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Source: Florida Entomologist, 85(3) : 464-473

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/0015-4040(2002)085[0464:DBAMCO]2.0.CO;2

DESCRIPTION, BIOLOGY, AND MATERNAL CARE OF *PACHYCORIS KLUGII* (HETEROPTERA: SCUTELLERIDAE)

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ABSTRACT

The life cycle of *Pachycoris klugii* on its native host, *Cnidoscoulus multilobus* (Euphorbiaceae), is reported in detail for the first time. Egg, nymphs, and adults are described and illustrated. Extensive variation was observed in the color pattern of adults. Maternal behavior was related to egg parasitism, habitat and host plant phenology. The tachinid fly *Trichopoda pennipes* was observed parasitizing adults and the scelionid wasp *Telenomus pachycoris* parasitized eggs of *P. klugii*.

Key Words: *Pachycoris*, maternal care, Euphorbiaceae, *Trichopoda pennipes*, *Telenomus pachycoris*

RESUMEN

El ciclo de vida de *Pachycoris klugii* en su hospedera natural *Cnidoscoulus multilobus* (Euphorbiaceae) se reporta en detalle por primera vez. Se describen e ilustran el huevo, ninfas y adultos. Se observó gran variación en los patrones de coloración de los adultos. El comportamiento materno estuvo relacionado a los parásitos de huevos, al habitat y a la fenología de su hospedera. El tachinido, *Trichopoda pennipes* se observó parasitando a los adultos, y la avispa scelionida, *Telenomus pachycoris* parasitando a los huevos.

Translation provided by author.

There have been several reports of maternal care in Heteroptera (Tallamy & Schaefer 1997), including the extensive study of *Antiteuchus tripterus limbativentris* Ruckes (Eberhard 1975). This behavior appears to be more common in Aradidae, Scutelleridae, Pentatomidae, Belostomatidae, Tingidae, and Reduviidae than in other families (Bequaert 1935, Parker 1965, Eberhard 1975, Tallamy & Denno 1981, Taylor 1988, Smith 1997). According to Wilson (1979) it corresponds to a subsocial behavior in which the parent offers shelter with its body, carries the nymphs around on its back or venter, or simply stands close by. Wilson (1979) mentioned that insect parental behavior is a polyphyletic behavioral solution to exceptional environmental challenges. Only when physical conditions are particularly rigorous, nutritional resources are exceptionally rich or ephemeral, or predation is unusually intense, is selection powerful enough to stimulate parental care in insects. In the genus *Pachycoris* Burmeister (Scutelleridae), females of a few species were reported to stand guarding the eggs and first instar nymphs (Hussey 1934, Bequaert 1935, Grimm & Maes 1997a,b).

Pachycoris klugii Burmeister (1835) is a common species in Mexico and Central America that in the past has been misidentified as *P. torridus* (Scopoli). It is an aposematic species that is brightly colored, with metallic green, and yellow, orange, or red spots and has been recently studied in Nicaragua as a pest of *Jatropha curcas* (L.) (Euphorbiaceae). Description of its damage, abundance, control, and some characteristics of its life cycle in Nicaragua are cited in several papers (Grimm 1996, Grimm & Maes 1997a, Grimm & Maes 1997b, Grimm & Fuhrer 1998, Grimm & Guhray 1998, Grimm & Somarriba 1998). However, these studies were done on *J. curcas* plantations which is not a natural habitat or its native host.

In this study, the life cycle of *P. klugii* on its native host is presented for the first time. Eggs, nymphal stages, adult and adult genitalia and stridulatory organs are described and illustrated. Adult color variation is also exemplified. General behavior of adults and nymphs as well as oviposition are described. Host plant phenology and egg and adult parasites are also examined in relation with maternal behavior.

MATERIALS AND METHODS

This study is based on periodic collection of data over a long period of time and in several localities in Mexico. Most of the biological data were obtained during several trips to the Biological Field Station of Los Tuxtlas in the state of Veracruz, Mexico from 1985 to 1989, and again in 1999. This area is situated between 95°04' and 95°09' W longitude and between 18°34' and 18°36' N latitude, with an altitude of 150 to 530 m. The main type of vegetation is tropical rain forest, but the zone has been cleared for agriculture and principally for cattle farming. More detailed information can be found in Lot-Helgueras (1976). Additional data were acquired during other collecting trips throughout Mexico, and by reviewing specimens in the Entomological Collections of Instituto de Biologia of the Universidad Nacional Autonoma de Mexico (CNIN) and the insect collection at Instituto de Ecologia, A.C. in Xalapa, Veracruz (IEXA)

