracker called subprimary since he never found it in any first instar larvae. Its presence in these species, however, is constant in all instars including the first.

At each molt after the first instar the setae increase in number, and in the genus Apantesis become less spinulose. The markings appear after the second or third molt, or in a few cases, after the first, and the warts change in proportion to the size of the segment and to each other. Consequently, several of the characters for separating the larvae used in the following key, e. g., the size of wart i in relation to ii, the smoothness of the setae, the approximate number of setae on wart i, and the body markings, do not become fixed or constant until the



2.



3.

Setal pattern of larva of Apantesis phalerata.

Fig. 2. First instar larva. Fig. 3. Mature larva.

a. Prothorax. b. Mesothorax and metathorax.

c. Abdominal segments one and two.

d. Abdominal segments three to six.

e. Abdominal segments seven and eight.

3 c. Abdominal segments one, two, seven, and eight.

larva is mature, although in the last two or possibly three instars the characters are usually sufficiently typical to permit the use of the key for an approximate determination.

By comparing figures 2 and 3, it will be seen that the only fundamental difference between first instar and mature larvae, other than increase in the number of setae and in the proportions of the warts, is the establishment of an additional wart - vi - on the abdominal segments between v and vii. In figure 2e a small wart is shown in this position, and occasionally traces of it appear on the proleg-bearing segments. However, the wart never bears a seta until after the first molt, and its presence or absence and its size in the first instar larvae vary with individuals of the same species.

Dyar in 1900 published a key to the larvae of eight species, and called attention to several characters which prove to be of real value: the size of wart i in relation to ii, the shininess of ii, and the smoothness of the setae. These features, with the color pattern, and with the additional reference to the number of setae on wart i, are the principal characters used in the following key.

The presence of short black spiny bristles intermixed with the longer paler setae of the dorsal warts, characteristic of the genus Apantesis, has been mentioned only once in the literature, by Forbes (23rd Rept. St. Entom. Ill. p. 76, 1905), although the character is seen distinctly in all species especially from a lateral aspect.

As previously mentioned, only the mature larvae can be determined accurately. A rather high magnification is necessary to see the number of setae on wart i, and since there is often a variation in the number of setae on the warts of the various segments, and even on corresponding warts of the same segment, as many counts as possible should be made and the high and low limits of variation

determined. Larvae have been examined for all species placed in the key, with the exception of nevadensis, which has been included from descriptions in the literature, and is followed by a question-mark. In a few cases, such as blakei, williamsii elongata, and nevadensis superba, only a few specimens have been seen, and a better knowledge of the larvae may result in changes in this section of the key.

Key to Genera

1a. Warts i, ii, and iii with setae of two kinds, short black spine-like setae scattered among longer usually pale setae; warts dull, not polished; dorsal abdominal setae smooth - Genus APANTESIS

1b. Dorsal warts without short black spine-like setae; all setae similar; warts dull or polished; dorsal abdominal setae usually barbed - Genus CALLARCTIA

Key to Subgenera of Callarctia

2a. Warts dull, gray or brown, not polished; setae finely barbed; dorsal stripe distinct; wart i one-third to one-fifth of ii, with 12 - 20 setae - Subgenus MIMARCTIA - 4

2b. Warts usually polished; setae coarsely barbed, sometimes smooth - - - - 3

3a. Warts dull, not highly polished; dorsal abdominal setae usually smooth; wart i one-third to one-fourth of ii, with 15 - 24 setae; a reddish dorsal stripe or series of spots - - - - - - - - - - - - - Subgenus NOTARCTIA

(One species, Callarctia proxima)

3b. Warts polished, ii with a broad shiny base; setae usually coarsely barbed - - - - - - - - - - - - - - - - - - - Subgenera CALLARCTIA and HOLARCTIA - - 5

Key to Species of the Subgenus Mimarctia

4a. Dorsal and subdorsal stripes distinct, subspiracular wavy; setae pale; wart i with 13 - 20 setae - - - - - - - - - - - - - - - - - - -

ly indicated on thoracic segments, rarely on abdominal; prothoracic setae mostly black; setae below spiracles reddish; setae above spiracles usually black, sometimes reddish - virguncula

8b. Wart i with 20 - 30 setae; spiracles usually orange or yellow; lateral and sometimes dorsal warts usually tipped with reddish or yellow; dorsal stripe or spots of cream or yellow often present; setae below spiracles and most prothoracic setae reddish, above blackish or reddish - - - - - - - - - virgo

9a. Lateral warts tipped with yellowish - 10

9b. Lateral warts not tipped with pale color - - - - - - - - - - - - - - - - - 12

10a. Wart i less than one-fourth of ii - 11

10b. Wart i more than one-fourth of ii; skin mottled; pale subdorsal stripe between ii and iii; dorsal stripe or series of spots - - - - nevadensis (?)

11a. Dorsal stripe or series of spots sometimes present; spiracles usually yellow-centered; wart i one-fourth to one-sixth of ii (with 18 - 24 setae) - parthenice

11b. Dorsal stripe distinct; pale subdorsal between warts ii and iii; skin mottled; spiracles black; setae pale; wart i one-fourth to one-fifth of ii, with 15 - 18 setae - blaksi

12a. Wart i with 18 or less setae - 13

12b. Wart i with 16 - 25 setae - 14

13a. A dorsal series of reddish dashes; setae all black; some setae smooth, not barbed; wart i one-fourth to one-sixth of ii, with 15 - 18 setae- placentia

13b. No dorsal stripe; setae pale; wart i one-third to one-fourth of ii, with 13 - 18 setae - *williamsii elongata*

14a. Pale subdorsal stripe between ii and iii; dorsal stripe or series of spots; skin mottled; spiracles black; setae mostly brownish; wart i one-third to one-fourth of ii - *nevadensis superba*

14b. No subdorsal stripe; faint dorsal stripe on thorax; spiracles and warts black; wart i one-third to one-fourth of ii, with 18 - 23 setae - - - - 15

15a. Mature larva 25 - 35 mm. long; setae all dark red-black, or reddish below spiracles; no dorsal stripe on abdomen; dorsal setae often sparsely barbed or smooth - *celia*

15b. Mature larva 40 mm. or longer; setae all reddish-brown to black - - - - 16

16a. Dorsal abdominal stripe sometimes present; setae red-brown or gray-brown; wart i with 18 - 22 setae - *figurata*

16b. No dorsal abdominal stripe; setae blackish-brown to black; wart i with 18 - 23 setae - *anna*

VIII. PUPAE.

The pupae are light brown to almost black in color, dusted with a powdery whitish bloom. The cast larval skin usually adheres to the caudal end. Clusters of minute sharply-pointed setae (ss), inconspicuous or indistinguishable except on the lighter pupae, indicate the positions of the larval warts. The surface of the head and thorax is lightly reticulated or rugose; the abdomen is finely punctate.

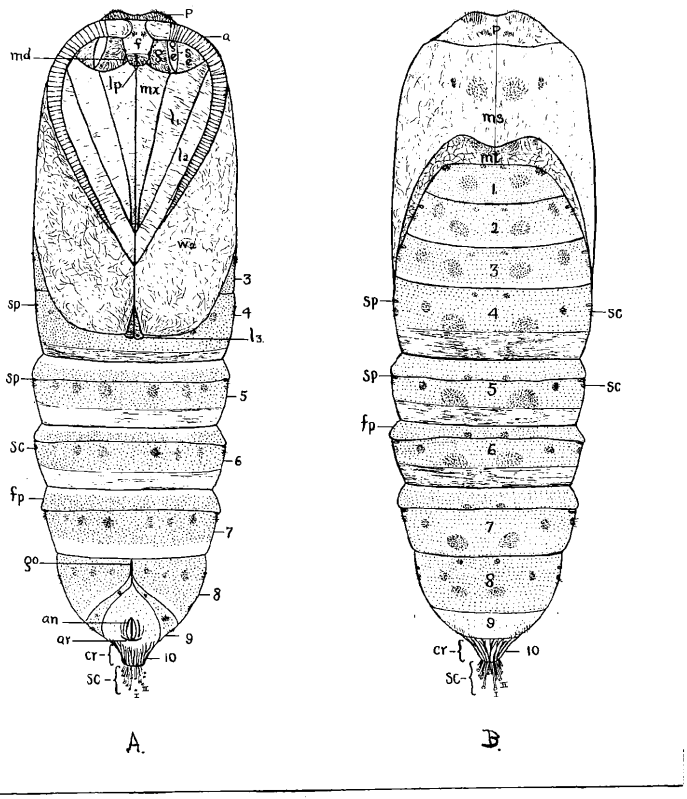


Figure 4. Pupa of Apantesis phalerata, female.

A. Ventral aspect. B. Dorsal aspect. a - antenna. an - anus. ar - anal rise. cr - cremaster. fp - flanged plate. f - fronto-clypeus. g - gena. ge - glassed eye-piece. go - female sexual opening. l - labrum. lp - labial palpi. l_1 - prothoracic leg. l_2 - mesothoracic leg. l_3 - metathoracic leg. md - mandible. ms - mesothorax. mt - metathorax. mx - galea of maxilla. p - prothorax. sc - spines of cremaster. se - sculptured eye-piece. sp - spiracle. ss - setal scar. w - mesothoracic wing.

Between and caudad of the bases of the antennae (fig. 4, a) lies the convex fronto-clypeus (f), with a pair of slightly elevated tubercles or prominences. These are located mesad of the bases of the antennae, and each bears a few minute setae. The labrum (l) is demarked from the fronto-clypeus by a faint clypeolabral suture, and may be rounded or slightly bilobed on its distal margin. The mandibles (md) are small areas indistinctly demarked on each side of the labrum. Laterad of the labrum is the gena (g); between the gena and the antenna is the compound eye. The eye is distinctly divided into a mesal lunate glazed eye-piece (ge) and a lateral sculptured eye-piece (se). The labial palpi (lp) are represented only by a minute triangular area caudad of the labrum. The maxillae (mx), which extend for two-thirds of the length of the wing, are elongate and adjacent on the meson. The antennae (a), which lie next to the wings, are approximately the same length as the maxillae.

The pronotum is nearly two-thirds the length of the mesonotum. Two slightly elevated cephalic lobes bear numerous but conspicuous setae. The prothoracic leg (l_1) which lies laterad of the maxilla is slightly shorter than the latter, while the mesothoracic leg (l_2) is noticeably longer. The metathoracic leg (l_3) is visible only beyond the caudal margin of the wings. The mesothoracic wings (w) are adjacent on the meson, extend well beyond the third segment on the ventral aspect, and are approximately half as long as the pupa. The metathorax is very short, and the wings are visible only from the dorsal aspect as narrow areas mesad of the mesothoracic wings.

Ten abdominal segments are discernible. Segments one to four and seven to ten are rigid and motionless. Motion is possible only between segments four and five, five and six, and six and seven. On the caudal margin of each of segments four to six is a narrow band, finely and transversely striated, which apposes the flanged plate (fp) on the cephalic margin of the following segment. Spir-

acles (sp) are present on segments two to eight, just below the flanged plate when that is present. Segments eight, nine, and ten are indistinctly separated. The female has a longitudinal slit-like sexual opening (go) on the ventral aspect of the eighth segment, adjacent to the posterior margin of the seventh; the sexual opening of the male is on the ninth segment some distance from the posterior margin of the eighth. In the female, segments nine and ten are extended forward mesally as far as the sexual opening. The anal opening (an) is on the tenth segment, usually on a prominent anal rise (ar) and often surrounded by lobes or folds. The tenth segment is prolonged into a blunt cone-like or a cylindrical spine-like cremaster (cr), armed with a variable number of slender spines with flattened apices (sc). According to Mosher's definition (1916), the length of the cremaster is measured on the ventral surface from its apex to its juncture with the curve of the body. The cremaster is distinctly separable into two lateral lobes, and since it is fundamentally bilaterally symmetrical, the spines on one lateral lobe are paired with spines similar in size and position on the opposite lobe. The symmetry, however, is not always exact, for the members of a pair may vary slightly in length or in position, and in the case of the smaller spines, one member may not be present.

Specific characters occur largely in the sculpturing of the cremaster, its length in relation to its width, and in the number and arrangement of the spines. In order to facilitate comparisons and descriptions of the pupae, it has been found necessary to designate the larger spines in some way. For this reason, the most distinct or so-called primary spines have been numbered according to their size. The number I always represents the longest pair, regardless of its position. Only the three or four longest pairs are of sufficient importance to merit designation. No attempt has been made to homologise the spines in the various species, although it is evident that spines I, II, III, and IV are actually

homologues in many of the species.

Key to Genera

1a. Cremaster often indistinct, usually shorter than wide; sides of cremaster not tuberculate, but marked with numerous strong longitudinal ridges at least as long as spines of cremaster; spines only at apex of cremaster

genus APANTESIS

1b. Cremaster usually longer than wide; sides of cremaster tuberculate, smooth, or marked with short ridges; spines sometimes along lateral margins - genus CALLARCTIA - - 2

Key to Subgenera of Callarctia

2a. Spines only at apex of cremaster - 3

2b. Spines along lateral margins of cremaster - - - - - - - - - - - - - - - 4

3a. Cremaster indistinct, wider than long; the sides sloping and marked with short ridges - subgenus NOTARCTIA

(One species, Callarctia proxima)

3b. Cremaster distinct, usually longer than wide; the sides nearly parallel at least at apex, and smooth or tuberculate - - - - - subgenus CALLARCTIA

4a. Spines conspicuous, at least a few nearly as long as cremaster is wide - subgenus MIMARCTIA

4b. Spines inconspicuous, not half as long as cremaster is wide - - - - - - - -

- - - -

unmodified. Female genitalia: ductus bursae entirely membranous, or armed with a single small dorsal plate, or two strongly curved lateral plates, or a complete narrow ring, free from genital plate; bursa copulatrix with four small circular signa composed of several concentric circles of minute teeth.

Color pattern: veins of primaries concolorous with rest of wing or partially or completely lined with pale scales; median vein never broadly lined unless other veins are also lined; transverse stripes four or less, complete from costa to inner margin, or incomplete; markings on primaries of some females reduced to a few white spots.

Larva: setae from dorsal warts all similar, never with many short setae mixed with longer ones; warts often shiny; dorsal setae usually barbed, sometimes smooth or sparsely barbed.

Pupa: sides of cremaster tuberculate, smooth, or with short ridges which never exceed the spines of the cremaster in length; cremaster usually distinct, longer than wide; spines at apex or along sides.

The subgenus Mimarctia Neumoegen & Dyar

Type of the subgenus, Callarctia arge (drury)

Arctia Shrank (in part). Hubner, 1816, Vers. bek. Schmett., p. 163.... Kirby, 1892, Syn. Cat. Lep. Het. I, pp. 266-7, - Apantesis Walker.

Eyprepia Ochsenheimer (Mimarctia Neumoegen & Dyar). 1894, Jour. N. Y. Ent. Soc. II, p. 9.... Dyar, 1897, Can. Ent. 29, p. 215, - Euprepia Ochsenheimer.... Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 43, - Arctia Shrank.

Female genitalia (pl. iv, f. 3): ductus bursae membranous throughout, unarmed. Male genitalia: aedeagus unarmed, evenly sclerotized throughout; clasper diamond-shaped, the ends pointed; juxta bilobed, broader than long, with a med-

ian thickening.

Color pattern: veins of primaries completely lined with pale scales; costal stripe wide, extending to radius.

Larva: warts dull, grey or tan, not polished; setae finely barbed.

Pupa: spines on lateral margins of cremaster as well as at apex; spines elongate, at least a few nearly as long as cremaster is wide; sides of cremaster finely striated.

1. Callarctia arge (Drury)

Plate IX

Noctua arge Drury. 1770, Ill. Exot. Entom. I, pp. 35-36, pl. 18, f. 3.

Bombyx dione Fabricius. 1775, Syst. Ent., p. 572.

Noctua incarnato-rubra Goeze. 1781, Entom. Beytr. IV, p. 241, = arge Drury.

Bombyx coelebs Martyn. 1797, Psyche, pl. 11, f. 25.— Kirby, 1892, Syn. Cat. Lep. Het. I, pp. 266-7, = arge Drury.

Phalaena dione (Fabricius). Smith & Abbot, 1797, Lep. Ins. Ga. II, pp. 125-6, pl. 63, = arge Drury.

Euplagia dione (Fabricius). Hubner, 1816, Verz. bek. Schmett., p. 180.

Spilosoma arge (Drury). Westwood, 1837, Ed. Drury Ill. Exot. Entom. I, pp. 33-43, pl. 18, f. 3.

Arctia arge (Drury). Hubner, 1816, Verz. bek. Schmett., p. 283— Harris, 1841, Rept. Ins. Mass., pp. 244-5.— Saunders, 1863, Can. Jour. n. s. VIII, pp. 255-6 (desc.).— Stretch, 1872, Zyg. & Bomb. N. A., pp. 225-227, pl. 9, ff. 11, 12 (desc.).— Coquillet, 1881, Trans. Dept. Ag. Ill. 18, App. p. 170 (biol.).— Edwards, 1889, Bull. U. S. N. M. 35, p. 58 (biol. biblio.).— Smith, 1890, Can. Ent. 22, pp. 11-12 (biblio.).— Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, pp. 379-380, pl. XVI,

f. 4 (desc.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 36-37, 47 (biol.).— Seifert, 1902, Jour. N. Y. Ent. Soc. X, pp. 1-10, pls. I-II, 36 figs. (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. II, ff. 16, 17.

Chelonia dione (Fabricius). Boisduval, 1868, Ann. Soc. Ent. Belge XII, p. 77.

Arctia dione (Fabricius). Neumoegen, 1883, Papilio III, pp. 148-151, = sp. dist.— Smith, 1887, Entom. Amer. III, pp. 109-112, = arge.

Apantesis arge (Drury). Kirby, 1892, Syn. Cat. Lep. Het. I, pp. 266-7.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 199 (desc.).— Gibson, 1903, Can. Ent. 35, pp. 122-3 (biol.).— Rummel, 1919, Bull. Ekln. Ent. Soc. XIV, pp. 62-3 (biol.).... Holland, 1922, Moth Book, p. 130, pl. XV, f. 15.— Huard, 1929, Natur. Canad. 57 (1), pp. 59-61 (desc., distr.).

Euprepia Ochsenheimer (Callarctia Packard) arge (Drury). Dyar, 1893, Psyche VI, p. 379.

Eyprepia Ochsenheimer (Mimarctia Neumoegen & Dyar) arge (Drury). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 9.

Arge is a distinctly marked, though variable, species, rarely confused with any other, for the pale markings on the primaries are unusually wide and reduce the black to small triangles or short dashes. It can readily be distinguished from doris (Bdv.), its nearest ally, by the greater width of the stripe on the median vein, which is approximately as wide as SM; by its whitish color, usually flushed with pale pink; by the triangular shape of M in the end of the cell; and by the strongly-angled PM, which forms with M a distinct X-shaped mark.

Male. Body, secondaries, and markings of primaries white faintly flushed with pink; vertex of head immaculate, palpi black, sometimes marked with whitish, antennae black or dark-brown, frequently covered with pale scales; patagia spot-

ted, thorax above with three black stripes, below mostly whitish, prothoracic coxae and anterior faces of femora of all legs flame-colored with black spots, tibiae and tarsi black with various whitish markings; primaries black with all veins, costal and inner margins, SM, transverse bands, and fringes whitish, costa sometimes streaked with flame, markings of wing broad, black interspaces often greatly reduced, M complete, PM usually complete from C to SM or below, very sharply angled outwards at lower angle of cell, forming with M a distinct X-shaped mark, R a triangular spot in the cell or a toothlike prominence on R, AM usually extending across cell, or toothlike, or absent; secondaries whitish, often tinged with pink, sometimes almost immaculate with only one or two minute black spots but usually with a variable number of small, sometimes large, marginal, submarginal, and discal spots, the spots rarely coalesced; wings below whitish, with marks as above and an additional black spot or dash on costal margin of secondaries, the costa of primaries with pale-salmon to bright flame-colored streak; abdomen concolorous with secondaries, or pale salmon, with dorsal, lateral, and two ventral rows of black spots, the dorsal row sometimes forming a stripe.

Antennae narrowly bipectinate, the branches of the antennae scarcely longer than the width of the shaft; in most other species of the genus, the antennae of the male are broadly pectinate, with branches twice as long as the width of the shaft.

Male genitalia (pl. IV, f. 1). Juxta with median thickening; uncus cylindrical on apical half, shoulders gradually narrowed, membranous area in proximal portion an inverted T, clearly outlined; tegumen with median thickening at least at proximal margin, distal margin often discontinuous at apex; clasper 2.5-3 mm. long, bluntly pointed, ventral margin shallowly concave between harpe and apex; harpe strongest on dorsal two-thirds of clasper, with a slight emargination on proximal side, a third distant from dorsal margin.

Female. Like the male, but usually larger and with black interspaces of primaries more reduced. Genitalia: pl. IV, f. 3.

Wing-expanse: Male: 34 - 52 mm.; female: 42 - 60 mm.

Callaretia arge ab. nervosa (Neumoegen & Dyar)

Euprepia arge var. nervosa Neumoegen & Dyar. 1893, Ent. News IV, p. 142.

Arctia arge (Drury). Grote, 1875, Can. Ent. VII, p. 196. 1904, Ent. News XV, p. 110.

Arctia arge (Drury) var. strigosa Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. VIII, f. 20.

(non) Bombyx strigosa Fabricius. 1793, Ent. Syst. III (1), p. 454.

A melanotic aberration, with the spots of the secondaries more or less fused, typically entirely so with only the veins pale, the transverse bands and W of primaries reduced or entirely wanting, and only the margins, veins, and SM pale; northern forms, especially early spring individuals, usually exhibit some tendency toward melanism.

Types. arge Drury; female holotype from N. Y., evidently lost;
female neotype, from Wis.,
deposited in U. S. N. M.
nervosa N. & D.: male holotype; U. S. N. M.

Distribution. From Nova Scotia to Florida, west to southern Ontario, Minnesota, eastern Nebraska, southwestern Colorado, and Texas. A single specimen from Guatemala City, 5000 feet, in the University of Minnesota collection. Reported from California and Vancouver, but these records have not been verified and may refer to doris Edw.

Locality records. CANADA: N. S.: Orange Co. ONT.: Ottawa, Toronto. QUE.: Montreal. UNITED STATES: ME.: Seekonk, Kennebunkport. NH: Webster. MASS.: Nahant, Weston, Amherst. CONN.: Storrs. N.Y.: Rochester, Ithaca, Albany, Binghamton. N.J.: Newark, Patterson. PA.: New Brighton, Jeannette. OHIO: Cleveland. VA.: Norfolk, Falls Church. GA.: Atlanta. N.C.: Raleigh, So. Pines, Wilmington, Black Mts. FLA.: DeFuniak Springs. W.VA.: Charlestown. KY.: Henderson. ARK.: Rogers, Hope. IND.: Lafayette. ILL.: Urbana, Decatur. MO.: St. Louis. IOWA: Sioux City. KANS.: Onaga. WIS.: Milwaukee. MINN.: Arnalea. OKLA.: Stillwater. MISS.: Greenville. COLO.: SW. TEX.: College Station, Gerrville, Dallas, Houston. GUAT.: Guatemala City.

Remarks. Arge is one of the commonest and most widely distributed species of the genus. There are two generations a year in the north, three in the south. Adults appear from April to May and from July to August in Illinois, in May and August in N. H., and in March, May, August, and October in N. C.

2. Callarctia doris (Boisduval)

Plate IX.

Chelonia doris Boisduval. 1869, Ann. Soc. Ent. Belge XII, p. 77.

Chelonia nerea Boisduval. 1869, loc. cit., p. 77.

Arctia michabo Grote. 1875, Can. Ent. VII, pp. 196-7.— Grote, 1886, Can. Ent. XVIII, pp. 108-9.— Smith, 1890, Can. Ent. XXII, p. 33 (biblio.).— Beutenmuller, 1898, Bull. Amer. Mus. N. Y. X, p. 380 (desc.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35-6, 47 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 7, pl. VIII, ff. 7-9.

Arctia arge ab. michabo (Grote). Neumoegen, 1893, Papilio III, p. 151.

Arctia doris (Boisduval). Edwards, 1887, Entom. Amer. III, p. 227-8.

Arctia nerea (Boisduval). Edwards, 1887, loc. cit., p. 227-8.

Apantesis nerea (Boisduval). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 266.

Apantesis michabo (Grote). Kirby, 1892, loc. cit., p. 266.

Apantesis doris (Boisduval). Kirby, 1892, loc. cit., p. 266.— Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI (2), p. 15.

Euprepia michabo (Grote). Dyar, 1893, Psyche VI, pp. 379.

Euprepia (Callarctia) michabo (Grote). Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 7.

Euprepia (Mimarctia) nerea (Boisduval). Dyar, 1894, loc. cit., p. 9, = arge Drury.

Euprepia (Mimarctia) doris (Boisduval). Dyar, 1894, loc. cit., p. 9, = arge Drury.

Apantesis michabo (Grote). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 398-9 (desc.).— Gibson, 1903, Can. Ent. 35, p. 116 (biol.).— Barnes & McDunnough, 1915, Can. Ent. XLVII, pp. 271-274 (biol.).— Seitz, Macrolep. World VI, p. 305, pl. 38 l.— Holland, 1922, Moth Book, p. 130, pl. XV, f. 17.— (Apantesis michabo (Grote).) Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI (2), p. 15, = nerea (Boisduval).

Apantesis doris form nerea (Boisduval). Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI (2), p. 15.

Doris is closely related to arge (Drury), but has the black markings of primaries less reduced, the secondaries a deeper red with larger spots, M an oblique band across the cell, the stripe on the median vein much narrower than SM, and a less distinct terminal X-mark on the primaries. It bears a superficial resemblance to small specimens of C. virgo (L.), but can easily be distinguished by the broad costal band of the primaries which extends to R.

Male. Head, thorax, and markings of primaries pale buff to deep salmon; ab-

domen and secondaries usually a deeper salmon; vertex of head immaculate, palpi black, sometimes partly buff, antennae black or brownish; patagia spotted, thorax above with three black stripes, below clothed with long salmon and black hairs, fore coxae bright salmon with a large black spot, femora of all legs buff or salmon, with apex and a basal spot black, tibiae black, more or less streaked with buff below, tarsi black; primaries deep black with all veins, costal and inner margins, fringes, SM, and transverse bands pale buff to deep salmon-color, stripe on median vein of variable width, but much narrower than SM, W complete, PM usually complete from C to SM, not extending below SM, angles outwards at lower angle of cell but not as sharply as in argo, M sometimes absent, when present a distinct oblique band usually extending from C to median vein, occasionally below cell, AM often present from C across cell, or merely indicated at C; secondaries usually deeper salmon than markings on primaries, with two or three small terminals, three larger subterminals, and one to four discals, occasionally fused to a variable extent; wings below a uniform buff or salmon with dull black markings as above, costa of primaries especially with a conspicuous streak of bright flame; abdomen concolorous with secondaries, with dorsal, lateral, and ventral rows of small spots, the dorsal rows sometimes forming a continuous line.

Male genitalia. (pl. IV, f. 2). Juxta with distal margin concave to half its depth, sides narrow, usually with a median thickening; uncus cylindrical for apical half, basal third broadly expanded, membranous area in proximal portion V-shaped, with a narrow median extension; tegumen with a median thickening, apical margin continuous; clasper abruptly concave on ventral margin distad of harpe, forming a right or acute angle, the distal portion of clasper a strongly curved, narrow finger-like lobe, clasper widest above harpe, about 3 mm. long; harpe low, transverse, with a short longitudinal ridge above harpe along dorsal margin;

aedeagus short, thick, sharply bent at almost right angles just above middle.

Female. Like the male.

Wing-expanse. Male and female: 34-47 mm., averaging 45 mm.

Callarctia doris form minea (Slosson)

Arctia minea Slosson. 1892, Ent. News III, p. 259.

Hyprepia michabo var. minea (Slosson). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 7.

Apantesis michabo ab. minea (Slosson). Hampson, 1901, Cat. Lep. Phal. Brit. Mus., p. 398-9.

Apantesis doris minea (Slosson). Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI, p. 15.

Secondaries, pale markings of primaries, and ventral surfaces of wings suffused with deep salmon or flame; apparently a color form rather than a distinct race, since it occurs along with typical doris.

Types. Doris Boisduval: female; Oberthur collection.

nerea Boisduval: female; Oberthur collection.

michabo Grote: male holotype from Nebraska; British Museum.

minea Slosson: male ectype from Franconia, N. H.; U. S. N. M.

Pupa. (pl. VII, f. 2). Length 21-23 mm. Cremaster about 1 mm. long, apical half smooth and shiny, base strongly ridged; 8 primary setae, all short and stout: I near meson, II slightly shorter and just ventrad of I, two pairs (III) about the length of II, laterad of I and II and just below apex; numerous smaller and more slender setae laterally and dorsally.

Larva. Similar to arge, with a distinct dorsal line, subdorsals broken,

indistinct, or wanting, and uneven coarse blackish and yellowish setae; head black with antennae, mouthparts, epicranial suture, and cheeks pale; body darker than in argo, greyish black, with a black patch in front of wart ii of abdomen, lighter below; warts dull, not polished, dark grey or brown; wart i of abdomen 1/3 - 1/5 the size of ii, with 12-15 setae; a distinct cream-colored dorsal stripe; a subdorsal series of light spots below ii forming an interrupted line, more distinct in early instars, sometimes wanting; spiracles blackish, or with pale yellow or whitish centers; setae mixed black and brown above the spiracles, mostly yellowish from iv and below; setae long, uneven, coarser than in argo, densely but very finely barbed; all legs ochreous; mature larva about 40 mm. long. Barnes and McDunnough (1915) report 6 instars in the female, 5 in the male.

Recorded food-plants. Fed in captivity on Plantago and lettuce; normal food-plants not recorded, but probably a general feeder.

Distribution. From Maine to Florida, west to No. Dakota, Arkansas, Colorado, and Texas. In Canada, from Ontario to B. C. Boisduval in his "Lepid. Calif." recorded the originals of his species as "from the south", although doris has not since been reported from California.

Locality records. CANADA: ONT.: Hymers. MANIT.: Aweme, Rounthwaite, SASK.: Moose Jaw, Veteran. ALTA.: Calgary. B.C.: Kaslo. UNITED STATES: ME.: Kittery Pt., Lincoln. N.H.: Franconia. MASS.: Athol. MD.: Baltimore. PA.: Pittsburgh, New Brighton. N.C.: So. Pines. FLA.: Fort Meade, Archer, Gainesville. ARK.: Hope. IOWA: Sioux City. KANS. NEB. COLO. S.D.: Volga. TEX.: Dallas, Hockley.

Remarks. There are probably two generations a year. Adults appear in June and September in Arkansas, from May to June and in September in Canada, in March and April in North Carolina and Florida, and in August in Pennsylvania.

The subgenus Callarctia Packard

Type of the subgenus, Callarctia ornata Packard

Female genitalia: ductus bursae armed with two lateral strongly curved plates. Male genitalia: aedeagus unarmed, evenly sclerotized throughout; clasper diamond-shaped, ventral margin distad of harpe concave; juxta bilobed, broader than long, uniform throughout.

Color pattern: veins of primaries lined with pale scales or concolorous with wing; markings of primaries reduced in some females to a few white spots; costal band when present never extending to radius.

Larva: warts shiny, ii with a broad polished base; setae usually coarsely barbed, but sometimes smooth in some individuals.

Pupa: spines only at apex of cremaster; sides of cremaster smooth or tuberculate; cremaster distinct, usually longer than wide.

3. Callarctia virgo (Linnaeus).

Plate IX.

Bombyx virgo Linnaeus. 1758, Syst. Nat. I, ed. X, p. 501.

Phalaena virgo (Linnaeus). Smith & Abbot, 1797, Lep. Ins. Ga. II, pp. 123-4, pl. 62.

Euplagia virgo (Linnaeus). Hubner, 1816, Vers. bek. Schmett., p. 130.

Arctia virgo (Linnaeus). Harris, 1835, in Hitchcock's Cat. Animals and Plants Mass., pt. IV, p. 593.— Saunders, 1863, Can. Jour. n. s. VIII, pp. 354-5 (desc.).— Stretch, 1872, Zyg. & Bomb. N. A., pp. 126-8, pl. 6, ff. 1, 2 (desc., biol.).— Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, pp. 377-8, pl. XVI, f. 3 (desc., biol.).— Dyar, 1900, Jour. N. Y.

Ent. Soc. VIII, pp. 35-6, 46 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 13, pl. VIII, f. 5.

Apantesis virgo (Linnaeus). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 266.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 396-7 (desc.).— Gibson, 1902, Can. Ent. 34, pp. 23-25 (biol.).— Gibson, 1903, Can. Ent. 35, pp. 113-4, pl. V (biol.).— Gibson, Can. Ent. 37, pp. 337-8 (biol.).— Holland, 1922, Moth Book, p. 129, pl. XV, f. 11.— Seitz, 1918-25, Macrolep. VI, p. 304, pl. 38 1.— Banderman, 1929, Intern. Entom. Zeits. 23, pp. 346-7, fig., pp. 460-461 (biol.).— Huard, 1929, Natur. Can. 57 (1), pp. 64-5, f. 33 (desc., dist.).

Euprepia virgo (Linnaeus). Dyar, 1893, Psyche VI, p. 379.

Eyprepia (Callarctia) virgo (Linnaeus). Neumoegen & Dyar, Jour. N. Y. Ent. Soc. II, pp. 6-7.

Apanresia virgo (Linnaeus). Kellogg, 1914, American Insects, p. 413, pl. VI, f. 3.

Virgo is the largest species of the genus, occasionally confused with parthenice (Kirby) from which it is easily separated by the width of the lining of the median vein, which is wider than the anal, and by the presence of more than one discal spot, one of which lies on the origin of Cu ; from Michabo (Grote), which may resemble it, it is distinguished by the narrower costal stripe which does not extend to R.

Male. Head, thorax, and markings of primaries pale ochreous; secondaries and abdomen deep red with black maculation; vertex immaculate, palpi and sides of frons black, antennae brownish; patagia spotted, thorax above with three black stripes, below mostly blackish, legs sometimes marked with ochreous; primaries deep black, with C, IM, SM, fringes, transverse bands, and all veins pale ochreous, median vein more broadly lined than anal, with the pale scales not restrict-

ed to the vein, W complete and attaining outer margin. PM usually complete from C to SM, strongly angled outwards, sometimes broken, M parallel to upper PM and extending from C or R across cell or below, AM from C to SM or only in cell or absent; secondaries deep red, fading to lighter red, with usually large black spots, costal margin black, two or three triangular marginals, three large rounded submarginals, the apical usually fused with apical marginal to costal streak, at least two discals, one at end of cell and one at origin of Cu_2, the second sometimes scarcely indicated, several other discals usually present, the spots sometimes more or less coalesced into discal dashes; wings below as above, the red less distinct; abdomen, above the color of secondaries with a black dorsal stripe, below entirely black or with a median ochreous patch or the segments sometimes edged with ochreous.

Genitalia. (pl. III, f. 1). Juxta bilobed, twice as broad as long; uncus slender, pointed, shoulders rounded, membranous area a V with widely divergent arms and a median projection; clasper 4-5 mm. long, apex bluntly pointed, ventral margin above harpe shallowly concave; clasper strongly developed, extending obliquely across harpe, as a sinuate ridge nearly as high as width of tegumen.

Female. Like the male, but secondaries and abdomen usually a deeper red and antennae black.

Wing-expanse. Male: 42-60 mm.; female: 45-75 mm.

Callarctia virgo ab. citrinaria (Neumoegen & Dyar)

Arctia virgo (Linnaeus). Graef, 1878, Bull. Bkln. Ent. Soc. I, p. 4.— Graef, 1882, loc. cit. IV, p. 58.— Hulst, 1883, loc. cit. VI, p. 71.

Euprepia virgo var. citrinaria Neumoegen & Dyar. 1893, Ent. News IV, p. 142.

Euprepia virgo var. citrinaria Neumoegen & Dyar. Neumoegen & Dyar, Jour. N. Y. Ent. Soc. II, pp. 6-7.

Arctia virgo var. citrinaria (Neumoegen & Dyar). Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, pp. 377-8.

Apantesis virgo var. citrinaria (Neumoegen & Dyar). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 398-9.

Like the typical form but with yellow secondaries.

Callarctia virgo ab. simplex (Stretch)

Plate IX.

Arctia virgo var. simplex Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 14, pl. VIII, f. 4.

Apantesis virgo ab. simplex (Stretch). Barnes & McDunnough, 1918, Checklist of the Lepid. Boreal America, p. 34.

Like the typical form, except that M of the primaries is lacking, and PM is frequently broken or absent.

Types. virgo Linnaeus: female holotype evidently lost.
female neotype from Harrison, Me., 8/12/20, deposited in U. S. N. M.
citrinaria N. & D.: female holotype, No. 33683, U. S. N. M.

Pupa. (Pl. VII, Fig. 6). Length of pupa 30-33 mm.; cremaster about 2 mm. long, very rough and corrugated on all aspects, with strong basal ribs; spines of cremaster in two prominent transverse rows: the dorsal row composed of four nearly twice as long as those in the ventral row, the ventral row composed of 4-6 pairs, decreasing slightly in length from mesal to lateral pairs, several smaller spines mesad of I and scattered among the others.

Larva. A large black and reddish or all reddish larva, usually with a

yellow dorsal stripe or spots and warts tipped with yellow; head black, with epicranial suture, cheeks, antennae, and mouthparts pale; body deep velvet black to blackish-brown, sometimes mottled with paler brown, lighter below; warts i and ii of abdomen usually black or dark brown, sometimes reddish or tipped with yellow, ii with a broad shiny base, iii and iv reddish or black tipped with yellow, occasionally all black, v and vi reddish or tipped with yellow or whitish, vii and viii reddish, sometimes almost black; yellow, cream, or flesh-colored dorsal stripe often present, sometimes broken into spots; wart i of abdomen 1/3 - 1/4 of ii, with 20-30 setae; spiracles orange or yellow with a black rim, sometimes all black; setae from iv or from upper part of v and above usually black, sometimes all reddish, below reddish, setae from thoracic shield reddish; setae stiff, distinctly barbed; thoracic legs blackish, prolegs reddish; length of mature larva 45-60 mm.; 8 instars recorded by Banderman (1929).

Recorded food plants. Fragaria, Chenopodium, Thermopsis rhombifolia, Gramineae, Simplocarpus foetidus, Epilobium latifolium, Mimosa.

Distribution. Widely distributed in Canada from Nova Scotia to British Columbia, and in the United States from Maine to Florida and west to Colorado and Utah.

Locality records. CANADA: N.S.: Halifax, Digby. N.B.: St. Johns. QUE.: Montreal. ONT.: Toronto, Kingston. MAN. SASK.: Nosthern. ALTA.: Edmonton, Calgary, Blackfalds. B.C.: Field. UNITED STATES: ME.: Kittery Pt., Orono, Sebec Lake. N.H.: Webster, Franconia. VT.: Bradon. MASS.: Amherst, Nantucket. R.I.: Westerley. CONN.: Ivoryton. N.Y.: Buffalo, Ithaca, Albany, Poughkeepsie, Catskill Mts., L. I. N.J.: Ramsay. PENNA.: Pittsburgh. N.C.: Black Mts. GA.: Atlanta. FLA.: Fort Meads. OHIO: Columbus. MICH.: Midland Co., Cheyboygan Co. ILL.: Chicago, Decatur. WIS.: Milwaukee, Plymouth. MINN.: St. Peter, Crookston, Cass Lake, Pine City. IOWA. COLO.: Durango. UTAH:

Provo.

