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BIONOMICS OF *GLYPHIDOCERA JUNIPERELLA* (LEPIDOPTERA: BLASTOBASIDAE), A NEWLY DISCOVERED PEST OF CONTAINER-GROWN JUNIPER

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ABSTRACT

The life history of *Glyphidocera juniperella* Adamski (Lepidoptera: Blastobasidae) is presented. Larvae of this newly described blastobasid moth are serious pests of nursery, container-grown junipers. Larval feeding causes twig dieback and reduces plant value. Head capsule measurements indicate 6 instars in the 2 summer generations and 7 instars for the partial 3rd or overwintering generation.

RESUMEN

Se presenta la historia de la vida de *Glyphidocera juniperella* Adamski (Lepidoptera: Blastobasidae). Las nuevas descritas larvas de las alevillas blastocidas, son plagas serias en viveros de plantas de junípero creciendo en macetas. Daño por las larvas al comer, causan la muerte de ramas pequeñas y reducen el valor de las plantas. Medidas de la cabeza indican que hay 6 estadíos en las 2 generaciones del verano y 7 estadíos por la parcial tercera o generación hibernante.

The wholesale nursery industry in Florida is valued at approximately $412 million per year. Container-grown junipers are one of the more important plants produced by the Florida nursery industry. As with all nursery products the aesthetic appearance of the plants must be maintained.

We recently discovered a new pest of container-grown juniper which was described as *Glyphidocera juniperella* Adamski (Adamski & Brown 1987). The larvae are serious pests of horizontal-growing ornamental juniper. This paper presents the bionomics of the moth.

MATERIALS AND METHODS

Field collections of *G. juniperella* were made weekly from March, 1984 until March, 1985 at a nursery in n. Florida. The webbing masses produced by larvae in infested branches were removed and placed in plastic bags for laboratory dissection. Addition-

ally, 3 infested plants were brought into the laboratory each week and dissected for eggs, larvae, and pupae. Larvae were collected from the webbing in the laboratory, fixed for 30 sec in boiling water, and preserved in a 70% alcohol for later measurement of head capsule width. Larval head capsule widths were measured to the nearest 0.01 mm for 1687 larvae by means of an ocular micrometer.

Pupae collected from the field were held individually in 1 oz diet cups until eclosion. Emerging adults were sexed and 25 pairs were placed in 8.5 cm × 4.5 cm plastic oviposition chambers along with fresh juniper twigs. Pairs were held until the female died, males were replaced as needed. The pre-oviposition period, fecundity and longevity of females and the time required for egg hatch were determined.

First instars were gathered from the oviposition chambers and placed on one of 6 artificial diets in an attempt to rear this species in the laboratory. The 6 diets used were: modified pinto bean diet (Shorey & Hale 1965, Schroeder 1970), Douglas-fir tussock moth diet (Lyon & Flake 1966), universal diet (Singh 1983), and each diet plus dried juniper needles at 1% dry weight. All rearing and diet tests were conducted in a rearing room with a photoperiod of 15:9 (L:D), temp 28° ± 2°C, and RH 50–80%.

For determination of pupal development time large larvae were collected from the field and placed on pinto bean diet. Larvae were checked daily for onset of pupation and pupal development time was recorded for 108 pupae. Larvae or pupae suspected of being parasitized were placed in gelatin capsules and held for parasite emergence. Pupal parasites were also collected from pupae placed in diet cups.

Results and Discussion

Fig. 1 shows the distribution of eggs, larvae, and pupae collected from the field in 1984–85. Large larvae and pupae of the overwintering cohort were collected in March of 1984. The 1st generation began in early May and the 2nd in late June-early July. Eggs for the 3rd generation, which overwintered as late instars or pupae, were collected in early October. Based on the field collections of early instars, development of each summer generation required ca. 70 days.

Female *G. juniperella* reared from field collected pupae laid an average of ($\bar{x}$±SD) 82.8 ±39 eggs. Eggs collected in the field were found on detritus and needles near the media surface. Eggs are laid singly or in groups up to 10. They are transparent at oviposition, turn a salmon color ca. 2 days later, and finally are bright pinkish-red prior to eclosion. Eggs hatched in 7.8 ± 1.2 days at 28°C in the laboratory. The preoviposition period for newly emerged females in the laboratory was 1.3 ± 0.6 days at 28°C. Female longevity ($\bar{x}$ ±SD n=21) in the laboratory was 3-14 days with a mean of 7.1 ± 2.9 days.