Between 1985 and 1987, monthly visits were made to Los Tuxtlas. Visits were made at irregular intervals during 1988 and 1989, and in 1999 the area was sampled every two months. The same area was sampled on each visit. The area sampled included the vegetation growing along the border of the road connecting Los Tuxtlas with the town of Catemaco. Only the first two km of the road from the station were sampled. All host plants (about 30 individuals) on this section of road were sampled and all *P. klugii* individuals (eggs, nymphs, and adults) were collected alive. The bugs were put in plastic containers (11 × 11 × 11 cm), accompanied by a small stem and part of a mature leaf of its host plant, as well as a piece of wet cotton. Containers were covered with muslin to avoid condensation and fungal growth. On several occasions females were observed in the field guarding eggs or nymphs; they were collected with the supporting leaf. Containers were checked daily to register eclosion, moulting or mortality and every three days the bugs were placed in clean containers with fresh host plant material. Containers were maintained in the laboratory at about 20°C and 70% RH. Eclosion, molting time, behavior, parasite eclosion, and mortality were recorded. Several individuals of each stage were fixed in 70% alcohol for illustration and description purposes. Ten individuals of each stage were measured (measurements are given in mm ± S.E.), and used for descriptions. Length of femur, tibia and tarsi were measured on the posterior legs. During the study 1785 eggs, 142, 335, 155, 119, 78 nymphs of instars 1-5, respectively, and 157 male and 129 female adults were observed.

Host Plant.—The host plant of *P. klugii* is *Cnidoscoulus multilobus* (Pax) I.M. Johnston (Euphorbiaceae), a species known locally as "mala mujer" (bad girl) or "chichicaste". It is a shrub or tree, two to 10 meters tall that grows as secondary vegetation in the border of roads and forest. In Mexico, it can be found from Colima to Chiapas on the Pacific side and from Tamaulipas to Quintana Roo in the Gulf of Mexico. It is also present in the central plateau in San Luis Potosi, Queretaro, Hidalgo, Morelos, and Puebla.

Cnidoscoulus multilobus occurs in different habitat types, from *Quercus* forests, to cloud forests and several kinds of tropical forests. As is typical of many Euphorbiaceae, *C. multilobus* has white sap. Leaves are 20 to 25 cm long, with 15 to 30 cm long petioles. The stems and leaves have stinging hairs which are less abundant on the upper side of the leaves. Leaves have five to seven lobules with serrated margins. Flowers are white, and fruits are small dehiscent capsules. It produces new leaves continuously and it can also be found flowering all year depending on the climatic conditions.

Results

Egg.—(Figs. 1-4) Barrel shaped, yellow when laid, turning reddish after three or four days at which time the eyes and egg burster are visible. Parasitized eggs turn blackish. Eggs that do not produce nymphs or parasitoids remain yellow. Chorion reticulated; pseudoperculum with 23 to 26 micropylar projections. Egg masses consisted of 56 to 95 eggs (81.4 ± 3.7) arranged in 8 to 11 regular lines. Egg length 1.65 ± 0.05; egg width 1.1 ± 0.03; micropilar projection length 0.05 ± 0.

First Instar.—(Fig. 5) Oval, convex dorsally, maximum width around abdominal segment two; margin of body setose. Legs and rostrum black; antennal segments black, except tip of segment II, base and tip of segment III, and base of IV, which are red. Head, pronotum, mesonotum, metanotum, lateral and middle plates dark brown. Eyes and dorsal and ventral surface of abdomen red. Head declivent, posterior margin contiguous with anterior margin of pronotum; tylus longer than juga and visible dorsally; eyes sessile, and not reaching anterior angles of pronotum; rostrum surpassing metacoxa. Anterior margins of pronotum, mesonotum and metanotum straight, lateral margins rounded; metanotum half the length of pronotum. Lateral abdominal plates rectangular; increasing in size up to the fifth segment and then decreasing posteriorly. Middle plates present on all abdominal segments and characterized as follows: those on segments I and II very thin; middle half of III compress and with gland openings; plates on segments IV-V and V-VI rectangular and with gland openings larger than those on segment III; plates VI, VII, and VIII much smaller and sometimes divided mesially, spiracles and a pair of trichobothria present on sternum II-VII. Body length 2.07 ± 0.08; body width 1.42 ± 0.06; head length 0.6 ± 0.04; head width 0.94 ± 0.02; interocular distance 0.62 ± 0.02; length of antennal segments: I 0.2 ± 0, II 0.26 ± 0.005, III 0.26 ± 0.007, IV 0.58 ± 0.01; length of rostral segments: I 0.22 ± 0.01, II 0.31 ± 0.01, III 0.28 ± 0.008, IV 0.27 ± 0.008; mesial pronotum length 0.25 ± 0.01; pronotal width across humeri 1.12 ± 0.08; pronotal width at anterior margin 0.93 ± 0.02; length of femur 0.63 ± 0.02; length of tibia 0.59 ± 0.01; length of tarsi: I 0.2 ± 0, II 0.32 ± 0.01.

