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BIOLOGICAL ASSESSMENT

RATTLESNAKE MASTER, *Eryngium yuccifolium*

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Technical Report 1999 (4)

Illinois Natural History Survey
607 East Peabody Drive
Champaign, Illinois 61820

Prepared for:
Midewin National Tallgrass Prairie
30071 South St. Rt. 53
Wilmington, IL 60481

11 February 1999

1.0 Taxonomy

1.1 Scientific name: *Eryngium yuccifolium* Michx.

1.2 Common name: Rattlesnake master, button snakeroot, and water-eryngo.

2.0 Identification

2.1 General Description

Eryngium yuccifolium Michx., is a perennial prairie species with a monocot appearance, found in the south east of the Great Plains (McGregor, 1991). In Illinois, *E. yuccifolium* blooms from mid July to early September. The solitary stem of *E. yuccifolium* has a height of 2-6 (3-5) feet. Each flower has five white petals and five greenish sepals. Flowers have two protruded stigmas and five anthers. On average the central flower head has 106 flowers (B. Molano-Flores unpublished data). In some plants the stigmas and bracts will have a pinkish-reddish color (personal observation). The flower head has a "honey-like" fragrance (Runkel and Rosa, 1989) and no nectar is visible. The species has a conservative coefficient of nine (Swink and Wilhem, 1994).

2.2 Diagnostic characteristics

The inflorescence (green spiny head) and leaves with a yucca appearance (parallel venation and spiny edges).

3.0 Legal Status

3.1 National status: Not listed at the federal level.

3.2 State(s) status: Not listed at the state level.

3.3 TNC rank: G5 (global) meaning that the species is widespread and stable, and a N5 in the USA ranking.

4.0 Range Map

Total and state distributions of *Eryngium yuccifolium* are shown on accompanying maps (see figure 1) Kindscher, 1992, for general range, and figure 2) Mohlenbrock and Ladd, 1978 for Illinois distribution).

5.0 Habitat

5.1 Natural Habitats: This species is found in wet or dry prairies.

5.2 Other habitats: Rocky open woodlands (Kindscher, 1992).

5.3 Limiting factors

5.3.1 Moisture: *E. yuccifolium* prefers moist, well-drained loam, but can tolerate dry to wet areas (Shirley, 1994).

5.3.2 Soils: This species can be found in acid to slightly basic soils (pH 5-7.3). Burell (1990) indicates that *E. yuccifolium* can do well on sandy, loamy and even clay soils that are not waterlogged. However, in rich soils (i.e. fertile soils) the plant will exceed its natural proportions and become weak-stemmed and floppy (Burell, 1990).

5.3.3 Shade tolerance: Full sun or partial sun. *E. yuccifolium* has vertical-leaves adapted for open habitats, allowing photosynthetic symmetry, thus maximizing carbon intake and water-use efficiency (Delucia et al., 1991).

6.0 Reproductive Ecology

6.1 Phenology

In general, a flower head of *E. yuccifolium* requires close to a month from the time flower buds open to when all its stigmas become receptive. Flowers in the flower head open acropetally. Styles are close together at the beginning and separate as they elongate. When fully expanded, styles bend outward. The sepals and petals separate enough to allow the stigmas to emerge. Full expansion of styles takes approximately a 1.5 weeks.

By two weeks, all the styles in a flower head are fully expanded, and the lower stamens begin expanding. The filament bends inward, and the petals hold the anther in place until the filament expands. The anthers are green at the beginning of expansion and then turn light pink or white before the filament expands. Anthers are ready to shed pollen almost immediately after completing expansion. There is a sequential expansion of the five stamens in each flower that takes from one to two days. However, all stamens in a flower head fully expand within five days. The life span of stamens within each flower is about three to four days. As the filaments expand and the anthers emerge, the petals open. After the stamens dehisce, the stigmas become receptive. Stigma receptivity begins about three days after all stamens have dehisced. Each stigma initially has a round shape but then spreads and becomes sticky when receptive. Finally, after the period of receptivity, first the stigma, and then the rest of the style, turns brown and remains attached to the fruit. The petals dehisce at or after the time the stamens dehisce. A strong fragrance is emitted during the full extent of this flowering phenology, reaching a peak at the time the anthers dehisce and the stigmas are receptive.