Remarks. Virgo is the largest, and one of the commonest and best-known species of the genus. The yellow-winged aberration is rather rare, although simplex forms occur rather commonly, especially among females. There is considerable difference in size between northern and southern individuals. The wide lining of the median vein is the most dependalbe diagnostic character, since the discal spot at the origin of Cu_2 is occasionally wanting, and occurs very rarely in parthenice.

Adults occur from May to October but are most abundant in July and August. There appears to be but a single generation.

4. Callarctia parthenice (Kirby)

Plate IX.

Callimorpha parthenice Kirby. 1837, Faun. Bor. Amer. IV, p. 204.

Arctia virgo var. ? parthenice (Kirby). Walker, 1855, Cat. Lep. Het. Brit. Mus. III, p. 608.

Arctia virguncula (Kirby). Saunders, 1863, Can. Jour. n.s. VIII, pp. 357-8.— Grote, 1864, Proc. Ent. Soc. Phil. III, pp. 75-77, = saundersii Grote.

Arctia saundersii Grote. 1864, Proc. Ent. Soc. Phila. III, pp. 75-7, p. 323-4, pl. 4, f. 3.— Saunders, 1873, Rept. Entom. Soc. Ont. 1873, p. 28, f. 16 (biol.).— Snow, 1875, Trans. Kans. Acad. Sci. IV, p. 38, = parthenice.— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 15.

Arctia parthenice (Kirby). Snow, 1875, Trans. Kans. Acad. Sci. IV, p. 38.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 39-40 (biol.).

Apantesis parthenice (Kirby). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 266.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 397-8.— Gibson,

1903, Can. Ent. 35, pp. 116-7 (biol., dist.).— Gibson, 1905, Can. Ent. 37, pp. 339-43 (biol.).— Seitz, 1916-25, Macrolep. World VI, pp. 305-6.— Holland, 1922, Moth Book, p. 123, pl. XVI, f. 13.— Huard, 1929, Natur. Can. 57 (1), pp. 63-4 (dist., desc.).

Apantesis saundersii (Grote). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.

Hyprepia (Callarctia) parthenice (Kirby). Neumoegen & Dyar, Jour. N. Y. Ent. Soc. II, p. 8.

Hyprepia saundersii (Grote). Neumoegen & Dyar, 1894, loc. cit., p. 8, = parthenice.

Euprepia parthenice (Kirby). Dyar, 1897, Can. Ent. 29, p. 215.

Callarctia parthenice (Kirby). Goodhue, 1902, Ent. News 13, pp. 397-8.

(non) Callimorpha parthenice Kirby. Emmons, 1854, Nat. Hist. N. Y. V, pp. 227-8 (= virgo Linnaeus).

(non) Arctia parthenice (Kirby). Saunders, 1863, Proc. Ent. Soc. Phil. II, p. 28 (biol.) (=virgo Linnaeus).— Saunders, 1863, Can. Jour. n.s. VIII, pp. 353-4 (=virgo Linnaeus).

Parthenice is smaller than C. virgo, closely resembling it, but distinguished by the narrow lining of the median vein which is restricted to the vein itself, and by the presence of only a single discal spot, with a second indicated at the origin of Cu_2 only in rare iinstances.

Male. Head, thorax, and markings of primaries buff; abdomen above and secondaries deep to pale red with black spots; vertex immaculate, palpi and sides of frons black, antennae brownish; patagia spotted, thorax above with three black stripes, below mostly black, legs sometimes marked with ochreous; primaries deep black, with C, BM, SM, fringes, transverse bands, and all veins buff, median vein lined as narrowly as anal, the pale spaces confined to vein, W complete, often attaining outer margin, PM usually extending from C to SM, strongly

angled outwards, sometimes below SM, M from C or R to median, SM, or below or rarely absent, AM usually absent, sometimes extending from C to SM or below; secondaries deep red to lighter orange-red, rarely yellow, with two or three small marginals and three or four larger submarginals usually present, the apical spots usually fused, the submarginals rarely absent or all spots fused into a more or less regular border, a single lunate discal spot at end of cell, very rarely a spot indicated at origin of Cu_2, fringes buff; abdomen above red with a black dorsal stripe and anal segments frequently entirely black, below usually entirely black or with a median ochreous spot or sometimes with segments edged with ochreous or black transverse bars broken into spots.

Genitalia. (pl. III, fig. 2). Juxta scarcely bilobed, twice as broad as long; uncus slender, gradually tapering, shoulders rounded, membranous area a V with widely divergent arms and a broad median projection; clasper 4-5 mm. long, apex bluntly rounded, ventral margin above harpe shallowly concave; harpe well developed but lower than in virgo (Linnaeus), distinctly sinuate.

Female. Like the male, except that the antennae, abdomen below, and anal segments are entirely black; costal margin is often black beyond basal third.

Wing-expanse. Male and female: 32-58 mm.

Callarctia parthenice ab. approximata (Stretch)

Arctia approximata Stretch. 1885, Entom. Amer. I, p. 104.— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VIII, f. 6.

Apantesis approximata (Stretch). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 397, = parthenice (Kirby).

Eyprepia parthenice var. approximata (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 8.

Apantesis parthenice var. approximata (Stretch). Dyar, 1902, U.S.N.M. 52, p. 68.

Like the typical form except that PM is partially broken or entirely wanting; M entire, broken, or wanting.

Callarctia parthenice form intermedia (Stretch)

Arctia intermedia Stretch. 1873, Syg. & Bomb. N. A., p. 216, pl. IX, f. 3.— Grote, 1875, Can. Ent. VII, pp. 196, 7, = saundersii (Grote).— Neumoegen, 1883, Papilio III, pp. 148-151, = sp. dist.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 39, 89 (biol.).— Dyar, 1901, Jour. N. Y. Ent. Soc. IX, pp. 25-6.— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, ff. 22, 23, 26, pl. VIII, f. 11.

Arctia stretchii Grote. 1875, Can. Ent., VII, p. 197.— Neumoegen, 1883, Papilio III, pp. 148-151, = intermedia Stretch ?

Apantesis stretchii (Grote). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.

Apantesis intermedia (Stretch). Kirby, 1892, loc. cit., p. 267.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 397-8, = parthenice (Kirby).— Holland, 1922, Moth Book, p. 129, pl. XVI, f. 20, = sp. dist.— Barnes & Benjamin, 1925, Pan. Pac. Entom. I, p. 132.

Eyprepia (Callarctia) intermedia (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 7-8.

Eyprepia intermedia var. stretchii (Grote). Neumoegen & Dyar, 1894, loc. cit., p. 7-8.

Euprepia intermedia (Stretch). Dyar, 1897, Can. Ent. 29, vp. 215.

Arctia intermedia var. circa Stretch. 1906, Jour. N. Y. Ent. Soc., pl. V, f. 26.

Apantesis circa (intermedia auct.) (Stretch). Forbes, 1926, Ins. N. Y., p. 666.

A southern form somewhat larger than typical parthenice, although forming a gradual transition to it, and usually exhibiting a tendency toward reduction of the black markings through a widening of the transverse bands which more often extend below SM, and a reduction in the size of the black spots of the secondaries.

Types. parthenice (Kirby): type lost; male neotype from Delaware Water Gap, Pa., deposited in U. S. N. M.

saundersii (Grote): Canada West; male holotype, Acad. Nat. Sci. Phil. No. 7688.

approximata (Stretch): Canada; female holotype in Stretch collection.

intermedia (Stretch): Texas; probable male holotype in Stretch collection, Calif. Acad. Sci.

stretchii (Grote): Texas; male holotype No. 33682 in U. S. N. M.

Larva. A blackish larva with the warts tipped with yellow or reddish, setae black and reddish or all reddish, and occasionally with a dorsal line, head black with cheeks, epicranial suture, antennae, and mouthparts pale; body brownish to black; warts i and ii of abdomen black tipped with yellow or all black, iii black tipped with yellow or reddish, iv - viii reddish or black tipped with reddish; wart i of abdomen 1/4-1/6 of ii, with 17-24 setae; wart ii shiny with a broadpolished base; dorsal stripe faintly indicated on thorax, occasionally present on abdomen; spiracles all black or black with a paler center; setae all black, slightly brownish below, or all reddish, smoke-red from wart iv and above and tawny below iv, or black above the spiracles and reddish below; prolegs and thoracic legs reddish; setae distinctly barbed. Length of mature larva 35-50 mm.; 8 instars.

Distribution. In Canada, from Nova Scotia to British Columbia; in United

States from Maine to Florida, west to Montana, Colorado, and Utah.

Locality records. CANADA: N.S.: Fullerton. N.B.: St. Johns. QUE.: Gaspe. ONT.: Hymers, Ottawa, Toronto. MANIT.: Cartwright, Aweme, Guelph. SASK.: Saskatoon, Indian Head. ALTA: Calgary. B.C.: Vancouver, Victoria. UNITED STATES: ME.: Sebec Lake, Bethel, Bar Harbor. N.H.: Claremont, Franconia, New London. MASS.: Springfield, Newton, Nantucket. CONN.: Litchfield. R.I.: Westerly. N.Y.: Big India Valley, Catskill Mts., Buffalo, Plattsburgh, Ithaca, Oneonta, Mt. Marcy. N.J.: Plainsfield. PENNA.: Wyoning, White Mills, Honesdale. W.VA.: N.C.: Black Mts. OHIO: Dayton, Butler. KY. MICH.: Emmet, Mackinac, Chatham. WIS.: Indian Mound, Argonne, Bailey's Harbor. ILL.: Decatur, Quincy, Elizabeth. MINN.: Case Lake, St. Paul, Crookston, Duluth. IOWA: Sioux City. MO.: St. Louis. ARK.: Rogers. ALA. KANS. NEBR.: Lincoln. MONT.: Bozeman, Glacier Nat. Park, Hamilton, Havre. COLO.: Ouray Peak, Lookout Mt., Jefferson Co. (7000), Rio Blanco, Glenwood Springs. UTAH: Beaver Valley, American Fork, Logan, Orem, Hooper, Farmington. TEX.: Clifton, Kerrville.

Remarks. Adults appear from June to September, but are most abundant in August in the north. There appears to be but a single generation a year.

Between parthenice and intermedia there seems to be no more difference than that caused by climatic effects, for individuals from the north, i. e., Minnesota, are constantly small, while southern specimens from North Carolina and Texas are much larger, although there is no sharp line of difference between large and small specimens. The southern forms, and especially those from the southwest, exhibit a tendency toward completion of all the transverse stripes of the primaries, but northern forms, while characteristically with only M and PM, and these bands not extending below SM, may also have all transverse bands complete. Occasional small forms from the south and larger ones from the north can easily be explained by favorable or unfavorable conditions of food, temperature, or mois-

ture experienced by the individual larvae. It was thought at first that two species or races could be differentiated by the black or pale costa of the female, but the former type has been taken in Mich., Iowa, Minn., Pa., N. H., Colo., N. Y., Sask., B. C., Manit., Ont., Que., and Texas, and the latter in Ala., N. C., Ill., Ont., Iowa, N. Y., Pa., R. I., apparently without geographical boundaries and without regard to size differences. The anal segment of the males, which is either entirely black, or striped, was considered, but separation of about 200 adults on this character resulted in the placing of some specimens from one locality in one group, and other specimens of the same size, pattern, and taken in the same season at the same place in the other group. Apparently both of these characters - the costal edge of the female, and the anal segment of the male - are not specific, and although possibly Mendelian in character and predominant in certain localities, do not seem to be of any value in the segregation of species.

The male genitalia vary in size only with the size of the insect, not with the locality. While there is a high degree of variation in the genitalia, they cannot be separated into two distinct groups through such variation. The larvae likewise exhibit great differences among themselves, as regards color of the setae, presence or absence of the dorsal stripe, and coloring of warts, but no correlation can be found between the larva and adult that would indicate distinct species.

5. Callaretia anna (Grote)

Plate X.

Arctia anna Grote. 1863, Proc. Ent. Soc. Phil. II, p. 335, pl. 8, f. 1.— Streeker, 1875, Lep. Rhop. et Het. I, p. 106, = persephone Grote. Grote, 1875, Can. Ent. VII, p. 196, = sp. dist.— Streeker, 1876, Proc. Daven. (Iowa) Acad. Sci. II, p. 273, = persephone Grote.— Hulst, 1883,

Bull. Bkln. Ent. Soc. VI, pp. 69-71, = parthenice (Kirby).— Neumoegen, 1883, Papilio III, pp. 148-151, = persephone Grote.— Smith, 1889, Can. Ent. XXII, p. 10 (biblio.).— Packard, 1895, Jour. N. Y. Ent. Soc. III, pp. 178-180 (biol.).— Dyar, 1897, Psyche VIII, pp. 53-4 (biol.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 40, 46 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 11.

Apantesis anna (Grote). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 401-2.— Brehme, 1913, Ent. News 24, pp. 193-194, pl. VII, ff. 1-6.— Rummel, 1919, Bull. Bkln. Ent. Soc. XIV, pp. 62-63 (biol.).

Hyprepia (Callarctia) anna (Grote). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 8.

Euprepia anna (Grote). Dyar, 1897, Can. Ent. 29, p. 215.

(non) Arctia anna Grote. Packard, 1889, Guide to Study of Insects, p. 285 (= quenseli Payk.).

Anna is easily distinguished from any other species by the wholly black abdomen and secondaries, the presence of only one or two transverse bands, and the pale linings of the veins.

Male. Typical anna occurs only in the female sex.

Female. Head and thorax above and markings of primaries yellow; secondaries and abdomen entirely black, vertex immaculate, palpi, sides of frons, and antennae black; patagia spotted, thorax above with three black stripes, below entirely black; primaries deep black with IM, SM, transverse bands, and most veins yellow, costa sometimes streaked with yellow at base, M usually complete, PM extending from C or R to SM, angled outwards, M absent or present in cell or rarely beyond cell, pale lining on veins often obsolescent toward outer margin, fringes entirely yellow or partly black; secondaries wholly black; wings below

as above but linings of veins indistinct; abdomen entirely black.

Wing-expanse. 35-47 mm.

Callarctia anna form persephone (Grote)

Plate IX.

Arctia virguncula (Kirby). Walker, 1855, Cat. Lep. Het. Brit. Mus. III, p. 609.- Grote & Robinson, 1868, Trans. Am. Ent. Soc. II, p. 71, = persephone Grote.

Arctia persephone Grote. 1863, Proc. Ent. Soc. Phil. II, p. 433.— Grote, 1864, Proc. Ent. Soc. Phil. III, p. 77,vpl. I, f. 3 (type). Strecker, 1875, Lep. Rhop. et Het. I, p. 106, = anna Grote.— Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, pp. 378-9 (desc.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 12, pl. VII, f. 24, pl. IX, ff. 14, 15.

Apantesis persephone (Grote). Kirby, 1892, Syn. Cat. Lep. Het., p. 267.—

Hyprepia (Callarctia) anna var. persephone (Grote). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 8.

Apantesis anna persephone (Grote). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 401-2 (desc.).— Holland, 1922, Moth Book, p. 130-131, pl. XV, ff. 8, 10.— Seitz, 1918-25, Macrolep. VI, p. 305, pl. 39a.

Callarctia anna persephone (Grote). Goodhue, 1902, Ent. News 13, pp. 286-7.

Distinguished from typical anna by the yellow secondaries bordered or spotted with black; sometimes confused with ornata f. ochracea (Stretch), from which it is separated by the black ventral surface of the abdomen, which is spotted in ochracea.

Male. Head, thorax and markings of primaries light yellow, abdomen and secondaries deep yellow, vertex immaculate, palpi and frons black, antennae

blackish, often with ochreous scales; patagia spotted, thorax above with three black stripes, below entirely black, the legs sometimes spotted with ochreous; primaries deep black, with C, IM, SM, fringes, transverse bands, and all veins ochreous, median vein narrowly lined, W usually complete, PM extending from C or R to SM, M sometimes absent, but usually extending across cell, rarely below cell, AM often indicated at C but not extending below R; secondaries deep yellow, fringes yellow, costal margin black, a wide black terminal border usually present, sometimes broken into several large spots, usually a single lunate discal spot at end of cell, disc of wing often streaked with black with yellow reduced to one or several irregular patches, approaching typical anna; wings below as above, but pale linings of veins indistinct; abdomen yellow above with a broad black dorsal stripe, entirely black below.

Genitalia. (pl. III, fig. 3). Juxta scarcely bilobed, twice as broad as long; uncus slender, pointed, shoulders abrupt, membranous area transverse with a median extension; clasper 4 mm. long, apex pointed, ventral margin abruptly concave distad of harpe, making an obtuse angle; harpe well-developed, sinuate; a ridge parallel to and below harpe sometimes present; similar virguncula (Kirby), but ventral margin of harpe usually more concave; differs from figurata (Drury) chiefly in size.

Female. Like the male, but costa ochreous only at base and thorax entirely black below.

Types. anna (Grote): Penna., female holotype, Acad. Nat. Sci. Phil. No. 7685. A specimen at the Museum of Comparative Zoology from Packard's collection bears a type label, but the locality label indicates New York. Another specimen at U. S. N. M. Type No. 53681, from Neumoegen's collection, bears a label "Typicum specimen", with the word "Type" in Neumoegen's handwriting on the specimen label. The species was described from a single female, definitely stated to have

been collected in Pennsylvania, and to be in possession of the Entomological Society of Philadelphia.

persephone (Grote): male holotype, from Penna., No. 6886, Acad. Nat. Sci. Phil.

larva. A blackish larva without pale markings, head dark brown, with cheeks and mouthparts pale; body dark brownish-black, paler below; warts shiny deep black-brown or black; wart i of abdomen 1/3 - 1/4 of ii, with 18-23 setae; spiracles blackish, pale centered; setae black, slightly brownish, all of the same color; legs and prolegs brownish. Packard (1895) reports the setae yellow ventrally in the third instar. Length of mature larva about 40 mm. 8 instars.

Distribution. Southern Ontario; in United States from New England to Georgia and west to eastern Nebraska and Kansas.

Locality records. CANADA: ONT.: Toronto, Trenton. UNITED STATES: ME.: Kittery. N. H.: Webster. MASS.: Weston, Malden. N. J.: Orange, Newark. N. Y.: Albany, Catskill Mts., Ithaca, Newburgh. PENNA: Pittsburgh, New Brighton, Ashley. MD.: Baltimore. D. C.: Washington. GA.: Atlanta. OHIO: Dayton. MICH. IND.: Clark Co. KY. WIS.: Milwaukee, Madison. ILL.: Decatur, Chicago. IOWA: Central. MO.: ARK.: Rogers. NEBR.: Nebraska City. KANS.

Remarks. Adults appear in June and early July. The species apparently has a single generation. The typical form anna is rare, but persephone is not uncommon. No males have ever been found with completely black secondaries, although the yellow is often reduced to small spots. The lack of any morphological distinction between anna and figurata (Drury), in both male genitalia and larval characters is unexpected, since the two species are so clearly distinct. Both anna persephone and figurata preciosa (Nixon), however, show the same type of maculation in yellow secondaries, with a broad even border and a single discal spot, with the black frequently extending over much of the wing and occasion-

ally obliterating the yellow altogether, as in typical anna and figurata lugubris (Hulst).

6. Callarctia virguncula (Kirby)

Plate X.

Callimorpha virguncula Kirby. 1837, Faun. Bor. Amer. IV, p. 304, pl. IV, f. 6.

Arctia virguncula (Kirby). Morris, 1860, Cat. Lep. N. A., p. 24.— Stretch, 1873, Zyg. & Bomb. N. A., pp. 218-219, pl. 9, f. 15 (desc.).— Coquillett, 1881, Papilio I, p. 7 (biol.).— Smith, 1889, Can. Ent. XXII, p. 74 (biblio.).— Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, p. 378.— Dyar, Jour. N. Y. Ent. Soc. VIII, pp. 35, 36.— Gibson, 1901, Can. Ent. 33, p. 323 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 5, pl. VIII, f. 21.

Arctia naia (Drury). Saunders, 1863, Can. Jour. n. s. VIII, pp. 356-7.— Grote, 1864, Proc. Ent. Soc. Phil. III, p. 77, = virguncula (Kirby).

Apantesis virguncula (Kirby). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 270.— Hampson, 1901, Cat. Lep. Phal. Brit.cMus. III, pp. 403-404 (desc.).— Gibson, 1903, Can. Ent. 35, pp. 114-116 (biol.).— Holland, 1922, Moth Book, p. 151, pl. XV, ff. 19, 16.— Seitz, 1918-35, Macrolep. VI, p. 305, pl. 39a (= otiosa N. & D.).

Eyprepia (Callarctia) virguncula (Kirby). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 7.

Euprepia virguncula (Kirby). Dyar, 1897, Can. Ent. 29, p. 215.

Callarctia virguncula (Kirby), Goodhue, 1902, Ent. News 13, pp. 286-7.

(nom) Arctia virguncula (Kirby). Walker, 1855, Cat. Lep. Het. Brit. Mus. III, p. 609.— Grote & Robinson, 1868, Trans. Am. Ent. Soc. II, p. 71, = persephone Grote.

(nom) Arctia virguncula (Moeschler). Saunders, 1863, Can. Jour. n. s. VIII, p. 357-8.— Grote, 1864, Proc. Ent. Soc. Phil. III, pp. 75-77, = saundersii Grote.

Virguncula had deep yellow black-spotted secondaries, and primaries with veins lined but usually devoid of any transverse bands except the W. The absence of the transverse bands clearly distinguishes it from any other yellow-winged species, except for occasional specimens of celia f. lineata, from which it may be separated by the broader lining of the median vein, and the usually larger size.

Male. Head, thorax, and markings of primaries buff-yellow; secondaries and abdomen deep yellow, vertex immaculate, palpi and sides of frons black, antennae blackish; patagia spotted, thorax above with three black stripes, below mostly black, coxae of forelegs with a large deep yellow patch, legs variously marked with buff, primaries deep black with C, IM, SM, fringes, W, and all veins buff-yellow, no transverse bands, median vein broadly lined, not as wide as SM but usually distinctly wider than the anal vein; secondaries deep yellow, fringes buff, costal margin usually black, three small marginals and three larger submarginals often more or less fused, sometimes distinct, forming an irregular border, a single discal spot at end of cell, a streak in the anal fold often extending to base, and one or more basal streaks which often coalesce and cover the basal third of the wing, in a few specimens the wings are almost entirely streaked with black; wings below as above, but entire surface suffused a rather deep yellow; abdomen deep yellow, with a black dorsal stripe, and lateral and two ventral rows of black spots, the ventral spots often coalesced into transverse bars or abdomen entirely black below except for median ochreous streak.

Genitalia. (pl. III, fig. 5). Juxta scarcely bilobed, twice as broad as long; uncus slender, gradually tapering, shoulders often abrupt, membranous area

a V with widely divergent arms and a broad median extension; clasper 4 mm. long, apex bluntly pointed, ventral margin above harpe abruptly concave making a right or obtuse angle opposite harpe; harpe well-developed, strongly incurved a third of the distance from the dorsal margin; a prominent ridge in clasper below and parallel to harpe.

Female. Like the male, but abdomen often entirely black below.

Wing-expanse. Male and female: 34-50 mm.; usually 35-45.

Callarctia virguncula ab. otiosa (Neumoegen & Dyar)

Plate X

Euprepia virguncula var. otiosa Neumoegen & Dyar. 1893, Ent. News IV, p. 142.

Eyprepia (Callarctia) virguncula var. otiosa Neumoegen & Dyar. Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 7.

Apantesis virguncula ab. otiosa (Neumoegen & Dyar). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 404.

Like the typical form except that there are indications of transverse bands which are rarely complete from C to SM. In all but one individual examined, M was the band partially present, usually extending only across the cell; in a single female PM was nearly complete from C to SM, and no trace of M was evident.

Types. virguncula Kirby: original type, from Canada, evidently lost; male from Iowa, June 13, 1936, deposited in U. S. N. M. as neotype.

otiosa N. & D.: male cotype, U. S. N. M. No. 3472; described from two males.

Pupa. (pl. VII, fig. 5). Length about 22 mm. Cremaster smooth, without striations, spines of cremaster of two primary lengths, the lateral pair slightly shorter than the apicals, numerous shorter spines of varying lengths; frontal

tubercles large and conspicuous.

Larva. A blackish larva without pale markings, the lower setae reddish and upper setae usually black, head black, cheeks, bases of antennae and mouthparts pale; body velvet black, paler ventrally; warts shiny black; wart i of abdomen 1/3 - 1/4 of ii, with 20-26 setae; spiracles black; whitish dorsal stripe faintly indicated on thoracic segments, and sometimes between abdominal segments; thoracic feet black, prolegs reddish; setae from lower part of iv and below reddish, from upper part of iv and above usually black, sometimes reddish, the posterior setae darker, setae from thoracic shield always black; setae stout, heavily barbed. Length of mature larva 35-45 mm. 7 instars recorded by Gibson (1901).

Recorded food plants. Polygonum, Plantago, Taraxacum.

Distribution. A northern species; in Canada from Newfoundland and Labrador west to Alberta; from New England and New York west to Montana and Idaho, south to Colorado and Kentucky.

Locality records. CANADA: NEWF.: St. Anthony. N. B.: Fredericton. QUE.: Montreal, Knowlton. ONT.: Ottawa, Hymers, Toronto, Sudbury, Thunder Bay. MAN.: Cartwright, The Pas, Aweme. ALTA.: Calgary. UNITED STATES: ME.: Sebec Lake, Orono. N. H. : Hampton, Franconia, Claremont. MASS.: Winchedon, Sherborn, Boston, Lenox. CONN.: New Haven, Storrs. N. Y.: Plattsburgh, Binghamton, Ithaca, L. I. PENN.: Delaware Water Gap. N. J.: Newark. KY. MICH.: E. Lansing. MINN.: St. Paul, Minneapolis, Crookston, Fargo. WIS.:Milwaukee, Madison. ILL.: Chicago, Algonquin. IOWA: Sioux City. COLO: Glenwood Springs, Ouray Peak. WYO.: Laramie. MONT.: Bozeman. IDAHO.

Remarks. Adults appear in June and July and again in August and September; there are apparently two generations a year.

Callarctia virguncula subspecies speciosa (Moeschler)

Arctia speciosa Moeschler. 1864, Wien. entom. Monat. 8, pp. 195-6, pl. 5, ff. 13, 14.— Packard, 1866, Proc. Boston Soc. Nat. Hist. XI, pp. 34-35, = quenseli (Payk.).— Stretch, 1873, Lyg. & Bomb. N. A., p. 219, = virguncula var.?— Neumoegen, 1883, Papilio III, p. 148-151, = quenselii (Payk.).

Arctia speciosissima Moeschler. Grote & Robinson, 1868, Lep. N. A., p. VIII.— Strecker, 1873, Lep. Rhop. et Het. I, p. 23, = speciosa.

Orodemnias speciosa (Moeschler). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 271.

Hyprepia (Orodemnias) quenseli var. speciosa (Moeschler). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 10.

Apantesis quenseli (Payk.). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 402-405.

Apantesis virguncula speciosa (Moeschler). Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI, p. 16.

A small northern race collected only a few times in Labrador, and not differing from the typical southern race except in size. A specimen collected in St. Anthony, Newfoundland, may belong to this race. Wing-expanse: 30-32 mm.

Type. speciosa Moeschler: female cotype from Labrador, in Field Museum; described from two males and one female.

The ornata complex

Recent catalogues of the Lepidoptera have assigned to the species ornata (Packard) the subspecies complicata (Walker), and numerous color-forms, among which are edwardsii (Stretch) and howletti (Barnes & McDunnough). An examination of the male genitalia of these three varieties shows that they differ distinctly and constantly from ornata. Moreover, the female genitalia of howletti shows a

decided exaggeration of the structures as compared with the normal ones of ornata; this is, as far as known, the only instance in the entire subgenus Callarctica in which the female genitalia shows specific characters; in all other species the genitalia of the female will not identify the specimen beyond the subgenus. Correlated with these genitalic differences, are fairly distinct, though somewhat intergrading, color patterns. The larvae of edwardsii and complicata are not known; the larvae of hewletti are said to answer to the description of those of ornata, but a close resemblance would be expected. Ornata extends over the entire range of the whole group, each of the other three being restricted to a portion of its range.

In a genus in which clearly distinct species often possess few, if any, structural differences in genitalia, it seems improbable that the constant differences that exist in this group can occur in a single species. Moreover, the possession of such non-intergrading morphological differences, correlated with corresponding color differences, and with the known distribution, seems a sound basis on which to found species, and one which can be disproved only by extensive breeding experiments.

Accordingly, the author recognizes four distinct species: ornata, complicata, hewletti, and edwardsii. Of these ornata and hewletti appear to be most closely related, and edwardsii least so. It is probable that ornata is the central form, from which the others have been evolved; and that through mutation following inbreeding, there have arisen three distinct offshoots of the parent species, each restricted to its own narrow range, and each possessing certain characteristics which distinguish it from all the others.

7. Callarctia ornata Packard

Plate X.

Callarctia ornata Packard. 1864, Proc. Ent. Soc. Phil. III, p. 115.

Arctia ornata (Packard). 1881, Bull. Bkln. Ent. Soc. IV, Checklist of N. A. Lep., No. 837.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 43 (biol).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, ff. 1, 2.

Arctia simplicior Butler. 1881, Ann. Mag. N. H. (5) 8, pp. 310-311.

Hyprepia (Callarctia) ornata (Packard). Dyar, 1883, Psyche VI, p. 556.— Neumoegen & Dyar, Jour. N. Y. Ent. Soc. II, p. 9 (desc.).

Arctia shastaensis Behrens. 1889, Can. Ent. 21, pp. 35-36.— French, 1889, Can. Ent. XXI, p. 162, fig. of type.—

Apantesis shastaensis (Behrens). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.— Dyar, 1893, Psyche VI, pp. 379-381, = Hyprepia (Cymbalophora) blakei (Grote).— Dyar, 1893, loc. cit. p. 556, = Hyprepia (Callarctia) ornata (Packard).— Dyar, 1902, Bull. U. S. N. M. 52, p. 89, = nevadensis (Grote & Robinson).— Barnes & McDunnough, 1916, Contr. Nat. Hist. Lep. N. A. III, pp. 158-9, = ornata (Packard).

Apantesis simplicior (Butler). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.— Dyar, 1893, Psyche VI, p. 556, = Hyprepia (Callarctia) ornata (Packard).

Hyprepia (Cymbalophora) blakei var. perpicta Dyar. 1893, Psyche VI, p. 381 (biol.).— Dyar, loc. cit., p. 556, = Hyprepia (Callarctia) ornata (Packard).

Euprepia ornata (Packard). Dyar, 1897, Can. Ent. 29, p. 215.

Apantesis ornata (Packard). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 399-401 (desc., syn.).— Gibson, 1903, Can. Ent. 35, pp. 120-122, pl. V, 3 figs. (biol.).— Gibson, 1905, Can. Ent. 37, pp. 337-347 (biol).

Ornata is easily distinguished from hewletti (B. & McD.) and from forms of nevadensis (G. & R.) by the absence of the subbasal half-band and by the presence

of a distinct thumb-like projection on the ventral margin of the clasper.

Male. Head, thorax, and markings of primaries deep ocher, secondaries orange-red with black spots; vertex usually immaculate, rarely spotted, palpi and sides of frons black, antennae blackish without pale scales; patagia usually spotted, rarely immaculate, thorax above with three black stripes, below mostly black, the coxae and femora of fore-legs with ochreous patches and other legs often streaked with ochreous; primaries black, with IM, SM, fringes, and transverse bands deep ocher, veins concolorous with wing except branches of M and Cu which may be faintly indicated with pale scales beyond W, W complete, its upper angle not attaining outer margin, PM generally extending from C to SM or below and slightly curved or angled outwards, M and AM usually complete from C to IM but sometimes broken, AM rarely absent, M more or less parallel to AM but forming with PM an uneven V; secondaries deep red-orange, with numerous black spots: two or three costals, more or less fused, two to four marginals, the two apical the largest and usually fused, three submarginals, and one to three or more discals, the submarginals frequently partially coalesced with marginals, and the discals often elongated and extending to base of wing; wings below as above with an additional inner dash on costa of secondaries, surfaces uniformly deep ochreous, with black maculation duller; abdomen deep ochreous, with a broad black stripe covering most of dorsum and lateral and two ventral rows of spots.

Genitalia. (pl. II, f. 1). Juxta slightly or not at all bilobed, nearly twice as broad as long; uncus slender, gradually tapering to a point, shoulders abrupt, membranous area indefinite, transverse; clasper 3-3.5 mm. long, "mitten-shaped", the ventral margin with a prominent "thumb-like" projection about a third of the distance from apex opposite harpe, clasper widest above harpe through thumb, apex bluntly rounded; harpe well-developed, oblique, deeply sinuate at mid-point.

Female. Like the male, except that abdomen is entirely black below, vertex may be entirely black, and dorsal abdominal stripe is narrower. Genitalia on pl. II, f. 2.

Wing-expanse. Male and female: 38-50 mm.

Callarctia ornata form sulphuricella (Strand)

Arctia nevadensis var. sulphurica Neumoegen, 1885, Ent. Amer. I, p. 93.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 400, = Apantesis ornata var. sulphurica (Neum.).— Barnes & McDunnough, 1918, Checklist Lep. Bor. N. A., p. , = Apantesis nevadensis var. sulphurica (Neum).

Apantesis ornata ab. sulphuricella Strand. 1919, Lep. Cat. 22, p. 416 = sulphurica (Neum.) of Hampson.

Like the typical form except that secondaries are pure yellow.

Callarctia ornata f. achaia (Grote & Robinson)

Plate X.

Arctia achaia Grote & Robinson. 1867, Trans. Amer. Ent. Soc. I, pp. 334-5, pl. VI, ff. 45-46.— Stretch, 1873, Zyg. & Bomb. N. A., pp. 124-5, pl. V, ff. 17-21, f. 19, = type (biol.).— Stretch, 1882, Papilio II, p. 147, = ornata (Packard).— Smith, 1890, Can. Ent. 22, p. 10 (biblio.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, ff. 5-6.

Chelonia achaia Boisduval. 1868, Ann. Soc. Ent. Belge XII, p. 76.

Arctia achaia var. barda Henry Edwards. 1881, Papilio I, p. 39.— Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267, = Apantesis achaia var. barda (Hy. Edw.).— Dyar, 1893, Psyche VI, p. 556, = Hyprepia (Callarctia) ornata var. complicata (Walker).

Hyprepia (Callarctia) ornata var. achaia (Grote & Robinson). Dyar, 1893, Psyche

VI, p. 556.

Apantesis achaia (Grote & Robinson). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.

Apantesis ornata var. achaia (Grote & Robinson). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 399-401.

Arctia achaia var. maculosa Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, ff. 3, 4.— Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34, = Apantesis ornata form achaia (G. & R.).

Arctia achaia var. rivulosa Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, ff. 8, 9.— Barnes & McDunnough, 1918, Checklist Lep. Bor. America, p. 34.— Apantesis ornata form achaia (G. & R.).

Readily distinguished from the typical ornata by the pale lining of all veins of primaries, sometimes partially obsolescent towards outer margin; marginals and submarginals of secondaries often coalesced into an irregular border and discals sometimes fused and covering inner third of wing so that only an irregular orange spot remains; transverse bands of primaries usually complete and extending below SM, but inner bands sometimes broken or wanting and non reaching below SM as in complicata; clasper always with thumb-like projection, which separates achaia from complicata (Walker); antennae never with pale scales.

Callarctia ornata ab. californica (Cassino)

Apantesis californica Cassino. 1917, Lepid. I, p. 100.— Cassino, 1918, Lepid. II, col. pl. opp. p. 60.

Apantesis ornata form achaia ab. californica Cassino. 1927, Barnes & Benjamin, Bull. So. Calif. Acad. Sci. XXVI, p. 16.

A peculiarly marked aberration of f. achaia in which AM is very broad, and PM and W are largely coalesced, nearly obliterating the black triangles between

them.

Callarctia ornata form ochracea (Stretch)

Arctia achaia var. ochracea Stretch. 1872, Zyg. & Bomb. N. A. I, p. 125, pl. 5, f. 21.-- Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, ff. 7, 11, 15.

Arctia ochracea Butler. 1881, Papilio I, p. 131.

Apantesis achaia var. ochracea (Stretch). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.

Euprepia (Callarctia) ornata (Packard). Dyar, 1893, Psyche VI, p. 556, = var. complicata (Walker).

Euprepia (Cambalophora) blakei (Grote). Dyar, 1893, Psyche VI, pp. 379-381, = var. sulphurica (Neum).

Apantesis ornata var. ochracea (Stretch). Hampson, 1901, Cat. Lep. Phal. Brit. Mus., p. 400.

Arctia achaia var. ochracea-rivulosa Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, f. 10.

Apantesis ornata form ochracea-rivulosa (Stretch). Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI, p. 16.

Markings as in form achaia, but secondaries pure yellow; distinguished from complicata (Wlk.), anna f. persephone (Crt.), and hewletti (B. & McD.), by the prominent "thumb" on the clasper; SB present as in hewletti in only a single specimen examined.

Types. ornata (Pack.): two males, one holotype, one paratype, from San Mateo, Calif.; M. C. Z.

perpicta (Dyar): female holotype from Yosemite, Calif.; U. S. N. M.

simplicior (Butler): female holotype from Jacksonville, Calif.;

British Museum.

achaia (G. & R.): female cotype from Sierra Nevada; American Museum; described from male and female.

barda (Hy. Edw.): two male cotypes from Dalles, Ore.; American Museum.

californica Cassino: female holotype from Eldredge, Calif.; U.S.N.M.

Pupa. (pl. VII, f. 10). Only two examined. Length 20-22 mm.; cremaster smooth, without striations; mesal setae (I) longest, II laterad of I and more than half as long, III dorsad of I and slightly shorter than II, a few other smaller setae.

Larva. Not available for examination. Gibson (1903, 1905) describes it as velvet black; warts shiny black, ii with a broad polished base; wart i of abdomen 1/3 of ii; dorsal stripe dull reddish, usually broken into irregular dashes, or visible on only thoracic segments or on a few abdominal segments, or lacking; spiracles black; setae from iv and above shiny black, from v and below rusty or silvery, slightly barbed; thoracic legs shiny black, prolegs reddish. Stretch (1872) describes the larva as having light brown setae, paler at the tips. Gibson records 6 instars.

Recorded food-plants. Trifolium, Viola, Plantago, Erodium.

Distribution. Pacific coast states, from Brit. Col. to California, and east to Montana and Colorado.

Locality records. CANADA: B. C.: Kaslo. UNITED STATES: WASH.: Pullman, Walla Walla. IDA.: Wallace. MONT.: Bozeman. ORE.: Dalles, Ashland, Brookings. CALIF.: Santa Cruz, Shasta Retreat, Lake Tahoe, Mendocino, Eureka, San Francisco, San Jose, Oxnard, Tulare Co. (8000'), Alma, Santa Rosa. NEV.: Reno. COLO.: Rico, San Miguel, Ouray Co., Siskiyou Co., Kensah Pass.