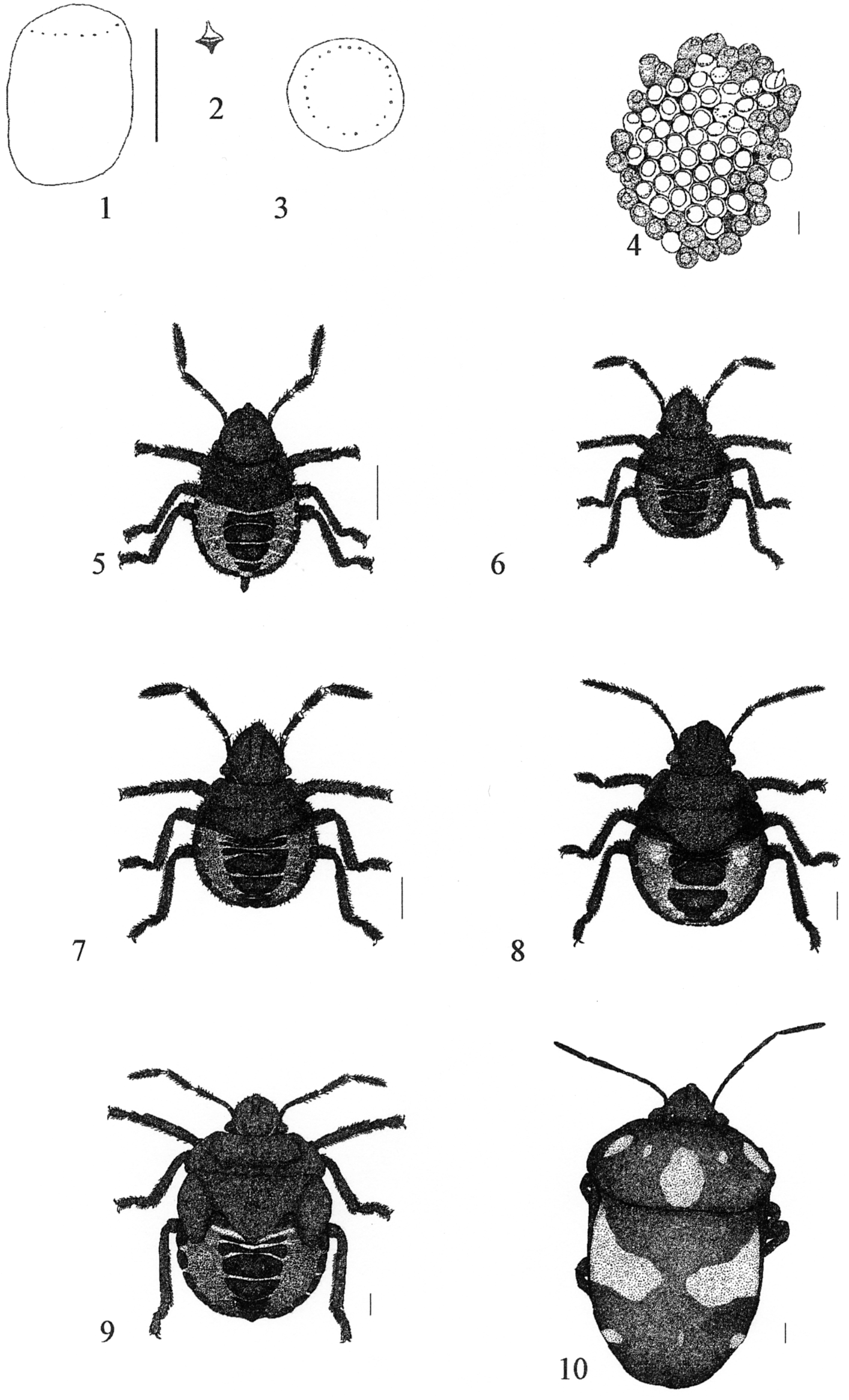
Second Instar.—(Fig. 6) Oval, slightly flattened dorsoventrally. Dorsum of head, thorax, and abdomen punctate. Body setose. Head, antennae, rostrum, legs, and lateral and middle abdominal plates black. Eyes red, anuli between antennal, leg and rostral segments yellow with red marks. Abdomen red with numerous dorsal, black punctures. Spiracles and trichobothria surrounded by black spots. Tylus longer than juga, rostrum extending beyond sternum VII; eyes kidney shaped and slightly separated from pronotum; width through the eyes broader than the width through anterior angles of pronotum; antennal segments setose. Lateral margins of promeso- and metatotum flattened; gland opening present between propleura and mesopleura. Dorsal middle plates present on abdominal segments I to VII; plates III-IV, IV-V, and V-VI with gland openings; plates I and II long and narrow. Plates VI-VII, VII, and VIII rectangular and smaller than others; spiracles and a pair of trichobothria present on sternum II-VII; abdomen slightly convex dorsoventrally, reaching its maximum around plate IV-V. Body length 3.29 ± 0.09; body width 2.2 ± 0.1; head length 1.08 ± 0.05; head width 1.35 ± 0.01; interocular distance 0.86 ± 0.02; length of antennal segments: I 0.32 ± 0.2, II 0.57 ± 0.02, III 0.59 ± 0.01, IV 0.8 ± 0.02; length of rostral segments: I 0.48 ± 0.01, II 1.04 ± 0.02, III 0.66 ± 0.02, IV 0.6 ± 0.02; mesial pronotum length 0.4 ± 0.01; pronotal width across humeri 1.66 ± 0.06; pronotal width at anterior margin 1.31 ± 0.03; length of femur 1.07 ± 0.02; length of tibia 1.14 ± 0.02; length of tarsi: I 0.22 ± 0.01, II 0.4 ± 0.008.

