PARATRIPHLEPS LAEVIUSCULUS, A PHYTOPHAGOUS ANTHOCORID NEW TO THE UNITED STATES (HEMIPTERA:ANTHOCORIDAE)[1]

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ABSTRACT

Paratriphleps laeviusculus Champion, a small phytophagous anthocorid, or flowerbug, lives primarily within the flowers of a single host, the sapodilla, *Manilkara zapotilla* (Jacq.) Gilly. It was first noted by the junior author in 1966 at the University of Florida Agricultural Research and Education Center, Homestead, Florida. This is the first record of this insect within the United States.

Adult females lay most of their elongate, opalescent eggs into the outer surface of the sapodilla flower buds in a narrow area at the junction of the calyx and stem. Eggs hatch in 3 or 4 days and nymphs complete their development within the blooms. In the laboratory at $27 \pm 1°C$, the nymphal durations were: first instar—2.5, second—1.3, third—1.6, fourth—2.5, and fifth —4.5 days, for an average nymphal duration of 12.4 days. The female preovipositional period is approximately 4 days. The immature stages are described.

Paratriphleps laeviusculus was described by Champion (1900) from specimens collected in Panama. Van Duzee (1916) erected the subfamily Dufouriellinae and transferred *P. laeviusculus* from the Lyctocorinae into this subfamily. Carayon (1972) does not recognize the Dufouriellinae and places *Paratriphleps* in the tribe Oriini of the Anthocorinae. This species has no synonyms in the literature.

Hambleton (1944) and Johannes (1951), working in Peru, listed *P. laeviusculus* as a predator of *Heliothis virescens* (Fab.) eggs and newly hatched larvae. Very likely the specimens were misidentified and were actually *Paratriphleps pallidus* (Reut.). Our specimens were first identified as *P. pallidus* then subsequently as *P. laeviusculus*. Herring (personal communication)[2], after studying a long series of specimens from Homestead, Florida and from the West Indies, is convinced that *P. laeviusculus* is a valid species and not a synonym as suggested by Barber (1939). Herring also informs us that *P. laeviusculus* has previously been reported only from Puerto Rico, the Virgin Islands, Mexico, and Panama, whereas *P. pallidus* occurs in South America. Data on specimens in the National Museum of Natural History indicate that *P. pallidus* is predaceous. The present investigation supports the distribution data, indicating that the species reported by Johannes and Hambleton was not *P. laeviusculus*.

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[2]J. L. Herring, Systematic Entomology Laboratory, c/o USNM, Washington, D. C. 20560.

Distribution and Abundance

Flowers of 34 species of trees, including 2 in the sapodilla family, were visually inspected during July 1967. During August 1967, several 3 hr sweepings were made of various habitats such as grasses, bushes, and weed fields. *P. laeviusculus* was never found on any host other than sapodilla.

Numbers of individuals per blossom varied considerably, with occasional blossoms having as many as 15 adults, but usually only 2-5 were present. Populations were sporadic; trees with very few flower bugs could be adjacent to trees with rather heavy infestations.

The range of *M. zapotilla* in Florida extends from Key West to Wabasso Island, approximately 23 miles north of Ft. Pierce on the east coast, and on the west coast to the Tampa, St. Petersburg area. Very few trees are known from the interior of the state. *P. laeviusculus* has been collected at Ft. Pierce, but not on Wabasso Island; it has been collected on Key Largo and on Key West as well as at several localities in the Homestead and Miami areas. We did not examine any sapodilla flowers on the west coast, but we feel the range of *P. laeviusculus* is coextensive with its host in Florida. *P. laeviusculus* was not found in several thousand flowers of the wild dilly, *Manikara emarginata* (L.) Britt. and Wils. examined from Key Largo.

Feeding Preferences

Two additional arthropod species were commonly associated with the sapodilla flower. A mite, *Proctolaelaps* sp. (Ascidae)[3] was found within the flowers picked at all locations, and appeared to be associated to some degree with an olethreutid larva, *Hemimene* sp.[4], also common at all locations. Mites were far more abundant in flowers infested with a larva than in non-infested flowers and were especially plentiful in flowers containing fresh larval frass. No dead mites were found within field-collected flowers, nor was *P. laeviusculus* ever observed feeding on this mite in the laboratory.

P. laeviusculus typically outnumbered the olethreutid larvae by a ratio of approximately 5:1 and was rarely found in the same flower as the larvae. Whereas the average number of *P. laeviusculus* per flower was between 2 and 3, the average was only 0.1 per larval-infested flower.