Adults appear from April to June in California, from May to July in Idaho,

and in July and August in Oregon. Apparently there is but one generation a year.

Ornata is an extremely variable species, with the veins lined with pale scales or concolorous with the wing, the secondaries either yellow or reddish, often greatly suffused with black, and the transverse bands varying in number and in extent. Form achaia is much more common than typical ornata, and ochracea more so than sulphuricella.

Mr. Frank Watson of the American Museum has kindly examined the two type specimens of barda (Hy. Edw.), and writes that the genitalia correspond with those of typical ornata (Packard), rather than with complicata (Wlk.) with which the form has been associated.

8. Callarctia complicata (Walker)

Plate X

Arctia complicata Walker. 1864, Cat. Lep. Het. Brit. Mus. XXXI, p. 279.— Stretch, 1872, Zyg. Bomb. N. A., pp. 78-79, = dahurica (Bdv.).

Arctia achaia var. complicata Walker. Neumoegen, 1883, Papilio III, p. 151.

Apantesis virguncula var. complicata (Walker). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 270.

Eyprepia (Callarctia) ornata var. complicata (Walker). Neumoegen & Dyar, 1893, Ent. News IV, p. 142.— Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 9.

Arctia ornata var. complicata Walker. Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 43.

Apantesis queneeli ab. complicata (Walker). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 402-3.

Apantesis ornata var. complicata (Walker), Barnes & McDunnough, 1918, Checklist Lep. Bor. America, p. 34.

Complicata is most closely allied to ornata f. achaia (G. & R.), but the markings of the primaries are less complete than in achaia, the transverse bands seldom extending below SM, and AM often wanting or broken. It can always be differentiated by the absence of the prominent thumb-like ventral projection of the clasper.

Male. Body and markings of primaries pale to deep ocher; secondaries yellow or orange; vertex usually immaculate, sometimes spotted, palpi and sides of frons black, antennae blackish; patagiae usually spotted, thorax above with three black stripes, below mostly blackish, coxae, femora, and tibiae of fore legs partly ochreous, and femora and tibiae of other legs sometimes streaked with ochreous; primaries brownish-black to deep black, with costal and inner margins, fringes, SM, transverse bands and all veins ochreous, W complete, its upper angle not attaining outer margin, PM usually complete and extending from C to SM, angled outwards, sometimes broken, M usually complete from C to SM, often broken and sometimes wanting, sometimes extending below SM, AM usually broken or lacking, sometimes complete from C to SM or occasionally below; secondaries yellow or orange with several costal spots forming a costal streak, apical marginal spots fused, and one or two other marginals usually fused, three or more submarginals usually coalesced with marginals to form a broad irregular border, several discals often coalesced, yellow markings often reduced to one or two irregular central spots; abdomen ocher, with a broad black dorsal stripe, lateral, and two ventral rows of spots. Wings below as above, with black maculation duller and ochreous of secondaries rarely tinged with orange.

Genitalia. (pl. II, fig. 5). Juxta, uncus, aedeagus as in ornata, clasper 3 mm. long, projection on ventral margin a third distant from apex a right or obtuse angle, often rounded, never produced apically into a distinct thumb, clasper above harpe scarcely narrowed, usually bluntly rounded but occasionally pointed.

Harpe prominent, much as in ornata, a transverse sinuous ridge extending from articulatory point on dorsal margin obliquely across clasper to dorsal angular projection.

Female. Like the male, but dorsal abdominal stripe narrower and abdomen entirely black below.

Wing-expanse. Male and female: 33-45 mm.

Type. complicata (Wlk.): male holotype from Vancouver Island; British Museum.

Distribution. Restricted to the northern part of the range of ornata; records verified only from B. C., Ore., and Wash.

Locality records. CANADA: B. C.: Victoria. UNITED STATES: WASH.: Puget Sound, Friday Harbor. ORE.: Corvallis, Sherwood, Brownsville, Tillamook, Saurie's Island, Klamath Lake.

Adults appear from April to July in Corvallis, Oregon. There is probably only a single generation a year. The larvae and pupae are undescribed.

True complicata is much less common than ornata f. achaia (G. & R.), and many of the specimens assigned to complicata belong to the latter species. As yet no specimens corresponding to typical ornata, with the veins unlined, have been associated with complicata.

Mr. W. H. T. Tams of the British Museum has been kind enough to send photographs of the type and of the genitalia. The type is a small melanistic form, about the size of quenseli (Payk.), but with both M and PM extending from C to SM. It closely resembles the specimen figured on plate X, the lower of the two specimens of complicata, but is slightly smaller and has the median band of primaries complete from C to SM. The clasper of the male is nearly identical with that shown in plate II, figure 5b. Hampson considered this an aberration of quenseli, but the genitalia place it without doubt as the species heretofore con-

sidered a race of ornata.

9. Callarctia hewletti (Barnes & McDunnough)

Plate X.

Apantesis ornata var. hewletti Barnes & McDunnough. 1918, Contr. N. H. Lep. N. A. IV, pp. 88-89, pl. XIII, ff. 3, 4.

Hewletti is closely related to ornata (Packard), but can be separated by the presence of the sub-basal band on the primaries, and by the absence of the "thumb" on the clasper. Hewletti may be confused with forms of nevadensis (G. & R.), which likewise possess the sub-basal half-band. However, in nevadensis the vertex and patagiae are usually spotted, and pure yellow secondaries are uncommon (f. sulphurica), the usual color being either pure rose-red or whitish tinged with pink; in hewletti the vertex is immaculate and the patagia nearly always so, while the secondaries are either deep yellow or overcast with a peculiar orange-red.

Male. Body deep ocher, markings of primaries ochreous sometimes tinged with pink to whitish, secondaries deep yellow or tinged with red; vertex immaculate, sides of frons and palpi black, palpi sometimes tipped with ochreous, antennae blackish; patagiae usually immaculate, but sometimes spotted, thorax above with three black stripes, below mostly blackish, the legs streaked with ochreous; primaries deep black, with costal and inner margins, fringes, SM, and transverse bands whitish, ochreous or tinged with pink, all veins occasionally ochreous, W and all markings usually complete and extending from C to IM, SB from C to SM; secondaries deep ochreous or tinged with orange, apical black margin formed by coalescence of marginal spots, one or two other marginals, three submarginals, and two or more discals, distinct, not coalescing, wings below as above, with

black maculation paler and secondaries without orange tinge; abdomen deep ocher, with dorsal stripe, and lateral and two ventral rows of spots.

Genitalia. (pl. II, fig. 3). Juxta as in ornata (Pack.), uncus shorter and broader, distal half broadly cylindrical, slightly hooked apically, shoulders strongly expanded laterally into rounded lobes, membranous area broadly oval; clasper with projection on ventral margin a third distant from apex a right or obtuse angle, never produced apically into a distinct thumb, widest through harpe, scarcely narrowed beyond and bluntly rounded, clasper 4 mm. long; harpe very prominent, almost as wide as tegumen, a transverse sinuate ridge extending obliquely across clasper from dorsal articulatory point to angular ventral projection; tegumen distinctly wider than in ornata, aedeagus strongly angled at mid-length.

Female. Like the male, but costa black, abdomen entirely black below, and secondaries either deep ochreous or deep orange-red with fringes ocher and black spots margined in ocher.

Genitalia. (pl. II, fig. 4). Differs from typical female genitalia in unusually broadly-expanded lips of ostium bursae, which are fully twice as wide as in ornata. The specimen figured has the surface of bursa and of ductus seminalis covered with numerous parallel folds and wrinkles. These evidently allow the full expansion of the bursa upon the introduction of the male spermatophore, as in Pl. II, fig. 2, which shows the bursa normally expanded.

Wing-expanse. Male and female: 40-48 mm.

Type. Male holotype, female allotype, from Nellie, Calif.; U. S. N. M.

Distribution. Apparently restricted to the vicinity of San Diego, Calif.

Locality records. CALIF.: San Diego, Nellie.

Adults have been taken in May. Larvae and pupae are undescribed, although Barnes and McDunnough write (1918) that larvae received from Nellie "correspond well with Gibson's (1903) description of stage VI of ornata larvae".

10. Callaretia edwardsii (Stretch)

Plate X.

Chelonia dahurica (Bdv). Boisduval, 1852, Ann. Soc. Ent. Fr. (2) X, p. 321.

Arctia dahurica (in part). Walker, 1855, Cat. Lep. Het. Brit. Mus. III, p. 597.- Oberthür, 1911, Etudes Lepid. Comp. V, pp. 103-104, pl. 81, f. 757, = sp. dist.

Arctia dahurica (Bdv). Clemens, 1861, Proc. Ac. Nat. Sci. Phila. XII, p. 527.— Grote, 1868, Trans. Am. Ent. Soc. I, pp. 336-337 (desc.).— Grote, 1869, Trans. Am. Ent. Soc. II, pp. 117-118 (syn.).— Stretch, 1872, Lyg. & Bomb. N. A., pp. 78-79, pl. III, f. 10.— Neumoegen, 1883, Papilio III, pp. 148-151, = complicata Walk.?.— Smith, 1890, Can. Ent. XXII, p. 13.—

Arctia edwardsii Stretch. 1872, Lyg. & Bomb. N. A., pp. 77-78, pl. III, f. 9.— Smith, 1887, Ent. amer. III, pp. 109-112, = dahurica.— Neumoegen, 1883, Papilio III, pp. 148-151, = achaia (G. & R.)?

Chelonia dahurica Bdv. (in part). Oberthür, 1884, Etudes d'Ent. VIII, pp. 36-38, = sp. dist.

Apantesis edwardsii (Stretch). Kirby, 1892, Syn. Cat. Lep.Het. I, p. 267.

Hyprepia (Callarctia) ornata var. achaia (G. & R.). Dyar, 1893, Psyche VI, p. 556, = syn. edwardsii (Stretch).

Hyprepia (Callarctia) ornata var. complicata (Walker). Dyar, 1893, Psyche VI, p. 556, = syn. dahurica (Bdv).

Apantesis ornata var. achaia (G. & R.). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 399-401, = edwardsii, dahurica.

Apantesis virguncula (Kirby). Hampson, loc. cit., pp. 403-404, = dahurica Bdv. of Grote, 1868, (= edwardsii).

Apantesis ornata form edwardsii (Stretch).— Barnes & McDunnough, 1918, Checklist Lep. Bor. America, p. 54.

Edwardsii is a small species evidently closely allied to ornata f. achaia (G. & R.), but easily differentiated from it by the smaller size, the frequent presence of SB, and the pale scales on the basal third of the antennae.

Male. Head, thorax and markings of primaries ocher, secondaries light orange-red, vertex usually, if not always, maculate, palpi black, often tipped with ochreous, antennae brownish, covered with pale ochreous scales at least on basal third; patagiae spotted, thorax above with three black stripes, below mostly blackish with all legs streaked with ochreous, in a few specimens thorax entirely black above except for edgings of patagia and tegulae; primaries brownish black, with costal and inner margins, fringes, SM, transverse bands, and all veins ochreous, W complete, its upper angle not attaining outer margin, PM usually complete from C to SM, M complete from C to SM, usually below, AM usually present, often from C to IM, sometimes broken or wanting, SB sometimes present or indicated from C to SM; secondaries orange red, the spots usually distinct, not greatly fused, apical margin black, formed by the coalescence of two apical spots, one or two other marginals, three submarginals, and several discals which may elongate into streaks; wings below as above, but black markings paler, secondaries without reddish tinge and with an additional costal dash; abdomen ochreous, tinged with orange, a broad black dorsal stripe, lateral and two ventral rows of spots, the ventral spots often obsolescent.

Male genitalia. (pl. II, fig. 6). Juxta broader than long, bilobed; uncus with distal two thirds cylindrical, shoulders narrow and rounded, membranous area indefinite, transverse; clasper 2.5 mm. long, projection on ventral margin a third distant from apex a right-angle or usually obtusely rounded, clasper distad of harpe gradually narrowed to a slender pointed apex, harpe distinct, a transverse sinuous ridge extending obliquely across clasper from articulatory point to ventral angular projection.

Female. Like the male; SB almost always present, and vertex often immaculate.

Wing-expanse. Male and female: 27-38 mm.

Callarctia edwardsii ab. obliterata (Stretch)

Arctia obliterata Stretch. 1885, Entom. Amer. I, p. 105.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43-44, = quenseli Payk.?— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VI, f. 14.

Euprepia (Orodemnias) obliterata (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 10.

Orodemnias obliterata (Stretch). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 270.

Euprepia obliterata (Stretch). Dyar, 1897, Can. Ent. 29, p. 215.

Apantesis obliterata (Stretch). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 401, pl. 48, f. 9 (desc.).— Gibson, 1903, Can. Ent. 35, p. 144, pl. V, = quenseli Payk.?— Dod, 1904, Can. Ent. 36, p. 351, = quenseli? — McDunnough, 1922, Can. Ent. 54, p. 137, - sp. dist.?— Barnes and Benjamin, 1925, Pan. Pac. Ent. I, pp. 132-133 = ornata (Packard) ab.?

Apantesis ornata f. edwardsii ab. obliterata (Stretch). Barnes & McDunnough, 1918, Checklist Lep. Bor. America, p. 34.

The species was described from a single male, locality unknown. The primaries show linings on all veins, and W complete; M and PM extend only to the median vein, and not below, in this respect closely resembling quenseli (Payk.). The secondaries, however, are dull reddish, as in ornata (Pack.) and related forms, and the disposition of the marginal, submarginal, and the several discal spots of the secondaries likewise resembles the ornata type of maculation. Gibson (1903) figures a specimen answering the description of obliterata in so far as colors

and markings of secondaries, and the extent of M and PM of the primaries is concerned, applying to it the name obliterata. This specimen, taken with typical queneeli turbans (Christ.) resembles that species almost exactly in the markings of primaries, but has additional discal spots never present in typical turbans. However, the heavy lining of the median vein, and the obsolescence of the linings of some of the veins of the primaries, particularly on the anal vein, which in turbans never reaches the outer margin, establish its relationship to turbans, of which it is apparently a very rare variety. Stretch's (1906) figure of obliterata shows a distinct lining on all the veins, extending to the outer margin, and a narrow lining of the median vein; these characteristics, as well as the color and maculation of the secondaries, point to a probable relationship to the ornata group. In wing expanse, 33 mm., and in the spotting of the vertex, the type comes nearest to edwardsii.

Types. edwardsii (Stretch): male holotype from San Francisco, Calif. lost; male neotype from Lake Merced, San Francisco Co., Calif., deposited in U. S. N. M.

obliterata (Stretch); male holotype, locality unknown, in Calif. Acad. Sci.

Distribution. Apparently limited to the vicinity of San Francisco, Calif.

Locality records. CALIF.: San Francisco, Lake Merced, Baker's Beach, San Francisco Co.

Remarks. Adults have been taken in May and June and also in September, indicating the probability of two generations a year. Larvae and pupae are undescribed.

Edwardsii was for some time identified with Chelonia dahurica Bdv., of Siberia. Boisduval himself believed edwardsii (before Stretch had named the species) to be the same as his dahurica, but subsequent writers have shown them to be dis-

tinct. Oberthür figures the type of dahurica in Etudes de Lep. Comp. V: pl. 60, fig. 1. As yet, no specimens corresponding to typical ornata have been found, all known edwardsii having the veins completely lined with pale scales.

11. Callarctia cervinoides (Strecker)

Plate X.

Arctia quenseli (Paykull). Packard, 1874, Hayden's Surv. Territ. for 1873, p. 558, f. 14.

Arctia cervinoides Strecker. 1876, Proc. Acad. Nat. Sci. Phil. 28, p. 151.— Packard, 1878, Rept. Chief. Engin. S. S., p. 1860, pl. 2, f. 4.— Bruce, 1900, Can. Ent. 22, pp. 67-68 (biol.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43, 45.— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 23.

Grodemnias cervinoides (Strecker). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 271.

Euprepia (Cymbalophora) cervinoides (Strecker). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 12 (desc.).

Euprepia cervinoides (Strecker). Dyar, 1897, Can. Ent. 29, p. 216.

Apantesis cervinoides (Strecker). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 407-408 (desc.).

Cervinoides is the smallest species of the genus, marked somewhat like a miniature oithona (Strecker) or phyllira (Drury), with the veins lined or unlined, but the secondaries white largely marked with blackish, much as in quenseli (Payk.); from quenseli, however, it is distinguished by the two or three transverse bands which usually extend below SM.

Male. Body and secondaries whitish with black markings; primaries brown-black with white markings; vertex spotted with black, sometimes entirely black,

palpi and sides of frons blackish, antennae blackish with white scales; patagia spotted, thorax above with three wide black stripes, below mostly blackish-brown, the legs variously marked with white, primaries black-brown, with SM and transverse bands whitish, the veins, fringes, costal and inner margins sometimes whitish, W complete, not attaining outer margin, PM extending from C to SM or IM, slightly angles outwards, M extending from C to SM or IM, AM indicated at costa in the specimens examined, often extending below cell, SB suggested at costa, all transverse bands usually extend in part below SM; secondaries whitish, sometimes almost entirely blackish, fringes either brown or white, the terminals and subterminals entirely or partially coalesced to form an irregular border, the subterminals sometimes distinct, a discal spot at end of cell and two dashes extending from marginal border to base of wing, one parallel to inner margin and a second between it and discal spot, all markings indistinct and blurred; wings below as above, the black paler; abdomen whitish, with a black dorsal stripe, lateral rows of small spots, and two subventral rows of small spots, sometimes coalesced into transverse bars.

Genitalia. (pl. II, fig. 8). Juxta bilobed, broader than long; uncus very slender, shoulders abrupt and nearly parallel, membranous area indistinct; clasper 1.5 mm. long, apex bluntly rounded, ventral margin distad of harpe shallowly and gradually concave, forming a rounded angle opposite harpe; harpe best developed near ventral margin, strongly curved distad near middle of clasper.

Female. The single specimen examined, in the collection of the Carnegie Museum, like the male.

Wing-expanse. Male and female: 22-25 mm.

Type. Male holotype, from above timberline on Mt. Flora, Colo., July 17, 1872; at Field Museum.

Distribution. Known only from Colorado.

Locality records. COLO.: Silverton (12,000'), Mt. Evans (12,000'), Hall Valley, Mt. Audobon, Estes Peak (12,000').

Remarks. Adults have been taken in July and August. Bruce (1900) reports finding the "pretty" larvae feeding on Sedum on Mt. Bullion, near Denver, Colo. He reared several adults and did not describe the larvae.

Cervinoides is the Rocky Mt. counterpart of the Alpine and Eastern quenseli (Payk.), found only at high altitudes, the colors black and white, blurred and indistinct, and the size very small. The species is not common, only 15 specimens being in the collections of the National Museum and Carnegie Institute. Of these, only two, from Mt. Audobon and from Estes Park, were of the hitherto undescribed form with pale linings on the veins.

12. Callarctia quenseli (Paykull)

Plate X.

Bombyx quenseli Paykull, 1793, Skriv. Naturhist. Selsk. II, pp. 99-100, pl. II, f. 2.

Bombyx strigosa Fabricius. 1793, Ent. Syst. III (1), p. 454, = quenseli Payk.

Callimorpha quenselii (Paykull). Ochsenheimer & Treitschke, 1810, Schmett. Eur. III, p. 316.

Arctia quenseli (Paykull). Geyer, 1837, Sutr. Samm. Ex. Schmett. (5) p. 14, ff. 847, 848.— Frey, 1876, Mitt. Schweiz. Ges. 4, p. 555 (biol.).— Zeller, 1877, Stett. Ent. Zeit. 38, pp. 432-433 (biol.).— Kirby, 1882, Eur. Butterflies and Moths, p. 105 (dest.).— Sandberg, 1883, Entom. Tidskr. 4, pp. 16-18 (biol.).— Sandberg, 1884, Entom. Tidskr. 5, pp. 139-140.— Sandberg, 1885, Berl. Ent. Zeit. 29, pp. 252-5 (biol.).— Spuler, 1910, Schmett. Eur. II, p. 139, III, pl. 73, f. 27, IV, pl. 13, f. 7.— Oberthür, 1911, Etudes Lep. Com. V, pp. 90-91.— Darmehl,

1928, Entom. Zeits. 42, pp. 114, 130-131.

Chelonia quenselii (Paykull). Herrich- Schaeffer, 1845, Schmett. Eur. II, pp. 145-6 (desc.).— Staudinger, 1856, Stett. Ent. Zeit. 17, pp. 39-40 (biol.).— Heyden, 1856, Stett. Ent. Zeit. 17, pp. 184-188 (desc.).— Guenee, 1864, Ann. Soc. Ent. Fr. (4) IV, pp. 679-687 (biol.).— Fallou, 1866, Bull. Ent. Soc. Fr. for 1866, pp. lv, xlii-xliii (biol.).— Fallou, 1871, Ann. Soc. Ent. Fr. 40, p. 110, pl. 2, f. 4 (larva).

Euprepia plantaginis var.? quenseli (Payk.). Doring, 1848, Stett. Ent. Zeit. IX, pp. 303-306.

Orodemnias quenselii (Paykull). Wallengren, 1863, Lep. Het. Skand. p. 315.— Seitz, 1912, Macrolep. II, p. 82, pl. 16.

Nemeophila quenselii (Paykull). Guenee, 1864, Ann. Soc. Ent. Fr. (4) IV, pp. 679-687.

Euprepia quenselii (Paykull). Frey, 1873, Mitt. Schweiz Entom. Ges. 4, pp. 153, 248 (desc.).

Eyprepia (Orodemnias) quenselii (Paykull). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 10.

Apantesis quenseli (Paykull). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 402-403 (desc.).

Orodemnias quenselii ab. ornata Dannehl. 1953, Entom. Zeits. 37, p. 147.

(non) Callarctia ornata Packard. 1864, Proc. Ent. Soc. Phil. III, p. 115.

Typical quenseli can be distinguished from other species of the genus by its small size, the usually broad lining of the median vein, the short transverse bands which rarely extend below the cell, and by the grey or black secondaries, slightly marked with whitish in the male and yellow in the female. Nemeophila cervini (Fallon), a high Alpine species, can be separated from quenseli by the absence of SM and of linings on all of the veins, the blurred appearance of the

transverse bands which usually extend below the cell, and the presence of an accessory cell on the primaries.

Male. Head, thorax, and markings of primaries pale yellow-white, secondaries blackish, with markings whitish, vertex spotted, sides of frons black, palpi black, sometimes tipped with yellow-white, antennae blackish; patagia broadly spotted, thorax above with three wide black stripes, below mostly blackish-brown, coxae and femora of forelegs and tibia and tarsi of all legs streaked with ocher; primaries deep-black-brown, with costal and innermargins, fringes, transverse bands, and all or nearly all veins yellow-white, costa sometimes black beyond basal third, M complete and not attaining outer margin, PM usually extending from R across the cell, often absent or broken, M usually extending across the cell, AM occasionally present in cell, median vein usually narrowly streaked, transverse bands seldom extending below cell; secondaries blackish, fringes usually white, a faint indistinct whitish w-shaped line usually indicated in the submarginal region, a discal spot across the end of the cell blacker; wings below much as above, the markings of primaries blurred, and the secondaries with more whitish, showing indistinct marginal, submarginal, and discal spots; abdomen blackish above, the segments laterally and ventrally edged with ocher, sometimes with a continuous sublateral line.

The male aberration ornata described by Dannehl, preoccupied by the ornata of Packard, has secondaries which more nearly resemble those of the female, with a wide yellow submarginal border, the black basal part of the wing very conspicuous and made up of streaks extending to the yellow border.

Genitalia. (pl. IV, fig. 8.) Juxta bilobed, wider than long; uncus slender, shoulders abrupt, membranous area transverse with a median extension; clasper about 2 mm. long, apex tapering to an acute point, ventral margin of clasper distad of harpe deeply and suddenly concave, leaving a nearly right angle; harpe

well developed, sinuate.

Female. Primaries like the male except that median vein is broadly lined; secondaries a rather deep yellow, the costal margin broadly black, extending to apex of wing, anal margin broadly black, a discal dash extends to submarginal spot and fuses with costal and anal dashes, so that basal half or two-thirds of wing is entirely blackish, three small triangular marginals, the apical fused with costal dash, three larger submarginals, more or less completely fused with costal, discal, and anal dashes, and a discal black spot at end of cell; wings below pale yellow, broad anal dash as above, but costal dash narrow and discal dash indistinct, so that base of wing is not entirely suffused with black, two or three marginals, three or four submarginals, and two or three discals usually distinct.

Wing-expanse. Male: 30 mm.; female: 37 mm.

Callarctia quenseli ab. integra (Dannehl)

Arctia quenselii var. integra Dannehl. 1928, Entom. Zeits. 42, p. 130.

An aberration of the male in which the secondaries are entirely black with no indications of pale markings.

Callarctia quenseli ab. falloui (Jourdhuil)

Chelonia quenselii ab. falloui Jourdhuil. 1866, Ann. Soc. Ent. Fr. (4) VI, pp. 127-8, pl. II, f. 14.

Phragmatobia cervina (Fallou). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 240.

Arctia quenselii var. falloui (Jourdhuil). Spuler, 1910, Schmett. Eur. II, p. 139.— Oberthür, 1911, Etudes Lep. Comp. V, pp. 90-91.— Dannehl, 1928,

Entom. Zeits. 42, pp. 130-131.

Orodemnias quenselii var. falloui (Jourdhuil). Seitz, 1912, Macrolep. II, p. 82, pl. 16.

Arctia quenselii var. pseudoliturata Dannehl. 1928, Entom. Zeits. 42, p. 130.

Arctia quenselii ab. gelpkei Dannehl. 1928, Entom. Zeits. 42, p. 130.

A rare aberration of the female showing extreme albinism: the primaries uniformly yellow, without black markings; secondaries yellow-red, only the anal angle blackish; black margins of thorax and abdomen greatly diminished in size; transitions in which the black margins are reduced to linear dots as in pseudoliturata and gelpkei of Dannehl lead to the normal form.

Types. quenseli (Payk.): described from one male, taken in Lapponia at Enonteckis; type probably lost.

integra (Dann.): described from 7 males, Stilfser Mt. (Grossglockner) So. Tyrol Mts., types probably in collection of Dannehl.

ornata (Dann.): from Stilfser Mt., Ortlergebiet, So. Tyrol Mts.; male type probably in collection of Dannehl.

falloui (Jourd.): female holotype; location unknown.

pseudoliturata (Dann.): gelpkei (Dann.): types from Stilfser Mt. and Piz Umbrail, So. Tyrol Mts.; probably in collection of Dannehl.

Larva. Numerous descriptions of the larvae are found in the literature. Staudinger (1856) describes it as black; in interrupted dorsal line of light spots or dashes; warts above spiracles dirty yellow, below spiracles black; setae grey-black above the spiracles, fox-red below; head and thoracic legs shiny black, prolegs whitish. Guenee (1864) described early and later instars; the later instar is essentially as above, but describes all warts as shiny black, the setae above the spiracles likewise shiny black, sometimes appearing as dull yellow and the dorsal line sometimes reduced to spots or wanting. Sandberg (1885) has observed

that some larvae have the warts above more or less golden-brown, a few have all the setae red-brown but in most the setae are black above, and in some there are irregular yellow-white spots on each side of the dorsal line, which is often broken.

Recorded food-plants. Erica vulgaris, Armeria alpina, Juncus sp., Graminese, Leontodon, Plantago, Geum montanum, Lathyrus, Lonicera xylasteum

Distribution. Lapland, the high Alps above 2000 meters, Tyrol Mts., and Dolomites.

Adults appear in July and August, flying at noonday. According to several authors they are found only every other year, the species thus requiring two years for its development and the larvae hibernating twice. Larvae are difficult to rear in the lowlands, but Fallou (1866) gives directions for successful rearing, and Kirby (1882) and others state that they must be fed on half-withered leaves.

Callarctia quenseli subspecies gelida (Moeschler)

Plate X.

Euprepia gelida Moeschler. 1849, Stett. Ent. Zeit. IX, p. 174.

Arctia gelida (Moeschler). Walker, 1855, Cat. Lep. Het. Brit. Mus. III, p. 611.

Arctia quenselii (Paykull). Moeschler, 1860, Wien. Entom. Monats. 14, p. 360.— Packard, 1866, Proc. Boston Soc. N. H. XI, pp. 34-35.— Stretch, Zyg. & Bomb. N. A., pp. 222-224, pl. 9, f. 8 (desc.).— Strecker, 1873, Lep. Rhop. et Het. I, p. 23.— Packard, 1874, Hayden's Surv. Territ. for 1873, p. 558.— Packard, 1888, Can. Ent. 20, p. 147.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 37 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 25, pl. VII, f. 15, pl. IX, f. 18.— Gibson, 1916, 46th Rept. Ent. Soc. Ont., p. 119.

Arctia quenselii var. gelida (Moeschler). Moeschler, 1876, Stett. Ent. Zeit. 37, pp. 295-6.— Moeschler, Stett. Ent. Zeit. 44, pp. 116-117.

Orodemnias quenselii var. gelida (Moeschler). Kirby, 1892, Cat. Lep. Het. Brit. Mus. III, p. 270.

Hyprepia (Orodemnias) quenselii (Paykull). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 10.

Apantesis quenselii (Paykull). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 402-403.— Holland, 1922, Moth Book, p. 131, pl. XV, f. 28.

Apantesis quenseli var. gelida (Moeschler). Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34.

(non) Chelonia gelida (Moeschler). Menetries, 1863, Cat. Lep. Pet. III, p. 149, pl. 15, f. 4 (= norvegica Strand).

The male like the typical male of quenseli but often with more white on the secondaries; the female with markings on primaries often deep yellow, linings of the veins occasionally nearly obsolescent, transverse bands sometimes extending below the cell, secondaries blackish with white markings as in the male, the marginals, submarginals, and discal dashes usually distinct; a male from Labrador at Carnegie Institute has head and thorax entirely black, a female from Labrador has M and AM extending from C to SM, PM only to median vein; another female, locality unknown, has PM extending to SM, M present only in the cell, but AM a wide stripe reaching from C to IM.

Wing-expanse. Male and female: 30-35 mm.

Type. Described from one male (?) from Labrador; location of type unknown.

Larva. Packard (1874) describes the supposed larva, from Mt. Washington, N. H., and Labrador, as being short and thick, with dense, short, even hairs; head black, setae dark brown, a broad subdorsal band of yellow on first eight abdominal segments; prolegs livid; one inch long; feeding on larch. Dyar (1900)

had a similar larva, also from Mt. Washington, but failed to rear it. It is quite possible that Packard's description refers to another species, since no European larvae have been described as possessing a subdorsal band; the "subdorsal" band, however, may refer to the dorsal stripe, or to the row of yellowish warts described by some European writers.

Distribution. North America, from Labrador and the highest peaks of New England and eastern Canada.

Locality records. LABRADOR: Main, Hopedale, Nain. QUE.: Mt. Albert. ME.: Mt. Katahdin. N. H.: Alpine Gardens of Mt. Washington (5000'), Mt. Madison. ? Greenland: (Holland 1922).

Since gelida was first described from Labrador, it seems reasonable to restrict this name to the North American race of quenseli, assigning to the following subspecies the European specimens with corresponding color-pattern. Adults occur in Labrador in July and August, but are rare. Nothing is known of the length of the life-cycle, nor whether the adults occur yearly or only in alternate years. A specimen reported by Gibson (1916) from the 141st meridian, north of Mt. Natazhat (near the Alaska boundary), may possibly refer to this subspecies, to turbans (Christ.), or to celia f. lineata, which has been collected from Yukon territory.

Callarctia quenseli subspecies norvegica (Strand)

Chelonia gelida (Moeschler). Nemetries, 1863, Cat. Lep. Pet. III, p. 149.

Arctia quenseli var. gelida (Moeschler). Schöyen, 1880, Archiv. für Math. og Naturv. V, p. 175, f. 3.— Schöyen &Sandberg, 1881, Tromsö Mus. Aarsh. 4, p. 64.— Sandberg, 1883, Entom. Tidskr. 4, pp. 16-18, 52-53.— Aurivillius, 1891, Nord. Fjärilar, p. 90.— Staudinger, 1892, Deutsch. Entom. Zeits. Iris V, p. 351, = typical quenselii, not gelida. Spuler,

1910, Schmett. Eur. II, p. 139.

Apantesis quenseli var. norvegica Strand. 1919, Lepid. Cat. 22, p. 292.

Orodemnias quenselii var. norvegica (Strand). Seitz, 1934, Macrolep. II, Suppl., p. 77.

Very similar to gelida (Moeschler), the markings of primaries deep yellow, the secondaries with white streaks between the basal dashes.

Distribution. Finnmarken (northern Norway).

Remarks. If the name gelida (Moeschler), is restricted to the North American race, then the extreme northern European form, resembling gelida in appearance, can be referred to this subspecies. Possibly norvegica is merely a color form of the typical quenseli described from Lapland and prevalent in the Alps; Spuler records forms resembling gelida from the highest Alps, in Engaden, and Lapland. His Alpine specimens may refer to the variety described by Dannehl as ornata, which may or may not be a distinct race, or Dannehl's ornata may be referred to norvegica, and norvegica applied to any gelida-like forms occurring in Europe. The problem can only be settled by those who have access to large series of European specimens.

Callaretia quenseli subspecies liturata (Menetries)

Plate X.

Chelonia liturata Menetries. 1859, Bull. Phys. Math. Acad. Sci. St. Petersb. XVII, p. 500.

Arctia quenselii var. liturata (Menetries). Lampa, 1885, Entom. Tidskr. VI, p. 36-36.

Orodemnias liturata (Menetries). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 270.

Arctia quenselii var.? liturata (Menetries). Staudinger, 1892, Roman. Mem. Lep. VI, p. 283.

Arctia liturata (Menetries). Staudinger, 1892, Deutsch. Ent. Zeits. Iris V, p. n 350.

Apantesis quenselii (Paykull). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 402-403.

Orodemnias quenseli var. liturata (Menetries). Seitz, 1912, Macrolep. II, p. 82.

Apantesis quenselii var. liturata (Menetries). Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci.xXXVI (2), p. 18.

According to the original description, the primaries are as in typical quenseli, the markings pale yellow, but the secondaries largely yellow spotted with black, the anal margin black. The specimen figured, a female from Naddefka (?), has secondaries, body, and markings of primaries deep yellow, and the broad dorsal abdominal stripe of quenseli reduced to a narrow line.

Wing-expanse. 37 mm.

Types. Described from a male taken June 10, near River Kaikhan, and a female, July 4, near Lake Toko-Baikal, Jakoutsk, East Siberia; Types in Zool. Acad. Sci., St. Petersburg.

Distribution. East Siberia: Jakoust, Blagoweschtschenk.

Callarctia quenseli subspecies daisetsuzana (Matsumura)

Orodemnias quenselii subsp. daisetsuzana Matsumura. 1927, Ins. Matsumura I, p. 113, fig.

The original paper concerning this variety has not been available, and no other reference to the name has been found. Its standing as regards species relationship has therefore not been checked. Presumably it occurs in Japan, and may possibly be near subsp. liturata.

The figurata complex

Whether there are three species in the figurata-celia-f-pallida group, or but one or two represented by distinct races, is a matter of some question. In either case figurata is the central form, with f-pallida adjoining its range on the west and celia on the north. The male genitalia show no structural differences, except a size difference correlated with the size of the individual specimen. The larvae of figurata and of celia apparently differ only in size, and Dyar's description of the larva of f-pallida answers well the description of figurata.

The adults, however, possess more or less distinct differences in color pattern. If f-pallida is but a race of figurata, it is remarkably constant in color-pattern, no trace of the W so common to figurata ever appearing, and all known females having head and thorax entirely black and the markings of primaries reduced to small spots and dashes, resembling the female form figurata snowi except for the secondaries. In figurata this form of female is exceedingly rare; in f-pallida it is the only form known. The differences between figurata and celia are more distinct: the pale costa, the ventrally-spotted abdomen, and the tendency to reduce the maculation from the base of the wing outwards, retaining W complete, as well as the smaller size, separate it at once from figurata. Moreover, celia has a form in which the vein of primaries are lined, a condition which has never been reported for figurata.

The specific ranking of each of these is retained in this paper, with the admission that f-pallida may very possibly be a western race of figurata, but that celia is in all probability a distinct species. Breeding of these species within their own range of distribution will scarcely settle the question, if we are dealing with races which breed true as long as conditions remain the same. The transferal of broods from one region to another, theappearance of characters

in the transferred brood typical of the species of the new region, and successful mating, inbreeding, and rearing experiments will be necessary to give the final solution.

13. Callarctia celia (Saunders)

Plate XII

Arctia celia Saunders, 1863, Proc. Ent. Soc. Phil. II, p. 59.— Saunders, 1863, Can. Jour. n. s. VIII, pp. 361-2 (desc.).— Grote & Robinson, 1867, Ann. Lyc. N. H. of N. Y. I, p. 369, = figurata (Drury)?— Saunders, 1870, Can. Ent. II, p. 74 (biol.).— Smith, 1890, Can. Ent. 22, p. 12 (biblio.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. IX, f. 11, VII, ff. 16, 17.

Arctia figurata (Drury). Moeschler, 1876, Stett. Ent. Zeit. 37, pp. 295-6.

Arctia figurata var. celia (Saunders). Neumoegen, 1883, Papilio III, p. 151.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 41-42 (biol.).

Apantesis figurata (Drury). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 269.

Hyprepia (Cymbalophora) phyllira var. celia (Saunders). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 13-14.

Arctia phyllira var. celia (Saunders). Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, p. 381 (desc.).

Apantesis phyllira ab. celia (Saunders). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 409-410.

Apantesis celia (Saunders). Dyar, 1902, Bull. U. S. N. M. 52, p. 90.— Gibson, 1903, Can. Ent. 35, pp. 150-2, pl. V (biol.).— Dod, 1904, Can. Ent. 36, p. 352.— Huard, 1927, Natur. Canad. 57 (1), pp. 61-2 (desc., dist.).

A small northern species closely allied to figurata (Drury), but differing by the usual completeness of the H, the pale costal edge, and in the male by the

spotted ventral surface of the abdomen. From its associates in western Canada, C. williamsi (Dodge) and allies, it may be distinguished by the immaculate vertex.

Male. Head, thorax, and markings of primaries whitish to pale yellow, secondaries and abdomen a deeper yellow or orange-red, with black markings, rarely largely or entirely black, vertex immaculate, palpi and sides of frons black, antennae brownish; patagia spotted, thorax above with three black stripes, below mostly blackish, coxae of forelegs with a large ochreous patch, and all legs more or less streaked with pale ochreous; primaries deep brownish-black to black, with IM, fringes, SM, and transverse bands narrowly buff, C usually narrowly edged with buff to M or beyond, rarely with black edging and narrow submarginal stripe or dash of buff, M usually complete, not attaining outer margin, and usually terminating just below C, PM usually extending from just below C to SM, straight or slightly angled outwards, sometimes broken or occasionally absent, M usually extending from C to SM, at an angle to PM, often broken or wanting, AM often slightly indicated at C; secondaries usually deep yellow, sometimes orange-red, fringes largely ochreous, a broad irregular brownish border formed by fusion of marginal and submarginal spots, costal margin black, one discal spot at end of cell, often joined to costal streak, and sometimes other small spots in disc, anal spot extending to base of wing as a dash, anal margin yellow, base of wing often suffused with black, in rare cases the secondaries completely or largely black, as in C. figurata f. excelsa (Neum.) and f. lugubris (Hulst); wings below as above, the markings paler; abdomen deep yellow, with dorsal stripe, lateral and two ventral rows of small black spots, the ventral spots sometimes fused into transverse bars in individuals with secondaries entirely or largely black, the abdomen is usually black.