Two hundred first instar larvae were placed individually on each of the 6 diets tested. Survivorship on all artificial diets was very low. The highest percentage survivorship, 2.5%, was on pinto bean diet without juniper. The few *G. juniperella* which did complete development on the diets were small and total development time was far greater than in the field under similar temperatures. No difference in survivorship was noted between diets with or without juniper.

Although survivorship and development of 1st instars was very low on the diets tested, last instars collected in the field were able to develop to pupae on pinto bean diet. The pupal stadium of field collected larvae placed on pinto bean diet lasted 9.3 ± 1.7 days (n=108). The average weight of 17 male and 12 female pupae was 9.5 ± 1.1 mg and 12.4 ± 1.9 mg, respectively.

The frequency distribution of larval head capsule widths (Fig. 2) has 5 apparent peaks centered at 0.22, 0.27, 0.38, 0.52, and 0.72 mm. Above the 0.72 mm peak the distribution is less clear, with 1 or 2 peaks possible. The head capsules of the last instar

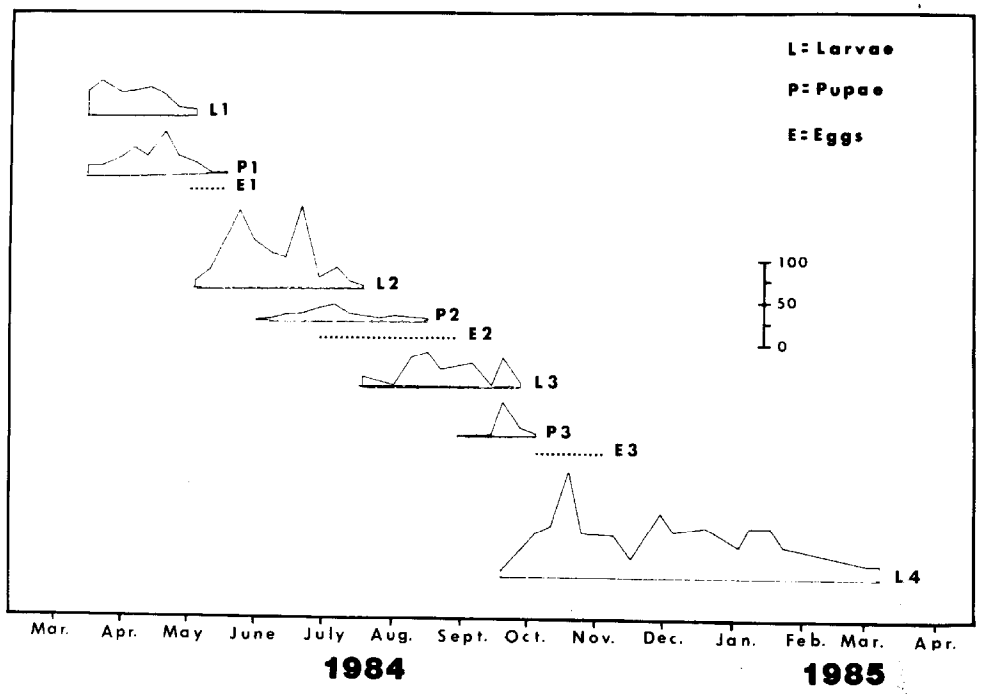

Fig. 1. Date of occurrence of eggs, larvae and pupae for 3 generations of *Glyphidocera juniperella* Adamski collected in the field from container grown juniper, 1984–1985.

of the 2 summer generations were smaller than those of the last instar in the overwintering generation (Fig. 3). This explains the ambiguity of the frequency distribution (Fig. 2) as to the number of instars above .71 mm. Various combinations of instar sequences were fitted to the data and compared using analysis of variance. Table 1 lists a 6 instar and a 7 instar model which best fit the data according to Dyar's rule (Dyar 1890). The 6-instar model was the best fit for head capsule widths from the two summer generations while the 7-instar model best fit the head capsule data of the overwintering generation. Data from the overwintering generation was comprised of pooled head capsule measurements from March–May 1984 and Nov. 1984–March 1985.