If the anthocorid were a predator upon olethreutid larvae, we would expect to find occasional dead larvae or to observe feeding. The finding of 1 dead larva among the hundreds observed suggests that no predator-prey relationship exists between *P. laeviusculus* and the olethreutid larvae.

To confirm the field observation, a series of laboratory tests were conducted to determine the survival period of *P. laeviusculus* on different diets. Field collected adults were confined in 5 × 60 mm petri dishes lined with moist filter paper along with (1) a single olethreutid larva which had been paralyzed with forceps so that it was alive but unable to crawl; (2) open pollen anthers of the sapodilla flower; (3) 1 complete sapodilla flower; (4) a sapodilla flower and an olethreutid larva feeding in it; or (5) moist filter paper only. The sapodilla flowers were changed daily. Three adults were placed in each dish and each food condition replicated 5 times. The experiment was repeated 3 times.

[3]Determined by H. A. Denmark, Division of Plant Industry, Florida Dep. of Agr. and Consumer Services, Gainesville, Florida 32601.

[4]Determined by D. Davis, Smithsonian Institute, USNM, Washington, D. C. 20560.

The results of the feeding tests indicate that *P. laeviusculus* is primarily phytophagous (Table 1). Adults and nymphs of *P. laeviusculus* were observed throughout the course of this study feeding on flower petals and pollen grains, but never on the mites or olethreutid larvae. Additionally, several individuals completed their development from hatching to adult on a piece of sapodilla flower with a pollen bearing anther.

TABLE 1. SURVIVAL OF *P. laeviusculus* ON 4 FOOD SOURCES; AVERAGE OF 3 REPLICATIONS OF 15 INDIVIDUALS EACH.

	Days		
Food	$\bar{x}$*	SD	Range
Check	2.80 a	0.67	2-4
Pollen	2.97 a	1.42	1-7
Larva	4.77 b	2.84	1-13
Flower	7.23 c	3.44	1-14
Lar. & Flower	7.97 c	3.10	1-14

*Means followed by the same letter are not significantly different at the 5% level using least significant difference test (LSD .05 = 0.876).

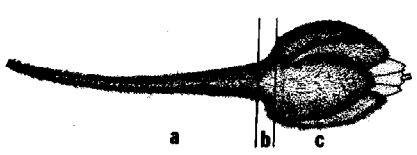
These findings are consistent with those of Carayon and Steffan (1959) for *Orius pallidicornis* (Reuter) (a member of the same tribe as *Paratriphleps*). Carayon reported *pallidicornis* to feed almost exclusively on the pollen of *Ecballium elaterium* Rich (Cucurbitaceae) and in the laboratory able to complete an entire life cycle in the absence of animal food. Carayon (1972) pointed out fundamental differences in the habits of the major Anthocorid taxa, the Lasiochilinae and Lyctocorinae being chiefly subcortical, or terrestrial in ground litter, whereas the Anthocorinae are usually found on living plants, particularly on their flowers. He believes that phytophagy in the subfamily is a secondary development of an otherwise predatory family.

It should be noted that the feeding habits of most members of the Anthocorinae are poorly known and the presence of phytophagy in 2 genera in different hemispheres may indicate a more extensive development of phytophagy than is at present realized.

REPRODUCTION AND DEVELOPMENT

Eggs are typically inserted at a slight angle into the external surface of the flower calyx, leaving only the operculum protruding from the plant tissue. Of the hundreds of flowers examined from field and laboratory studies 73% of the eggs were deposited within a 2 mm band at the very base (Fig. 1, area b) which consists of about 10% of the outer surface area, 23% in the flower head region (area c), and 4% were in the stem (area a).

Fifth nymphal instars were collected in the field and reared individually in 50 × 12 mm plastic petri dishes to obtain virgin females. The bottom of each dish was covered with moist filter paper and a fresh sapo-



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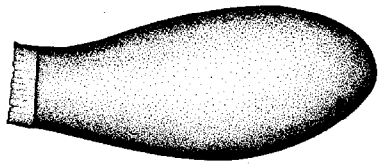

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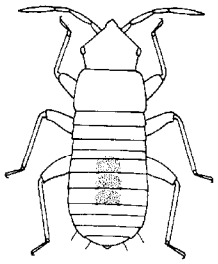

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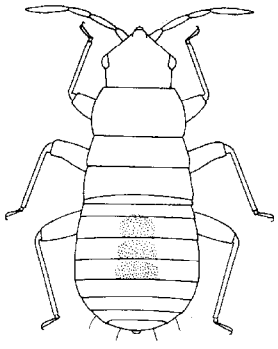