Genitalia. Not differing from figurata in structure, but much smaller.

(pl. III, fig. 7)

Uncus slender, shoulders abrupt, membranous area transverse with a median projection; clasper 2 mm. long, usually sharply pointed, ventral margin distad of harpe shallowly concave leaving rounded angles; harpe strongly-developed, sinuate.

Female. Like the male, but abdomen all black below, or black with a median ochreous patch.

Wing-expanse. Male and female: 27-35 mm.

Callarctia celia form lineata new form

Plate XII.

Apantesis sp. Dod, 1904, Can. Ent. 36, p. 362.

Like the typical form except that some or all of the veins of primaries are lined with pale scales. Some specimens closely resemble virguncula (Kby.), but can be distinguished by the narrow lining of the median vein, and in the female by the solid black of the ventral surface of the abdomen which is without definite series of spots. Described from five specimens, male holotype from Ft. Yukon, Alaska; a female paratype from Klondike River, Yukon Territory; and three male paratypes from Calgary, Alta., collected in 1895 by F. H. W. Dod. The normal form of celia was collected with lineata in both Alberta and Yukon Territory.

Callarctia celia form franconia (Henry Edwards)

Arctia franconia Henry Edwards. 1880, Entom. Amer. III, p. 194.

Hyprepia (Cymbalophora) phyllira var. celia (Saunders). Hemmosgen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 13-14.

Apantesis celia (Henry Edwards). Dyar, 1902, Bull. U. S. N. M. 52, p. 90.

Apantesis figurata form franconia (Henry Edwards). Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 55.

Apantesis celia form franconia (Henry Edwards). Barnes & McDunnough, 1918, Contr.

N. H. Lep. N. A. IV, p. 90.

Among specimens from the vicinity of Franconia, N. H., are found typical celia (which the type of franconia appears to be), typical figurata (Dru.), and figurata f. preciosa (Nixon), and others which most nearly resemble celia in size, in maculation of secondaries, and in the tendency to break up M and PM before M, but which recall figurata in the black edging of the costa and in the unspotted ventral surface of the abdomen. Probably we have here either the transition between northern and southern forms of the one species or the occasional interbreeding of two closely related species, in a region where the normally larger figurata is reduced through the effect of temperature to the smaller size of celia.

Types. celia (Saunders): male holotype from Toronto, Ont.; Can. Nat. Coll.

franconia (Hy. Edw.): male holotype from Franconia, N. H.; American Museum.

lineata Smith: male holotype from Ft. Yukon, Alaska, at USNM; 1 female paratype, Klondike River, Yukon Territory, USNM; 3 male paratypes, Calgary, Alberta, Can. Nat. Coll.

Larva. A black larva, without markings, the setae below the spiracles reddish or yellowish, head black, cheeks, antennae, and mouthparts pale, body brownish-black, lighter below, warts blackish, wart i of abdomen with 18-23 setae, 1/3-1/4 of ii, pale dorsal stripe faintly indicated on thorax, setae above spiracles blackish or brownish-black, thoracic setae darker, setae from iv and below reddish or yellow-brown; dorsal abdominal setae sparsely barbed, some smooth; spiracles black, thoracic legs black, prolegs brownish; length of mature larva 28-33 mm. Gibson (1903) reports 7 instars, with a dorsal stripe in instars 2-4 and traces of it in 5.

Distribution. Northern U. S. from Maine tocMichigan; throughout Canada from

Quebec to Alberta and north to Yukon Territory and Alaska.

Locality records. UNITED STATES: ME.: Sebec Lake. N. H.: Franconia. N. Y.: Plattsburgh. MICH.: Portage Point. CANADA: QUE.: Montreal, Fairy Lake, Bobcaygeon, Grand Bend, Woods, Meach Lake. ONT.: Ottawa, Sudbury, Toronto. MAN.: Aweme. ALTA.: Calgary, Banff. YUKON TERRITORY: Klondike River, Klondike Valley near Dawson. ALASKA: Ft. Yukon.

Remarks. Adults have been taken in June and July in Klondike Valley, and in June in New York, Alberta, and Meach Lake, and Quebec.

The validity of C. celia as a distinct species has often been questioned. Larvae and male genitalia of celia and figurata (Dru.) differ only in size, and although figurata is generally larger than celia, typical figurata f. preciosa (Nixon) from Franconia, N. H. is the normal size of celia. The pale edging of the costa, characteristic of celia, is never seen in figurata, but it is occasionally absent in celia. Figurata never has ventral abdominal rows of black spots as in most celia, but in some celia the spots are largely fused into a solid black color. Occasional specimens of both with all black or largely black secondaries show melanistic tendencies. Figurata, however, is not known to possess a form with the veins lined, as in celia f. lineata, nor have larvae of celia been reported, as in figurata, with a distinct dorsal stripe when mature. It would be interesting to procure eggs from a typical southern figurata and rear part of the larvae in Canada, where crossing with celia could be attempted.

14. Callarctia figurata (Drury)

Plate XII.

Bombyx figurata Drury. 1770, Ill. Exot. E tom. II, p. 22, pl. 12, f. 4.

Euplagia ceramica Hubner. 1816, Verz. bek. Schmett., p. 180, = figurata (Drury).

Arctia figurata (Drury). Harris, 1835, Hitchcock's Cat. Anim. Plants Mass., Pt.

IV, p. 593.— Graef, 1878, Bull. Bkln. Ent. Soc. I, pp. 3-4 (biol.).— Hulst, 1883, Bull. Bkln. Ent. Soc. VI, pp. 69-71 (biol.).— Smith, 1890, Can. Ent. 22, p. 31 (biblio.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 14, pl. IX, f. 4.— Rothke, 1907, Ent. News 18, pp. 314-316 (biol.).— Rothke, 1914, Deutsch. Ent. Zeits. Iris XVI, pp. 1-14, pl. I (biol.).

Apantesis figurata (Drury). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 269.— Gibson, 1903, Can. Ent. 35, pp. 152-153.— Holland, Moth Book, p. 132, pl. XV, f. 12.— Huard, Natur. Canad. 57 (1), pp. 62-63.

Pyrrepia (Cymbalophora) phyllira var. figurata (Drury). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 13-14.

Euprepia figurata (Drury). Dyar, 1897, Can. Ent. 29, p. 216.

Arctia phyllira var. figurata (Drury). Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35-42.

Apantesis phyllira ab. figurata (Drury). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 409-410.

Figurata usually shows reduction in the W, and has yellow or red black-bordered secondaries; it is distinguished from celia (Saund.) and phyllira (Dru.) by the black-edged costa and the black ventral surface of the abdomen; from phyllira further by the broad black margin of the secondaries.

Male. Head, thorax, and markings of primaries buff, sometimes flushed with reddish, secondaries and abdomen reddish, vertex immaculate, palpi and sides of frons black, antennae blackish; patagia spotted, thorax above with three black stripes, below blackish-brown, coxae of foreleg with large yellowish patch, often reddish, femora and tibiae of all legs streaked with buff; primaries black or brownish-black, with SM, IM, and transverse stripes narrowly ochreous, fringes partly ochreous, costa often with pale ochreous dash along margin at base, W

seldom complete, usually broken, sometimes entirely wanting, PM nearly always complete from C or just beneath C to SM, rarely broken, M usually extending from C or just below C to SM, often incomplete or reduced to a small dash across the end of the cell, AM occasionally indicated at C; secondaries pale reddish to bright crimson, with a broad rather regular terminal border formed by the fusion of marginal and submarginal spots, more or less indented between M and Cu_1, costal margin black, a lunate discal spot beyond cell, usually attached to costal border, a second spot often present on costa near base, a black dash sometimes present in anal fold and extending to base of wing, basal region of wing sometimes suffused with black, a few other small discals may be present; wings below as above, the secondaries showing less red; abdomen above, the color of secondaries, with a broad black dorsal stripe and lateral rows of small spots, which may be indistinctly separated from the entirely black ventral surface, rarely ochreous below with two rows of black spots.

Genitalia. (pl. III, f. 8). Juxta bilobed, broader than long; uncus slender, shoulders abrupt, membranous area transverse, with a broad median extension; clasper 2.5-3 mm. long, apex sharply or bluntly pointed, ventral mar in distad of harpe shallowly concave leaving a rounded angle; harpe well-developed, sharply curved near center.

Female. Like the male, but thorax and abdomen entirely black below.

Wing-expanse. Male and female: 30-42 mm., usually 35-40.

Callarctia figurata form precisa (Nixon)

Arctia figurata (Drury). Graef, 1878, Bull. Bkln. Ent. Soc. I, pp. 3-4 (biol.). — Rothke, 1907, Ent. News 18, pp. 314-316. (biol.).— Rothke, 1914, Deutsch. Entom. Zeits. Iris XXVI, pp. 1-14, pl. I, 24 figs. (biol.).

Arctia phyllira var. figurata (Drury). Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35-42.

Apantesis figurata var. preciosa Nixon. 1911, Proc. Ent. Soc. Wash. XIII, p. 232.— Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 35, = figurata form franconia (Henry Edwards).— Barnes & McDunnough, 1918, Contr. N. H. Lep. N. A. IV, p. 90, = figurata form preciosa Nixon.

Arctia figurata form flava Rothke. 1914, Deutsch. Entom. Zeits. Iris 26, pp. 10-11.

Apantesis figurata ab. pretiosa Nixon. Hampson, 1920, Cat. Lep. Phal. Brit. Mus. Suppl. II, p. 457.

Like the typical form, but secondaries and abdomen deep yellow, not reddish.

Callarctia figurata form excelsa (Neumoegen)

Plate XII.

Bombyx figurata Drury. Palisot de Beauvois, 1805, Ins. Afr. & Amer., pp. 264-5, pl. 24, f. 4.

Arctia figurata (Drury). Graef, 1878, Bull. Bkln. Ent. Soc. I, pp. 3-4 (biol.).

Arctia excelsa Neumoegen. 1883, Papilio III, p. 70.— Hulst, 1883, Bull. Bkln. Ent. Soc. VI, pp. 69-71 (biol.).-, = nais (Dru.).

Arctia figurata var. excelsa Neumoegen. Neumoegen, 1883, Papilio III, p. 151.— Rothke, 1907, Ent. News 18, pp. 314-316 (biol.).— Rothke, 1914, Deutsch. Entom. Zeits. Iris XXVI, pp. 1-14, pl. I (biol.).

Euprepia phyllira var. excelsa (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 13-14.

Apantesis phyllira ab. excelsa (Neumoegen). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 408-409.

Apantesis figurata form excelsa (Neumoegen). Barnes & McDunnough, 1918, Check-

list Lep. Bor. Amer., p. 35.

Primaries like the typical form, but secondaries largely suffused with black, leaving only a small yellow or reddish-orange spot; abdomen often entirely black; head and thorax usually normal, but thorax often largely or entirely black below; in one specimen head and thorax are entirely black except for reddish lateral borders of the patagia.

Callarctia figurata form lugubris (Hulst)

Plate XII.

Arctia phyllira ab. lugubris Hulst. 1887, Entom. Amer. II, p. 182.

Apantesis phyllira var. lugubris (Hulst). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.

Hyprepia (Cymbalophora) phyllira var. excelsa (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 13-14.

Arctia figurata (Drury). Rothke, 1907, Ent. News 18, pp. 314-316 (biol.).-- Rothke, Deutsch. Entom. Zeits. Iris XXVI, pp. 1-14, pl. I (biol.).

An extreme form of excelsa in which the secondaries are entirely black.

Callarctia figurata form snowi (Grote)

Arctia snowi Grote. 1875, Can. Ent. 7, p. 197.-- Hulst, 1883, Bull. Bkln. Ent. Soc. VI, pp. 69-71, = nais (Drury).--

Apantesis snowi (Grote). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 269.

Hyprepia (Cymbalophora) placentia var. snowi (Grote). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 14.

Apantesis placentia ab. snowi (Grote). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 412.

Arctia figurata var. snowi (Grote). Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VIII, p. 25.

Spantesis figurata form snowi (Grote). Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 35.

An aberration of excelsa, agreeing in the black secondaries with a single reddish or yellow spot, but differing in having the head and thorax entirely black, and in having the markings of primaries reduced to two short dashes in the positions of M and PM. Only one female, the type, known.

Types. figurata (Drury): female holotype from Va., evidently lost; nectype will be deposited in U. S. N. M.

preciosa (Nixon): probable male holotype from Baltimore, Md., in U. S. N. M.

excelsa (Neum.): male holotype from N. C., in U. S. N. M.

snowi (Grote): female holotype from Kansas, in U. S. N. M., No. 33673.

Larva. A blackish larva with brownish-black hairs and usually without pale markings, head black, cheeks, mouthparts, base of antennae pale; body brownish-black, lighter ventrally; warts black, ii with a broad shiny base; wart i of abdomen 1/3-1/4 of ii, with 18-22 setae; spiracles black; dorsal stripe faintly indicated on thoracic segments, and between some of abdominal segments; setae brownish-black, a few all black, thoracic legs black, prolegs brownish. Length of mature larva 45-60 mm. Rothke (1914) reports a light yellow or reddish dorsal line, sharper on the thorax, on some individuals scarcely visible on the abdomen, and grey-brown setae. Dyar (1900) reports a faint whitish dorsal line, heavy in one individual, which may be broken into spots.

Recorded food-plants. Taraxacum.

Distribution. New England and New York south to Georgia, and west to Iowa,

Missouri, and Arkansas, rare in Southern Quebec and Ontario.

Locality records. CANADA: QUE.: Meech Lake, Aylmer. ONT.: Toronto. UNITED STATES: N. H.: Franconia, Durham. MASS.: Framingham, Falmouth, Malden, Weston, Cohasset, Martha's Vineyard. R. I.: Bristol. CONN.: Storrs. N. J.: Runyon, Ramsay, Lakehurst. N. Y.: Bear Mt. PA.: Scranton, Pittsburgh, Ashley, Jeannette. MD.: Baltimore. D. C.: Washington. VA.: Richmond. W. VA.: N. C.: Tryon, So. Pines. GA.: Atlanta. ALA.: Talladega, Valley Head. TENN.: Knoxville ARK.: Rogers. MO.: Carter Co. IOWA.

Remarks. Adults appear in May and June in the north, April and May in the south; August records from Mass., Pa., and Ala. indicate that there may be two generations a year.

15. Callarctia f-pallida (Strecker)

Plate XII.

Arctia f-pallida Strecker. Rept. Chief. Engin. 1878, App. S. S., p. 1860, pl. II, f. 3.

Arctia quadranotata Strecker. Oct., 1878, Proc. Daven. (Iowa) Acad. Sci. II, p. 271, pl. IX, f. 6.— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 26.

Arctia figurata var. f-pallida Strecker. Neumoegen, 1883, Papilio III, p. 151.— Hulst, 1883, Bull. Wkln. Ent. Soc. VI, pp. 69-71, ♂ nais (Drury).

Arctia figurata var. quadranotata Strecker. Neumoegen, 1883, Papilio III, p.151.

Apantesis f-pallida (Strecker). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Apantesis quadranotata (Strecker). Kirby, 1892, loc. cit., p. 268.

Hyprepia (Cymbalophora) figurata (Drury). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 13-14.

Hyprepia (Cymbalophora) placentia var. snowi (Grote). Neumoegen & Dyar, 1894,

loc. cit., pp. 13-14.

Apantesis figurata (Strecker). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 409-410.— Dyar, 1903, Proc. U. S. N. M. XXV, pp. 372-373 (biol.).

Apantesis placentia ab. snowi (Grote). Hampson, 1901, loc. cit., p. 412.

Arctia figurata var. pallida Strecker. Stretch, 1906, pl. VII, f. 22, pl. IX, f. 16.

Apantesis socíata Barnes & McDunnough. 1910, Jour. N. Y. Ent. Soc. 18, p. 149.— Barnes & McDunnough, 1912, Contr. N. H. Lep. N. A. I (IV), p. 29, pl. XIII, f. 6.— Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 35, = var. quadranotata (Strecker).

Apantesis moierra Dyar. 1914, Ins. Insc. Menst. II, pp. 161-2.— Hampson, 1920, Cat. Lep. Phal. Brit. Mus. Suppl. II, p. 457, = figurata var. moierra Dyar.— Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer. p. 35, = quadranotata (Strecker).

The male is similar in color-pattern to some forms of figurata (Drury), but no trace of W is ever present. The female is like placentia (A. & S.) female in having markings of primaries reduced to a few small spots and head and thorax entirely black, but secondaries have a wide black border without distinct submarginal spots.

Male. Wings black with abbreviated cream-colored markings; secondaries reddish or yellow with a wide even border and a single discal spot; vertex pale coral-red usually immaculate, but sometimes spotted, palpi and sides of frons black, antennae brownish-black; patagia pale coral spotted with black, thorax above with three black stripes, below mostly blackish-brown, coxae of fore-legs marked with cream or pinkish and other legs sometimes streaked with cream; primaries brownish-black to black, SM and transverse bands light cream-color, fringes black or whitish, no trace of W, PM usually present from C to SM, slightly angled

outwards, sometimes with a slight tooth at the angle marking the position of W, sometimes not quite extending to SM, M usually present from C to SM, sometimes not quite attaining SM, two to three times as far from PM on costa as on SM, SM never extends beyond base of PM, and transverse bands never extend below SM; secondaries usually pale to deep coral-red, occasionally yellow, costal margins narrowly black, outer margin with a broad even black border, fringes usually black, sometimes pale, a single black lunate discal spot joined to costal margin, rarely 1-3 additional spots; abdomen below entirelu black, sometimes with ochreous patches but rarely ochreous with definite black spots, above the color of the secondaries, with a narrow black stripe; wings below as above but paler.

Genitalia. (pl. III, f. 9). Like figurata (Drury), but smaller; juxta bilobed; uncus slender, tapering, shoulders rounded or abrupt, membranous area transverse with a broad median extension; clasper 2-2.5 mm. long, ventral margin distad of harpe shallowly concave leaving a rounded angle, distal portion gradually narrowed, apex bluntly pointed; harpe well-developed, deeply indented in the center.

Female. Markings of primaries extremely reduced, usually to one or two small dots or dashes as in placentia females, head, palpi, antennae, legs, and thorax usually entirely black, one specimen showing a cream-colored spot on vertex, while in another there two small buff spots on the mesothorax; primaries blackish-brown to deep black, with buff markings, no indication of W, PM sometimes lacking, but usually indicated by one or two small spots or an elongate dash beyond the end of the cell, AM represented by a short dash or spot in the cell, occasionally absent, SM represented in only one specimen by a dash from base of wing to below base of AM, not touching AM, transverse dashes or spots not extending to costa; secondaries deep red, costal margin narrowly black, in some specimens a broad even black border with a single discal spot, or slight indications of other discal spots, in

others (quadranotata Strecker) a slight extension of black border into the disc of the wing below discal spot, in still others this extension reaches half the distance to the base, and coalesce with the discal spot, cutting off a small red spot, fringes black; wings below as above; abdomen below entirely black, above deep red with a broad notched dorsal stripe, last segment sometimes entirely black.

Types. f-pallida (Strecker): male holotype from Rio Navajo, Colo.; Field Museum.

quadranotata (Strecker): female holotype from Dallas, Texas; Field Museum.

moierra (Dyar): female holotype from Dallas, Texas, June 20, 1906; U. S. N. M. No. 19075.

sociata (B. & McD.): female holotype from Ft. Wingate, N. M., June 16-23; U. S. N. M.

Larva. Dyar (1903) describes a larva from the foothills of Colorado which produced a moth of the form f-pallida as follows: head shiny black with cheeks pale; body black-brown; warts black; i small, less than 1/3 of ii, ii with large shining base; a broad distinct sharp dorsal cream-white dorsal line; setae all black, even; prolegs pale reddish. It fed on alfalfa, and was taken May 12.

Remarks. Adults have been taken in April and July at Alpine, Texas; in May at Shovel Mt., June at Fort Wingate, Dallas, and Big Bend, July at Plainview, and August at Los Vegas. There may be two generations a year in the southern part of its range.

The quadranotata of Strecker has been known only as the female, and in a genus in which females are much more rarely found than are the males, such a situation is outstanding. The only females reported for the species f-pallida (Strecker) have been two specimens which are at the U. S. N. M., collected by

Bruce in Colorado with the males. One of these is shown on plate XII, and closely resembles the male in size and in maculation of secondaries, but has the head, thorax, and primaries entirely black with only a few white spots. A series of specimens from Dallas, Texas, includes a typical male f-pallida, and a group of four females, all of which are shown on plate XII. The females were referred to by Strecker, in his description of quadranotata, as being identical with his species, and come from the type locality of both quadranotata (Strecker) and moierra (Dyar). The females shown on Plate XII, collected in Colorado, and in Kerrville and Dallas, Texas, show a gradual transition from the form described as quadranotata by Strecker to that known as sociata (Barnes & McDunnough). The Colorado specimens, males as well as females, are generally smaller than those from eastern Texas, but this difference may be attributed to the cooler and drier climate of the mountains. The association of male f-pallida with female quadranotata in both Colorado and Texas, the close agreement in maculation of secondaries, and the occurrence in closely related species of females with head, thorax, and entirely black primaries, makes it very probable that f-pallida and quadranotata are male and female, respectively, of the one species.

The priority of the name f-pallida may be questioned, since both f-pallida and quadranotata were described by Strecker in 1878. The description of quadranotata appeared in October. No month of publication is given for the 1878 report of the chief of the engineers in which f-pallida was described, but since the report covers only the period from June, 1877, to June, 1878, its appearance was doubtless soon thereafter.

16. Callaretia phyllira (Drury)

Plate XI.

Bombyx phyllira Drury. 1770, Ill. Exot. Entom. I, pl. 7, f. 2.

Geometra b-ata Goeze. 1781, Entom. Beytr. (IV) 3, p. 428, = phyllira (Drury).

Bombyx plantaginis Martyn. 1797, Psyche, pl. 15, ff. 36-7.

Phalaena phyllira (Drury). Smith & Abbot, 1797, Lep. Ins. Ga., pp. 127-128, pl. 64.

Euplagia phyllira (Drury). Hubner, 1816, Verz. bek. Schmett., p. 180.

Arctia phyllira (Drury). Harris, Hitchcock's Cat. Anim. & Plants Mass., Pt. IV, p. 593.— Hulst, 1883, Bull. Bkln. Ent. Soc. VI, p. 70, = nais (Drury). — Hulst, 1883, loc. cit., p. 120, - sp. dist.— Smith, 1890, Can. Ent. 22, p. 35 (biblio.).— Packard, 1895, Jour. N. Y. Ent. Soc. III, pp. 178-180 (biol.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 41-42, 47 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, ff. 10, 18, 19.

Callimorpha phyllira (Drury). Westwood, 1837, Ed. Drury's Illus. I, p. 15.

Arctia philyra (Drury). Saunders, 1863, Can. Jour. n. s. VIII, pp. 359-360.

Arctia dodgei Butler. 1881, Ent. Mon. Mag. 18, pp. 135-136.— Smith, 1892, Can. Ent. 24, pp. 133-136, = phyllira (Drury).

Arctia figurata var. phyllira (Drury). Neumoegen, 1883, Papilio III, p. 151.

Apantesis phyllira (Drury). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267-8.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 409-410 (desc.).— Gibson, 1903, Can. Ent. 35, pp. 149-150, pl. V.— Barnes & McDunnough, 1911, Can. Ent. 43, pp. 257-259, pl. III (biol.).— Barnes & McDunnough, 1912, Can. Ent. 44, pp. 132-135 (biol.).— Holland, 1922, Moth Book, p. 132, pl. XV, f. 14.

Apantesis dodgei (Butler). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 409-410, = phyllira ab. dodgei (Butler).

Eyprepia (Cymbalophora) phyllira (Drury). Neumoegen, 1894, Jour. N. Y. Ent.

Soc. II, pp. 13-14.

Euprepia phyllira (Drury). Dyar, 1897, Can. Ent. 29, p. 216.

Cymbalophora phyllira (Drury). Goodhue, 1902, Ent. News 13, pp. 286-287.

Phyllira is a rather large species with deep red, spotted secondaries and usually two transverse bands on the primaries besides the W, similar to male placentia (A. & S.), but distinguished by the ventrally-spotted abdomen and the more nearly parallel M and PM, which are rarely more than twice as far apart on the costa as on SM; from figurata it may be differentiated by the spotted abdomen, the completeness of the W, and the spotted, not broadly-bordered secondaries.

Male. Head, thorax and markings of primaries pale ochreous; secondaries deep red, fading to paler, very rarely yellow; vertex immaculate, palpi and sides of frons black, antennae blackish; patagia spotted, thorax above with three black stripes, below mostly brownish-black, coxae of forelegs with a bright reddish patch, and all legs variously marked with ochreous; primaries black with C, IM, SM, fringes, and transverse bands ochreous, W nearly always complete, not attaining terminal border, PM from C to SM straight, very rarely broken, M usually extending from C to SM, sometimes broken or absent, AM usually slightly indicated at AM; secondaries light to deep red, very rarely yellow, fringes ochreous, costal and outer margins narrowly and unevenly black, 3 distinct submarginals, the apical often extending to costal streak, a lunate apical across the end of the cell, usually reaching costa, an inner spot on costa, sometimes extending into cell, rarely one or two other discal spots. Wings below as above, but red of secondaries paler, and markings of primaries flushed with pale red; abdomen the color of secondaries, with a series of black dorsal spots usually forming a dorsal stripe, and lateral and two ventral rows of small black spots.

Genitalia. (pl. III, f. 6). Juxta scarcely or not at all bilobed, wider than long; uncus short, stout, shoulders abrupt, membranous area transverse;

clasper 3 mm. long, tapering slightly distad of harpe to a bluntly rounded apex; harpe nearly straight, strong on ventral side of clasper, gradually tapering beyond middle; a low ridge below and parallel to harpe.

Female. Like the male.

Wing-expanse. Male and female: 34-44 mm.

Callarctia phyllira ab. conspicua (Stretch)

Plate XI.

Arctia conspicua Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. VIII, f. 2.

Apantesis rectilinea form conspicua (Stretch). Barnes & McDunnough, 1918, Check-list Lep. Bor. Amer., p. 34.

Apantesis oithona ab. conspicua (Stretch). Barnes & Benjamin, 1927, Bull. Soc. Calif. Acad. Sci. XVI, p. 15.

Like typical phyllira, but with the veins partially lined with white scales. The bases of the median and anal veins are usually the first to show pale scales, although in a few specimens from Ft. Collins, taken with typical phyllira, the branches of radius and media are pale. Form conspicua is a transition between typical phyllira and oithona.

Callarctia phyllira oithona (Strecker)

Plate XI.

Arctia oithona Strecker. 1877, Lep. Rhop. and Het., p. 131.-- Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 40, = ab. rectilinea French.

Apantesis oithona (Strecker). Kirby, 1878, Syn. Cat. Lep. Het. I, p. 270.

Syprepia (Callaretia) intermedia (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 7-8.

Apantesis parthenice (Kirby) var. oithona (Strecker). Strand, 1919, Cat. Lep.

22, p. 287.

Much like typical phyllira, but all veins of primaries lined with pale scales; primaries reduced, narrower than in phyllira, the transverse bands very narrow, broken, or wanting; secondaries and abdomen as in phyllira; an aberrational form which occurs more often in the female.

Callarctia phyllira oithona form norm. rectilinea (French)

Plate XI.

Arctia rectilinea French. 1879, Can. Ent. XI, p. 45.— French, 1891, Can. Ent. 23, pp. 130-132 (biol.).— Beutenmuller, 1898, Bull. Amer. Mus. N. Y. X, p. 379.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 40-41 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 24.

Apantesis rectilinea (French). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267.— Gibson, 1903, Can. Ent. 35, pp. 117-119, pl. V (biol.).— Gibson, 1905, Can. Ent. 37, pp. 337-347 (biol.).— Holland, 1922, Moth Book, p. 129, pl. XV, f. 1.

Euprepia (Callarctia) rectilinea (French). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 8.

Euprepia rectilinea (French). Dyar, 1897, Can. Ent. 29, p. 215.

Apantesis oithona var. rectilinea (French). Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 40.

Like typical phyllira, but all veins of primaries fully lined, although sometimes partially obsolescent at outer margin.

Types. phyllira (Drury): female holotype, from New York, evidently lost; neotype in U. S. N. M.

oithona (Strecker): female holotype from Dallas, Texas; Field Mus-

eum.

rectilinea (French): two male and two female cotypes from Carbondale, location unknown.

dodgei (Butler): female holotype, type locality unknown, in BM.

Larva. A light brown larva mottled with darker brown, the warts tipped with yellow, a dorsal stripe or series of dashes, and setae blackish above and silvery or reddish below; head dark brown, the cheeks, mouthparts, and antennae pale; body light brown, mottled with dark brown patches and dashes; wart i of abdomen yellowish, ii shiny black or brown or tipped with yellow; iii and below dark brown or black, with yellow posteriorly, pale warts with tan to dark brown setiferous tubercles, wart i of abdomen very small, 1/8-1/9 of ii, with 6-12 setae; spiracles yellowish, with black rims; setae from i-iii dark brown to blackish, with a few silvery hairs, from iv and below silvery or pale rust-red; setae conspicuously barbed; from i and ii of abdomen sometimes smooth; thoracic legs black, prolegs brownish; length of mature larva 35-50 mm. 7 instars.

Recorded food-plants. Corn, peas, wheat, tobacco, cotton, Helianthus divaricatus, Castilleja sessiliflora, Taraxacum, Lupinum.

Puna. Length 21-23 mm. Cremaster less than 1 mm. long, broadened at base, all surfaces smooth and shiny, the apex slightly duller; I less than 1 mm. long, near the meson; II laterad of I and slightly shorter, sometimes shorter than III, which is just ventrad of I; several lateral and dorsal setae shorter than III.

Distribution. New England and New York south to Florida and west to South Dakota, Colorado, and Texas; in southern Canada from Ontario to Alberta.

Locality records. oithona. UNITED STATES: N. H.: Hampton, Manchester. MASS.: Milton, Nantucket, Sherborn. R. I.: Bristol. CONN.: Storrs. N. Y.: Brooklyn, Babylon. N. J.: Plainfield. VA: Nelson Co. GA.: Atlanta, Experiment. FLA.: Portland, Fort Meade. ALA.: Blount Springs. MISS.: Starkville, Macon. TENN.: Nashville, Fayetteville, KY. OHIO: Shelby.

MICH.: E. Lansing. WISC.: Milwaukee. MINN.: St. Paul. ILL.: Carbondale, Quincy, Chicago. IOWA: Sioux City. MO.: St. Louis, Ranken. ARK.: Rogers. LA.: Mansfield. TEX.: Houston, College Station. OKLA.: Norman, Payne Co., Stillwater. KANS.: Douglas Co. NEBR.: Florence, Lincoln. COLO.: Lookout Mt., Jefferson Co. (7000'), Denver, Ft. Collins. S. D.: Volga. CANADA: ONT.: Grand Bend. MANI.: Aweme, Rounthwaite. ALTA.: Calgary.

phyllira: UNITED STATES: N. H.: Hampton, White Mts., Jaffrey. MASS.: Nantucket. CONN. PA.: Scranton. MD.: Baltimore, N.J.: Jamesburg, Lakehurst. GA.: Atlanta. N.C.: Raleigh, So. Pines, Highlands. FLA.: Archer, Fort Meads, Tampa, Gainsville. ILL. MICH.: E. Lansing. MINN.: St. Paul. WIS.: Waushara Co. COLO.: Ft. Collins, Lookout Mt., Plainview, Clear Creek Canyon, Pine Cliff. CANADA: ONT.: Grand Bend, Toronto, Paris, Ottawa, St. Ives, Norfolk. ALTA.: Medicine Hat.

Typical phyllira has been taken only as above.

Remarks. Adults appear in May and June and again in August and September in New York, Illinois and Nebraska, as early as March and April and until October or November in Florida and Georgia. There are apparently two generations a year, possibly three in the south, as French (1891) obtained adults in May, July, and early September. It is more common in the south than in the north, particularly in the Mississippi Valley region. Rectilinea, the normal form of variety oithona, is more abundant than typical phyllira.

Oithona and its normal form rectilinea have frequently been associated with phyllira, and their specific relationships discussed. The only distinction between the two is the presence of pale lines on the veins in oithona. The male genitalia show no morphological differences; the larvae are indistinguishable; and the distribution of the two is essentially the same. Moreover, there are frequent intergrading specimens of the form conspicua, which show usually

the bases of median and anal veins marked with white scales. In a series of phyllira, it is difficult to find specimens in which the median vein is not slightly indicated; and in a group of Colorado phyllira, several show distinct pale lines on the branches of radius, media, and cubitus. In many other species of the genus, there occur both unlined and lined forms: ornata (Pack.) and ornata achaia (G and R), hewletti (B. and McD.), cervinoides (Stkr.) celia (Saund.) and celia lineata (Smith). In view of the lack of morphological differences, the similarity of the larvae, and the seemingly transitional forms, it seems reasonable to conclude that the two species are but varieties of the one, possibly Mendelian, in which case the more abundant oithona is dominant. It is true that phyllira and oithona have never been bred from the same brood, but extensive breeding of typical phyllira has not been done.

17. Callarctia placentia (Abbot & Smith)

Plate XII

Phalaena placentia Abbot & Smith. 1797, Lep. Ins. Ga. II, p. 129, pl. 65.

Heraclia placentia (Abbot & Smith). Hubner, 1816, Verz. bek. Schmett. p. 180.

Arctia placentia (Abbot & Smith). Walker, 1855, Cat. Lep. Het. Brit. Mus. III, p. 610. - - Hulst, 1883, Bull. Bkln. Ent. Soc. VI, p. 70, = nais (Drury). - - Smith, 1890, Can. Ent. 22, pp. 52-53 (biblio.). - - Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 35, 42 (biol.). - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, ff. 12, 20, 21, pl. IX, f. 13.

Apantesis placentia (Abbot & Smith). Kirby, 1892, Syn. Cat. Lep. Het. I, p.269. - - Barnes & McDunnough, 1911, Can. Ent. 43, pp. 257-259, pl. III (biol.). - - Barnes & McDunnoug , 1912, Can. Ent. 44, pp. 136-136 (biol.).

Euprepia (Cymbalophora) placentia (Abbot & Smith). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 14.

Euprepia placentia (Abbot & Smith). Dyar, 1897, Can. Ent. 29, p. 216.

The male is similar to phyllira (Dru.) in maculation, but distinguished by the black-tip and black ventral surface of the abdomen, by the pale costa, and by the greater distance between M and PM on the costa, which is at least three times the distance between them on SM. The female resembles the female f-pallida (Strecker), with head, thorax, and primaries black, a few white spots on the primaries, and the secondaries red with black border. In placentia, however, there is a distinct row of large submarginal black spots within the very narrow black border.

Male. Head, thorax, and markings of primaries cream; secondaries and abdomen above deep coral red, vertex immaculate, palpi and sides of frons lack, antennae blackish; patagia spotted, thorax above with three black stripes, below mostly blackish-brown, coxae of fore-legs marked with bright flame, femora and tibiae sometimes streaked with cream; primaries black with C, IM, fringes, SM and transverse bands cream-color, M. complete, not attaining outer margin, PM complete from C to SM, straight or slightly angled outwards, M extending from C to SM, the distance on costa between M and PM three to four times the distance between them on SM, AM sometimes indicated at C, rarely present across cell to SM, no transverse bands extending below SM; secondaries deep coral red, costal and outer margins narrowly black, fringes cream, three submarginal black spots, the anal largest and usually fused with margin, the apical usually attached to costal margin, a single lunate discal spot, joined to costal stripe; wings below with markings as above, suffused with pale coral; abdomen deep coral-red above, with a black dorsal stripe and last segment entirely black, abdomen below entirely black.

Genitalia. (p. II, fig. 7). Juxta twice as wide as long, slightly bilobed; uncus with distal half slightly spear-shaped, hooked at apex and acutely pointed, shoulders rounded, membranous area transverse, indistinct, with a median projection; clasper 3 mm. long, broadest below harpe, ventral margin

strongly concave just distad of harpe, leaving a rounded obtuse angle, and sinuous basad of harpe, apical portion scarcely narrowed, of nearly equal dimensions throughout, bluntly rounded, articulatory point on dorsal margin below mid-length; harpe narrow, slight, strongest just within dorsal angle.

Female. Head, palpi, antennae, thorax, and legs all black, without pale markings, primaries deep black with two or three small whitish spots, one in cell in position of M, one or two beyond end of cell, in position of PM; secondaries deep coral red, costa and outer margins narrowly black, fringes black, three submarginal black spots, the apical usually attached to costa, the two anal usually fused with outer margin, a single lunate discal spot attached to costal margin; wings below as above, but spots on primaries pale coral red; abdomen entirely black below, above deep coral-red with a narrow black dorsal stripe, often broken into spots, and last two or three segments entirely black.

Wing-expanse. Male and female: 40-45 mm.

Callarctia placentia f. flammea (Neumoegen)

Arctia flammea Neumoegen. 1881, Papilio I, pp. 9-10. - - Hulst, 1883, Bull. Bkln. Ent. Soc. VI, p. 70, = mais (Drury).

Arctia placentia var. flammea Neumoegen. Neumoegen, 1883, Papilio III, pp. 148-151. - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VIII, f. 24, pl. IX, f. 12.

Apantesis flammea (Neumoegen). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 269.

Evprepia (Cymbalophora) placentia var. flammea (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. XIV, p. 14.

Apantesis placentia ab. flammea (Neumoegen). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 412.

Types. placentia (A. & S.): female holotype from Georgia; female neotype, from So. Pines, N. C., deposited in the U. S. N. M.

flammea (Neum.): female holotype from Indian River, Fla.; U.S.N.M.

Larva. Velvety black, with black setae and a broken red dorsal stripe; head black, antennae, epicranial suture, and small areas on cheeks pale; body dark brownish-black, occasionally marbled with light grey, with velvet-black patches around warts i and ii; warts shiny black-brown or black, paler below spiracles; wart i of abdomen 1/4-1/6 of ii, with 15-18 setae; dorsal stripe whitish and narrow on thoracic segments, broken into a few small reddish dots on abdomen, often almost entirely lacking; spiracles black; setae black, from below spiracles black-brown; setae from warts i and ii, and from most of iii, sparsely or not at all barbed; thoracic legs dark brown, prolegs paler; length of mature larva 37-50 mm. Barnes and McDunnough (1912) record seven instars.

Recorded food-plants. Rubus, Taraxacum, Lupinus, corn, peas.

Distribution. Known only from the southeastern states, N. C. to Fla.

Locality records. N. C.: So. Pines. GA. FLA.: Jacksonville, St. Petersburg, Miami, Indian River.

18. Callarctia favorita (Neumoegen)

Plate XI.

Arctia favorta Neumoegen. 1890, Entom. Amer. VI, p. 173. Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43, 45.

Callarctia favorita (Neumoegen). Kieby, 1892, Syn. Cat. Lep. Het. I, p. 272.