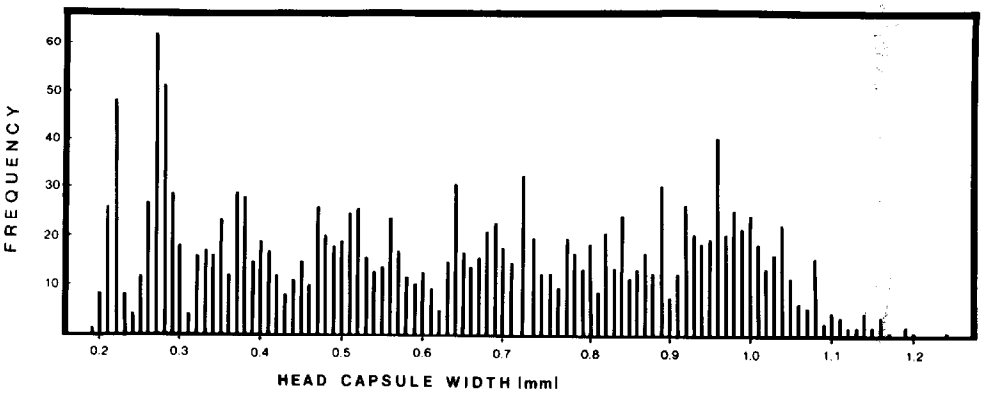

Fig. 2. Frequency distribution of head capsule widths of 1687 *Glyphidocera juniperella* Adamski larvae collected from container grown juniper.

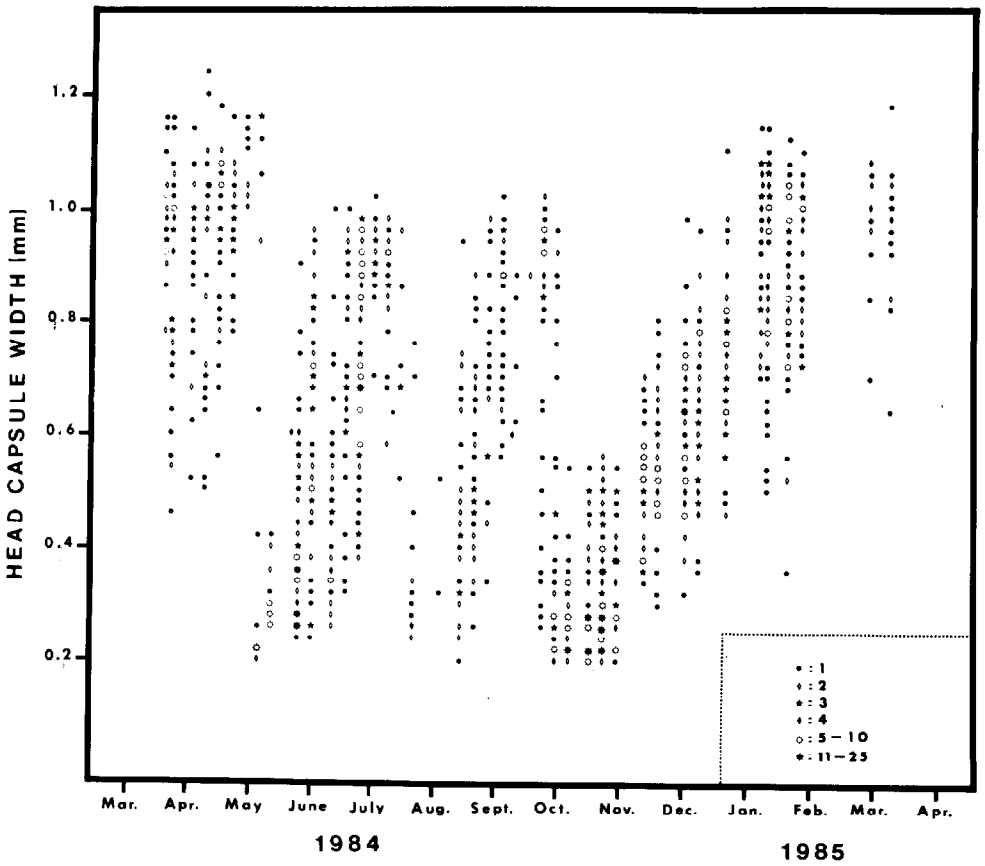

Fig. 3. Distribution of larval head capsule widths of *Glyphidocera juniperella* Adamski vs collection date, 1984–1985.

Developmental polymorphism has been described for many lepidopteran species. Schmidt & Lauer (1977) found varying instar numbers in each of 3 different *Choristoneura* spp., Watson and Johnson (1974) described 4 and 5 instar larvae for *Pectinophora gossypiella* (Saunders), and Solomon (1973) found instar number varied in *Prionoxystus robiniae* (Peck). Postulated reasons for variable instar numbers have included nutrition, temperature, humidity, and photoperiod. *G. juniperella* overwinters mainly as late instar larvae and these larvae are active on warm days during the winter. The occurrence of an extra instar in the overwintering generation may accommodate the long period of time spent in the last instar larvae.