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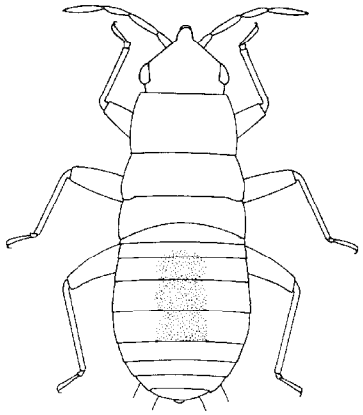

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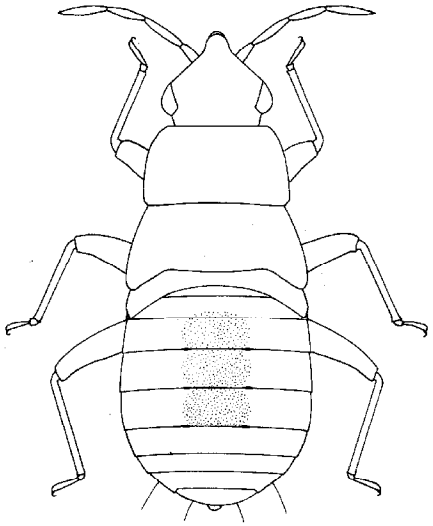

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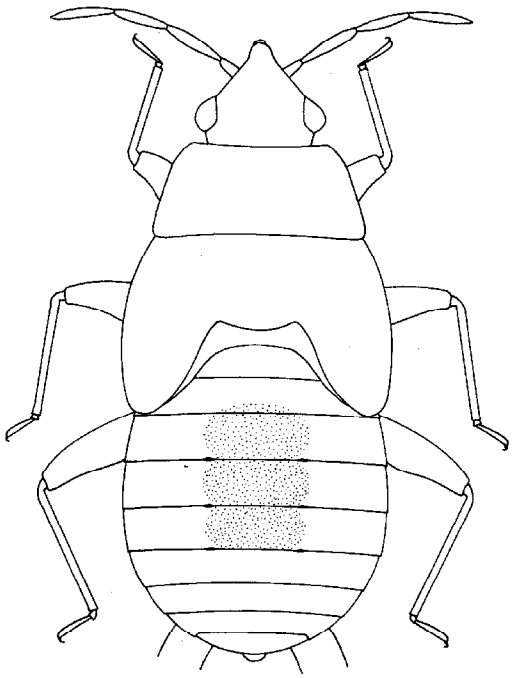

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Fig. 1. Sapodilla flower showing arbitrary areas for egg deposition. (a) stem region; (b) mid region; (c) flower head region. Fig. 2-7 *P. laeviusculus*. Fig. 2. Egg. Fig. 3. 1st instar. Fig. 4. 2nd instar. Fig. 5. 3rd instar. Fig. 6. 4th instar. Fig. 7. 5th instar.

dilla flower was added daily. Sixteen newly emerged females were selected, and placed in separate dishes with a field-collected male and a fresh flower. In the event that the male died before the female, another male was added. Five additional females were checked for eggs and replaced daily. All eggs collected were incubated for other studies.

None of the unmated females laid any eggs. These females lived from 2-14 days with a mean of 9.2 days. Only 2 of the 16 mated females did not lay any eggs. Both of these died within 48 hr. One female started laying eggs on the 3rd day, 10 on the 4th, and 3 on the 5th day. The mated females lived from 1-19 days with a mean of 11.3. Considering the first 3 days as a preoviposition period, the mean number of eggs deposited per day was 2.2. The maximum number per day was 7 and the maximum number by an individual was 36. The collected eggs were incubated at $26 \pm 1°C$ and hatched in 3-4 days with a mean of 3.2 days. Egg viability was 92.6%.

Nymphs were reared in microcages made by cementing a 25 mm square of 3 mm thick Plexiglas® having a 12 mm diam hole in it to a microscope slide. Cover slips, secured to the Plexiglas with a thin layer of vaseline, were used as lids for the microcages. The bottom of each microcage was covered with moist filter paper. First instars that had hatched within 24 hr were placed individually in the cages with a piece of sapodilla flower bearing at least 1 anther. The filter paper was moistened and the flower changed daily.

The average duration in days of the 5 stadia based on 10 observations per instar, at $26 \pm 1°C$ was: first—2.5, second—1.3, third—1.6, fourth—2.5 and fifth—4.5. The total nymphal duration ranged from 10 to 16 days with an average of 12.4.