Euprepia (Cymbalophora) favorita (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 13.

Euprepia favorita (Neumoegen). Dyar, 1897, Can. Ent. 39, p. 216.

Apantesis favorita (Neumoegen). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 406. - - Barnes & McDunnough, 1912, Contr. Nat. Hist. Lep. N. A. I (IV), p. 9.

Apantesis phyllira ab. favorita (Neumoegen). Dyar, 1902, Bull. U. S. N. M. 52, p. 90.

Apantesis favorita ab. favoritella Strand. 1919, Lep. Cat. 22, p. 284.

Favorita is similar to phyllira (Dru.) in color pattern, but easily distinguished by the spotted vertex and the usually broader transverse bands which are often confluent, and which extend below SM. It is somewhat like some forms of nevadensis (G. & R.) in appearance, but lacks the basal half band.

Male. Head, thorax and markings of primaries cream, abdomen and secondaries reddish with black spots; vertex tinged with pink, spotted, palpi and sides of frons blackish, antennae brown-black, patagia spotted with brownish-black, thorax above tinged with coral, with three brownish-black stripes, below mostly blackish legs streaked with cream; primaries dark brown-black with inner margin, fringes, base of costa above, SM, and transverse bands cream-colored sometimes suffused with coral-red, W complete, not attaining outer margin, PM straight, often not attaining costa, and usually indicated below SM, M present, often partially coalesced with PM, and usually extending below SM, AM present or at least indicated at C and SM, often coalesced partially with M, often extending to IM, base of A sometimes streaked with cream, C pale to median band; secondaries pale to deep coral red, fringes cream-colored, costal border black, outer margin with irregular black border formed by fusion of two or three marginal spots, three submarginals usually present, the anal often fused with the border, one discal usually present, and sometimes one or two other minute discals; wings below with markings as above, costa of primaries black, and pale maculation suffused with salmon; abdomen deep coral red, with dorsal black stripe, and lateral and two ventral rows of spots, the ventral rows sometimes coalesced into transverse bars.

Genitalia. (pl. III, fig. 4). Juxta wider than long, bilobed; uncus cylindrical for apical half, slightly hooked at apex, shoulders prominent, subparallel, membranous area a broad inverted T, indistinct; clasper 3 mm. long, widest below harpe, ventral margin distad of harpe deeply concave forming an obtuse angle, dorsal margin strongly convex, apex bluntly pointed; harpe very

prominent, broad and heavy, sharply emarginate at mid-length.

Wing-expanse. 35-43 mm.

Female. Unknown.

Type. Idaho Springs, Colo.; 1 male cotype: U.S.N.M. No. 33676; described from two males.

Distribution. Recorded only from Colorado. The only specific locality is Idaho Springs.

Remarks. The species is apparently rare, only nine specimens having been seen: six at U. S. N. M., two at Philadelphia Academy of Sciences and one at Cornell. The time of flight is not recorded. Early stages are unknown.

19. Callarctia nevadensis (G. & R.)

Plate XIII

Arctia nevadensis Grote & Robinson. 1866, Proc. Ent. Soc. Phil. VI, pp. 142, pl. I, f. 1. - - Coquillot, 1898, Jour. N. Y. Ent. Soc. VI, p. 250 (biol.). - - Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 44-45 (biol.). - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, ff. 8-10.

Arctia behrii Stretch. 1872, Zyg. & Bomb. N. A. pp. 75-76, pl. III, ff. 11, 12. - Stretch, 1873, loc. cit. pp. 238, = nevadensis.

Arctia incorrupta var. nevadensis Grote & Robinson. Neumoegen, 1883, Papilio III, p. 151.

Apantesis nevadensis (Grote & Robinson). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268. - - Dyar, 1906, Bull. Bkln. Inst. Mus. I, pp. 194-5 (biol.). - Barnes & McDunnough, 1916, Contr. N. H. Lep. N. A. III, pp. 158-159. - Holland, 1922, Moth Book, pp. 131-132, pl. XVI, f. 29.

Arctia blakei var nevadensis Grote & Robinson. Dyar, 1893, Psyche VI, pp. 379-381.

Hyprepia (Cymbalophora) blakei var. nevadensis (Grote & Robinson). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 12, 13.

Apantesis blacei ab. nevadensis (Grote & Robinson). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 406-407.

Nevadensis is an extremely variable species, but always possesses the subbasal half-band and three or four other transverse bands. The typical form has head and thorax entirely black. These features separate it from other species of the genus.

Male. Head and thorax entirely black, markings of primaries cream-color, secondaries whitish tinged with rose; a few indivuduals with traces of white on sides of patagia and tegulae, antennae brownish, coxae of fore legs with a large ochreous patch, femora and tibiae of all legs variously marked with cream; primaries deep black with costal margin to M or beyond, IM, fringes, SM, and transverse bands cream, SB always present and extending from C to SM, AM usually extending from C to IM and angled outwards at SM, but often broken, M extending from C to IM, rarely broken, PM extending at least from C to SM, often below or united with M in a V, strongly curved outward above SM, W complete and often attaining outer margin; secondaries whitish tinged with rose especially along inner margin, with a variable number of black or brownish spots, sometimes nearly immaculate with only one or two small submarginal spots but usually with one to three marginals, the apical often fused into a narrow border, two to four distinct submarginals, and usually one, but sometimes as many as four, discals, fringes whitish; wings below as above, but the black markings paler, and the secondaries usually with an additional costal spot towards base; abdomen above flushed with pink at base, whitish towards apex, with a dorsal stripe and lateral rows of small spots, below whitish with two rows of black spots often fused into transverse bars with the segments edged with white.

Genitalia. (pl. IV, fig. 11). Juxta bilobed, broader than long; uncus slender, shoulders abrupt, slanting, membranous area indistinct; clasper 3 mm., long, ventral margin distad of harpe deeply and abruptly concave, leaving a

right or obtuse angle opposite harpe, apex bluntly rounded, rarely pointed, clasper scarcely narrowed beyond harpe; harpe best developed near ventral margin, abruptly curved at center.

Female. Only two specimens at hand; both essentially like the male in color-pattern, but the antennae black, secondaries a deeper red, even throughout, with two distinct marginals, 3 or 4 submarginals, and 1 or 2 discals; the abdomen entirely black below in one specimen.

Wing-expanse. Male: 30-45 mm.; female: 30-32 mm.

Callarctia nevadensis form alexanderi, new form

Plate XIII

Arctia nevadensis form incorrupta Henry Edwards. Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43-44.

Apantesis blacei (Grote). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 406-407.

Apantesis blakei (Grote). Barnes & McDunnough, 1912, Contr. N. H. Lep. N. A. I (IV), p. 9, =bolanderi (Stretch)?.

Apantesis nevadensis (Grote & Robinson). Barnes & McDunnough, 1918, Contr. Nat. Hist. Lep. N. A. III, pp. 158-159.

Like typical nevadensis, and occurring in the same brood, but with head and thorax whitish, vertex and patagia spotted, and the thorax striped with black. It is here given a varietal name in order to emphasize its distinctness from geneura (Stretch) (=incorrupta Hy. Edw.), which it has often been called, but from which it differs by its smaller size, and its less brightly colored and more maculate secondaries. With typical nevadensis it occupies a more northern range than does the southern race geneura.

Callarctia nevadensis form sulphurica (Neumoegen)

Arctia incorrupta var ochracea Neumoegen. 1883, Papilio III, p. 71. (non)

Callarctia ornata form ochracea (Stretch). 1882, Zyg. & Bomb. N. A., p. 125.

Arctia incorrupta var. sulphurica Neumoegen. 1885, Entom. Amer. I, p. 93.

Euprepia (Cymbalophora) blakei var. sulphurica (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 12-13.

Arctia nevadensis var. sulphurica Neumoegen. Ottolengui, 1895, Ent. News 6, pp. 287-8.

Apantesis nevadensis geneura ab. sulphurica (Neumoegen). Barnes & McDunnough, 1916, Contr. N. H. Lep. N. A. III, pp. 158-159.

A rather rare form with pure yellow secondaries, sometimes occurring as a form of nevadensis f. alexanderi, or of geneura.

Types. nevadensis (G. & H.): male holotype from Nevada; Phil. Acad. Sci. No. 7687.

sulphurica (Neum.): male holotype from Prescott, Ariz.; U. S. N. M. No. 33679.

alexanderi Smith: male holotype from Colo.; U. S. N. M.; female paratype from Colo., U. S. N. M.; 2 male paratypes from Utah, A. M. and author's collection; 2 male paratypes from Frenchglen, Ore., U. S. N. M., and Oregon State Ag. College, Corvallis.

Larva. Dyar (1906) describes larvae from Utah as follows: head shining black, sutures pale; body pale, heavily mottled with blac, lighter ventrally; warts iii, v, and vi light red, the rest black; dorsal and subdorsal stripes absent; setae from wart i pale yellow-brown, from warts i and iii black, from iv and below pale.

Distribution. In the mountains from Colorado north to Montana and west to the Pacific Coast.

Locality records.

MONT.: #Missoula, #Ravalli Co., #Bozeman, #Havre. COLO.: Glenwood Springs, #Oak Creek Canyon. UTAH: Logan, *Stockton, *Eureka, *Lehi, *Spanish Fork, *Beaver Creek Hills. NEV.: *Reno. IDAHO: Riverdale, *Bald Mt. ORE.: Riley, Frenchglen, *Malheur Lake. WASH.: *Yakima.

Sulphurica occurs throughout the entire range of nevadensis and its races, as follows: B. C., CAN.: Vernon. WASH.: Easton. COLO. ARIZ.: Easton.

Remarks. Adults have been taken in August and September in Utah, July and August in Oregon. A single specimen taken in Utah in early June indicates that there may be an earlier spring generation.

Callarctia nevadensis subspecies geneura (Stretch)

Plate IX

Arctia geneura Strecker. 1878, Proc. Daven.(Iowa) Acad. Sci. II, p. 270, pl. IX, f. 5. - - French, 1885, Papilio IV, p. 158.

Arctia incorrupta Henry Edwards. 1881, Papilio I, pp. 38-39. — Neumoegen, 1883, Papilio III, p. 71.

Arctia incorrupta var. nevadensis Grote & Robinson. Neumoegen, 1883, Papilio III, p. 151.

Arctia nevadensis var. incorrupta Henry Edwards. Neumoegen, 1885, Entom. Amer. I, pp. 93-94. - - Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43-44. - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. IX, ff. 6-9.

Apantesis nevadensis var incorrupta (Henry Edwards). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268. - - Dyar, 1902, Bull. U. S. N. M. 52, p. 89. Barnes and McDunnough, 1912, Can. Ent. 44, pp. 188-189 (biol.). — Barnes and McDunnough, 1916, Contr. N. H. Lep. N. A. III, pp. 158-159. = geneura (Strecker).

*only typical nevadensis

#only nevadensis f. alexanderi

Apantesis geneura (Strecker). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Arctia blakei var. nevadensis syn. geneura, incorrupta. Dyar, 1893, Psyche VI, pp. 379-381.

Eyprepia blakei syn. incorrupta (Henry Edwards). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 12.

Eyprepia superba syn. geneura (Strecker). Neomoegen & Dyar, 1894, loc. cit., p. 14.

Arctia superba syn. geneura Stretch. Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 45.

Apantesis blakei syn. incorrupta (Henry Edwards). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 406-7.

Apantesis superba syn. geneura (Stretch). Hampson, 1891, loc. cit., p. 408.

Apantesis nevadensis var. superba syn. geneura (Stretch). Dyar, 1902, Bull. U. S. N. M. 52, p. 89.

Apantesis nevadensis var. geneura (Stretch). Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34. - - Comstock, 1935, Bull. So. Calif. Acad. Sci. 34, pp. 150-151, pl. 42, 43.

(non) Arctia geneura Stretch. French, 1889, Can. Ent. XXI, pp. 162-163, (=ornata Packard).

(non) Apantesis nevadensis var. incorrupta (Henry Edwards). Gibson, 1903. Can. Ent. 35, p. 145, pl. V. - - Dod, 1904, Can. Ent. 36, p. 352. - - Gibson, 1905, Can. Ent. 37, pp. 337-347 (=var. gibsoni McDunnough).

Male. Larger and differing from typical nevadensis in the color of the secondaries, which are often deep rose throughout, or yellowish flushed with red, the spots often fewer in number and distinct, not fusing. The form with the black thorax rarely occurs; I have seen it in only one Arizona specimen.

Female. Markings on primaries broader, as in males but usually cream-colored; secondaries uniformly deep red with one or two small marginals, and

three or four submarginals; abdomen above concolorous with secondaries with dorsal and lateral series of small spots, below black with a median ochreous patch.

Wing-expanse. Male: 3[illegible]-35 mm.; female: 46 mm.

Types. geneura (Strecker): male holotype from Gilpin Co., Colo., at 8500'; Field Museum.

incorrupta (Hy. Edwards): supposedly described from 3 females from Dalles, Ore. In the Edwards collection at A.M. are two males from Ariz. and one from Dalles, Ore. The Arizona specimens answer the description and are in all probability the original cotypes.

Pupa. (pl. VII, fig. 7). Length of pupa 18-20 mm.; cremaster short, wider than long, with the sides parallel, smooth, not striated; setae of several primary lengths: I nearmeson, more than 1 mm. long; II just ventrad of I and about one half as long; III laterad, slightly shorter than II; IV ventrad of II and a third or less the length of I; I curved ventrad, nearly approximate towards apex but divergent at apex; several lateral and dorsal setae shorter than IV.

Larva. Coquillet (1898) describes larvae from Santa Monica, Calif., as follows: head black and yellow; body black with a purplish tinge, lighter below; warts grey; dorsal line dull white, broken; spiracles yellow-brown with black rims; setae mixed black and reddish-black or black and yellowish above, the red and yellow most numerous, bright brick-red to pale straw-yellow below; prolegs largely pale yellowish; length of larva 36 mm.

Barnes and McDunnough's (1912) description of fourth instar larva from Arizona is very similar but the dorsal line is distinct, the spiracles black, and the warts black, the lateral ones orange at the bases. Comstock (1935) describes larvae from Glendale, California, as entirely black, the setae russet

brown below the spiracles, black above, but this answers the description of ornata Packard.

Recorded food plants. Malva borealis, Purshia, Artimisia.

Distribution. In the mountains from eastern Texas west to southern Nevada and California, and extending north into Colorado and western Nebraska.

Locality records. TEX.: Alpine, Big Bend (5000'). N.M.: Ft. Wingate, Jemez Springs. COLO.: Clear Creek, Ouray Co., Estes Pk., Chimney Gulch, Durango, Denver, Hayden Mts. ARIZ.: Prescott, Paradise, Yavapai, Palmerlee, Mohave Co., Wilgus, Pima Co., Baboquivari Mts., Redington, Chiricahua Mts., Cochise Co., Gila Co., Line, Jerome, Globe. NEV.: Verde. CALIF.: San Diego, Los Angeles. NEBR.: Scottsbluff.

Remarks. Adults have been taken in Alpine, Texas, from March to May, and again in September; Colorado and New Mexico records are July. There is probably a second generation and Nebraska records are May 19 and late July.

Callarctia nevadensis subspecies gibsoni (McDunnough)

Plate XIII

Apantesis nevadensis var. incorrupta (Henry Edwards). Gibson, 1903, Can. Ent. 35, p. 145, pl. V. - - Dod, 1904, Can. Ent. 36, p. 352. - - Gibson, 1905, Can. Ent. 37, pp. 337-347.

Apantesis gibsoni McDunnough. 1937, Can. Ent. 69, pp. 152-3.

Differs from typical nevadensis in the deeper red, more heavily spotted secondaries; the black form is not known to occur in this race: secondaries with costal margin narrowly black, three triangular marginals, the apical two of which are usually fused and joined to costal streak, three or four submarginals, the apical one or two attached to costal streak, and three or four distinct discals; the base of anal vein of primaries often marked with pale scales.

Wing-expanse. 30-37 mm.

Types. gibsoni (McD.): male holotype from Calgary, Alta., Aug. 7, 1902; Can. Ent. 35, pl. 5, middle specimen of incorrupta; allotype female from Sask., Aug. 20, 1901, lower figure of incorrupta; 20 males as paratypes, from Aweme, Man., 1 female paratype from Rounthwaite, Man., three males from Calgary, Alta., Aug. 6, 1902, and two females from Calgary, July 30, 1893, and July 4, 1907; Canadian Nat. Coll.

Larva. Gibson (1905) describes the mature larva as follows: head black with epicranial suture, mouthparts, and a patch above ocelli pale; body grey, streaked with black or purplish-black, lighter below; warts ochre yellow; wart i nearly half the size of ii; dorsal stripe complete on thoracic segments, broken into three spots on each abdominal segment, the central one yellow, the others white; spiracles black; setae mostly whitish, some yellowish and black from dorsal warts; t oracic feet black, prolegs yellowish. Length of mature larva 38 mm.

Recorded food-plants. Chenopodium, Castilleia sessiliflora.

Distribution. In the Canadian prairies, from Manitoba to Alberta.

Locality records. MANI.: Aweme, Rounthwaite, Calgary. ALTA.: Lethbridge.

Adults occur in July and August.

Callarctia nevadensis subspecies superba (Stretch)

Plate XIII

Arctia superba Grote. 1873, Zyg. & Bomb. N. A. pp. 227-228, pl. 9 f. 12. - - Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43-46 (biol.). - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 4.

Apantesis superba (Grote). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 267. - - Gibson, 1905, Can. Ent. 37, pp. 337-347. (biol.).

Euprepia (Cymbalophora) blakei (Grote). Dyar, 1893, Psyche VI, pp. 379-381.

Eyprepia (Cymbalophora) superba (Grote). Neumoegen & Dyar, 1894, Journ. N. Y. Ent. Soc. II, p. 13.

Apantesis nevadensis var. superba (Grote). Dyar, 1902, Bull. U. S. N. M. 52, p. 89.

Apantesis blakei var. superba (Grote). Barnes & McDunnough, 1916, Contr. N. H. Lep. N. A. III, pp. 158-159.

Typical superba differs from nevadensis f. alexanderi in the fusion of the spots on secondaries into a more or less solid border, but a series showing gradual transition from one form to the other can be built up. Northern forms of nevadensis typically show a greater amount of spotting of the secondaries, and in certain localities both nevadensis alexanderi and superba intermediates occur.

Markings on primaries often narrow and linear, SB sometimes broken or only slightly indicated, secondaries pale to deep pink, or yellowish-white tinged with pink, marginals and submarginals typically fused into a broad border, its inner edge uneven, with three or four discal spots, two usually united to form a streak in the anal fold, fringes chiefly pale, sometimes partially blackish.

A female from Peachland, B. C. has rather deep red secondaries with spots on the costa, three small marginals of which the apical two form a narrow border, three small and distinct submarginals, and a single discal, thus showing affinity with the Rocky Mt. race, and not with the B. C. male superba.

Wing-expanse. Male: 32-40 mm.; female: 38 mm.

Type. Male holotype from Vancouver Island, B. C.; A. M.

Larva. Head black-brown; body brownish-black, lighter below; warts i and ii black, shiny, others paler; a broken white dorsal line formed by three spots on each segment; a subdorsal line below ii formed by white mottlings; spiracles black; wart i one third of ii with 17-21 setae; setae above iv brownish, from iv and below and also from dorsal warts of first two thoracic segments mostly reddish; thoracic legs blackish, prolegs red; length of blown larva 43 mm.

This is the specimen from Easton, Washington, described by Dyar (1900); Gibson (1905) describes five larvae from Vernon, B. C.; the body of these was grey, streaked and mottled with white; the dorsal stripe pure white to pale yellow, complete or broken into spots; all warts black and shiny, i a fifth the size of ii; spiracles black with a pale orange center; setae above iv black and yellowish, below iv yellowish or rust-red; thoracic feet black, prolegs reddish; length of larvae 40 mm.

Distribution. Occasional from Colorado north to Montana and west to Oregon; typical in British Columbia.

Locality records. COLO.: Gunnison Co. near Almont (8050'), Grand River (9500(), Mt. Meeker (13,500'). WYO: Carter Co., Yellowstone National Park. MONT.: Silverbow Co. (5800(), Missoula, ORE.: Heppner, Frenchglen. B.C., CANADA: Victoria, Lytton, Nicola, Peachland, Seton Lake, Vernon, Summerland, Pendicton.

Remarks. Adults have been taken in July and August in British Columbia, from late June to July in Colorado., and August and Sept. in Oregon. There is probably only a single generation a year.

20. Callarctia blakei (Grote)

Plate XIII

Arctia blakei Grote. 1864, Proc. Ent. Soc. Phil. III, pp. 523-4, pl. V, f. 2. - Stretch, 1873, Zyg. & Bomb. N. A. pp. 224-225, pl. 9, f. 9.

Euprepia (Cymbalophora) holanderi (Stretch). Dyar, 1893, Proc. Boston Soc. Nat. Hist. XXVI, pp. 153-154 (biol.). - - Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 45-46. = blakei.

Euprepia (Cymbalophora) holanderi (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 12 (=blakei.)

Euprepia blakei (Grote). Dyar, 1897, Can. Ent. 29, p. 216.

Apantesis blakei (Grote). Barnes & McDunnough, 1916, Contr. N. H. Lep. N. A. III, p. 159.

? Apantesis bolanderi (Stretch) ab. Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 405.

? Apantesis bolanderi ab. confluentis Strand. 1919, Lep. Cat. 22, p. 284.

(non) Eyprepia (Cymbalophora) blakei (Grote). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 12-13 (=nevadensis G. & R.

Apantesis blacei (Grote). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 406-407 (=nevadensis G. & R.)

Apantesis blakei (Grote). Barnes & McDunnough, 1912, Contr. N. H. Lep. N. A. I (IV) p. 9 (= ab. williamsii tooele B. & McD.).

Blakei is a small species allied to nevadensis and williamsi, but usually readily separated by the smaller size, the distinctly pale antennae, and the pale lining of base of anal vein.

Male. Head, thorex, and markings of primaries pale yellow-white; secondaries deep yellow or tinged with red, vertex spotted, sides of frons black, palpi black but usually with pale scales below, antennae brownish, distinctly marked with whitish scales to apex; patagia spotted, thorax above with three black stripes, below mostly whitish with black hairs around bases of legs, legs whitish marked with black; primaries deep brownish black, with C to PM or beyond, IM, fringes, SM, and transverse stripes whitish, SB frequently present or indicated between C and SM or sometimes wanting, AM usually extending from C to IM, angled outwards at SM, but often broken or wanting, M extending from C to below SM, rarely broken, PM complete from C to SM, joining M at SM in a V, W complete, not attaining outer margin, base of anal vein always marked with pale scales; secondaries deep yellow or yellow tinged with red, with spots free or partially fused into an irregular border, costal edge usually narrowly black, two or three marginals, three submarginals, three or four discals, and a dash in the anal fold, fringes white; wings below as above; abdomen above concolorous with secondaries, with a dorsal black stripe and lateral series of small spots,

below whitish, nearly immaculate or with two rows of small spots.

Genitalia. (pl. IV, fig. 10.) Juxta bilobed, broader than long; uncus slender, short, shoulders sloping, membranous area indistinct; clasper 2-2.5 mm. long, ventral margin distad of harpe deeply and abruptly concave, leaving an obtuse angle, clasper distad of harpe gradually narrowed to a pointed apex;harpe well-developed, strongly curved based at center.

Female. Primaries like the male; secondaries deep yellow or orange, costal border black, a narrow apical terminal border, three submarginals, a discal, and a faint streak in anal fold; abdomen below black, the segemnts edged with white.

Wing expanse. Male: 25-32 mm.; female: 25-27 mm.

Type. Female holotype from Colo.; Acad. Nat. Sci. Phil., No. 7684.

Puna. (pl. VII, fig. 8). Length about 17 mm.; cremaster slender, tapering, rough apically; spines of two primary lengths, the mesal pair the longest, II more than half the length of I; several small setae less than half the length of II.

Larva. Dyar (1903) describes the 8th instar as follows: head black; body black, mottled with whitish; warts i and ii very black, iii distinctly light red, the rest less reddish; dorsal stripe broad, vermilion-red, yellowish between segments; setae black, pale laterally, and pinkish-red subventrally. Length of mature larva: 25 mm. Larvae in the Canadian National collection have an uneven dorsal stripe, a subdorsal stripe below ii; warts i and ii black, tipped with yellow, other warts light with dark bases; wart i 1/4-1/5 the size of ii, with 15-18 setae; spiracles black; setae yellowish below spiracles, smoky above; prolegs black; mature blown larvae measured 35 mm.

Distribution. From Colorado and western Kansas north to Montana and British Columbia.

Locality records. UNITED STATES: KANS.: Hays, Ellis Co. (2000'). COLO.: Ft. Collins, Akron, Denver, Oak Creek, Berkeley. NEBR.: Scottsbluff.

S. D.: Philip. MONT.: Medicine Lake, Toole Co. CANADA: B. C.: N. W. British Columbia.

Remarks. Adults have been taken most commonly during July and August. A single specimen from Ft. Collins, Colo., was collected in late April, which would suggest the possibility of an early spring generation; one specimen was taken on June 12 at Scottsbluff, Nebraska, where the species is not uncommon.

21. Callarctia bolanderi (Stretch)

Arctia bolanderi Stretch. 1872. Zyg. & Bomb. N. A., p. 76, pl. 3, f. 13. - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 6.

Apantesis bolanderi (Stretch). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268. - Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 405-406 (in part) Gibson, 1903, Can. Ent. 35, pp. 144-145 - - Barnes & McDunnough, 1916, Contr. N. H. Lep. N. A. III, p. 159.

Euprepia bolanderi (Stretch). Dyar, 1897, Can. Ent. 29, p. 216.

(non) Euprepia (Cymbalophora) bolanderi (Stretch). Dyar, 1893, Proc. Boston Soc. Nat. Hist. XXVI, pp. 153-154. - - Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 45-46, = blakei (Grote).

Euprepia (Cymbalophora) bolanderi (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 12 (=blakei Grote).

Apantesis bolanderi (Stretch). - - Bod, 1904, Can. Ent. 36, pp. 351-352. - - Barnes & McDunnough, 1912, Contr. Nat. Hist. Lep. N. A. I (IV), p. 9, (= nevadensis G. & R.)

Bolanderi is known only from the original specimen. Its small size, rose-colored secondaries, and three transverse bands distinguish it from any other species yet known.

Male. Head, thorax, and markings of primaries a dirty yellow; secondaries and probably abdomen rose-color, marked with black, patagia spotted, thorax above with three black stripes; primaries dark black-brown with costal and inner margins, fringes, SM, and transverse bands yellowish, M and PM extending from

C to SM and meeting below SM in a V, AM indicated at C but not complete; secondaries rose, marginal spots fused into narrower border, three small distinct submarginals; abdomen probably concolorous with secondaries, with a dorsal black stripe deeply dentate between segments.

Wing-expanse. 25 mm.

Type. Described from one male from Mt. Shasta, No. Calif. Type lost.

Remarks. In appearance and size, it suggests blakei (Grote), and as such has sometimes been listed, but blakei has never been taken in northern California, nor in neighboring parts of Oregon or Nevada. Ornata (Pack.) is the only species of the genus thus far recorded from Mt. Shasta, but bolanderi seems to be quite distinct from any known form of ornata. Its specific standing must remain in question until similar specimens are again taken from the type locality or the range of blakei is known to extend into Calif.

22. Callarctia williamsii (Dodge)

Arctia williamsii Dodge. 1871, Can. Ent. III, p. 67, f. 34. - - Stretch, 906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 9.

Apantesis williamsii (Dodge). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268. - - Barnes & McDunnough, 1916, Contr. Nat. Hist. Lep. N. A. III, p. 159.

Euprepia (Cymbalophora) williamsii (Dodge). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 13.

Euprepia williamsii (Dodge). Dyar, 1897, Can. Ent. 29, p. 216.

Apantesis williamsii (Dodge). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 408.

Williamsii is distinguished from other species of the genus by the brownish wings, the two transverse bands which do not cross SM or C, and the largely brownish secondaries, and can further be distinguished from celia and from phyllira by the spotted vertex. Typical williamsii is an aberrational female lacking the median transverse band, which has not been taken since the species was named.

Female. Head, thorax, and markings of primaries creamy-white; secondaries dull red with dark brown spots; vertex spotted, sides of frons brown, antennae brown; patagia spotted, thorax above with three brown stripes, below brownish; primaries rich chocolate-brown, with costal margin lighter, SM, IM, and transverse stripes cream colored, PM extending from just below C to SM, W complete and not attaining outer margin; secondaries dull red, costal and outer margins with brown border formed by confluent spots, the two anal submarginals partially distinct, three discals, a dasy in anal fold, fringes dirty yellow.

Callarctia williamsii form determinata (Neumoegen)

Plate XIII.

Arctia determinata Neumoegen. 1881, Papilio I, pp. 28, 29. - - Neumoegen, 1883, Papilio III, pp. 148-151, =blakei Grote. Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. IX, f. 5.

Apantesis determinata (Neumoegen). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Eyprepia (Cymbalophora) williamsii var. determinata (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 13.

Arctia williamsii var. determinata (Neumoegen). Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43, 45.

Apantesis williamsii ab. determinata (Neumoegen). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 408.

Apantesis williamsii var determinata (Neumoegen). Dyar, 1902, Bull. U. S. N. M. 52, p. 90. - - Gibson, 1903, Can. Ent. 35, pp. 146-149, pl. V (biol.). Dod, 1904, Can. Ent. 36, p. 352, - - Barnes & McDunnough, 1916, Contr. Nat. Hist. Lep. N. A. III, p. 159.

The typical form, with M a dash in the cell or a complete stripe, head and thorax whitish or light brown; vertex spotted, sides of frons brown, palpi brownish sometimes marked with cream, antennae brown, often with pale scales; thorax above with three blackish-brown stripes, below mostly brownish, the legs

usually marked with cream; primaries rich brown with IM, SM, and transverse stripes cream-colored, C edged with pale scales for a varying distance but pale to apex, fringes usually brown, sometimes dirty whitish, AM often indicated at C, M a dash in cell or extending to SM, PM from below C to SM, W complete and not attaining outer margin, markings often broken , never extending below SM in this form, and usually not attaining costal margin; secondaries pale pink, reddish or nearly white, more or less obscured by coalescence of brown spots, marginals and submarginals fused into an irregular border, costal margin brown, a dash in the anal fold, several discals often united into streaks and extending to terminal border, cutting off a narrow pale anal streak and an irregular discal area which usually shows a discal spot, in extreme examples the wing almost entirely chocolate-brown with only a slight indication of pale markings; wings below as above, but the brown lighter and the pale markings less distinct; abdomen above concolorous with secondaries with a brown dorsal stripe and a lateral series of spots, below mostly whitish with two rows of small spots.

Genitalia. (pl. IV, fig. 9). Juxta usually distinctly bilobed; uncus slender, shoulders abrupt, membranous area transverse; clasper 3 mm. long, ventral margin distad of harpe deeply and abruptly concave leaving a right or obtuse angle opposite harpe, apex bluntly pointed; harpe well developed, deeply emarginate at middle.

Female. Primaries as in male, transverse bands not extending to C, M a dash in cell; secondaries yellow or reddish, costal border black, outer border narrowly black, three large subterminals partially distinct, two or three discals, and a dash in anal fold; thorax and abdomen below entirely brown. A single specimen from Jackson, Wyoming, differs by having secondaries a rather deep orange-red and in lacking the anal dash.

Wing-expanse. Male: 31-37 mm.; female: 27-32 mm.

Gallarctia williamsii form dieckii (Neumoegen)

Plate XIII.

Arctia dieckii Neumoegen. 1890, Entom. Amer. VI, p. 62.

Apantesis dieckii (Neumoegen). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Hyprepia (Cymbalophora) var. determinata syn. dieckii (Neumoegen). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 13.

Apantesis villiamsii syn. dieckii (Neumoegen). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 408.

Apantesis williamsii var. determinata syn. dieckii (Neumoegen). Dyar, 1902, Bull. U. S. N. M. 52, p. 90. - - Barnes & McDunnough, 1916, Contr. Nat. Hist. Lep. N. A. III, p. 159, = var. blakei (Grote).

Apantesis blakei dieckii (Neumoegen). Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34. - - McDunnough, 1927, Can. Ent. 59, p. 193, = male blakei elongata (Stretch).

Differs from williamsii f. determinata in the extension of the transverse stripes below SM and to C, and by the usual presence of AM; closely approaches some forms of nevadensis f. alexandari and nevadensis superba, but distinguished by the lack of SE; secondaries pinkish or yellowish, usually with an irregular terminal border and discal spots and dashes which cover most of the disc of the wing.

Types. williamsii (Dodge): described from one female from Colorado. Type lost.

determinata (Neum.): male holotype from middle or southern Colorado; U. S. N. M. No. 33678; 1 male paratype (?) U. S. N. M. .

dieckii (Neum.): male holotype from Spence's Bridge, B. C.; American Museum, No. 33677.

Larva. Gibson (1903) describes the 6th instar as being blackish with a distinct dorsal stripe, the setae black above, rusty below; head shiny black, mouthparts and patch above ocelli pale; body greyish mottled with velvet-black;

warts shiny black, wart ii margined with yellow on inside; wart i one-fifth of ii, ii with a broad polished base; dorsal stripe distinct, orange yellow, paler between segments; a pale yellow subdorsal stripe between ii and iii, less distinct than dorsal; spiracles black; setae from i, ii, iii and upper part of iv black, from lower part of iv and below pale rusty; thoracic legs shiny black; prolegs dark reddish; length of 6th instar, 14 mm.

Recorded food-plants. Erigeron filifolius, Senecio.

Distribution. Widely distributed in Canada from western Quebec to British Columbia, and in the Rockies of the United States from Montana to Colorado.

Locality records. CANADA: QUE.: Wright, St. Agathe, Murray Bay. ONT: Thunder Bay, Slate River, Sudbury, Hymers, Smoky Falls, Mattagami River. MANI.: Aweme, Cartwright, Miniota, Rounthwaite. SASK.: Saskatoon, Indian Head, Perce. ALTA.: Lethbridge, Nordegg, Calgary. B. C.: #Spence's Bridge, Kamloops. UNITED STATES: MONT.: Bozeman, Bimfield, Hamilton. WYO.: 7500', Willow Springs. COLO.: Creede (8844'), #Glenwood Springs, Ackman, *Paonia, Denver, Leadville. Moffat Co. ? CALIF. ? N. M.: Jemez Springs.

Remarks. Adults have been taken from May to early August, but are apparently most numerous in June and July. There seems to be but one generation a year.

Callarctia williamsii subspecies toocle (Barnes & McDunnough)

Plate XIII

Apantesis toocle Barnes & McDunnough. 1910. Can. Ent. 42, pp. 208-209. – – Barnes & McDunnough, 1912, Contr. Nat. Hist. Lep. N. A. I (IV), pp. 9, 29, pl. III, f. 3., pl. XIII, f. 4.

Apantesis blakei (Grote). Barnes & McDunnough, 1912, Contr. Nat. Hist. Lep. N. A. I (IV), p. 9, pl. III, ff. 1, 8 (=toocle ab.).

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*only form diecki

#both determinata and diecki

Apantesis williamsii tooele Barnes & McDunnough. Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34. - - Hampson, 1920, Cat. Lep. Phal. Brit. Mus. Suppl. II, pp. 456-457 (desc.).

Differs from williamsii determinata only in the secondaries, which are bright red, with the brownish marginals and submarginals more or less fused into a terminal border, the costal edge brownish, and several discal spots present. The transverse stripes do not as a rule reach costa nor extend below SM, but an aberrant female shows both M and AM extending from C to IM, and the secondaries with spots smaller, more distinct, and only one discal present.

Callarctia williamsii tooele form ophir (Barnes & McDunnough)

Plate XIII.

Apantesis tooele form ophir Barnes & McDunnough. 1910, Can. Ent. 42, pp. 208-209. - - Barnes & McDunnough, 1912, Contr. Nat. Hist. Lep. N. A. I (IV), p. 9, pl. III, ff. 2, 9.

Apantesis williamsii tooele form ophir Barnes & McDunnough. Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34. - - Hampson, 1920, Cat. Lep. Phal. Brit. Mus. Suppl. II, pp. 456-457, pl. LXIII, f. 15.

Like typical tooele, but head and thorax entirely black. An aberrant male shows three transverse bands of primaries extending from C to below SM and partially coalesced transversely, approaching favorita (Neum.) in habitus.

Distribution. Known only from Utah.

Locality records. UTAH: Eureka, American Fork, Spanish Fork, Logan, Strawberry, Granite, Stockton, Kaysville, Divident, Provo, Bountiful.

Remarks. Adults have been taken in June and July, and a single specimen the middle of August at Strawberry.

Callarctia williamsii subspecies elongata (Stretch)

Plate XIII

Arctia elongata Stretch. 1885. Entom. Amer. I, p. 105. - - Neumoegen, 1885, Entom. Amer. I, p. 93, = nevadensis (G. & R.)? - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 6.

Apantesis elongata (Stretch). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Eyprepia (Cymbalophora) blakei var. sulphurica syn. elongata (Stretch). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 12-13.

Arctia nevadensis var. elongata Stretch. Ottolengui, 1895, Ent. News VI, p. 287-8. - - Barnes & McDunnough, 1916, Contr. Nat. Hist. Lep. N. A. III, pp. 158-9, = blakei elongata (Stretch).

Apantesis ornata var. sulphurica syn. elongata (Stretch). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 399-401.

Apantesis blakei elongata (Stretch). Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 34. - - McDunnough, 1927, Can. Ent. 59, p. 193.

Elongata appears to be closely allied to williamsi f. dieckii, of which it may prove to be merely a form, but as now conceived may be distinguished by the narrow lining of the median vein.

Male. Head, thorax, secondaries, and markings of primaries whitish; vertex spotted, sides of frons black, palpi black and whitish, antennae black or brownish, often clothed with pale scales; patagia spotted, thorax above with three black stripes, below mostly blackish, fore coxae spotted with yellow or ochreous, legs variously streaked with ochreous; primaries deep blackish-brown to black, with costal and inner margins, fringes, SM, and transverse bands whitish, median vein narrowly lined to beyond M, base of A sometimes narrowly lined, AM often indicated at C, M extending from C to SM or broken, PM extending from C to Sm, slightly angled outwards, W complete and not attaining outer margin; secondaries whitish with the black or brownish-black markings extensive, fringes white or blackish, a rather broad terminal border formed by fusion of marginal and submarginal spots, a dash in anal fold extending from

base of wing to outer margin, a dash just below cell extending from base nearly to or completely to outer border, a discal spot at end of cell, costal border black; wings below as above, but the discal dash less noticeable; abdomen above whitish or pale yellowish with a broad dorsal stripe and lateral rows of small spots, below with two series of spots, sometimes fused into transverse bars.

Female. Like the male, except that transverse bands of primaries may extend below SM and secondaries are dull yellow with spots as follows: costal border narrowly black, three triangular marginals usually fused into a narrow irregular border, three submarginals, one or two discals, and a dash in anal fold; fringes yellow; abdomen below black, the segments sometimes narrowly edged with white.

Wing expanse. Male and female: 32-37 mm.

Type. Female holotype from Spokane Falls, Wash.; U. S. N. M. No. 33680.

Larva. Larvae in the Canadian National Collection, from Waterton, Alta., are entirely black; setae yellowish, smoky dorsally; wart i one third to one fourth of ii with 13-18 setae.