Third Instar.—(Fig. 7) Body eliptical, abdomen strongly convex dorsoventrally. Maximum width at abdominal segment II. Similar to second instar except red coloration of abdomen turns darker and the black areas acquire a green shine; anuli of first antennal segment reddish. Ventral surfaces of legs with numerous thick hairs, those of tibia and tarsi III most dense. Dorsal middle plates cover most of the abdomen, and appear as a continuous black longitudinal band. Middle, ventral abdominal plates present on sternum IV, V, VI, VII, and VIII, those on sternum V, VI, and VII with striated areas (stridulitrum) on either side of midline. Body length 4.51 ± 0.27; body width 2.92 ± 0.16; head length 1.37 ± 0.04; head width 1.57 ± 0.05; interocular distance 0.98 ± 0.03; length of antennal segments: I 0.35 ± 0.2, II 0.76 ± 0.03, III 0.78 ± 0.04, IV 1.03 ± 0.04; length of rostral segments: I 0.73 ± 0.03, II 1.41 ± 0.05, III 0.9 ± 0.03, IV 0.86 ± 0.02; mesial pronotum length 0.6 ± 0.03; pronotal width across humeri 2.26 ± 0.08; pronotal width at anterior margin 1.54 ± 0.04; length of femur 1.48 ± 0.02; length of tibia 1.52 ± 0.08; length of tarsi: I 0.31 ± 0.01, II 0.56 ± 0.02.