Immature Stages

All measurements are given in millimeters.

Egg (Fig. 2)

The egg is elongate, slightly curved, with a chalky white operculum. It is opalescent throughout development, undergoing little or no visible color change until about 12-18 hr before hatching when it turns a very pale yellow.

The operculum is nearly circular, with the outer marginal cells occupying about three-fourths of the area. Within this row of cells is a second circle of radial cells surrounding 5-9 irregularly shaped central cells.

Measurements: length 0.51-0.57 ($\bar{x}=0.54$), width 0.21-0.24 ($\bar{x}=0.22$), operculum diameter 0.10-0.14 ($\bar{x}=0.12$).

First Instar (Fig. 3)

General color luteus; antennae, legs, margin of thorax and abdomen paler than remainder of body; scent glands dark luteus; antennae pubescent; thorax and abdomen glabrous except for 1 long posteriorly-projecting hair on each side of the last 2 abdominal segments.

Measurements: length head 0.14-0.15 ($\bar{x}=0.14$), width 0.16-0.18 ($\bar{x}=0.17$); interocular space 0.14-0.16 ($\bar{x}=0.15$); length pronotum 0.11-0.13 ($\bar{x}=0.12$), width 0.20-0.21 ($\bar{x}=0.20$); length antennal segment I 0.04, II 0.06-0.08 ($\bar{x}=0.07$), III 0.05-0.07 ($\bar{x}=0.06$), IV 0.12-0.13 ($\bar{x}=0.12$); length rostrum 0.20-0.24 ($\bar{x}=0.21$); length abdomen 0.29-0.34 ($\bar{x}=0.31$); total length 0.63-0.72 ($\bar{x}=0.67$).

Second Instar (Fig. 4)

Similar in form to instar 1.

Measurements: length head 0.17-0.19 ($\bar{x}=0.18$), width 0.20-0.21 ($\bar{x}=0.21$); interocular space 0.17-0.18 ($\bar{x}=0.18$); length pronotum 0.14-0.15 ($\bar{x}=0.15$), width 0.27-0.28 ($\bar{x}=0.28$); length antennal segment I 0.05, II 0.08-0.09 ($\bar{x}=0.09$), III 0.07-0.08 ($\bar{x}=0.07$), IV 0.13-0.14 ($\bar{x}=0.13$); length rostrum 0.24-0.26 ($\bar{x}=0.25$); length abdomen 0.42-0.44 ($\bar{x}=0.43$); total length 0.88-0.92 ($\bar{x}=0.90$).

Third Instar (Fig. 5)

Similar in form and color to instar 2.

Measurements: length head 0.20-0.24 ($\bar{x}=0.22$), width 0.24-0.30 ($\bar{x}=0.26$); interocular space 0.20-0.21 ($\bar{x}=0.20$); length pronotum 0.16-0.20 ($\bar{x}=19$), width 0.34-0.43 ($\bar{x}=0.37$); length antennal segment I 0.06-0.07 ($\bar{x}=0.07$), II 0.11-0.13 ($\bar{x}=0.12$), III=0.09-0.10 ($\bar{x}=0.09$), IV 0.13-0.14 ($\bar{x}=0.14$); length rostrum 0.28-0.33 ($\bar{x}=0.30$); length wing pad 0.10-0.14 ($\bar{x}=0.12$); length abdomen 0.46-0.62 ($\bar{x}=0.56$); total length 1.04-1.26 ($\bar{x}=1.16$).

Fourth Instar (Fig. 6)

Similar in form and color to instar 3.

Measurements: length head 0.25-0.28 ($\bar{x}=0.27$), width 0.28-0.33 ($\bar{x}=0.31$); interocular space 0.18-0.22 ($\bar{x}=0.20$); length pronotum 0.21-0.24 ($\bar{x}=0.23$), width 0.38-0.48 ($\bar{x}=0.45$); length antennal segment I 0.07, II 0.13-0.14 ($\bar{x}=0.14$), III 0.12, IV 0.15-0.16 ($\bar{x}=0.15$); length rostrum 0.32-0.42 ($\bar{x}=0.36$); length wing pad 0.21-0.28 ($\bar{x}=0.25$); length abdomen 0.70-0.80 ($\bar{x}=0.77$); total length 1.36-1.54 ($\bar{x}=1.47$).

Fifth Instar (Fig. 7)

Similar in form and color to instar 4.