Typical damage of *G. juniperella* on junipers includes removal of the outer bark and phloem (Fig. 4). The twig is often girdled causing "flagging"—red colored needles. Girdling behavior is most prevalent in late fall and winter. Damage is not evident during the winter due to plant dormancy and cool temperatures, but with the onset of warm weather the needles on the girdled limbs of infested plants turn red.

While no effort has been made to determine the distribution of *G. juniperella* it is apparently confined to the southeastern U.S. It has been collected in Poplarville, Mississippi; Cairo, Georgia; N. Florida (Quincy, Monticello, and Jacksonville); and from Tampa, Florida. All collections were made from juniper nursery stock and considering the commerce in juniper between nurseries, *G. juniperella* is no doubt wide spread at least south of the latitude of Cairo, Georgia. Cold temperatures appear to strongly affect the distribution of this pest.

TABLE 1. LIMITS OF LARVAL HEAD CAPSULE WIDTHS FOR 6 AND 7 INSTAR GROUPINGS OF *GLYPHIDOCERA JUNIPERELLA* ADAMSKI.

6 INSTAR GROUPING (SUMMER GENERATIONS)

Instar	N	Range (mm)	Mean+SD (mm)	Ratio of Increase
1	19	.191–.248	.223±.017	
2	98	.250–.328	.283±.021	1.270
3	88	.330–.425	.376±.027	1.325
4	126	.430–.618	.517±.053	1.377
5	129	.629–.809	.700±.047	1.353
6	182	.813–1.142	.908±.053	1.296
				Avg = 1.324

7 INSTAR GROUPING (OVERWINTERING GENERATION)

Instar	N	Range (mm)	Mean+SD (mm)	Ratio of Increase
1	80	.196–.247	.216±.008	
2	123	.250–.326	.279±.015	1.2937
3	96	.330–.428	.376±.025	1.3443
4	181	.430–.618	.521±.046	1.3872
5	143	.622–.759	.691±.039	1.3255
6	156	.764–.9292	.833±.051	1.2051
7	266	.933–1.235	1.02±.058	1.2250
				Avg = 1.2968

Field sampling was originally planned for 2 yr; however the extreme temperature of January 1985, −20°C in N. Florida, virtually wiped out populations of the moth. As of December, 1985 populations were low even in juniper cultivars which normally had high populations.

Two species of larval parasites and one pupal parasite were found during 1984 in Florida. The pupal parasite in Florida was identified as a *Brachymeria* sp. (chalcidoid). The 2 larval parasites are as yet unidentified. One of the larval parasites was frequently found parasitizing 20–30% of larvae during the summer generation. A pupal parasite *Rubicundiella annulicornis* (Ashmead) (Ichneumonidae) was collected from *G. juniperella* in Poplarville, Mississippi.

G. juniperella exhibits a definite preference for low growing, prostrate cultivars of juniper. Cultivars such as *Juniperus horizontalis*, 'Wiltonii' (Blue rug); *J. chinensis* var. *procumbens* 'Nana'; *J. horizontalis* 'Prince of Wales'; and 'Andorra compacta', were often heavily infested while other more upright cultivars were free of *G. juniperella.*

Plant age and the relation of plant size and form to pot size are important factors in preference. Low growing cultivars that have grown over the edge of the containers are most frequently infested. This plant type usually has a large amount of dead material on the media surface, making it ideal habitat for *G. juniperella.* Other upright growing junipers may also become infested if needle clippings from pruning build up in the container. *G. juniperella* larvae can be found feeding in the dead needles. However, in these plants girdling of stems was not observed. We also have reared *G. juniperella* larvae from early instars to adults using only dead, dried leaves of live oak trees, (*Quercus virginiana* Mill). This and other observations suggest that *G. juniperella* is a