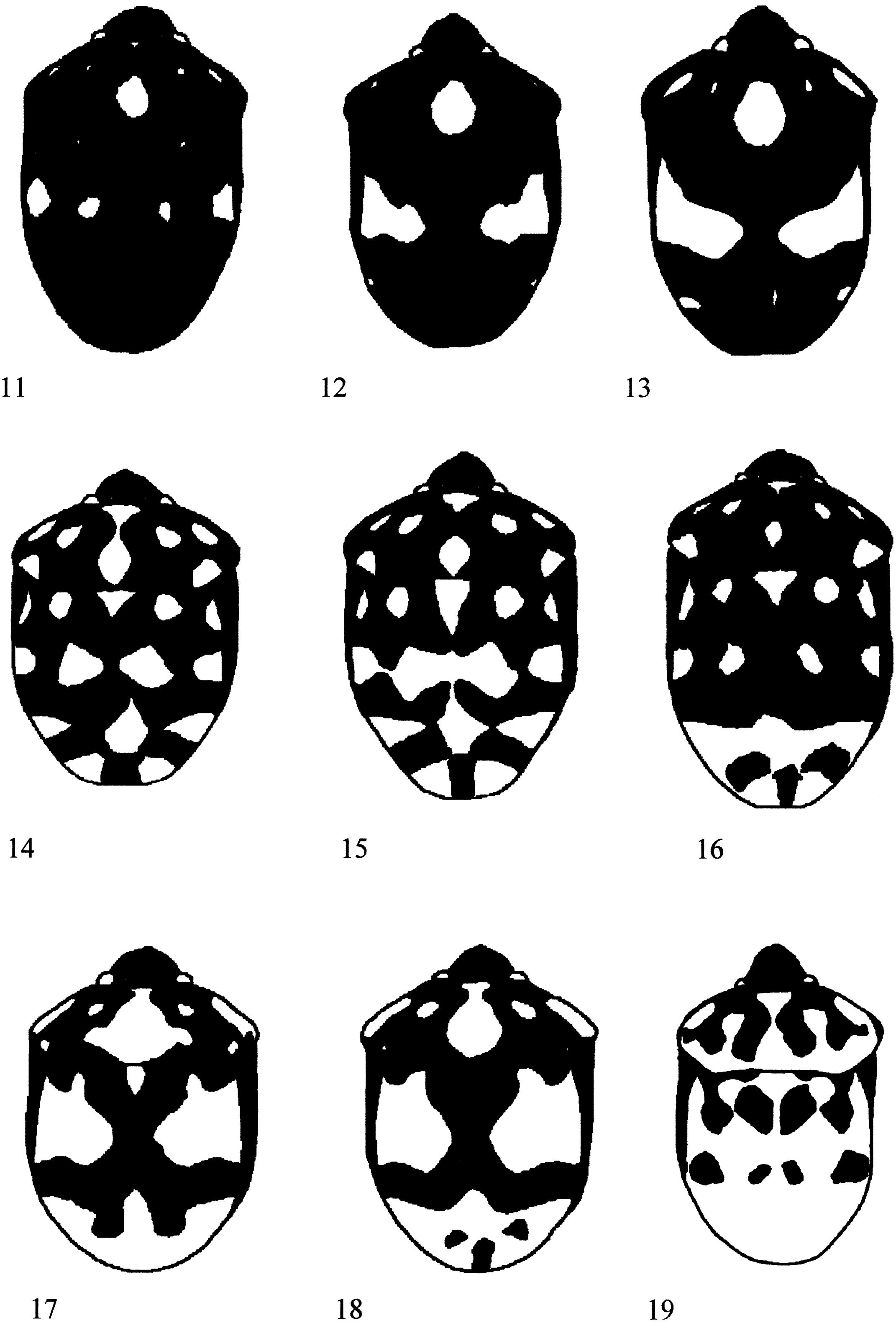
Fourth Instar.—(Fig. 8) Body eliptical, convex dorsally, maximum width at abdominal segment II. Head, thorax, antennae, rostrum, legs and lateral and middle plates dark shiny green. Dark green punctures present on head, thorax, and abdomen. Head declivent; tylus longer than juga; rostrum reaching sternum VII. Lateral margin of pronotum flattened; wing pads evident, wider than long, reaching abdominal segment II; scutellum reaching base of metanotum. Ventral abdominal plates as in third instar. Body length 6.82 ± 0.1; body width 5.05 ± 0.09; head length 1.68 ± 0.06; head width 2.61 ± 0.03; interocular distance 1.63 ± 0.03; length of antennal segments: I 0.54 ± 0.2, II 1.17 ± 0.03, III 1.15 ± 0.03, IV 1.38 ± 0.03; length of rostral segments: I 0.9 ± 0.04, II 1.84 ± 0.03, III 1.09 ± 0.03, IV 1.04 ± 0.02; mesial pronotum length 1.11 ± 0.02; pronotal width across humeri 4.41 ± 0.13; pronotal width at anterior margin 1.31 ± 0.03; scutellum length 1.65 ± 0.03; scutellum width 3.48 ± 0.04; length of femur 2.28 ± 0.04; length of tibia 2.47 ± 0.05; length of tarsi: I 0.49 ± 0.02, II 0.74 ± 0.03.