Pupa. Length of pupa 19-21 mm. Cremaster elongate, subcylindrical, lateral margins uneven but smooth; spines short, mesal pair longest; II laterad of I and more than half as long; III laterad of II and nearly as long as II; about four other pairs of very short spines, one dorsal of I, one or two laterad of III, and the remaining ventrad of II and III.

Distribution. Western Canada from Alberta to British Columbia and northwestern United States.

Locality records. CANADA: ALTA.: Waterton Lakes, Banff, Calgary. B.C.: Lillooet, Hope Mts., Osoyoos. UNITED STATES: Mont.: Missoula. WASH.: Spokane Falls.

The subgenus Holarctia, new subgenus

Type of the subgenus, Callarctia turbans (Christoph)

Female genitalia: ductus bursae completely encircled by a sclerotized ring scarcely longer than wide. Male genitalia: aedeagus armed with numerous cornuti along lateral margins of orifice; uncus short and stout, beaklike; clasper nearly quadrangular, ventral margin distad of harpe with a sharp indentation; harpe a high angled ridge; juxta about as long as wide, widest at base.

Color pattern: veins of primaries lined with pale scales, but markings obsolescent towards outer margin; median vein broadly lined; transverse stripes usually not extending below cell.

Larva: warts shiny, ii with a broad polished base; setae coarsely barbed, sometimes smooth; apparently indistinguishable from subgenus Callarctia.

Pupa: spines along lateral margins of cremaster as well as at apex; spines short, less than half the width of the cremaster; cremaster about three times as long as wide.

23. Callarctia turbans (Christoph)

Plate X.

Arctia turbans Christoph. 1892, Horae Soc. Ent. Ross. XXVI, pp. 460-461. - - Staudinger, 1892, Entom. Zeits. Iris V, pp. 349-351, = quenselii Payk.? Alpheraky, 1897, Roman. Mem. Lep. 9, p. 199, pl. X, f. 10, = sp. dist.

Anantesis quenselii var turbans (Christoph). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, p. 403. - - Gibson, 1903, Can. Ent. 35, pp. 143-144, pl. V. - - Dod, 1904, Can. Ent. 36, p. 351. - - McDunnough, 1922, Can. Ent. 54, p. 137 (biol.), = quenselii Payk.?

Orodemnias turbans (Christoph). Seitz, 1912, Macrolep. II, p. 82, pl. 16.

Anantesis turbans (Christoph. Strand, 1919, Cat. Lep. 2 2, p. 294.

Turbans, long considered a subspecies of quenseli (Payk.) resembles that species in the maculation of the primaries, but differs by having pure yellow secondaries with marginal, submarginal, and only one discal spot, the base of the wing not clouded with black as in quenselii.

Male. Head, thorax, and markings of primaries pale yellow; secondaries deep yellow, spotted with black; vertex spotted, palpi and sides of frons black, palpi often ochreous below, antennae brownish; patagia spotted, thorax above with three black stripes, below blackish with yellow hairs intermixed, the legs streaked with yellow; primaries deep black, with costal and inner margins, fringes, SM, transverse bands, and many of the veins pale yellow, M complete but not attaining outer margin, PM usually extending from C or R to median vein but sometimes broken or wanting, M from C or R across cell, occasionally broken, AM often extending from C to R or entirely wanting, veins partially lined with pale scales, the linings absolescent toward outer margin, median vein broadly lined; secondaries deep yellow, rarely tinged with orange, fringes, yellow, three triangular marginals partially fused, to form a scalloped border, three or four rounded submarginals, the two apical often united, a single discal spot at end of cell; wings below essentially as above, but primaries suffused with deeper yellow and lines on veins sometimes distinct to outer margin, the secondaries often with an additional spot on costa just above discal spot, and a second costal spot toward base; abdomen deep yellow with a broad black dorsal stripe, a row of small lateral spots, and two ventral rows of spots, the spots often united so that lateral and ventral margins of segments are edged with yellow.

Genitalia. (pl. IV, fig. 4). Juxta bilobed, as long as broad, constricted at mid-length; uncus slender, shoulders broad, rounded, nearly parallel, membranous area indistinct; clasper 1.5 mm. long, ventral margin distad of harpe deeply notched leaving a right angle opposite harpe, ventral margin below harpe

with a broadly-expanded median lobe, apex of clasper sub-truncate; harpe only a fourth of the length of the clasper from apex, well-developed, with a median emargination.

Female. Like the male.

Wing expanse. Male and female: 32-37 mm.

Types. Described from both males and females from Tunga-Alpen, southwest Irkutsk, Siberia. Location of type unknown.

Larva. Small; shiny black above, the lower setae reddish; head black; cheeks pale; body blackish; warts shiny black, wart i of abdomen 1/3-1/4 as ii, with 25-30 setae; a dorsal series of spots often present, with a large and a small one on each segment; spiracles black; setae reddish below spiracles, shiny black above, only sparsely barbed from warts i and ii. Length of mature larva 25-30 mm.

Recorded food-plants. Galium.

Pupa. Length 17-20 mm.; cremaster more than 1 mm. long, apical half to 3/4 cylindrical and only a fourth as wide as length of cremaster; the apical half thickly and irregularly set with minute capitate spines less than half width of cremaster, among which lie numerous acutely-pointed spines.

Distribution. Siberia and the western prairies of Canada and adjacent parts of United States.

Locality records: SIBERIA: Irkutsk; Munko, Sardyk, Sajan Mts.; Mongolia, Kentei, Dauria. CANADA: MAN.: Awema, ALTA.: Calgary, Lethbridge, Nordegg. UNITED STATES: MONT.: Glacier National Park. COLO.: (?) (Carnegie Institute).

Remarks. Adults occur in July and August in North America, and are not uncommon during certain years.

Alpheraky (1897) considered the Siberian turbans to be quite distinct from quensali liturata (Men.) while McDunnough (1922) grave doubted that the American turbans was a variety of quensali (Payk.).

Genitalic structures of both male and female differ remarkably from quenseli, both from the typical Alpine species, from the Labrador gelida (Moesch.) and from the Siberian liturata. Not only are these differences sufficient to give turbans specific standing, but the characters of the male and female genitalia and of the pupae are so distinct that turbans cannot be assigned to the same subgenus to which quenseli belongs, and must, therefore, be placed in a new subgenus.

Females from Siberia at the National Museum possessed the same type of genitalia as those from Canada; although no Siberian males were available for examination, the close resemblance in color pattern and the structural agreement of the female genitalia support the belief that only one species is involved, represented by, so far as is known, two widely-separated centers of distribution. The American turbans might well be assigned to a distinct subspecies or geographical race, although subsequent collecting in the northern parts of North America and Eurasia may show the species to be more generally distributed.

The subgenus Notarctia, new subgenus

Type of the subgenus, Callarctia proxima (Guerin)

Female genitalia: ductus bursae armed with a single small triangular dorsal plate. Male genitalia: aedeagus armed apically with a small plate bearing numerous very short teeth-like or file-like spines; uncus short, broad, diamond-shaped, proximal portion of uncus with lateral extensions which project inwards; clasper bluntly rounded apically, ventral margin slightly convex; juxta longer than wide, widest apically.

Color pattern: veins of primaries except the median vein concolorous with the rest of the wing; median vein narrowly lines with pale scales but lining frequently obliterated by coalescence of transverse stripes with submedian stripe; apical two or three abdominal segments entirely black.

Larva: warts dull, not highly polished; setae from dorsal abdominal warts usually smooth, not barbed.

Pupa: cremaster indistinct; spines at apex of tenth abdominal segment; sides of cremaster marked with short ridges, shorter than the spines.

24. Callarctia proxima (Guerin)

Plate XI

Chelonia proxima Guerin. 1844, Icon. Regne Animal 3, p. 514.

Euprepia docta Walker. 1855, Cat. Lep. Het. Brit. Mus. III, p. 592. - - Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268, =Callarctia proxima (Guerin).

Arctia mexicana G. & R. 1867, Ann. Lyc. N. H. of N. Y. 8, pp. 367-368. pl. 13, f. 3. - - Grote & Robinson, 1868, Trans. Amer. Ent. Soc. II, p. 71. - - Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268. =Callarctia proxima (Guerin).

Arctia docta (Guerin). Grote & Robinson, 1868, Trans. Amer. Ent. Soc. II, p. 71. - - Dyar, 1900, Entom. Amer. VI, pp. 117-118 (biol.).

Callarctia proxima (Guerin). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Euprepia (Cymbalophora) proxima (Guerin). Neumoegen & Dyar, 1894, Jour.N. Y. Ent. Soc. II, pp. 11-12.

Euprepia proxima (Guerin). Dyar, 1897, Can. Ent. 29, p. 215.

Arctia proxima (Guerin). Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, pp. 43, 46 (biol.). - - Seifert, 1905, Can. Ent. 37, pp. 73-78, pl. III (biol.).

Apantesis proxima (Guerin). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 404-405. - - Holland, 1922, Moth Book, p. 131, pl. XV, f. 14.

Proxima can be distinguished from varieties of nevadensis (G. & R.) by the absence of the sub-basal half-band and by the narrow lining of the median vein. A few aberrational females from Mexico resemble Apantesis phalerata (Harris) but may be distinguished by the narrow lining of the median vein and the wholly black apical abdominal segments.

Male. Head and thorax, secondaries, and markings of primaries pale ochreous-white; vertex immaculate, sides of frons and palpi black, antennae

blackish; patagiae immaculate, thorax above with three black stripes, below mostly blackish-brown, coxae and femora of fore legs, and often the tibiae, with patches of deep ocher, coxae and femora of other legs often with ochreous streaks or spots; primaries black, with costal and inner margins, fringes, and median vein narrowly ochreous, SM, M, and three transverse bands broadly ochreous, markings broad, reducing the black to small triangles and rectangles, transverse bands normally extend from C to IM, sometimes broken below SM, AM occasionally broken or wanting, M occasionally broken; secondaries pale ochreous-white, often tinged with red along anal margin, with one or two small terminals, three large submarginals, and one discal, distinct, only the two apical submarginal sometimes fused; wings below as above, with an additional dash on costa about half the length of wing; abdomen black below, usually with a median ochreous patch, above deep red, dorsal black stripe narrow, often indistinct, two terminal segments entirely black.

Male genitalia. (pl. IV, f. 6) Juxta more than twice as long as wide, strongly convex ventrally, nearly parallel-sided, rounded apically, emarginate basally; uncus diamond shaped, keeled dorsally, beaked slightly at apex, shoulders with free triangular marginal flaps which project inwards, membranous area broadly transverse, irregular, dorsal surface of uncus, at laterad of membranous area, with a rounded prominence or knob; clasper 3-3.5 mm. long, broadly rounded beyond harpe, harpe oblique across clasper from articulatory point on dorsal margin to near ventral margin just below apex; distal portion of clasper deeply concave between margin and harpe; aedeagus evenly sclerotized throughout, with a heavy plate less than a fourth the length of aedeagus on mid-ventral surface at apex, the plate bearing a variable number of small teeth directed caudad, and appearing sawlike in lateral aspect, usually five or six teeth in longest row, flanked by rows of smaller teeth; vesica with conspicuous flat scale-like teeth or cornuti.

Female. Head, thorax, and primaries as in the male, except that the transverse stripes are narrower, median vein usually distinctly lined, AM more frequently broken or wanting; rarely are all transverse stripes wanting; secondaries deep red, with one or two marginals, three large submarginals, and two or three discals, the submarginals often partially coalesced. Abdomen as in male, but three terminal segments entirely black.

Female genitalia. (pl. IV, f. 7). Ductus bursae with a heavily sclerotized genital plate in dorsal membrane, roughly triangular in outline, as wide as the ductus.

Wing-expanse. Males: 35-42 mm., averaging about 40 mm.; females: 35-50 mm., averaging about 45 mm.

Callarctia proxima form autholea (Boisduval)

Plate XI

Chelonia autholea Boisduval. 1867. Ann. Ent. Soc. Belge 12, p. 76. - - Stretch, 1872, Lyg. & Bomb. N. A. pp. 74-75, pl. 3, ff. 3,4.

Arctia autholea (Boisduval). Moeschler, 1876, Stett. Ent. Zeit. 37, pp. 295-6. Butler, 1881, Ann. Mag. N. H. (5) VIII, p. 310, = docta (Walker). Seifert, 1905, Can. Ent. 37, pp. 73-78, pl. III (biol.).

Callarctia proxima syn. autholea (Boisduval). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Arctia docta var. autholea (Boisduval). Neumoegen, 1883, Papilio III, pp. 148-151. - - Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, ff. 2, 3, pl. VII, f. 1.

Zygaena (Cymbalophora) proxima var autholea (Boisduval). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, pp. 11-12.

Apantesis proxima var autholea (Boisduval). Dyar, 1902, Bull. U. S. N. M. 52, p. 89. — Holland, 1922, Moth Book, pl 131, pl. XV, f. 14.

Form autholea has immaculate or nearly immaculate secondaries, and occurs

only in the male. Although usually referred to as a distinct race, it appears to be distributed over the whole range of the species, but occurs less commonly in the subspecies arizoniensis. Seifert (1905) reports autholea as making up about a third of his brood.

Types. proxima (Guerin): Male holotype from Orizaba, Mexico, evidently lost; male neotype deposited in U. S. N. M.

mexicana (G. & R.): male holotype from Mexico; American Museum.

docta (Walker): two male cotypes from Mexico; British Museum.

autholea (Boisduval): probable allotype in Oberthur collections.

Pupa. (pl. VII, f. 3). Length 20 mm. Cremaster not distinct, the setae on conical apex of 10th segment; ventral surface of cremaster rough, with a few striations, sides and dorsum with fine longitudinal striations or ribs; setae of three primary lengths: the mesal pair (I) longest, II just latered of I and slightly shorter, III just ventrad of I and slightly longer than IV, which is laterad of II.

Larva. A brownish caterpillar with reddish dorsal dashes, and dull brown warts bearing irregular reddish to black setae; head dark brown to black, with cheeks, epicranial suture, antennae, and mouthparts pale; body light to very dark red brown, lighter below, black patches cephalad of i and ii of abdomen and between iii and iv; warts dull, not highly polished, ii without a broad polished base, darker than body, i, ii, iii almost black, the others lighter; wart i of abdomen 1/3 - 1/4 of ii, with 13-24 setae, usually 14-17; dorsal stripe rarely complete, a narrow whitish dorsal stripe on thorax; a series of dull red spots or dashes on abdominal segments 2-8; spiracles color of body, black rimmed; setae from i, ii, iii, and upper setae from iv deep red brown to almost black, from lower part of iv and below reddish, with a few scattered setae darker, a few longer pale setae from posterior segments, and some pale ones on thorax;

setae from abdominal warts i, ii, iii smooth, a few short ones barbed, from warts iv and below smooth or barbed, thoracic setae barbed, legs color of body or slightly darker, thoracic legs blackish. Length of mature larva 54 mm. 6 instars.

Recorded food-plants. Dilophonota ello.

Distribution. From southern California, Arizona, and Texas, south along the mountain-ranges of Mexico and Central America to the Andes of eastern Colombia.

Locality records. UNITED STATES: ARIZ.: Tempe, Douglas, Tucson, Phoenix, Christmas. TEX.: San Antonio. CALIF.: Los Angeles, Claremont, Pasadena, Alma, Exeter, San Diego, Oxnard, Santa Barbara. MEXICO: Orizaba, Morelia, Hidalgo (9000'), Jalapa, Cordoba, Guadalajara, Cuernavaca, Tucubaya. GUAT.: Guatamala City (5000'), Purulha. COSTA RICA: Tuis (5600'), San Jose. PANAMA CANAL ZONE: Porto Belo, Gabima, Corozal. SAN SALVADOR. COLOMBIA: Medillin, Popayan.

Remarks. There are two generations a year in the north, perhaps more in the southern part of its range. Adults appear in March in California, in May and June and again in August and September in Utah, and until October or later in Mexico.

Callarctia proxima subspecies arizoniensis (Stretch)

Plate XI.

Arctia arizoniensis Stretch. 1873, Zyg. & Bomb. N. A., p. 217, pl. IX, f. 4 - Neumoegen, 1883, Papilio III, pp. 148-151, = docta (Walker).

Arctia mormonica Neumoegen. 1885, Entom. Amer. I, p. 93.

Arctia incorrupta mormonica Neumoegen. Edwards, 1887, Entom. Amer. III, pp. 227-228.

Hyrcania (Cymbalophora) proxima syn. mormonica, arizoniensis. Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 11.

Arctia nevadensis var. mormonica (Neumoegen). Ottolengui, 1895, Ent. News VI, pp. 287-8.

Anantesis proxima syn. mormonica, arizoniensis. Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 404-405.

Anantesis proxima mormonica (Neumoegen). Barnes & McDunnough, Checklist Lep. Bor. Amer., p. 34.

Arizoniensis is a distinct geographical race in which the markings of the primaries are broad, often obliterating the lining of the median vein.

Types. arizoniensis (Stretch). Male holotype from Arizona; evidently lost.

mormonica (Neumoegen): male holotype from Salt Lake City, Utah; U. S. N. M. No. 33675.

Distribution. Restricted to the Rocky Mountain region, from Idaho and South Dakota to Colorado and northern Arizona.

Locality records: IDA.: Twin Falls. S. D.: Slim Buttes, Volga. COLO.: Canon City, Richfield. UTAH: Salt Lake City, Ogden, Provo, Spanish Fork, American Fork, Logan, Vineyard, Hopper, Vernal, Richfield, Farmington.

The genus Apantesis Walker

Type of the genus, Apantesis radians Walker

Apantesis Walker. 1855, Cat. Lep. Het. Brit. Mus. III, pp. 331-332.— Grote & Robinson, 1868, Trans. Am. Ent. Soc. II, pp. 69, 71, = Arctia (Shrank). — Kirby, 1892, Syn. Cat. Lep. Het. I, p. 266, = Apantesis Walker.

Euprepia Ochsenheimer (Apantesis Walker) Dyar, 1893, Psyche VI, p. 379.

Eyprepia Ochsenheimer (Apantesis Walker) Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 14.— Dyar, 1897, Can. Ent. 29, p. 219, = Euprepia Ochsenheimer.— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 43, = Arctia Shrank.

Male genitalia: aedeagus armed with a heavily sclerotized callum on ventral surface near apex, bearing one or more stout spines at apex; vesica armed with rows of cornuti; clasper broad, diamond-shaped or triangular, the apex slightly produced into a finger-like lobe; harpe low, irregular; ampulla well-developed, but simple and naked; uncus elongate, slender, diamond-shaped; juxta longer than wide, usually triangular, widest at base, and projecting from anellus like a hood. Female genitalia: ductus bursae armed with a greatly expanded dorsal plate continuous with the genital plate; bursa copulatrix with four signa as in Callarctia.

Color pattern: Veins of primaries concolorous with the rest of the wing, except for median vein which is lined with a stripe as broad as the submedian stripe; markings of primaries in male of A. bicolor reduced to a few white spots or wanting; transverse stripes represented only by the upper arm of the postmedian band.

Larva: Dorsal warts with two kinds of setae, short black spinelike setae scattered among much longer slender setae; warts dull, not highly polished; dorsal abdominal setae of mature larvae smooth, not barbed.

Pupa: Cremaster indistinct, usually broader than long; spines only at apex of cremaster; sides of cremaster marked by heavy longitudinal ridges at least as long as apical spines.

The nais-complex

The species of the nais-group, nais (Drury), vittata (Fabr.), radians Walker, and phalerata (Harris) are so similar in superficial appearance and vary so extensively, each along the same line, that separation by color pattern alone is often impossible, although one familiar with the group can usually place most specimens correctly. Frequently an examination of the genitalia is necessary before the determination can be assured. Unfortunately it has not been until recently that the genitalic characters have become known. As a result, citations in the literature and the disposition of synonyms are in many cases based upon misidentifications, and even a detailed description of the specimen does not always confer to the reader an idea of the species concerned.

Mr. W. H. T. Tams of the British Museum has very kindly sent photographs of the type specimens in the British Museum and of their dissected genitalia, and in every case but one definite identification has been possible, resulting in numerous changes in the synonymy of the nais-group. The the case of the type of vittata (Fabricius), which is at Glasgow, the genitalia were not dissected out, hence definite verification of the species which it represents was not possible. Although it most nearly resembles phalerata (Harris) in color-pattern, the name vittata is retained for the species generally considered under that name until such time as the genitalic structures can be examined.

1. Apantesis nais (Drury)

Plate XIV.

Noctua nais Drury. 1770, Illus. Exot. Entom. I, pp. 14-15, pl. 7, f. 3.

Bombyx cuneata Goeze. Entom. Beytr. IV (3), p. 63, = nais Drury.

Bombyx defloriana Martyn. 1797, Psyche, pl. 28, ff. 78-79.

Arctia nais (Drury). Hübner, 1816, Vers. bek. Schmett., p. 183.— French, 1882, Papilio II, pp. 176-179 (biol.).— Bean, 1884, Can. Ent. 16, pp. 65-66 (biol.).— Edwards, 1889, Bull. U. S. N. M. 35, p. 57 (biblio.).— Smith, 1890, Can. Ent. 22, p. 33 (biblio.).— Beutenmuller, 1898, Bull. Amer. Mus. Nat. Hist. X, p. 381, pl. XVI (desc.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 34 (biol.).— Seifert, 1902, Jour. N. Y. Ent. Soc. X (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. VII, f. 11, pl. VIII, f. 16.

Spilosoma nais (Drury). Westwood, 1837, Ed. Drury's Illus., pp. 15-16, pl. 7, f.3.

Apantesis nais (Drury). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.— Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 411-412.— Gibson, 1903, Can. Ent. 35, p. 153.— Werner, 1917, Psyche 24, pp. 59-60.— Learned, 1927, Psyche 34, pp. 135-146, 2 pl.

Apantesis ab. subterminalis Strand. 1919, Lep. Cat. 22, p. 285.

Nais can be distinguished from vittata (Fabr.) by the black costa, from phalerata (Harris) and radians (Wlk.) by the single slender laterally-directed spine at the tip of the aedeagus of the male. The markings are usually complete, the patagia usually immaculate in the male, nearly always spotted in the female, and the secondaries and abdomen deep yellow, sometimes flushed with red.

Male. Body, secondaries, and markings of primaries deep ocher; vertex immaculate, palpi black, antennae dark brown; patagia usually immaculate, often spotted, thorax above with three black stripes, below mostly blackish, the femora of the fore legs with ochreous markings; primaries deep black with C, IM, SM, fringes, and median vein broadly ochreous, the subterminal W and upper branch of PM usually present but sometimes reduced or wanting, costa always narrowly edged with black;

secondaries clear yellow, often suffused with pink, especially near the abdomen, occasionally nearly immaculate with a stripe on costal margin and one or two other small spots, but usually with a marginal and three submarginal spots, the apical often fusing with costal streak, spots coalesced only when markings of primaries are reduced; abdomen black below, the sides yellow, seldom suffused with red, a black dorsal stripe narrowed anteriorly and posteriorly.

Genitalia. (pl. V, f. 3). Juxta conical, longer than wide, proximal portion expanded and margin emarginate, distal two thirds conical, strongly convex, apex slightly hooded, bluntly rounded or acute, often bearing two lateral plates which are pointed apically and rounded proximally; uncus spear-shaped, apex usually acute, shoulders slanting, membranous area usually transverse with a narrow median extension, indistinct; clasper 3-3.5 mm. long, dorsal margin evenly convex, ventral margin concave just basad of apex, producing a slight point, and strongly convex about mid-length; harpe scarcely differentiated from inner surface of clasper except near apex where clasper is deeply concave; ampullae narrow, three times as long as wide; aedeagus with heavily sclerotized callum covering apical third or more of ventral surface, strongly convex, with a single slender spine at apex, usually twice as long as wide at base, extending laterad or slightly cephalad; callum slightly angulate below spine, but seldom as strongly so as in vittata (Fabr.), proximal portion not merging gradually into normally sclerotized aedeagus but terminating in a distinct slender twisted arm; spine occasionally bifurcate from base.

Female. Head, thorax, and primaries as in the male, but the patagia usually spotted; secondaries either deep yellow or reddish, not as deep as in phalerata (Harris); spots of secondaries larger than in the male and fused into a wide border when markings of primaries are incomplete; abdomen usually deep yellow, rarely tinged with red, the black dorsal stripe never widened posteriorly.

Genitalia. Ductus bursae with a dorsal triangular or cordate plate, approximately one to one and one-half times the width of the eighth segment; apical funnel either central or lateral in position, as in vittata (Fabr.)., smaller in proportion to the width of the plate, usually about one-half, sometimes wider; lips of ostium crenulate, as long as width of eighth segment, as wide as length of funnel; genital groove lobed, with a blind pouch.

Wing-expanse. Male and female: 30-40 mm., averaging 33-37.

Types. nais (Drury): male holotype from N. Y., evidently lost; male neotype from N. Y. deposited in U. S. N. M.

subterminalis Strand: male holotype; British Museum.

Larva. Very variable and often indistinguishable from other species of the genus; head blackish, cheeks, epicranial suture, bases of antennae and mouthparts pale; body light to dark brown with velvety black patches between abd cephalad of warts i and ii, and around the spiracles; warts dull, not highly polished, darker thanxthe body; wart i of abdomen about 1/6 of ii, with 10-13 setae; dorsal stripe usually present or broken into spots or dashes, pale yellow to reddish, sometimes nearly obsolete except on thoracic segments; spiracles yellow, rimmed with black; setae from warts i, ii, iii pale brown to black, with many short spine-like setae black or at least tipped with black, setae from iv and below rust-red to straw-yellow; thoracic setae barbed, dorsal abdominal setae smooth, lower abdominal setae usually sparsely barbed; legs darker than the body, concolorous with warts; length of mature larva 35-40 mm., 7 instars recorded by French and Learned.

Recorded food-plants. Taraxacum, Plantago, Artimesia, Chenopodium, Fragaria.

Pupa. (pl. VII, f. 15). Length 19-20 mm.; cremaster a blunt cone, the ventral surface irregularly marked with short ridges but smooth in the center, dorsal and lateral surfaces with 12-15 strong longitudinal ridges; spines of two primary lengths: I near mesom, II laterad of I and slightly shorter, all other spines

short and of approximately the same length.

Distribution. From southern Maine to Florida, west to Minnesota, eastern Colorado, and Oklahoma; in Canada from southern Ontario and Quebec.

Locality records. CANADA: QUE.: Montreal. ONT.: Kingsville, Hamilton. UNITED STATES: ME.: Kittery Pt., Seekonk. N. H.: Webster. MASS.: Amherst, Nahant. CONN.: New London. N. Y.: New York City. N. J.: Paterson, Chester. PA.: Pittsburgh. N. C.: Raleigh. FLA.: Charlotte Harbor, Biscayne Bay. OHIO: Butler, Dayton. IND.: Lafayette. ILL.: Urbana, Chicago, Decatur. WIS.: Milwaukee. MINN.: St. Paul. MO.: Webster Groves. KANS.: Lawrence. IOWA: Ames. OKLA.: Stillwater. COLO.: Idalia.

Remarks. This species probably has two or three generations a year, depending upon the latitude, the adults appearing in May, July, and September in Illinois.

2. Apantesis vittata (Fabricius)

Plate XIV.

Bombyx vittata Fabricius. 1787, Mant. Ins. II, p. 127.

Arctia decorata Saunders. 1863, Proc. Ent. Soc. Phil. II, p. 60.-- Grote & Robinson, 1867, Ann. Lyc. N. H. of N. Y. 8, p. 369, = nais (Drury).-- Grote, 1869, Trans. Amer. Ent. Soc. II, p. 117, = radians (Walker).-- French, 1881, Papilio I, pp. 81-82.-- French, 1882, Papilio II, p. 179 (biol.).-- Neumoegen, 1883, Papilio III, pp. 148-151.-- Smith, 1890, Can. Ent. 22, p. 13 (biblio.).-- Ottolengui, 1895, Can. Ent. 6, pp. 287-8/

Arctia nais var. decorata Saunders. Stretch, 1872, Syg. & Bomb. N. A., p. 73.

Arctia ochreata Butler. 1881, Entom. Mag. XVIII, p. 156.-- Smith, 1892, Can. Ent. 24, pp. 133-136, = nais (Drury).

Apantesis nais var. vittata syn. decorata (Saunders). Kirby, 1892, Syn. Cat. Lep.

Het. I, p. 269.

Apantesis ochreata (Butler). Kirby, 1892, loc. cit. p. 269.— Dyar, 1902, Bull. U. S. N. M. 52, p. 90, = nais (Drury).

Euprepia vittata syn. decorata (Saunders). Dyar, 1893, Psyche VI, pp. 470-480.— Neumoegen & Dyar, 1893, Ent. News IV, p. 214 (desc.).— Beutenmuller, 1898, Bull. Amer. Mus. N. Y. City X, pp. 381-382 (desc.).

Arctia vittata (Fabricius). Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 34 (biol.). — Gibson, 1900, Can. Ent. 32, p. 375 (biol.).— Seifert, 1902, Jour. N. Y. Ent. Soc. X, pp. 1-10, pl. I, II (biol.).

Apantesis vittata ab. ochreata, decorata. Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 410-411.

Apantesis vittata syn. decorata (Saunders). Dyar, 1902, Bull. U. S. N. M. 52, p. 90.— Gibson, 1903, Can. Ent. 35, p. 135 (biol.).— Gibson, 1905, Can. Ent. 37, p. 347 (biol.).— Marchand, 1917, Psyche 24, pp. 59-60.— Holland, 1922, Moth Book, p. 132, pl. XV, ff. 22, 25.— Learned, 1927, Psyche 34, pp. 135-145, 2 pl.

Apantesis vittata ab. phaleratula Strand. 1919, Lep. Cat. 22, p. 296.

Vittata can be distinguished from nais (Drury) by the pale costa, and from phalerata (Harris) and radians (Walker) by the genitalia. The markings are usually incomplete, the patagia seldom spotted in the male, the secondaries of the male either deepxyellow or a peculiar orange-red, of the female either red or yellow with a wide black border.

Male. Body, secondaries, and markings of primaries ocher yellow; vertex immaculate, palpi black, antennae dark brown; patagia usually immaculate, the thorax above with three black stripes, below mostly blackish, the coxae, femora and often the tibiae of fore legs with ochreous patches; primaries deep black, with C, 1M, SM, fringes and median vein broadly ochreous, W and upper PM often present, usually

reduced or broken, frequently wanting; secondaries deep yellow, usually superficially flushed with red or orange, the spots distinctly bordered with yellow, costal edge, a marginal, and two or three submarginals black, the spots large, frequently more or less coalescent, even when the markings are nearly complete; abdomen black below, sometimes with a median ochreous patch, a black dorsal band usually although not always widened posteriorly and covering much of the caudal half of the abdomen, sides of abdomen yellow, rarely tinged with red. A few males have been reported which were nearly devoid of scales in the region of the black border of the secondaries, the wings having a nearly transparent terminal border.

Genitalia. (pl. V, fig. 2). Juxta conical, longer than wide, the proximal portion expanded and the margin emarginate, the distal two-thirds keeled, convex, apex hooded, usually acute; uncus usually spear-shaped, sometimes almost cylindrical, shoulders abrupt, membranous area transverse, usually with a median extension, indistinct; clasper 3-3.5 mm. long, dorsal margin distad of harpe evenly convex, ventral margin concave just basad of apex, strongly convex below mid-length; harpe scarcely differentiated from inner surface of clasper, except near apex where clasper is deeply concave; ampullae broadly expanded, half as wide as long; aedeagus with heavily sclerotized callum covering ventral surface of apical half or less, strongly convex, bearing at the apex a single slender spine usually twice as long as width at base, extending directly laterad or slightly cephalad; callum usually abruptly widened basad of spine, proximal end merging gradually into normally sclerotized aedeagus.

Female. Head, thorax, and primaries as in the male, but patagia usually spotted; markings of primaries very seldom complete; secondaries either red or yellow, with a broad black border; dorsal stripe of abdomen usually, although not always, broadened posteriorly so as to cover the terminal half of the abdomen.

Genitalia. Ductus bursae armed with a triangular or nearly circular plate

with a prominent funnel or neck; plate smaller than in phaleratа (Harris), usually larger than in radians (Walker), approximately one and one-half times the width of the eighth segment; funnel more than half as wide as plate, extending from edge of plate to beyond center.

Wing-expanse. Male and female: 33-43 mm., averaging 37-40 mm.

Types. vittata (Fabr.).: female holotype in Mus. Dom. Hunter, Glasgow.

ochreata (Butler).: female holotype in British Museum.

phaleratula Strand: male holotype in British Museum.

Pupa. Length, about 19 mm.; cremaster distinct, pyramidal, but wider than long, highly polished, all surfaces with strong longitudinal ridges or ribs, apex dull and slightly roughened; spines broken, but apparently I at meson, II laterad of I and slightly smaller, two smaller spines laterad of II and one ventrad of I, several others much smaller. Only one specimen examined.

Larva. No specimens available for study. Described by Gibson (1900, 1903) as velvet-black; tubercles black, i 1/6 of ii; no dorsal stripe; setae rust-red, the dorsal setae darker, nut none black, not barbed; thoracic legs blackish-brown. Descriptions by Dyar (1900), and French (1878, 1892) may or may not refer to this species.

Recorded food-plants. Taraxacum, Plantago.

Distribution. From southern Maine to Florida, and west to Minnesota and Oklahoma; southern Ontario and Quebec.

Locality records. CANADA: QUE.: Montreal. ONT.: Ottawa. UNITED STATES: ME.: Kittery Pt. MASS.: Natick, Weston. Conn.: Storrs. R. I.: Bristol. N. J.: Plainfield. PENN.: Pittsburgh. MD.: Baltimore. VA.: Falls Church. N. C.: Tarbara. FLA.: Payne Co. OHIO: Dayton. IND.: Lafayette. ILL.: Chicago, Quincy, Decatur. WIS.: Milwaukee, Madison. MINN.: St. PAUL. IOWA: Ames, Mt. Pleasant. KANS.: Douglas Co. MO.: Charlestown, Webster Groves. OKLA.: Payne Co.

aculum and narrow streak on edge of costa flame-color, secondaries with costa at base flame-color; abdomen red above, concolorous with secondaries, with a broad black dorsal stripe, below entirely black. Hampson describes one specimen as having costal half of secondaries black, and another as having a crimson ring on "neck", the primaries with pale crimson streak on C to beyond middle and a small white spot at lower angle of cell.

Genitalia. (pl. VI, f. 2). Juxta slightly bilobed, conical, tapering from base to slender apex; uncus very slender, slightly spear-shaped, shoulders abrupt, nearly paralle, membranous area indistinct; clasper 4 mm. long, ventral and dorsal margins convex, apex sub-truncate with an apical hooked projection on ventral margin and a triangular tooth on dorsal margin at apex; harpe scarcely differentiated from inner surface of clasper; a slight ridge parallel to harpe below membrane in outer layer of clasper; aedeagus with ventral surface heavily sclerotized on apical half, bearing apically a single stout conical spine directed nearly caudad, and on opposite side of aedeagus, on dorsal surface, a single minute spine.

Female. Not known.

Wing-expanse. 38-44 mm.

Types. Male holotype and three paratypes (or four cotypes?) from Abaco, Bahamas; in British Museum.

Distribution. Bahamas.

Remarks. Nothing is known of the early stages or of the female. A specimen received from the British Museum for examination was taken December 23, 1902. In habitus, the species suggests some of the females of the genus Callarctia, such as placentia (A. & S.) and f-pallida (Streckor), but in the structure of the male genitalia it comes surprisingly close to phalerata (Harris).

Remarks. There are probably two generations a year, the adults appearing in May and June and again in August and September.

Vittata is less common than either nais (Drury), or phalerata (Harris), and usually has a shaggier, stouter appearance than either of them. The type specimen of vittata, at Glasgow, is a female with a reduced type of wing pattern, and without the broad abdominal band usually characteristic of vittata. Although the genitalia cannot be examined without dissection, it would not be at all surprising if it should prove to be, upon examination, the species now known as phalerata (Harris).

3. Apantesis radians Walker.

Plate XIV.

Apantesis radians Walker. 1855, Cat. Lep. Het. Brit. Mus. III, p. 632.-- Grote & Robinson, 1868, Trans. Amer. Ent. Soc. II, p. 69, = nais (Drury).-- Grote & Robinson, 1869, Trans. Amer. Ent. Soc. II, p. 117.-- Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 15, - vittata (Fabr.).-- Learned, 1927, Psyche 34, pp. 135-145, 2 pl.

Aloa colorata Walker. 1864, List Lep. Het. Brit. Mus. 31, p. 302.-- Grote & Robinson, 1868, Trans. Amer. Ent. Soc. II, p. 69, - Apantesis radians Walker.

Apantesis vittata var. radians Walker. Hampson, 1901, Cat. Lep. Het. Brit. Mus. III, pp. 410, 411.

Arctia radians (Walker). Seifert, 1902, Jour. N. Y. Ent. Soc. X, pp. 82-89, pl. XI (bio.).

Apantesis vittata (Fabr.). Learned, 1928, Ent. News XXXIX, pp. 265-269, pl. XIII (biol.), (= radians Walker).

Radians closely resembles the other species of the group and cannot always be distinguished from them by color pattern alone. The aedeagus of the male, however,

is distinctive in bearing one or more short spines at the base of a longer one.

Male. Body, secondaries, and markings of primaries ocher; vertex immaculate, palpi and sides of frons black, antennae dark brown; patagia usually spotted, thorax above with three black stripes, below mostly blackish, the fore legs with ochreous streaks on coxae, femora, and tibiae; primaries black with C, IM, SM, median vein, and fringes broadly ochreous, costa sometimes narrowly edged with black, M and upper PM sometimes complete but usually broken or absent; secondaries pale ocher tinged with red, deep ocher, or superficially flushed with orange-red as in vittata (Fabr.), the spots margined with yellow, costal edge, a marginal and three submarginal spots black, sometimes small and distinct but usually partially or entirely coalesced into a wide black border, even when markings of primaries are not greatly reduced; abdomen black below, sometimes with a median ochreous patch, a black dorsal stripe, usually narrowed posteriorly, the sides of the abdomen yellow, rarely tinged with red.

Genitalia. (pl. V, fig. 1). Juxta conical, basal portion expanded and margin emarginate, distal two-thirds keeled, hooded at apex, tapering gradually to a blunt apex; uncus spear-shaped or nearly cylindrical, usually with an acute apex, shoulders abrupt, membranous area transverse, indistinct; clasper 3-3.5 mm. long, distal margin sub-truncate, rounded, laterally extended into an acute apex which projects beyond ventral margin; harpe scarcely differentiated from inner surface of clasper; a slight ridge often parallels harpe in outer layer of clasper; aedeagus with heavily sclerotized callum covering ventral surface on apical half or less, strongly convex, bearing at apex a short stout conical spine directed laterad, and at base of spine one or more minute spines, callum merging gradually into normally sclerotized aedeagus.

Female. Head, thorax, and primaries as in the male, but markings usually greatly reduced, rarely nearly complete; secondaries deep red with a wide black

border, seldom partially broken; abdomen yellow or tinged with red.