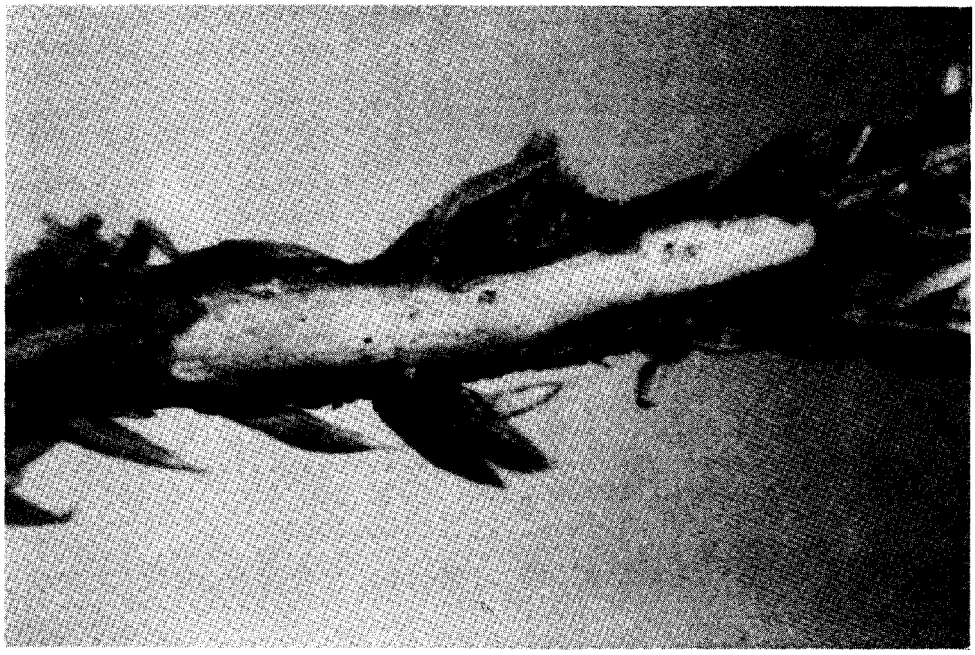

Fig. 4. Typical feeding damage of *Glyphidocera juniperella* Adamski larvae on small juniper twigs.

detritivore capable of developing on a variety of dead plant material. *G. juniperella* does not appear capable of actually killing plants, but can cause considerable aesthetic damage to junipers and requires control by nurserymen (Mizell and Schiffhauer 1987). Further research into the factors which induce buildup of large populations is needed.

While sampling for *G. juniperella*, larvae of the moth, *Oleuthreutes cespitana* Hubner (Tortricidae), was often found feeding on green needles either in the same webbed masses or adjacent to those of *G. juniperella*. Larvae and adults of the moth were found mainly in the spring and early summer in juniper but disappeared in fall. These larvae in early instars can easily be mistaken for *G. juniperella* larvae. A larval parasite, *Orgilus* sp. (Braconidae) was reared from *O. cespitana*.

End Note

We thank Dr. Dale Habeck for help in identifying the lepidopteran larvae found in container-grown junipers and Imperial Nursery for providing the plants for sampling. Drs. Dale Habeck and Ronald Oettig provided helpful comments on a previous draft of the manuscript. We thank Drs. L. Stange and V. Gupta, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, for identifying the parasites and David Adamski and Richard Brown, Mississippi State University, for identifying the moth and providing the pupal parasite. Florida Agricultural Experiment Station Journal Series No. 7215.

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EVALUATION OF INSECTICIDES FOR CONTROL OF *GLYPHIDOCERA JUNIPERELLA* (LEPIDOPTERA: BLASTOBASIDAE) IN CONTAINER-GROWN JUNIPER

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ABSTRACT

Glyphidocera juniperella Adamski (Lepidoptera: Blastobasidae) is a pest of container grown juniper in the southeastern U.S. Larvae of this pest girdle stems and damage the appearance of ornamental juniper. Pesticides covering a range of formulations were tested for efficacy against *G. juniperella* in field and laboratory tests. An entomophagous nematode, *Neoaplectana carpocapsae* Weiser, was also field tested for control of *G. juniperella*. All formulations of *Bacillus thuringiensis* Berliner tested gave good control, as did cypermethrin and acephate. Nematodes were ineffective.

RESUMEN

Glyphidocera juniperella Adamski (Lepidoptera: Blastobasidae) es una plaga de juníperos en macetas en el sudeste de los Estados Unidos. Larvas de esta plaga circundan los tallos y dañan la apariencia de juníperos ornamentales. Se probaron pesticidas que cubrían varias formulaciones para determinar su eficacia contra *G. juniperella* en pruebas de campo y de laboratorio. El nemátodo entomofago, *Neoaplectana carpocapsae* Weiser, se probó también en el campo para controlar a *G. juniperella*. Todas las formulaciones de *Bacillus thuringiensis* Berliner que se probaron dieron buen control, así como cypermethrin y acephate. Los nemátodos fueron inefectivos.