Fifth Instar.—(Fig. 9) Body round, convex dorsally, abdomen slightly concave ventrally; maximum width at mesonotum. Head, thorax, lateral and middle plates and punctures metallic green; antennae, rostrum, and legs dark brown with metallic irridescent green; ventral middle plates brown; rest of abdomen golden dorsally and yellowish ventrally. Tylus longer than juga; ocelli present for the first time; rostrum reaching base of sternum V. Wing pads reaching base of abdominal segment IV; scutellum wider than long, reaching base of abdominal segment III. Body length 10.11 ± 0.15; body width 8.0 ± 0.21; head length 1.91 ± 0.04; head width 3.41 ± 0.06; interocular distance 2.21 ± 0.05; interocelar distance 0.45 ± 0.02; length of antennal segments: I 0.7 ± 0.3, II 1.75 ± 0.03, III 1.51 ± 0.05, IV 1.53 ± 0.07; length of rostral segments: I 1.34 ± 0.03, II 2.24 ± 0.05, III 1.36 ± 0.02, IV 1.23 ± 0.02; mesial pronotum length 1.91 ± 0.02; pronotal width across humeri 7.07 ± 0.18; pronotal width at anterior margin 3.77 ± 0.09; scutellum length 3.4 ± 0.08; scutellum width 5.66 ± 0.17; length of femur 3.54 ± 0.08; length of tibia 3.61 ± 0.08; length of tarsi: I 0.79 ± 0.02, II 1.03 ± 0.03.

Adult.—(Fig. 10) Overall, head shiny black with metallic green sheen; antennal segments shiny black, anuli reddish. Eyes brown and ocelli red, other parts of the body ranging from a metallic green to black, with macules that are extremely variable in size and color which ranges from yellow to red (Figs. 11-19). Head, pronotum, scutellum, and abdominal venter with dense black puntuations, punctures on the macules slightly paler. Rostrum and legs blackish. Head wider than long, posterior margin contiguous with anterior margin of pronotum, width through eyes no greater than width through anterior angles of pronotum; antennal segment I not reaching apex of juga; juga shorter than tylus; eyes kidney shaped; ocelli small; distance between



Figs. 1-10 Different instars of *P. klugii*. Fig. 1. Dorsal view of egg. Fig. 2. Egg burster. Fig. 3. Lateral view of egg. Fig. 4. Egg mass. Fig 5. First instar nymph. Fig. 6. Second instar nymph. Fig. 7. Third instar nymph. Fig. 8. Fourth instar nymph. Fig. 9. Fifth instar nymph. Fig. 10. Adult.



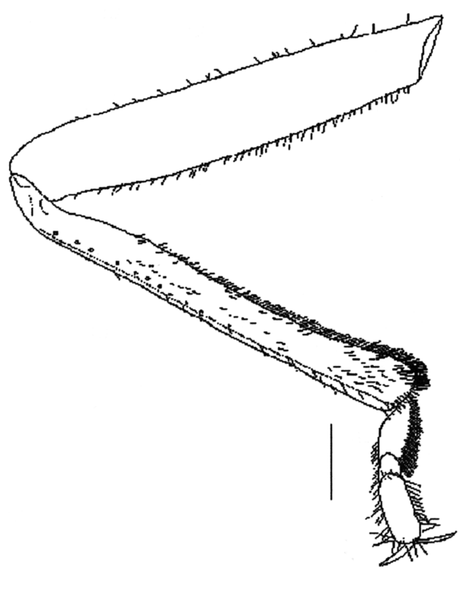
Figs. 11-19. Variation in the pattern of macules of *P. klugii*, Fig. 15 represents the basic pattern.

ocelli greater than distance between ocelli and eyes; antennal tubercule short; bucculae well developed, covering half of rostral segment I; rostrum almost reaching base of sternite IV. Pronotum wider than long; anterolateral margins slightly concave; anterior and humeral angles with rounded apices; anterior margin concave; posterior margin straight; posterolateral margins sinuated; orifice of metathoracic peritreme small, evaporative area covering three quarters of metapleura. Ventral surface of all legs with numerous thick hairs, those on metathoracic leg more dense, forming a plectrum (Fig. 20). Sterna V, VI, and VII striated (stridulitrum) (Fig. 21).

Female.—(Figs. 22, 23) Slightly larger than males. Gonocoxae I rectangular, elongated; paratergites IX rectangular with round apices. Spermatheca spherical with two sclerotized rings around the oviduct. Body length 17.12 ± 0.23; body width at II abdominal segment 10.76 ± 0.15; head length 3.54 ± 0.08; head width 4.34 ± 0.03; interocular distance 2.76 ± 0.03; interocellar distance 0.5 ± 0; length of antennal segments: I 0.92 ± 0.2, II 1.0 ± 0.02, III 1.41 ± 0.01, IV 2.14 ± 0.04, V 2.35 ± 0.04; length of rostral segments: I 1.65 ± 0.03, II 3.08 ± 0.05, III 1.71 ± 0.02, IV 1.61 ± 0.03; mesial pronotum length 4.62 ± 0.07; pronotal width across humeri 10.71 ± 0.11; pronotal width at anterior margin 4.32 ± 0.05; scutellum length 10.47 ± 0.20; scutellum width 10.23 ± 0.1; length of femur 5.21 ± 0.05; length of tibia 4.97 ± 0.05; length of tarsi: I 0.87 ± 0.02, II 0.41 ± 0.01, III 0.73 ± 0.02.