Genitalia. (pl. VI, f. 4). Ductus bursae armed with a large, somewhat cordate, heavily sclerotized plate on dorsal surface, slightly wider than eighth segment, strongly convex, with a proximal funnel-like neck more than half as wide as the plate, and wider than long; lips of ostium moderately crenulate, about equal to width of funnel.

Wing expanse. Males and females: 30-40 mm., averaging 33-37 mm.

Apantesis radians form floridana Cassino.

Apantesis floridana Cassino. 1918, Lepid. II, pp. 2-4, pl. opp. p. 60.— Barnes & Benjamin, 1927, Bull. So. Calif. Acad. Sci. XXVI (2), p. 16, = vittata var. radians Walker.

Apantesis floridana form ochracea Cassino. 1918, Lepid. II, p. 4, pl. opp. p. 60.— Barnes & Benjamin, Bull. So. Calif. Acad. Sci. XXVI (2), p. 16, = vittata var. radians Walker.

Floridana closely resembles the male of phalerata (Harris). The markings of the primaries are generally complete, and the secondaries pale ocher with a pinkish tinge. In the form ochracea the secondaries are yellowish with no red cast.

Types. radians Walker; female holotype, British Museum.

colorata Walker; female holotype, British Museum.

floridana Cassino; holotype and paratypes from Florida in U. S. N. M.

ochracea Cassino; holotype and paratypes from Florida in U. S. N. M.

Pupa. (pl. VII, fig. 12). Length 18-20 mm.; cremaster distinct, nearly as long as wide, apex slightly roughened, base smooth ventrally, 16-18 distinct dorsal and lateral ridges; spines of three primary lengths: the longest pair (I) near meson, about 1 mm. long, II laterad of I and more than half as long, two setae laterad of II about the length of II or slightly shorter, several shorter spines

laterally, ventrally, and just mesad of I.

Larva. Brownish to black, with or without a dorsal stripe, the setae blackish above, rusty below; head black with cheeks, epicranial suture, antennae, and mouthparts pale; body dark brown, blackish above; warts dull, not highly polished, darker than the body, sometimes black; wart i of abdomen 1/6 of ii, with 10-15 setae; whitish dorsal stripe sometimes present, often broken, usually obsolete except for faint traces on thoracic segments; spiracles whitish rimmed with black; setae from warts i, ii, iii dark brown to black with many short black spine-like setae, from iv and below pale rust-red to straw-color; thoracic setae barbed, dorsal abdominal setae smooth, lower abdominal setae smooth or barbed; legs darker than body, concolorous with warts, thoracic legs sometimes black; length of mature larva 35-40 mm. 7 instars recorded by Seifert.

Distribution. Restricted to the southern states; common in Florida, reports verified from only three other states, North Carolina, Texas, and Arkansas.

Locality records. FLA.: Lutz, Bradentown, Portland, Ocala, Island Grove, Ft. Meyers, Florida City, Hastings, Orlando, St. Petersburg. ARK.: Hope. N. C.: Raleigh, Warsaw. TEX.: Dallas.

Remarks. There are probably three generations a year, the adults appearing in April and May, and again in July and September.

Although the least common and widely distributed species of the group, individuals from each of the other species showing extreme reduction in the markings of the primaries have been assigned to radians at one time or another, with the result that records in the literature and from collection labels give radians a wider distribution than is actually the case.

4. Apantesis phalerata (Harris)

Plate XIV.

Arctia phalerata Harris, nomen nudum. 1835, Hitchcock's Cat. Anim. Plants Mass., pt. IV, p. 593.— Harris, 1837, Cat. Ins. Mass., p. 73.

Arctia phalerata Harris. 1841, Ins. Mass. Inj. Veg., p. 245.— Harris, 1862, Ins. Inj. Veg., p. 347, f. 166.— Saunders, 1863, Can. Jour. n. s. VIII, p. 359 (desc.).— Grote, 1869, Trans. Amer. Ent. Soc. II, p. 117, = male nais (Drury).— Coquillet, 1881, Trans. Dept. Ag. Ill. 18, app. p. 171, (biol.).— Smith, 1890, Can. Ent. 22, p. 33 (biblio.).— Beutenmuller, 1898, Bull. Amer. Mus. N. H. X, p. 382 (desc.).— Dyar, 1900, Jour. N. Y. Ent. Soc. VIII, p. 38 (biol.).— Gibson, 1900, Can. Ent. 32, pp. 369-376. (biol.).— Gibson, 1902, Can. Ent. 34, pp. 50-51 (biol.).— Stretch, 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, ff. 19, 20?.

Arctia rhoda Butler. 1881, Entom. Mon. Mag. 18, p. 136, = female phalerata Harris ?— Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268, = Apantesis rhoda (Butler).— Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 15, = Euprepia phalerata (Harris).

Arctia incompleta Butler. 1881, Ann. Mag. Nat. Hist. (5) VIII, p. 311.— Edwards, 1887, Entom. Amer. III, pp. 227-228, = phalerata incompleta Butler.

Arctia nais var. phalerata Harris. Neumoegen, 1883, Papilio III, p. 151.

Apantesis nais var. phalerata (Harris). Kirby, 1892, Syn. Cat. Lep. Het. I, p. 268.

Euprepia phalerata (Harris). Dyar, 1895, Psyche VI, pp. 479-480.— Neumoegen & Dyar, 1893, Ent. News IV, p. 213 (desc.).

Euprepia (Apantesis) phalerata (Harris). Neumoegen & Dyar, 1894, Jour. N. Y. Ent. Soc. II, p. 15.

Apantesis vittata syn. phalerata (Harris). Hampson, 1901, Cat. Lep. Phal. Brit. Mus. III, pp. 410-411.

Apantesis vittata var. phalerata (Harris). Dyar, 1902, Bull. U. S. N. M. 52, p. 90.

Apantesis phalerata (Harris). Gibson, 1903, Can. Ent. 35, p. 154, pl. V (biol.).- Barnes & McDunnough, 1912, Can. Ent. 44, pp. 189-190 (biol.).— Marchand, 1917, Psyche 24, pp. 59-60.— Learned, 1927, Psyche 34, pp. 135-145.

Arctia phalerata var. incarnata Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. V, f. 21, pl. VII, ff. 4, 5.— Barnes & Benjamin, 1925, Pan. Pac. Entom. I, pp. 134-135.

Arctia phalerata var. pulcherrima Stretch. 1906, Jour. N. Y. Ent. Soc. XIV, pl. VIII, ff. 18, 19.— Barnes & McDunnough, 1918, Checklist Lep. Bor. Amer., p. 35, - syn. vittata var. phalerata Harris.

Apantesis nais ab. naidella Strand. 1918, Lep. Cat., p. 285.

Apantesis vittata ab. vittatula Strand. 1919, Lep. Cat., p. 296.

Apantesis vittata ab. rhodana Strand. 1919, Lep. Cat., p. 296.

Phalerata can easily be distinguished from any other member of the genus by an examination of the aedeagus of the male, which bears two short, equal spines directed nearly straight caudad. The female has deep red secondaries, with the spots usually free; those of the male are pale yellowish-white suffused with pink.

Male. Body, secondaries, and markings of primaries pale ocher yellow, the secondaries and abdomen usually flushed with pink; vertex of head immaculate, frons and palpi black, antennae dark brown; patagia always spotted, thorax above with three black stripes, below mostly blackish, the femora of the fore legs and often of the other legs streaked with ochreous, the tibiae often with ochreous markings; primaries deep black with C, IM, SM, and median vein broadly ochreous, subterminal W sometimes broken, rarely entirely wanting, upper PM usually present but often broken or wanting, costa narrowly edged with black in nearly half the specimens; secondaries pale ocher, usually flushed with pink or red, especially along anal margin, but often fading, occasionally immaculate, except for a costal stripe, but usually with one marginal and two or more small submarginal spots, the apical spot

the largest, seldom large and very rarely partially coalesced, even when markings of primaries are reduced; abdomen deep yellow, usually flushed with red, black below, a dorsal black stripe narrowed anteriorly and usually posteriorly, rarely widened posteriorly.

Genitalia. (pl. VI, fig. 1). Juxta conical, proximal portion expanded and margin emarginate, distal two-thirds a triangular pyramid tapering gradually to a blunt apex; uncus slightly spear-shaped or cylindrical, shoulders abrupt, nearly parallel, membranous area transverse with a median extension; clasper 4.5-5 mm. long, distal end terminating in an acute hook, dorsal margin distad of ampulla with two obtusely-angled projections, one a third distant from ampulla, a second near apex, ventral margin with a broadly rounded lobe about mid-length; harpe scarcely differentiated from inner surface; a parallel ridge below harpe in dorsal layer of clasper below membrane; aedeagus with ventral surface of apical two-thirds heavily sclerotized bearing apically two equal slightly diverging conical spines, directed almost caudad; occasional aberrations occur as shown on plate VI.

Female. Head, thorax, and primaries as in the male, but markings of primaries more often reduced or broken; secondaries deep red, with streak on costal edge, a small terminal, and large subterminal and apical spots black; spots often more or less fused, forming a wide border when markings on primaries are reduced; abdomen deep red on the sides, entirely black below, with a black dorsal stripe of equal width throughout or widest through the middle.

Genitalia (pl. VI, fig. 3). Ductus bursae armed with a heavily sclerotized triangular plate, twice the width of the eighth segment; lips of ostium conspicuously crenulate, as long as eighth segment is wide.

Wing expanse. Male and female: 31-44 mm., averaging 35-40 mm.

Types. phalerata (Harris): male holotype or cotype, from Mass.; B. S. N. H.

rhoda (Butler): female holotype from Mass.; British Museum.

incompleta (Butler): male holotype from Washington, D. C.; British Museum.

incarnata (Stretch): type probably lost.

pulcherrima (Stretch): probable female holotype, from Carbondale, Ill.; Calif. Acad. Sci., Stretch collection.

naidella Strand: male holotype in British Museum.

vittatula Strand: male holotype from Miami, Fla.; in British Museum.

rhodana Strand: female holotype from Miami, Fla.; in British Museum.

Pupa. (pl. VII, fig. 13). Length 18-22 mm.; cremaster short, broad, a blunt cone, apex roughened, ventral surface usually ridged, sides and dorsum with short longitudinal ridges; primary spines variable in number and length: I near meson and usually longer than any others, II a group of three or more spines laterad of I and more than half its length, III ventrad of I and shorter than the laterals (II); or I may be of same length as II; or spines laterad of I may be longer than any other laterals of group II, so that the arrangement of setae is as in radians Walker.

Larva. Brownish, with dark dorsal setae and reddish laterals, a dorsal stripe sometimes present; head black, cheeks, epicranial suture, mouthparts, and antennae pale; body dark brown to blackish; warts dull, not highly polished, darker than the body, i - iv almost black, lighter below iv, wart i of abdomen 1/6 of ii, with 10-15 setae; dorsal stripe sometimes distinct, more often faint or broken into dots, usually present only on thoracic segments; spiracles yellow, black-rimmed; setae from i, ii, iii pale brown to black, often lighter than body, with many short black spine-like setae, from iv and below rust-red to straw-yellow; setae of dorsal abdominal segments smooth, thoracic setae usually barbed, lower abdominal setae usually partly barbed; length of mature larva 35-40 mm. 7 instars.

Recorded food plants. Taraxacum, Plantago, Polygonum, corn, grape.

Distribution. From Maine to Florida, west to Minnesota and Texas, south into Mexico.

Locality records. CANADA: Toronto. UNITED STATES: ME.: Kittery Pt. MASS.: Weston, Natick, Forest Hills, Amherst. R. I.: Westerly. CONN.: New London. N. Y.: Rochester, Poughkeepsie, Buffalo. N. J.: Newark, Elizabeth. PENNA.: Pittsburgh. N. C.: Raleigh. GA.: Atlanta. FLA.: Lutz, Ft. Meiers, Portland, Lakeland, Everglades, Hastings. OHIO: Butler. IND.: Lafayette. ILL.: Urbana, Carbondale. MICH.: Detroit, Gillette. MO.: Charleston. WIS.: Milwaukee, Madison. IOWA: Decorah, Ames. TENN.: Chattanooga. ALA.: Gurley, Auburn. TEX.: College Station, Galveston. MEXICO: Orizaba.

Remarks. Phalerata is the most common and most widely distributed species of the genus.

There are at least two generations a year, sometimes three; adults appear in Illinois in May and June and again from late July to September.

5. Apantesis bicolor Hampson

Plate XIV.

Apantesis bicolor Hampson. 1904, Ann. Mag. Nat. Hist. 14, p. 166.— Hampson, 1920, Cat. Lep. Phal. Brit. Mus. Suppl. II, p. 458, pl. lxiii, f. 17.

Bicolor is very closely related to phalerata (Harris) in structure of the male genitalia, but resembles some of the females of Callarctia in the entirely black head, thorax, and primaries. No other males, however, are so marked.

Male. Head, thorax, and primaries black, secondaries red with black maculation, femora of forelegs with a large flame-red spot on ventral face, femora of other legs with smaller spots; secondaries red, costal margin broadly black to apex, one to three small submarginals, a small marginal sometimes present below apex; wings below with black areas more brownish than above, primaries with retin-

X. EXTRA-LIMITAL SPECIES.

The Apantesis fasciata Hsp. listed by Hampson and Strand in their catalogues possesses external morphological characters, including venation, identical with those of the genera Callarctia Packard and Apantesis Walker, but genitalic structures indicate a closer relationship to some of the species of Arctia, and in particular, to Platyprepia virginalis Bdv. The peculiarly-shaped clasper, which is nearly an isosceles triangle, differs markedly from any known from the two genera under consideration. The distinct angle on the dorsal margin of the clasper, at the point of articulation with the tegumen, is characteristic of some of the Arctias, and does not occur in any species of Apantesis or Callarctia described in this paper. In spite of the occurrence of the same type of venation, which may be the result of convergent rather than of parallel evolution, the species fasciata is not here considered congeneric with those species placed within either Apantesis or Callarctia. Although a comparison of the larvae and pupae with those of the American species may corroborate the evidence offered by the venation, it seems preferable to remove fasciata from Apantesis (s. s.) and to refer it provisionally to Arctia until workers who have access to other European material can determine its proper relationships.

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PLATE I.

VENATION

Figure 1. Normal venation.

Figure 2. Normal branching of radius and M_1.

Figure 3. R_2 stalked with R_{3-4-5}.

Figures 4-8. Areole formation between R_2 and R_{3-4-5}.

Figure 9. R_3 stalked with R_2.

Figure 10. Loss of one branch of radius.

Figure 11. R_4 stalked with R_5.

Figure 12. Areole formation between R_1 and R_s.

Figure 13. R_1 stalked with R_2.

Figure 14. Areole formation between R_{3-4-5}.

Figure 15. M_1 stalked with R_{3-4-5}.

Figure 11 from Callarctia virgunoula (Kirby).

Figure 14 from C. oithona rectilinea (French).

All other figures from C. arge (Drury).

PLATE I

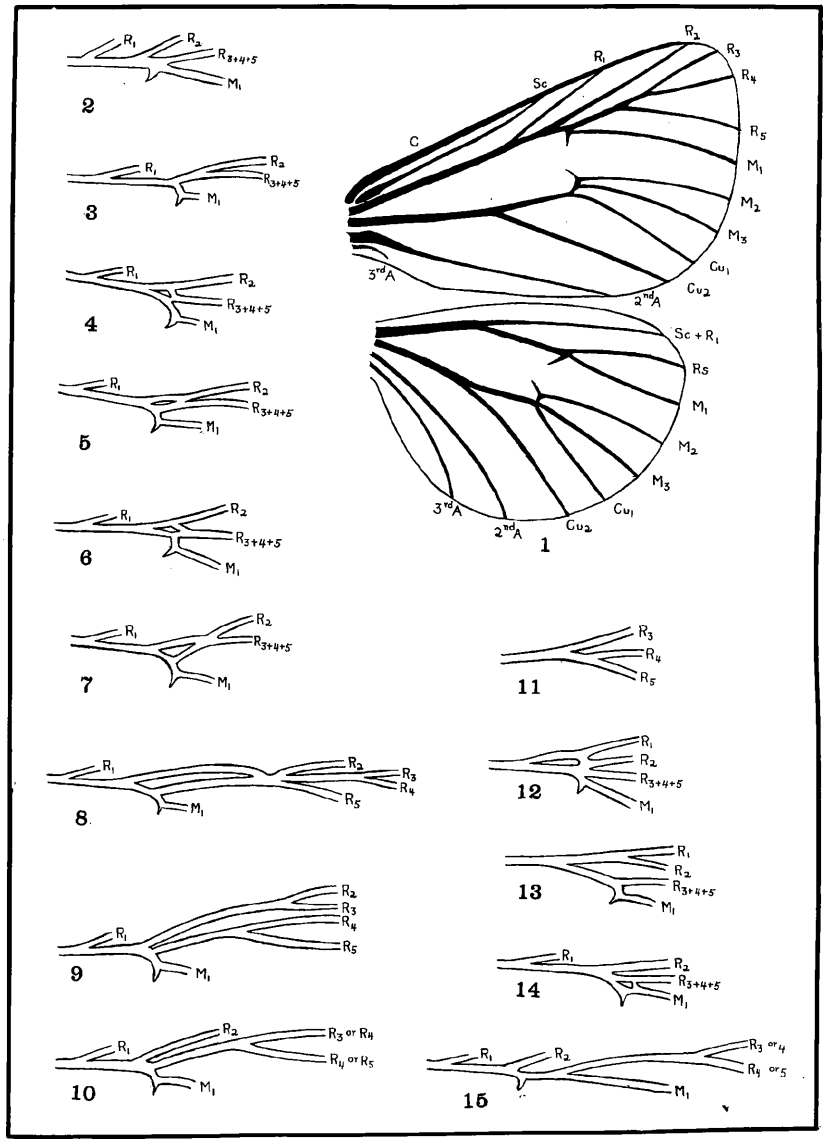

2
3
4
5
6
7
8
9
10
11
12
13
14
15
1
C
Sc
R1
R2
R3
R4
R5
M1
M2
M3
Cu1
Cu2
3rdA
2ndA
Sc + R1
Rs
R3+4+5
R3 or R4
R4 or R5

PLATE II.

Genitalia of Callarctia.

1. Male genitalia of C. ornata Pack.; a - ventral aspect; b - aedeagus; c, d - inner aspect of left clasper.
2. Female genitalia of C. ornata Pack.; ventral aspect.
3. Male genitalia of C. hewletti (B. & McD.); a - ventral aspect; b - aedeagus; c - inner aspect of left clasper.
4. Female genitalia of C. hewletti (B. & McD.); ventral aspect.
5. Male genitalia of C. complicata (Wlk.); a - ventral aspect; b, c - inner aspect of left clasper.
6. Male genitalia of C. edwardsii (Stretch); a - ventral aspect; b, c - inner aspect of left clasper.
7. Male genitalia of C. placentia (A. & S.); a - ventral aspect; b - inner aspect of left clasper.
8. Male genitalia of C. cervinoides (Stkr.); a - ventral aspect; b - inner aspect of left clasper.

un - uncus; teg - tegumen; vin - vinculum; cl - clasper; jx - juxta; h - harpe; amp - ampulla.

ov - oviporous; ten - tendon; gg - genital groove; p - pouch; db - ductus bursae; lp - lateral plate; bc - bursa copulatrix; s - signum; sd - ductus seminalis.

PLATE II

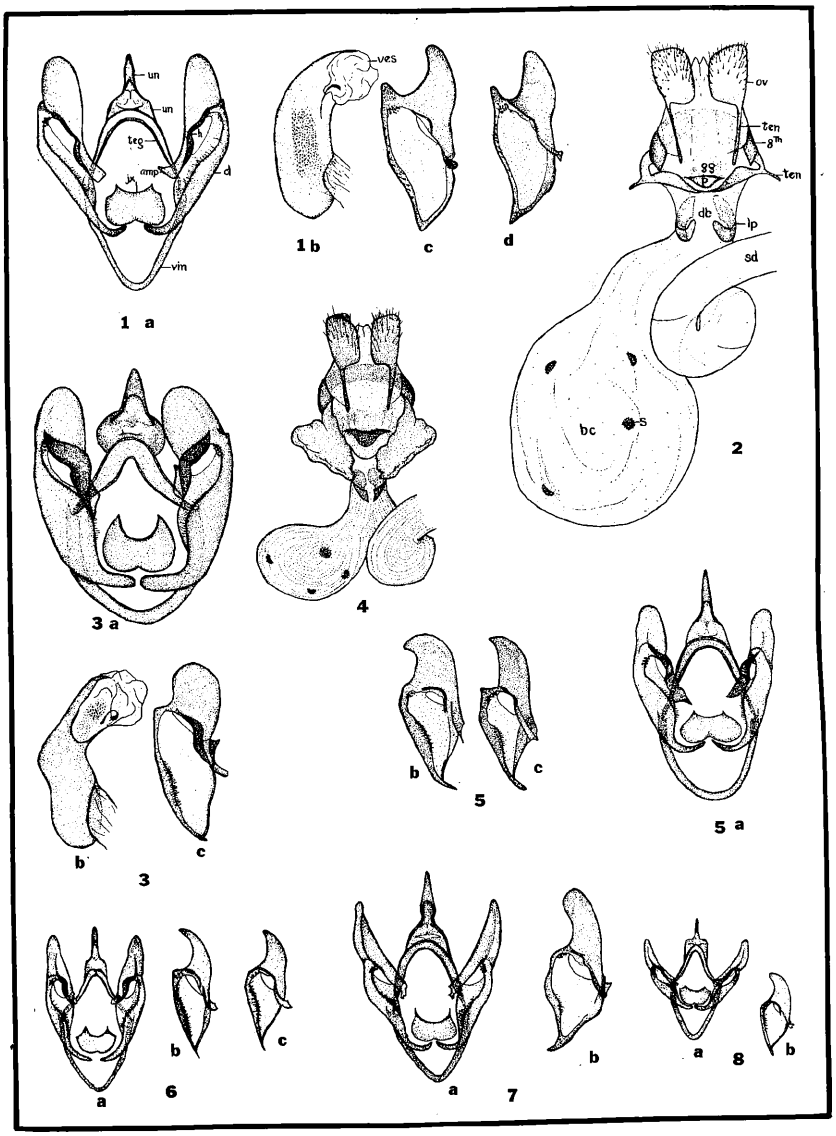

un
un
teg
amp
d
vin
1 a
ves
1 b
c
d
ov
ten
8th
ten
gg
db
lp
sd
bc
s
2
3 a
4
b
c
3
b
c
5
5 a
a
6
b
c
a
7
b
a
8
b

PLATE III.

Genitalia of Callarctia.

1. Male genitalia of C. virgo (L.); a - ventral aspect; b - inner aspect of left clasper.

2. Male genitalia of C. parthenice (Kirby); a - ventral aspect; b - inner aspect of left clasper; c - ventral aspect of right clasper of f. intermedia (Stretch).

3. Male genitalia of C. anna f. persephone (Grote); a - ventral aspect; b - inner aspect of left clasper.

4. Male genitalia of C. favorita (Neum.); a - ventral aspect; b - inner aspect of left clasper.

5. Male genitalia of C. virguncula (Kirby); a - ventral aspect; b - inner aspect of left clasper.

6. Male genitalia of C. phyllira (Drury); a - ventral aspect; b - inner aspect of normal left clasper; c - inner aspect of abnormal left clasper.

7. Male genitalia of C. celia (Saund.); a - ventral aspect; b - inner aspect of left clasper.

8. Male genitalia of C. figurata (Drury); a - ventral aspect; b - inner aspect of left clasper.

9. Male genitalia of C. f-pallida (Streckor); a - ventral aspect; b - inner aspect of left clasper.

PLATE III

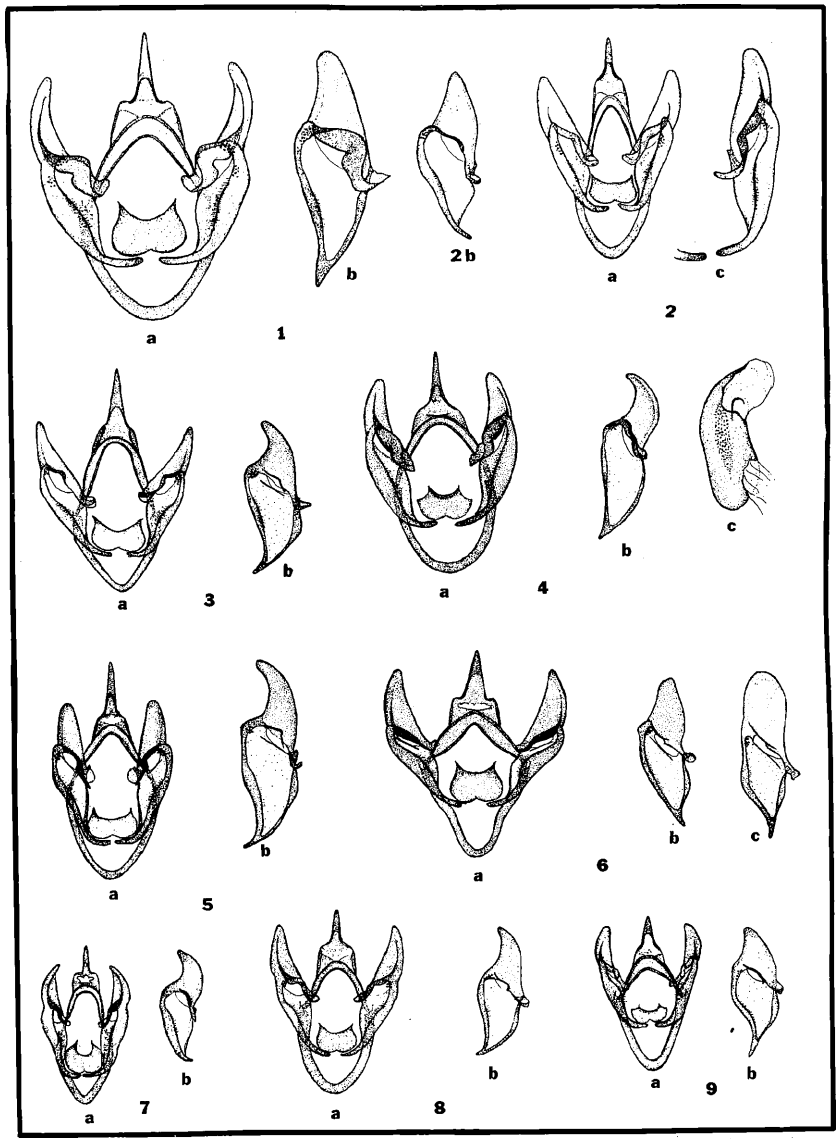


PLATE IV.

Genitalia of Callarctia.

1. Male genitalia of C. (Mimarctia) arge (Drury); a - ventral aspect; b - inner aspect of normal left clasper; c - inner aspect of abnormal left clasper; d - aedeagus.
2. Male genitalia of C. (Mimarctia) doris (Bdv.); a - ventral aspect; b - inner aspect of left clasper; c - aedeagus.
3. Female genitalia of C. arge (Drury); ventral aspect.
4. Male genitalia of C. (Holarctia) turbans (Christ.); a - ventral aspect; b - inner aspect of left clasper; c - ventral aspect of right clasper; d - aedeagus.
5. Female genitalia of C. (Holarctia) turbans (Christ.); ventral aspect.
6. Male genitalia of C. (Notarctia) proxima (Guerin); a - ventral aspect; b - aedeagus; c - inner aspect of left clasper.
7. Female genitalia of C. (Notarctia) proxima (Guerin); ventral aspect.
8. Male genitalia of C. (Callarctia) quenseli (Payk.); a - ventral aspect; b - inner aspect of left clasper.
9. Male genitalia of C. (Callarctia) williamsii f. determinata (Neum.); a - ventral aspect; b - inner aspect of normal left clasper; c - inner aspect of abnormal left clasper.
10. Male genitalia of C. (Callarctia) blakei (Grote); a - ventral aspect; b - inner aspect of left clasper.
11. Male genitalia of C. (Callarctia) nevadensis (G. & R.); a - ventral aspect; b, c - inner aspect of left clasper.

PLATE IV

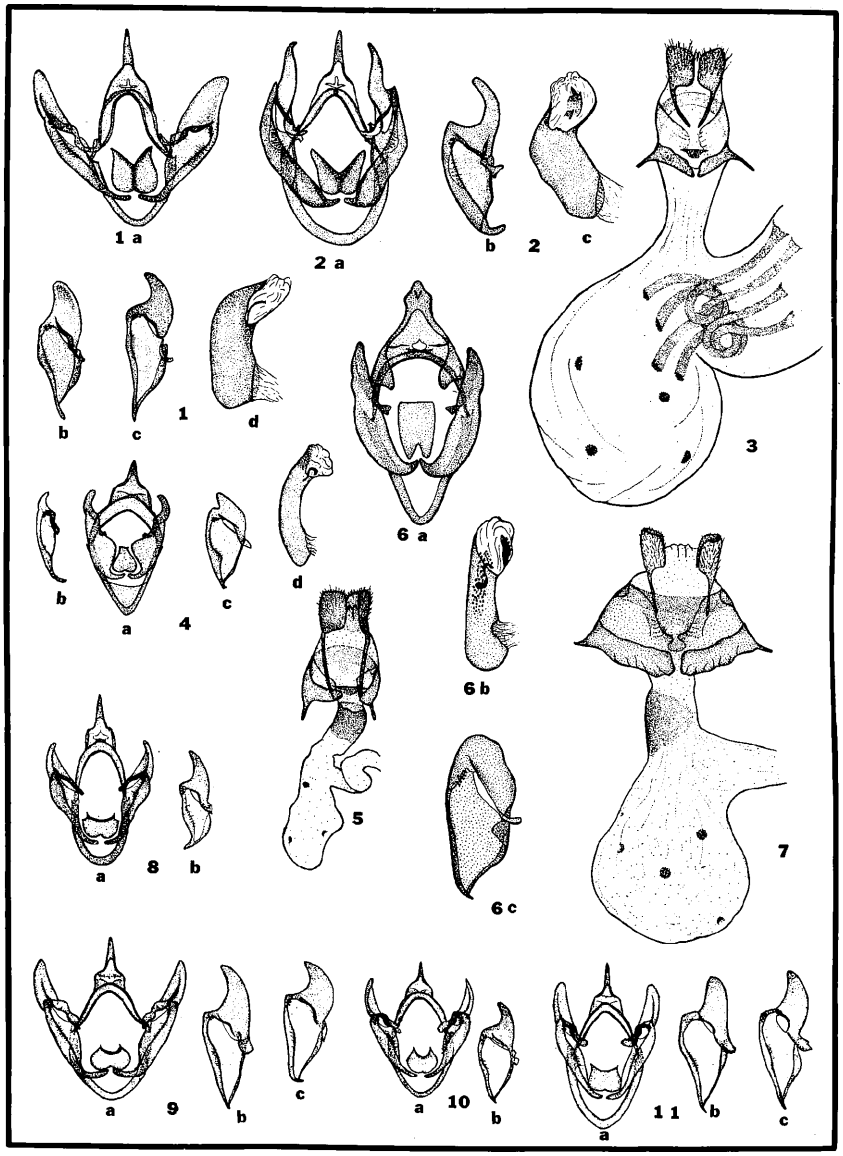


PLATE V.

Genitalia of *Agonteesis*.

1. Male genitalia of *A. vedians* Walker; a - ventral aspect; b - normal aedeagus; c - aberrant aedeagus; d - inner aspect of left clasper; e - ventral aspect of abnormal uncus.
2. Male genitalia of *A. vittata* (Fabr.); a - ventral aspect; b - normal aedeagus; c - aberrant aedeagus; d - apex of left clasper; e - inner aspect of left clasper.
3. Male genitalia of *A. zais* (Drury); a - ventral aspect; b, c - aedeagus; d - inner aspect of left clasper; e - aberrant aedeagus.
4. Female genitalia of *A. zais* (Drury); ventral aspect.
5. Female genitalia of *A. vittata* (Fabr.); ventral aspect.

PLATE V

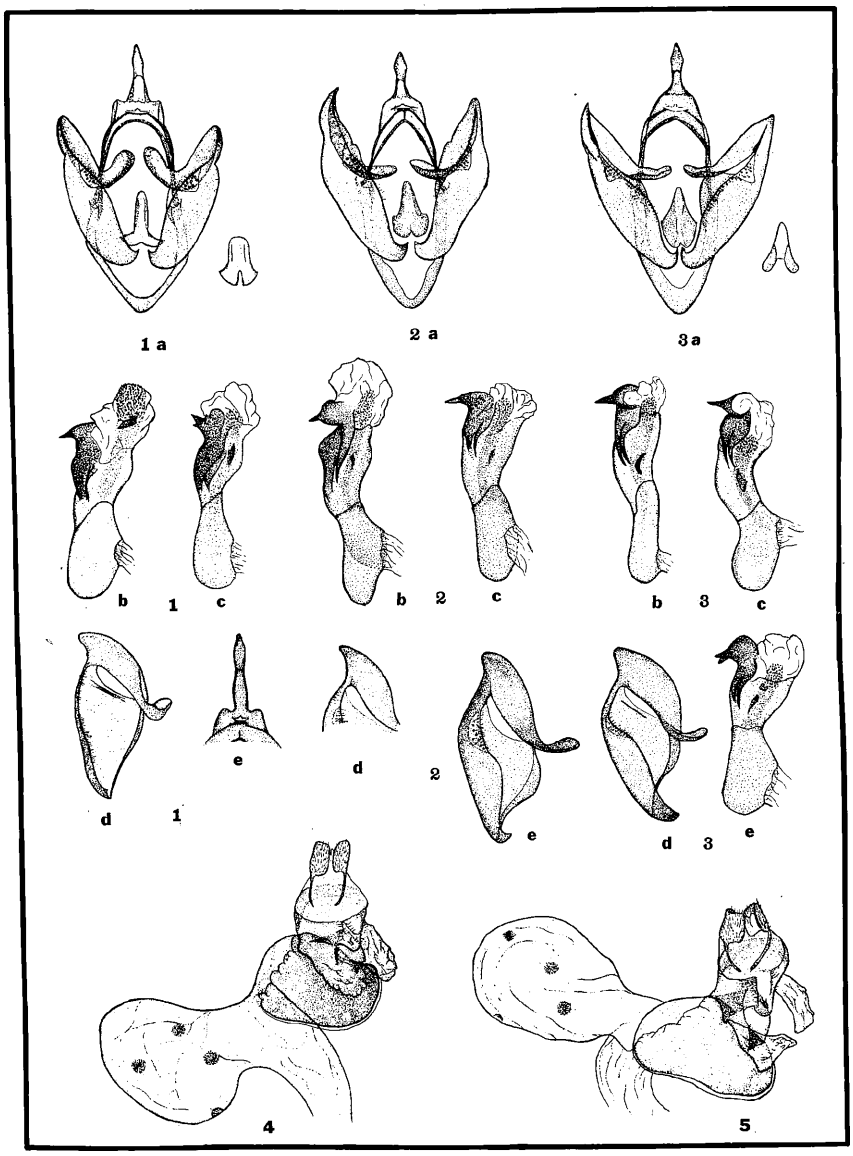


PLATE VI.

Genitalia of Apantesis.

1. Male genitalia of A. phalerata (Harris); a - ventral aspect; b - inner aspect of left clasper; c - normal aedeagus; d, e, f - aberrant aedeagus.
2. Male genitalia of A. bicolor Hampson; a - ventral aspect; b - inner aspect of right clasper; c - aedeagus.
3. Female genitalia of A. phalerata (Harris); ventral aspect.
4. Female genitalia of A. radians Walker; ventral aspect.

PLATE VI

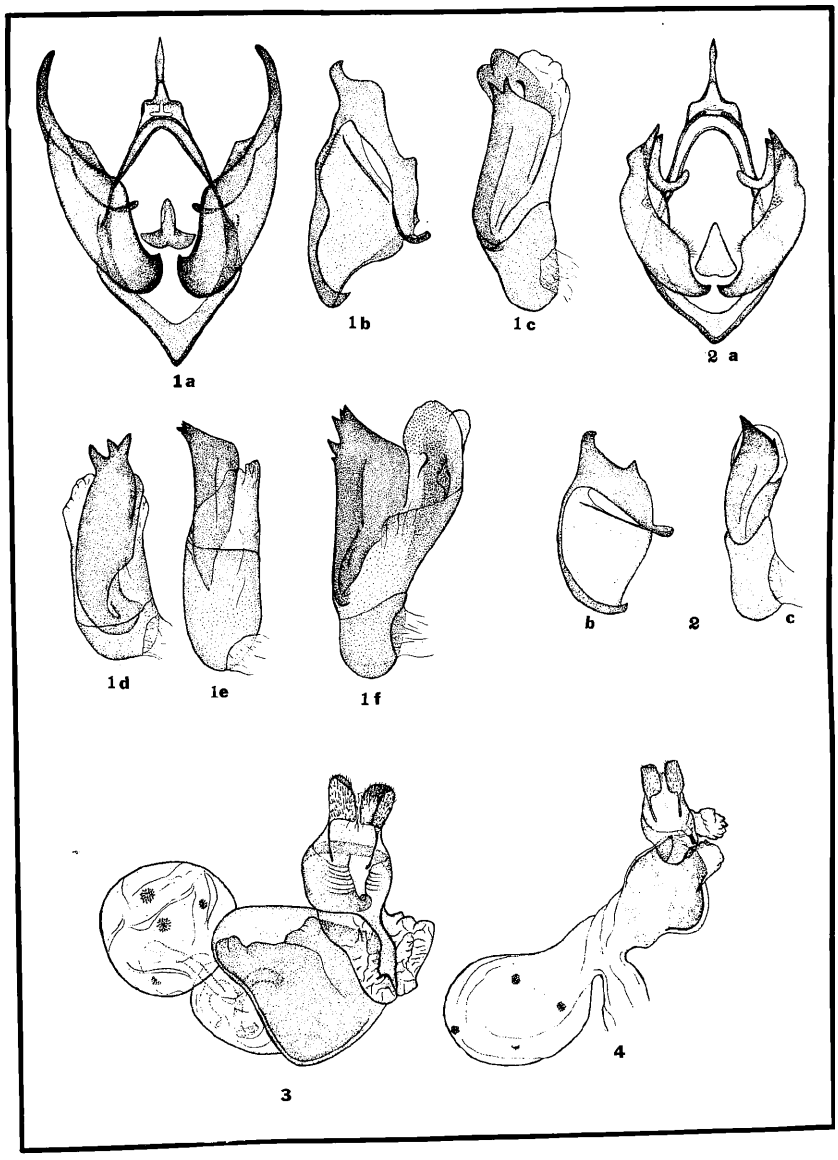


PLATE VII.

Cremasters of the pupae.

(ventral aspect)

1. Callarctia (Mimarctia) arge (Drury).
2. " " doris (Bdv.).
3. " (Notarctia) proxima (Guer.).
4. " (Holarctia) turbans (Christ.).
5. " (Callarctia) virguncula (Kby.).
6. " " virgo (Linn.).
7. " " nevadensis geneura (Stretch).
8. " " blakei (Grote).
9. " " williamsii elongata (Stretch).
10. " " ornata Packard.
11. " " phyllira oithona (Stretch).
12. Apantesis radians Walker.
13. " phalerata (Harris).
14. " vittata (Fabr.).
15. " nais (Drury).