6.2 Breeding system

Eryngium yuccifolium is a xenogamous self-compatible species (Molano-Flores manuscript in preparation). Several lines of evidence in support of this include: 1) high pollen-ovule ratio falling within the range of xenogamous species (Cruden, 1977, Cruden and Lloyd, 1989); 2) absence of fruit and seed set in caged flowers; and 3) hand pollinations suggest that the species is self-compatible (Molano-Flores manuscript in preparation).

6.3 Pollination mechanisms and pollinators

E. yuccifolium is visited by small bees, bumblebees, butterflies (*Danus plexippus* and *Vanessa cardui*), and moths (*Cisseps fulvicollis*). Soldier beetles (*Chauliognathus pennsylvanicus*) have been observed eating pollen (personal observations).

6.4 Other factors affecting seed production

Molano-Flores (manuscript in preparation) found that herbivory by the larva of an unidentified moth at Grant Creek Prairie (Will County, IL) affected between 40-60% of the flower and fruit-seed of *E. yuccifolium*. However, flower heads from Midewin National Tallgrass Prairie (Will County, IL) had only 1% herbivory. This suggests that seed production can be highly affected depending on the abundance of this herbivore and isolation of the *E. yuccifolium* populations.

The oviposition of the eggs of this unidentified moth appears to be during the early stages of flower development making the identification of healthy flower heads before damage to the ovaries and seeds is done almost impossible. The larva buries into the center of the flower head and eats the ovaries and seeds. Indications of flower

damage include accumulation of feces around individual flowers and the flower heads turning brown.

7.0 Population Ecology

7.1 Demography/life history

Little information is available regarding the life history of *E. yuccifolium*. However, Burell (1990) indicates that the plants will flower the second year from seed.

7.2 Abundance

Vegetation analyses of both prairie remnants and restored prairie have found that, in general, *E. yuccifolium* can have a percent cover of 1-30% (Gardner, 1995; Johnson and Anderson, 1986; Wistendahl, 1975). Even though no percent cover values were given, a study by Cottam and Wilson (1966) suggest that in restored areas it can become dominate.

7.3 Trends

Although *E. yuccifolium* is consider a highly conservative species (Swink and Wilhem, 1994) this species seems to be secure in Illinois.

7.4 Limiting factors for population viability

With the exception of habitat destruction or degradation, and some herbivores, *E. yuccifolium* does not seem susceptible to factors that can affect its population viability.

8.0 Genetic issues

Studies addressing genetic issues have not been done for this species.

9.0 Interactions with other organisms

9.1 Alleopathy

No evidence of alleopathy for this species has been reported.

9.2 Critical host plant for arthropods of conservation concern

This species serves as a food source for the state threatened eryngium stem-borer moth (*Papiapena eryngii*) (Panzer and Derkovitz, 1992).

9.3 General food/shelter source for wildlife/insects

This species provides nectar and pollen to several insects. Beside providing food for *Papiapena eryngii*, Panzer and Derkovitz (1992) found that *E. yuccifolium* can also host *Papiapena baptisiae* (indigo stem borer), *P. silphii* (silphium root borer), and, potentially, *P. activorens*.

9.4 Effect of browsing/grazing by ungulates

Grazing by ungulates and rabbits occurs on new palatable and nutritious-growth (Kirt, 1995; Shirley, 1994).

9.5 Seed production

Seed production is affected by the larva of an unidentified moth. A study at Grant Creek Prairie (Will Co. Illinois) showed that almost 60% of the flowers or fruits were damaged compare to less than 2% at Midewin National Tallgrass Prairie (Will Co. Illinois) (Molano-Flores manuscript in preparation). This intense herbivory is not an isolated case, as herbivory like this has been observed in other *E. yuccifolium* populations resulting in almost no fruit and seed sets (Eric Ulaszek personal communication).