Male.—(Figs. 24-26) Pygophore large, with posterior margin concave; parameres “L” shaped, bases robust and apices acute; aedeagus with four apical sclerotized projections, two broad and two knife shaped with a small tooth three quarters from its base. Body length 15.01 ± 0.26; body width 9.17 ± 0.19; head length 3.26 ± 0.06; head width 3.95 ± 0.06; interocular distance 2.48 ± 0.06; interocellar distance 0.42 ± 0.01; length of antennal segments: I 0.86 ± 0.2, II 0.93 ± 0.02, III 1.37 ± 0.02, IV 1.98 ± 0.03, V 2.2 ± 0.03; length of rostral segments: I 1.51 ± 0.04, II 3.54 ± 0.06, III 1.55 ± 0.03, IV 1.44 ± 0.03; mesial pronotum length 3.9 ± 0.11; pronotal width across humeri 9.38 ± 0.18; pronotal width at anterior margin 3.92 ± 0.09; scutellum length 9.13 ± 0.16; scutellum width 8.68 ± 0.21; length of femur 4.53 ± 0.1; length of tibia 4.45 ± 0.11; length of tarsi: I 0.8 ± 0.02, II 0.39 ± 0.01, III 0.73 ± 0.02.

Variation.—(Figs. 11-19) Macules on pronotum and scutellum are variable in color (red, orange, or yellow), and number, position and size. The basic pattern on the pronotum consists of eight macules (Fig. 15) as follows: one semicircular macule located on each anterolateral margin; one semicircular macule on each posterolateral margin; two slightly elongated macules, situated on the midline, one reaching the anterior margin and the other one near the posterior margin; two round macules laterad of the midline and between the other macules. Macules on the midline are almost always present and sometimes fused with each



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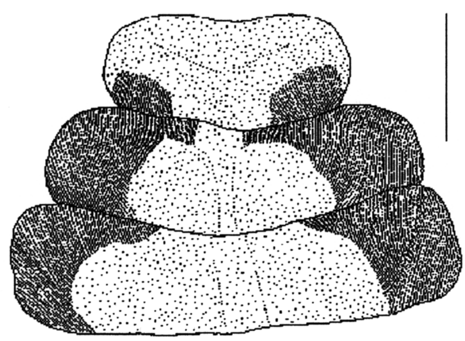

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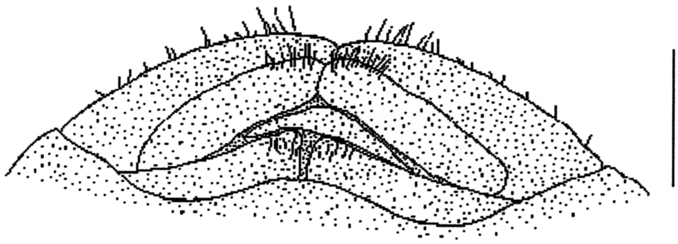
Figs. 20, 21. Fig. 20. Posterior leg of *P. klugii*. Fig. 21. Sterna VII, VI, and V, showing the striated areas (stridulitrum).



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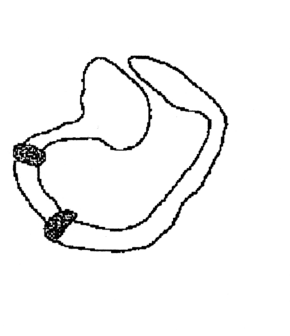

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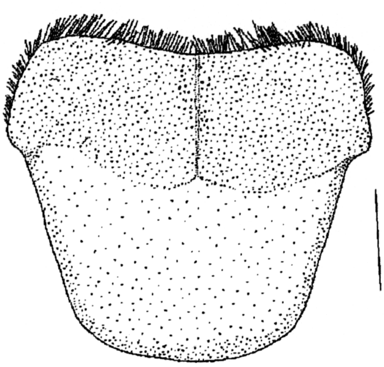
Figs. 22, 23. Fig. 22. Genital plates of female of *P. klugii*. Fig. 23. Spermatheca.

other; other macules can vary in size, be fused or disappear completely. The basic pattern on the scutellum consists of 14 macules as follows: one pair of semicircular macules located on the lateral margin, near the base of scutellum; another macule situated immediately posterior to the first pair and separated by a distance similar to the size of the macule; one pair of triangular macules situated laterally on the posterior half of the scutellum; two triangular macules situated on the posterior end of scutellum; one triangular macule located basally on the midline; one pair of round macules situated on each side of midline; one irregular macule situated on middle line between the triangular macules of the posterior half of scutellum, which may be divided in three small macules. All macules can vary in size, shape, color, can be fused, resulting in a range of 4 to 14 macules.