PLATE VII

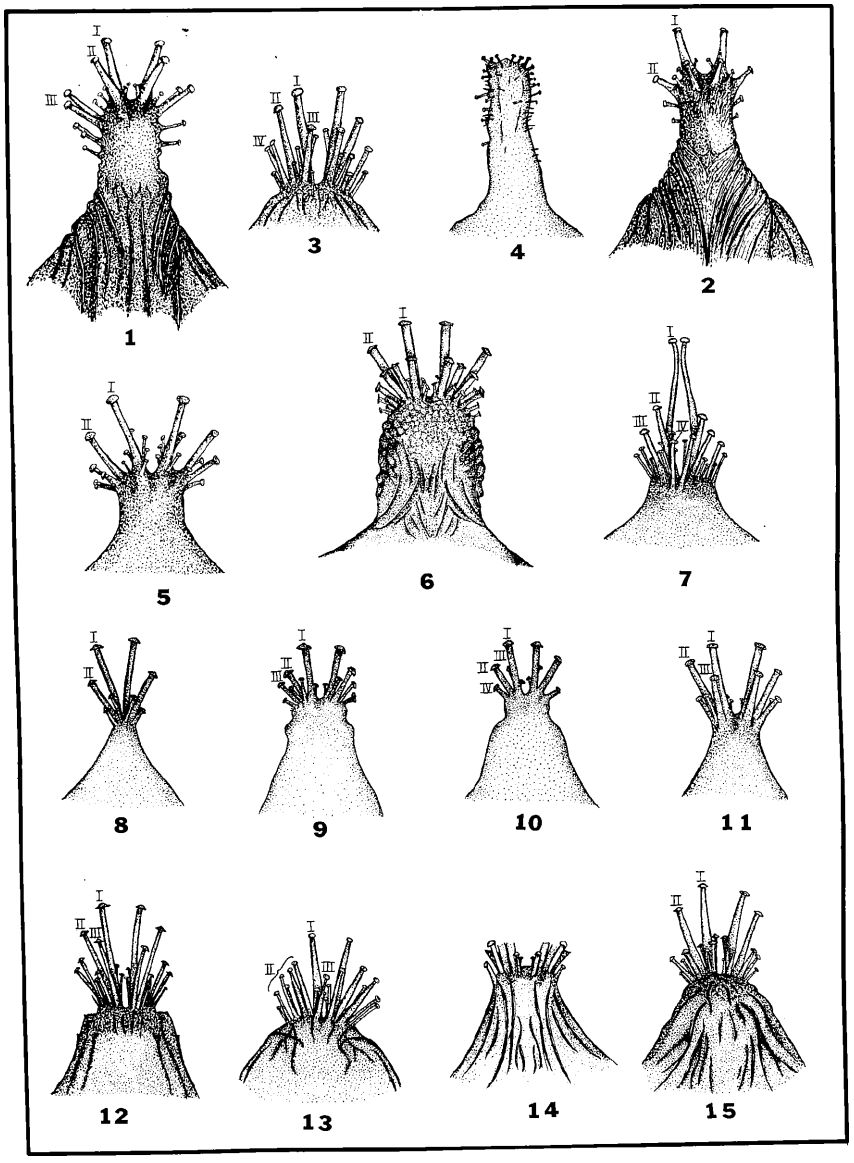


PLATE VIII.

Larvae and pupae.

First row across.

Callarctia arge (Drury).

Callarctia parthenice (Kirby).

Callarctia parthenice (Kirby).

Callarctia virgo (Linnaeus).

Callarctia virgo (Linnaeus).

Apantesis phalerata (Harris).

Second row across.

Callarctia proxima (Guerin).

Callarctia virgunculs (Kirby).

Callarctia nevadensis superba (Stretch).

Callarctia anna (Grote).

Callarctia phyllira (Drury).

Callarctia figurata (Drury).

Third row across.

Callarctia phyllira oithona (Streckor).

Callarctia phyllira oithona (Streckor).

Callarctia arge (Drury).

PLATE VIII

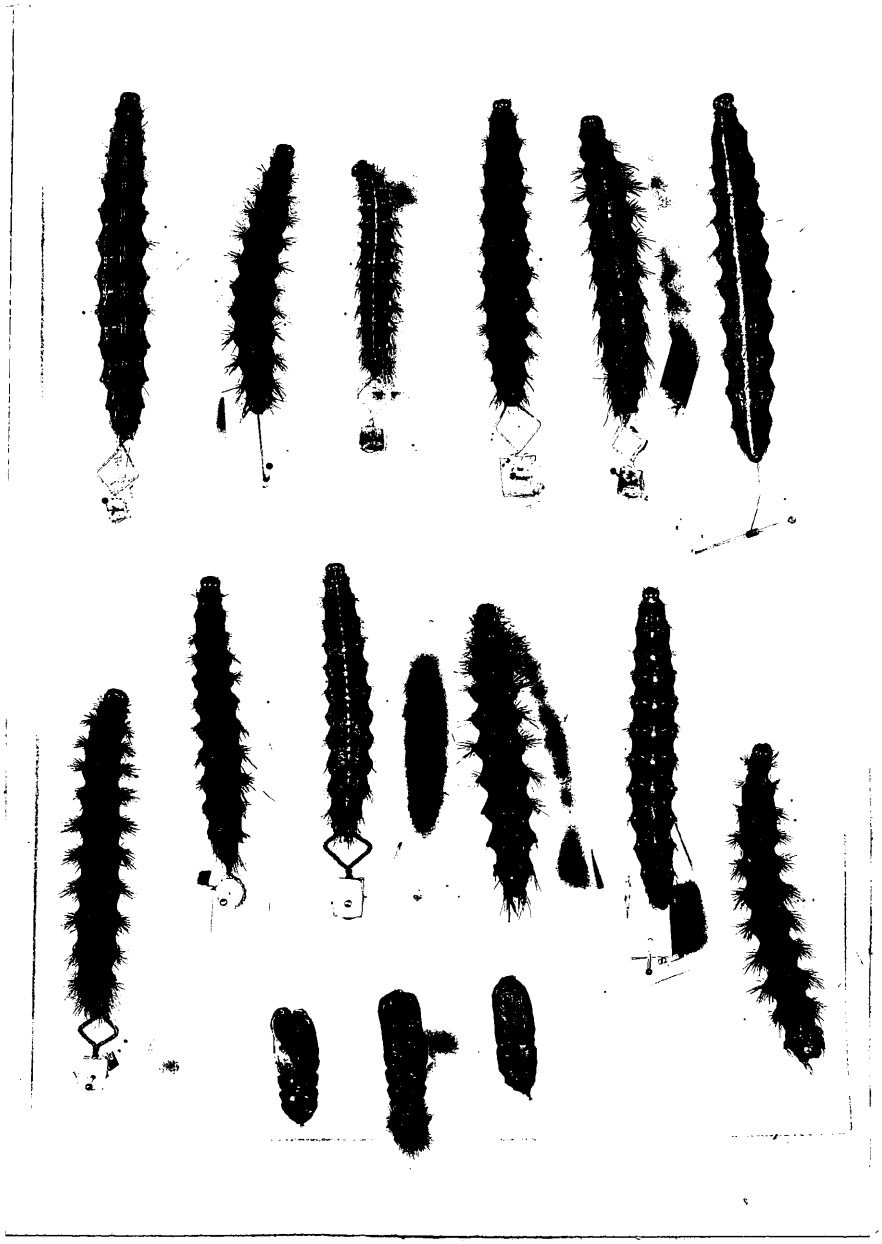


PLATE IX.

First row, down.

Callarctia (Mimaretia) arge (Dru.), male, Newark, N. J.; A. M.

C. arge (Dru.)., female neotype; U. S. N. M.

C. doris (Bdv.), female, New Brighton, Pa.; U. S. N. M.

C. doris (Bdv.), female, So. Pines, N. C.; U. S. N. M.

C. parthenice f. intermedia (Stretch), male, Kans.; Purdue.

C. virgo (Linn.), female neotype, Harrison, Me.; U. S. N. M.

Middle row.

C. parthenice ab. approximata (Stretch), male, Minn.; Univ. Minn.

Third row, down.

C. parthenice (Kirby), male, Franconia, N. H.; A. M.

C. parthenice (Kirby), male neotype, Delaware Water Gap; U. S. N. M.

C. parthenice f. intermedia (Stretch), male, Nantucket, Mass.;
C. P. Kimball.

C. parthenice f. intermedia (Stretch), male, Logan, Utah; Utah
Ag. Exp. Sta.

C. parthenice f. intermedia (Stretch), ab., female, St. Louis,
Mo.; F. L. Meiners.

C. virgo ab. simplex (Butler), male, Crawford Notch, N. H.; A. M.

PLATE IX

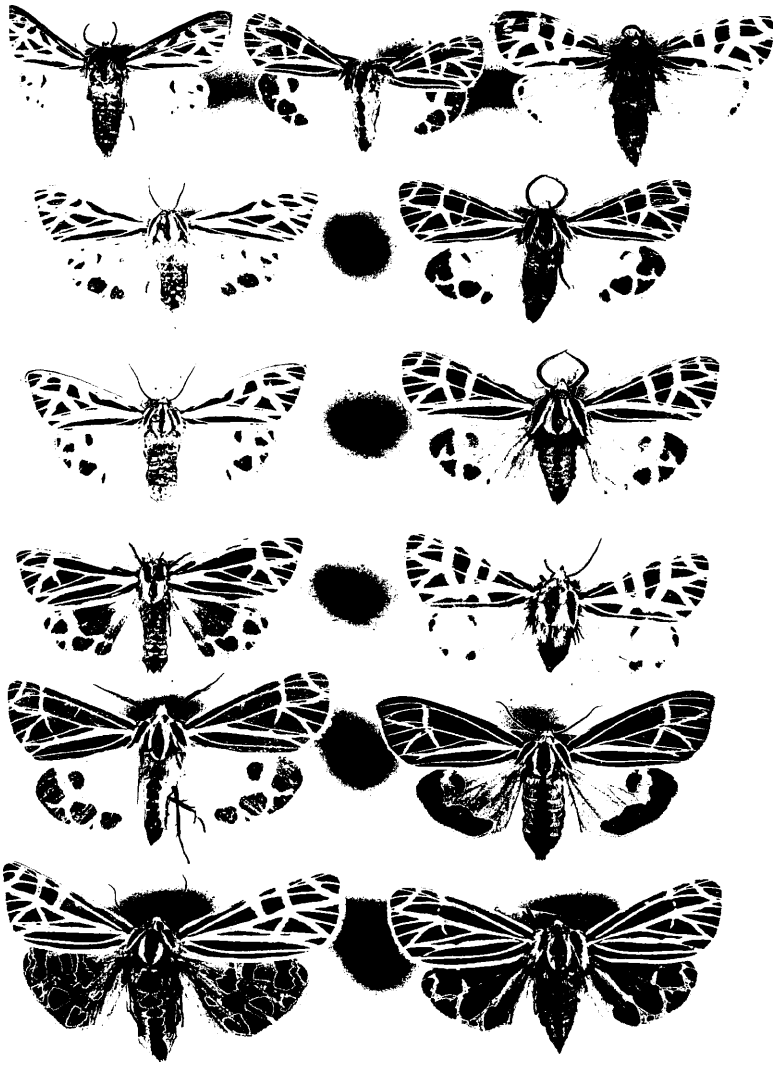


PLATE X.

First row, down.

Callarctia anna (Grt.), female, New Brighton, Pa.; U. S. N. M.

C. anna f. persephone (Grt.), female, New Brighton, Pa.; U. S. N. M.

C. anna f. persephone (Grt.), male, Madison, Wis.; U. S. Sieker.

C. anna f. persephone (Grt.), male, Md.; U. S. N. M.

C. virguncula (Kby.), male neotype, Iowa; U. S. N. M.

C. virguncula (Kby.), male, Franconia, N. H.; A. M.

C. virguncula ab. otiosa (H. & D.), male, Ill.; M. E. Smith.

Middle row, down.

C. quenseli (Payk.), male, Zermatt, Europe; U. S. N. M.

C. quenseli gelida (Mooseh.), male, Labrador; U. S. N. M.

C. quenseli (Payk), female, Amoor; U. S. N. M.

C. quenseli liturata (Menet.), female, Raddefka; U. S. N. M.

C. (Holarctia) turbans (Christ.), male, Aweme, Manit.; Can. Nat. Coll.

C. cervinoides (Stkr.), male, Colo.; U. S. N. M.

C. cervinoides (Stkr.), male, Colo.; U. S. N. M.

C. edwardsii (Stretch), male, Lake Merced, Calif.; M. E. Smith.

C. edwardsii (Stretch), female, Lake Merced, Calif.; M. E. Smith.

Third row, down.

C. ornata Pack., female, Nico, Colo.; U. S. N. M.

C. ornata f. achaia (G. & R.), male, Wallace, Ida.; M. E. Smith.

C. ornata f. ochracea (Stretch), male, Calif.; U. S. N. M.

C. complicata (Wlk.), male, Corvallis, Ore.; Ore. St. Ag. Coll.

C. complicata (Wlk.), male, Corvallis, Ore.; Ore. St. Ag. Coll.

C. complicata (Wlk.), female, Friday Harbor, Wash.; U. S. N. M.

C. hewletti (B. & McD.), male, Nellis, Calif.; U. S. N. M.

C. hewletti (B. & McD.), male, San Diego, Calif.; U. S. N. M.

PLATE X

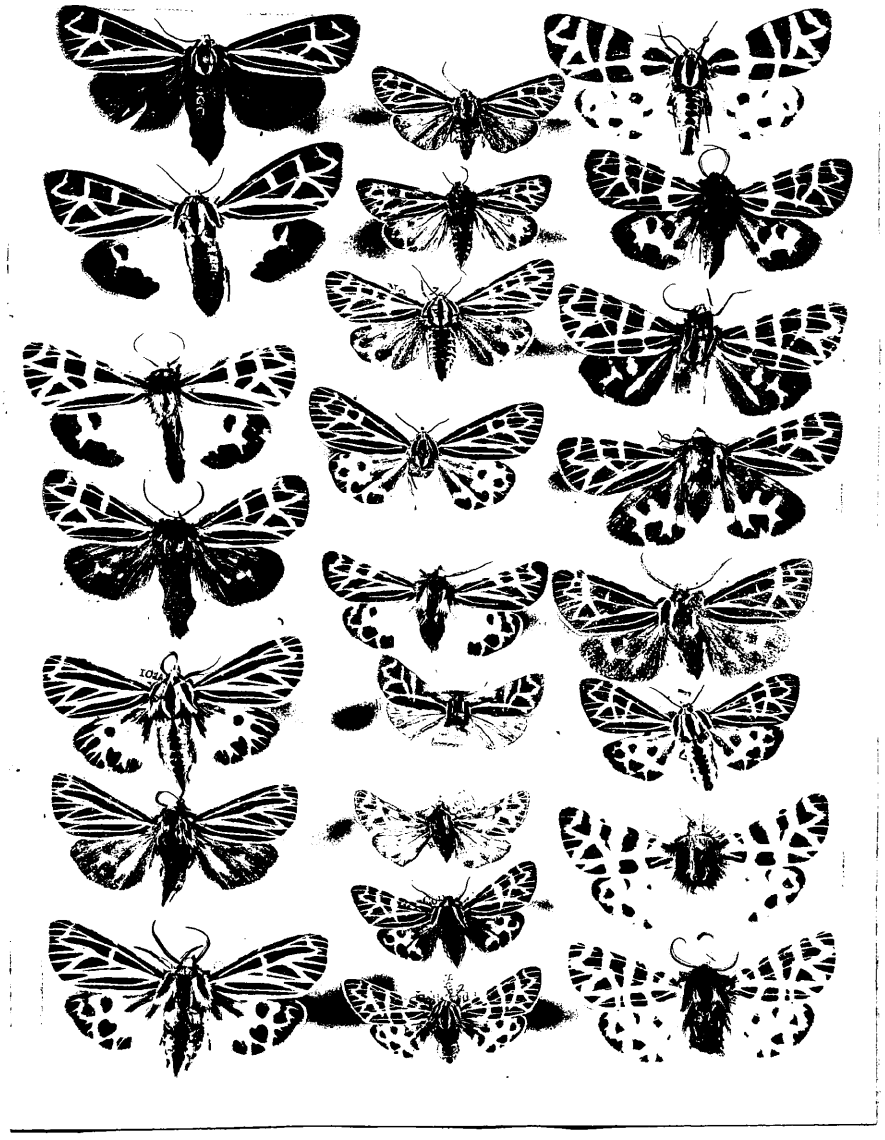


PLATE XI.

First row, down.

Callarctia phyllira (Dru.), male, Wis.; Univ. Wis.

C. phyllira (Dru.) ab., male, White Mts., N. H.; A. M.

C. phyllira (Dru.) ab., male, Nantucket, Mass.; B. S. N. H.

C. phyllira (Dru.), female, Southern Pines, N. C.; U. S. N. M.

C. phyllira (Dru.), male, Ft. Collins, Colo.; A. M.

C. favorita (Neum.), male, Colo.; U. S. N. M.

C. favorita (Neum.), male, Colo.; U. S. N. M.

Middle row, down.

C. phyllira f. rectilinea (Fr.), male, Kans.; Purdue.

C. phyllira f. conspicua (Str.), yellow form, male, Plainfield, N. J.; A. M.

C. phyllira f. conspicua (Str.), male, Nantucket, Mass.; C. P. Kimball.

C. phyllira f. rectilinea (Fr.), male, Nantucket, Mass.; C. P. Kimball.

C. phyllira f. oithona (Stkr.), female, Kansas; Purdue.

C. phyllira f. conspicua (Str.), male, Ft. Collins, Colo.; A. M.

Apantesis phalerata (Harr.), Orizaba, Mex.; U. S. N. M.

Third row, down.

C. proxima (Guer.), male, San Diego, Calif.; A. M.

C. proxima f. autholea (Bdv.), male, San Diego, Calif.; A. M.

C. proxima (Guer.), female; U. S. N. M.

C. proxima arizoniensis (Str.), male, Colo.; U. S. N. M.

C. proxima arizoniensis (Str.), female, Ariz.; A. M.

C. proxima (Guer.), female ab., Orosi, Costa Rica; British Museum.

PLATE XI

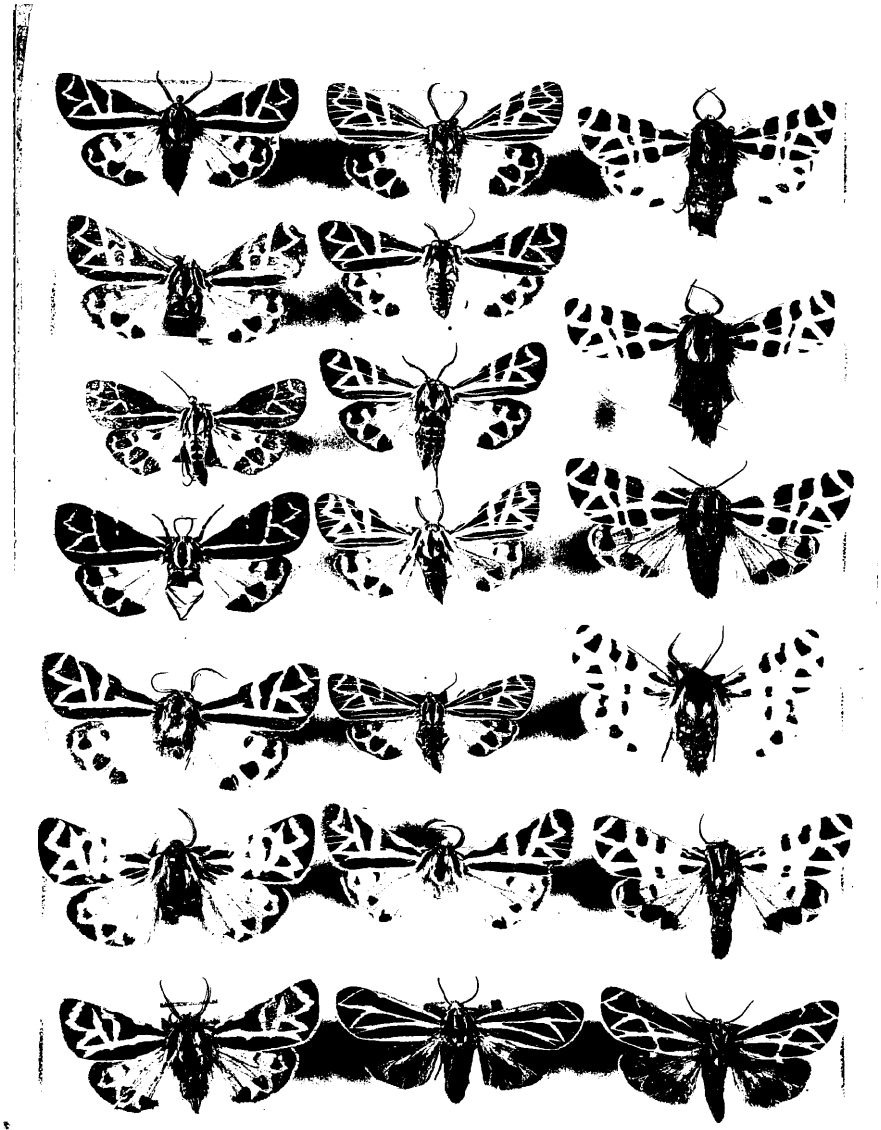


PLATE XII.

First row, down.

Callarctia placentia (A. & S.), male, Southern Pines, N. C.; U.S.N.M.

C. placentia (A. & S.), female neotype, Southern Pines, N. C.; U.S.N.M.

C. celia (Saund.), male, Meach Lake, Que.; U.S.N.M.

C. celia (Saund.), male, Klondike Valley, Yukon Territory, near Dawson; Can. Nat. Coll.

C. celia (Saund.), female, Bobcaygeon, Ont.; Can. Nat. Coll.

C. celia (Saund.), male, Bobcaygeon, Ont.; Can. Nat. Coll.

C. celia f. lineata, new form, male holotype, near Ft. Yukon, Alaska; U.S.N.M.

C. celia f. lineata, female paratype, Klondike River, Yukon Territory; Can. Nat. Coll.

C. celia f. lineata, male paratype, Calgary, Alta.; Can. Nat. Coll.

Middle row, down.

C. f-pallida (Stkr.), male, Colo.; A. M.

C. f-pallida (Stkr.), male, Dallas, Tex.; M. C. Z.

C. f-pallida (Stkr.), female, Colo.; U.S.N.M.

C. f-pallida (Stkr.), female, Dallas, Tex.; M. C. Z.

C. f-pallida (Stkr.), Dallas, Texas; M. C. Z.

C. f-pallida (Stkr.), female, Dallas, Tex.; M. C. Z.

C. f-pallida (Stkr.), female, Dallas, Tex.; M. C. Z.

C. f-pallida (Stkr.), Kerrville, Tex.; U.S.N.M.

Third row, down.

C. figurata (Dru.), male, Md.; U.S.N.M.

C. figurata (Dru.), male, Martha's Vineyard, Mass.; B.S.N.H.

C. figurata (Dru.), f. excelsa (Neum.), Md.; U.S.N.M.

C. figurata (Dru.), male, Weston, Mass.; M.C.Z.

C. figurata f. preciosa (Nix.), Weston, Mass.; M.C.Z.

C. figurata f. preciosa (Nix.), Franconia, N. H.; A. M.

C. figurata (Dru.), female, Md.; U.S.N.M.

C. figurata f. lugubris (Hist.), Athens, Ohio; Ohio Univ.

PLATE XII

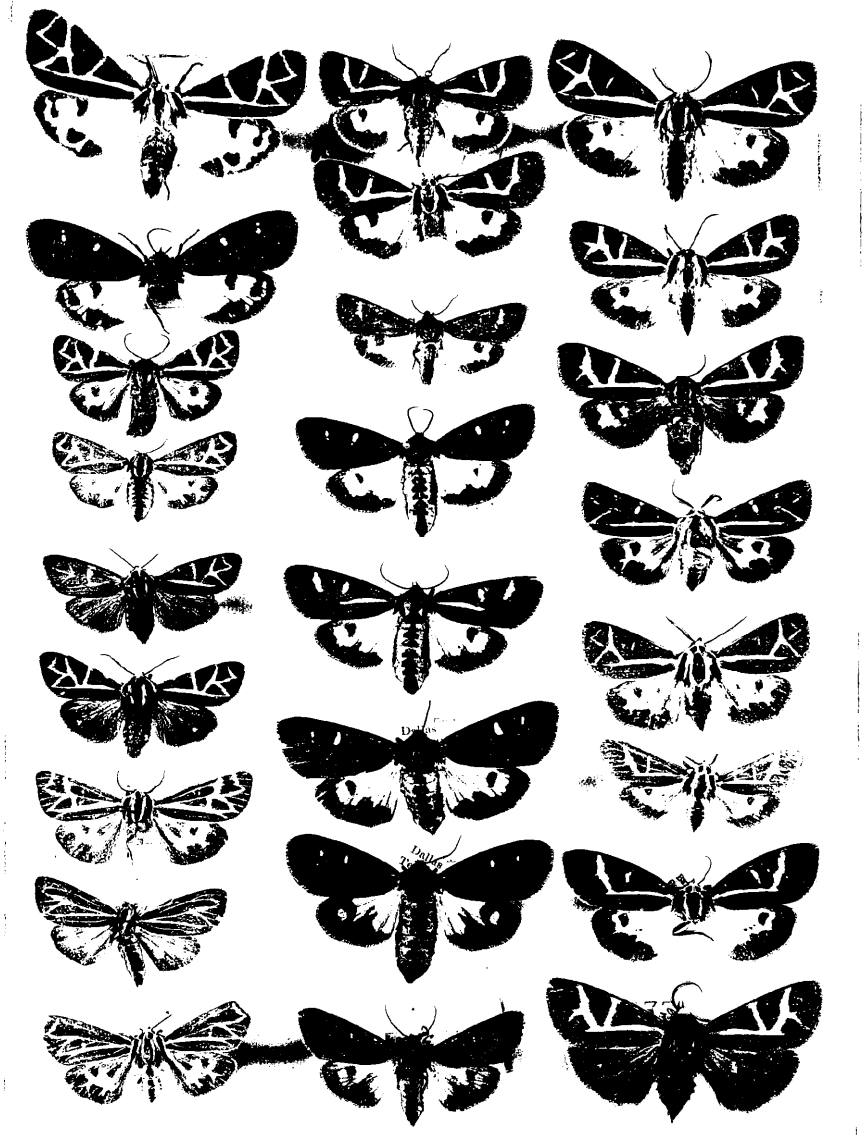


PLATE XIII.

First row, down.

Callarctia nevadensis (G. & R.), male, Lehi, Utah; Utah Exp. Sta.

C. nevadensis (G. & R.), male, Riley, Oregon; Ore. Exp. Sta.

C. nevadensis f. alexanderi, new form, male holotype, Colo.; U.S.N.M.

C. nevadensis (G. & R.), female; U.S.N.M.

C. nevadensis f. alexanderi, female paratype, Colo.; U.S.N.M.

C. nevadensis geneura (Stretch), male, Arizona; A. M.

C. nevadensis geneura (Stretch), female, Ft. Wingate, N. M.; U.S.N.M.

Middle row, down.

C. nevadensis superba (Stretch), male, Nicola, B. C.; Can. Nat. Coll.

C. nevadensis superba (Stretch), male, Almont, Colo.; U.S.N.M.

C. nevadensis superba (Str.), female, Peachland, B. C.; Can. Nat. Coll.

C. nevadensis gibsoni (McD.), male, Aweme, Manitoba; Can. Nat. Coll.

C. blakei (Grt.), male, Hays, Kansas; U.S.N.M.

C. blakei (Grt.), N. W. British Columbia; U.S.N.M.

C. williamsii toocle (B. & McD.), male, American Fork, Utah; Utah. Exp. Sta.

C. williamsii toocle f. ophir (B. & McD.), male, American Fork, Utah; Utah. Exp. Sta.

Third row, down.

C. williamsii f. determinata (Neum.), male; U.S.N.M.

C. williamsii f. determinata (Neum.), female; A. M.

C. williamsiif. determinata (Neum.), male Glenwood Springs, Colo.; U.S.N.M.

C. williamsii f. dieckii (Neum.), male, Paonia, Colo.; A. M.

C. williamsii f. dieckii (Neum.), male, Glenwood Springs, Colo.; U.S.N.M.

C. williamsii elongata (Stretch), male, Missoula, Mont.; Mont. Exp. Sta.

C. williamsii elongata (Stretch), female, Waterton Lakes, Alta.; Can. Nat. Coll.

C. williamsii toocle f. ophir (B. & McD.) ab., Eureka, Utah; U.S.N.M.

PLATE XIII

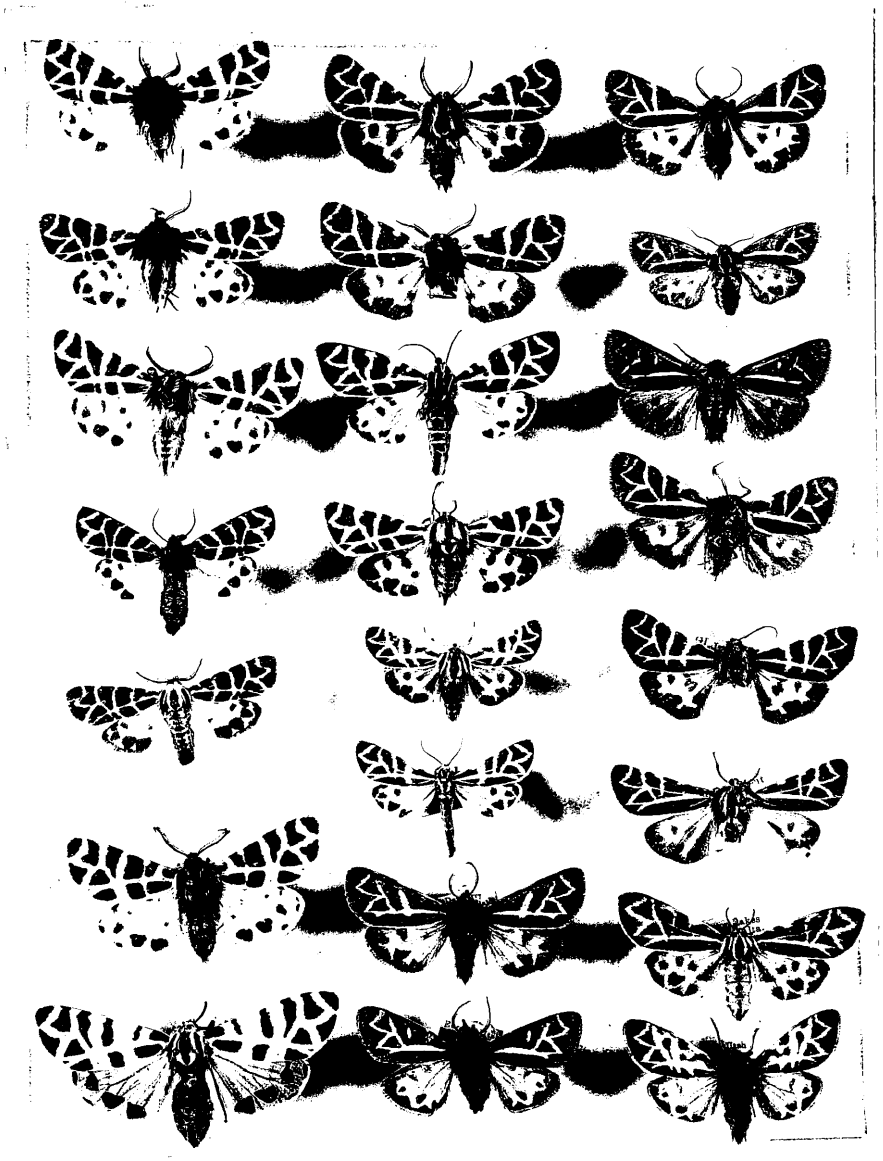


PLATE XIV.

First row, down.

Apantesis nais (Dru.), male, Okla.; N. C. St. College.

A. nais (Dru.), male, N. J.; M. E. Smith.

A. nais (Dru.), female, New York City; A. M.

A. nais (Dru.) ab. female, Athens, Ohio; Ohio Univ.

A. vittata (Fabr.), male, Minn.; Univ. Minn.

A. vittata (Fabr.), male, Quincy, Ill.; U.S.N.M.

A. vittata (Fabr.), female, Madison, Wis.; Wm. Sieker.

A. vittata (Fabr.), female, Athens, Ohio; Ohio Univ.

Middle row, down.

A. radians Wlk., male, Florida; A. M.

A. radians Wlk., male, Florida; A. M.

A. radians Wlk., male, Florida City, Fla.; M. E. Smith.

A. radians Wlk., male, Orlando, Fla.; A. M.

A. radians Wlk., female, Hope, Arkansas; M. E. Smith.

A. radians Wlk., female; U.S.N.M.

A. bicolor Hampson, male, Bahamas; British Museum.

Third row, down.

A. phalerata (Harr.), male, Minn.; Univ. Minn.

A. phalerata (Harr.), male, Minn.; Univ. Minn.

A. phalerata (Harr.), male, Raleigh, N. C.; N. C. Dept. Ag.

A. phalerata (Harr.), female, Elgin, Ill.; M. E. Smith.

A. phalerata (Harr.), female, Green Village, N. J.; M. E. Smith.

A. phalerata (Harr.), female, Elizabeth, N. J.; A. M.

Callarctia proxima (Guer.), female, Tuis, Costa Rica; U.S.N.M.

Pl. [illegible] XIV.

First row, down.

Agrotis mile (Bru.), male, Ohio.; N. C. St. College.

A. mile (Bru.), male, N. J.; P. R. Smith.

A. mile (Bru.), female, New York City; A. H.

A. mile (Bru.) ab. female, Athens, Ohio; Ohio Univ.

A. vittata (Fabr.), male, Minn.; Univ. Minn.

A. vittata (Fabr.), male, Quincy, Ill.; U.S.N.M.

A. vittata (Fabr.), female, Madison, Wis.; Mrs. Sieker.

A. vittata (Fabr.), female, Athens, Ohio; Ohio Univ.

Middle row, down.

A. radians (Wlk.), male, Florida; A. H.

A. radians (Wlk.), male, Florida; A. H.

A. radians (Wlk.), male, Florida City, Fla.; P. R. Smith.

A. radians (Wlk.), male, Orlando, Fla.; A. H.

A. radians (Wlk.), female, Cape, Arkansas; P. R. Smith.

A. radians (Wlk.), female; U.S.N.M.

A. bicolor (Augsm.), male, Bahamas; British Museum.

Third row, down.

A. phalerata (Harr.), male, Minn.; Univ. Minn.

A. phalerata (Harr.), male, Minn.; Univ. Minn.

A. phalerata (Harr.), male, Raleigh, N. C.; N. C. Dept. Agric.

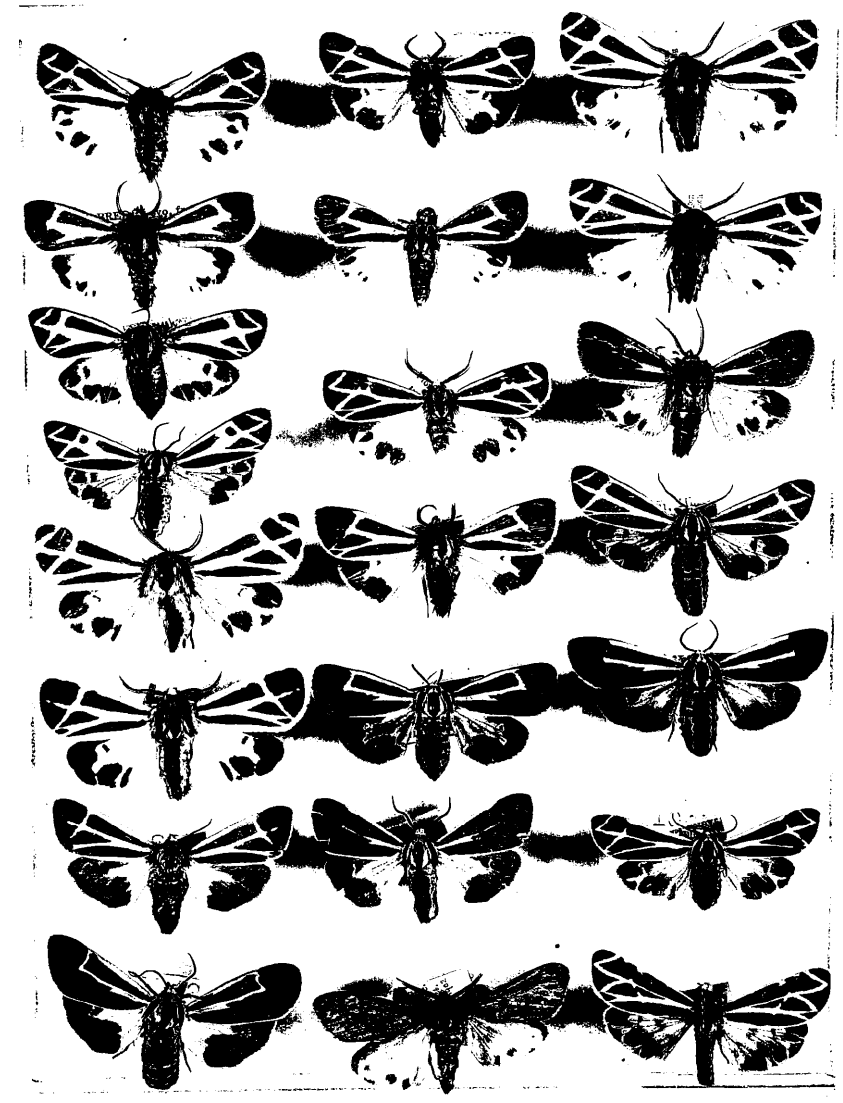
A. phalerata (Harr.), female, Elgin, Ill.; P. R. Smith.

A. phalerata (Harr.), female, Beacon Village, N. J.; P. R. Smith.

A. phalerata (Harr.), female, Elizabeth, N. J.; A. H.

Calleretia peruana (Guer.), female, Cuzu, Costa Rica; U.S.N.M.

PLATE XIV



XII. VITA.

Marion Estelle Smith was born March 2, 1913, in Marion, Massachusetts. Being the daughter of a Methodist minister, she attended schools in several different towns of Vermont and Massachusetts, graduating from junior high school in Lynn, Massachusetts, in 1928, and from Greenfield (Mass.) High School in June, 1931. The following September she entered Massachusetts State College, Amherst. In the spring of 1935 she was elected to Phi Kappa Phi, and was graduated in June, Magna cum Laude, with honors in entomology. The summer of 1935 was spent in Amherst working for the experiment station on a light-trap problem, which was continued into the fall and again in the spring of 1936. She entered the graduate school of Massachusetts State College in September, 1935, where she pursued a major in entomology and a minor in botany. In the spring of 1936 she was placed in charge of a laboratory section in introductory entomology. She completed her research on morphological and distributional studies of New England Arctiidae, and in June, 1936, received a Master of Science degree. During the school years 1936-37 and 1937-38, she held a university fellowship at the University of Illinois. She was elected to associate membership in Sigma Xi in the spring of 1937, and to Phi Beta Kappa in 1938, and is a member of the Entomological Society of America.

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