Measurements: length head 0.27-0.34 ($\bar{x}=0.32$), width 0.37-0.38 ($\bar{x}=0.37$); interocular space 0.21-0.25 ($\bar{x}=0.24$); length pronotum 0.25-0.28 ($\bar{x}=0.26$), width 0.60-0.64 ($\bar{x}=0.63$); length antennal segment I 0.08, II 0.18-0.19 ($\bar{x}=0.18$), III 0.15-0.16 ($\bar{x}=0.15$), IV 0.18-0.19 ($\bar{x}=0.18$); length rostrum 0.36-0.46 ($\bar{x}=0.43$); length wing pad 0.49-0.54 ($\bar{x}=0.52$); length abdomen 0.80-0.94 ($\bar{x}=0.87$); total length 1.64-1.84 ($\bar{x}=1.73$).

Adult (Fig. 8)

Since Champion did not provide them we are including measurements of both sexes. Male: length head 0.28-0.36 ($\bar{x}=0.33$), width 0.34-0.39 ($\bar{x}=0.37$); interocular space 0.17-0.20 ($\bar{x}=0.19$); length antennal segment I 0.09-0.10 ($\bar{x}=0.09$), II 0.21-0.23 ($\bar{x}=0.22$), III 0.15-0.19 ($\bar{x}=0.17$), IV 0.18-0.20 ($\bar{x}=0.19$); length rostrum 0.41-0.48 ($\bar{x}=0.45$); length pronotum 0.33-0.38 ($\bar{x}=0.36$) width 0.67-0.75 ($\bar{x}=0.72$); length scutellum 0.37-0.46 ($\bar{x}=0.40$); total length 1.56-1.81 ($\bar{x}=1.70$). Female: length head 0.32-0.37 ($\bar{x}=0.35$) width 0.36-0.40 ($\bar{x}=0.39$); interocular space 0.19-0.23 ($\bar{x}=0.20$); length antennal segment I 0.09-0.10 ($\bar{x}=0.09$), II 0.19-0.24 ($\bar{x}=0.21$), III 0.15-0.17 ($\bar{x}=0.16$), IV 0.18-0.19 ($\bar{x}=0.18$); length rostrum 0.44-0.49 ($\bar{x}=0.47$); length pronotum 0.35-0.41 ($\bar{x}=0.38$), width 0.74-0.79 ($\bar{x}=0.77$); length scutellum 0.38-0.48 ($\bar{x}=0.42$); total length 1.80-2.05 ($\bar{x}=1.93$).

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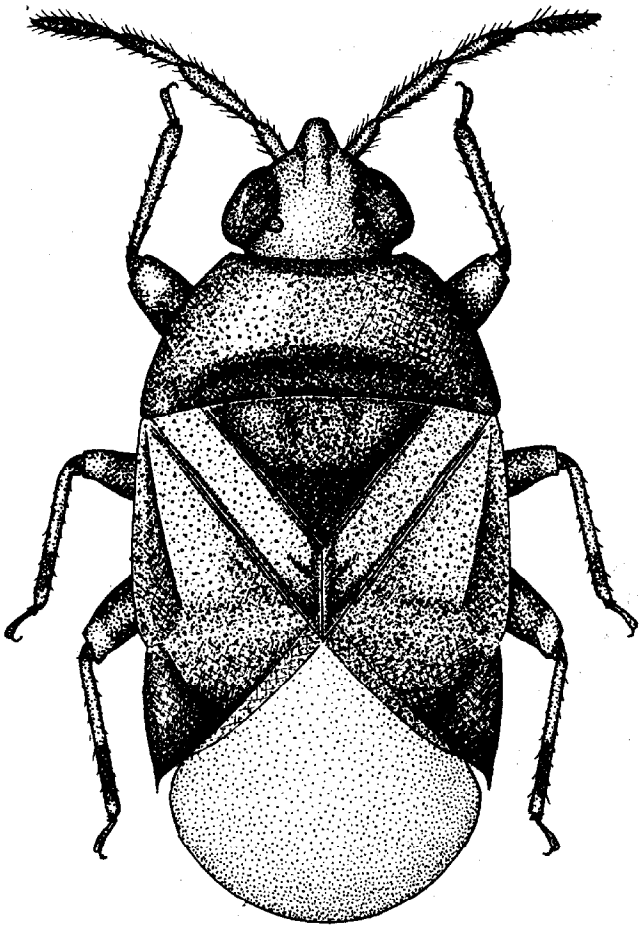

Fig. 8. *P. laeviusculus* adult.

us with copies of some of Carayon's papers and Dr. J. A. Slater, University of Connecticut for providing us with additional literature and for reviewing the manuscript.

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