14.0 Propagation practices

14.1 Seed germination requirements

Seed should be collected from mid-September to mid-October (Apfelbaum et al., 1997). Seeds need cold-moist stratification 33-38°F for 60 days (Shirley, 1994; Steffen, 1997). Green and Curtis (1950) reported that *E. yuccifolium* had a 40% germination with stratification and 0% with no stratification.

14.2 Vegetation propagation

Smith and Smith (1980) suggest that mature plants can be divided and planted in spring or fall.

14.3 Best (most effective) propagation techniques

The most effective way to propagate *E. yuccifolium* is by seed with a spring stratification (Rock, 1974; Shirley, 1994).

15.0 Monitoring protocols

15.1 Natural populations

Regular counts of individuals should be done to determine population status. Transects and quadrats should be used to determine the size of the population in a large area. Hand counts can be done if the population is small (less than 100 individuals).

In addition to determining population size, plants should be classified as adults (flowering and non-flowering), juvenile, and seedlings. This classification will provide important demographical information regarding changes in the age structure of the population.

15.2 Restored populations

Because *E. yuccifolium* has the potential to become a weedy species, counts of plants should be done to determine changes in the population. If the species becomes weedy, removal of the flower heads should be done to decrease additional recruitment.

16.0 Current research programs

B. Molano-Flores is studying the reproductive biology of this species. To my knowledge no other active research programs currently focus on *Eryngium yuccifolium* in Illinois.

17.0 Research needs

Research needs associated with *Eryngium yuccifolium* are: 1) Demographic studies; 2) Studies to determine the effects of herbivory and fire on reproduction; and 3) Genetic studies to determine the genetic variability of the species.

18.0 Summary

Eryngium yuccifolium is an easy species to reintroduce. This species serves as a host and food source for several species including the Illinois state threatened eryngium stem-borer moth (*Papiapena eryngii*). However, in restoration careful monitoring of the amount of seed in the seed mix and amount of seeds that are produced by the established plant should be done because of the potential for the species to become weedy.

19.0 Acknowledgements

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Figure 1) Distribution of *Eryngium yuccifolium* in North America (from Kindscher, 1992)

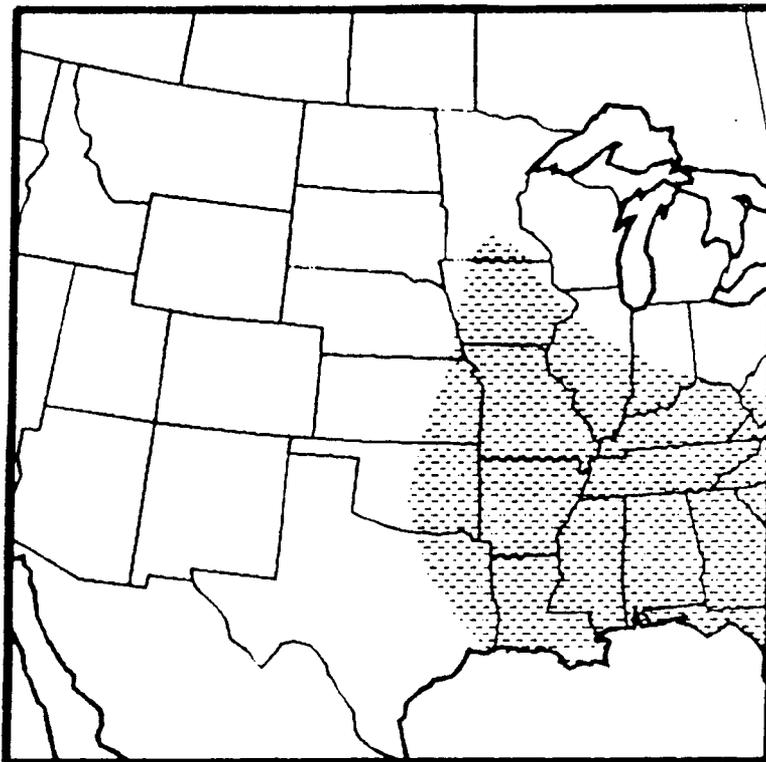


Figure 2) Distribution of *Eryngium yuccifolium* in Illinois (from Mohlenbrock and Ladd, 1978)