Biology.—In Mexico, this subsocial bug was observed feeding exclusively on *C. multilobus*. *Pachycoris klugii* was found in all months of the year, although it was more abundant between March and September. It had at least two generations each year. Females began ovipositing in early March and continued until August. Females laid an average of 81.4 ± 3.7 eggs (n = 10) in a compact and regular mass. Eggs were oviposited singly following a regular pattern. After one egg was deposited, the second one was deposited next to the first, the third egg was deposited on a new line between the two eggs previously deposited. The fourth egg was positioned next to the second egg in line with the egg one. The fifth egg was positioned between the second and fourth, next to the third egg. The female continued in this way until the first two lines had between 5 and 7 eggs each. She then began the next line, which usually had one more egg than the previous line. This pattern was followed to make two or three lines at a time. When a line reached 10 eggs, the number of eggs per line started to decrease until the last row had three to five eggs. In this way a regular and uni-



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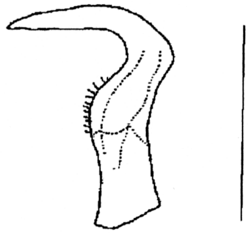

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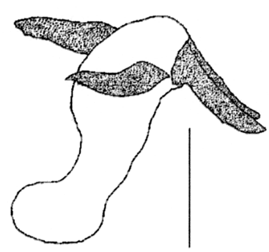

26

Figs. 24-26. Fig. 24. Pygophore of *P. klugii.* Fig. 25. Lateral view of paramere. Fig. 26. Aedeagus.

form mass was formed, in a rhomboid shape. The eggs are glued to the underside of a still slightly curled new leaf.

As soon as the female deposited the last egg, she positioned her body over the whole mass. The egg mass surface (77.95 ± 6.03 mm^2) was smaller than the females' ventral area (161.6 ± 4.46 mm^2), so females usually covered the entire mass. She stayed in that position until the first instar nymphs molted. When the female was approached by an egg parasitoid, a parasitoid fly, or predator, she moved her body down according to the direction from which the intruder was approaching. During a frontal approach, the female moved her antennae towards the intruder. Occasionally the female also moved her legs and tried to repel the intruder. The mother sometimes turned around, towards the intruder, so she may not have maintained the same position throughout the period when she was guarding the eggs and nymphs. Eggs hatched around 6 days after oviposition. First instar nymphs remained under the mother's body without much movement. After 5 days they molted and second instar nymphs started to move away from the mother in a group. By this time the female appeared to be weakened, possibly because we did not observe her feeding while guarding the eggs and nymphs. Females kept in the lab while guarding the eggs died as soon as the second instars appear. Third instar nymphs appeared after six days, and remained together. It was common to find masses of 30 to 40 individuals of third, fourth, and fifth instars on the host plant, which probably corresponded to the same cohort.

As with many pentatomids and other scutellerids, third, fourth, fifth instar nymphs and adults (except guarding females) dropped from the plant and feigned death when disturbed. It was also common to observe *P. klugii* nymphs and adults stridulate and expel liquid through their anus and metathoracic scent glands when they were disturbed. Duration of fourth and fifth instars was about seven days each depending on the quality of food and temperature. Adults were found in groups, but numbers were much lower than in the groups of nymphs. Three to seven adults were found on the same plant. Males usually lived longer than females, and were kept alive for up to a year. Females that had oviposited usually died after the second instar nymphs appear. Females that reached September or October without producing eggs, survived until March or April of the next year, at which they oviposited for first time. A large number of second instar nymphs died for unknown reasons, as has been observed in many other Hemiptera (Brailovsky et al. 1992). This high mortality may be due to a change in the habits of the nymphs, first instar nymphs usually do not feed. It has also been mentioned that in order to process their food, nymphs need to acquire some microorganisms that live in their gut (Buchner 1965).

Both nymphs and adults feed on new leaves and were commonly found feeding on fruits and flowers of the host plant. When molting, nymphs usually perched on the under side of a fully expanded old leaf. From October to February the number of *P. klugii* on *C. multilobus* was lower. In localities with colder climates, it was common to find adults on Bromeliaceae (*Tillandsia* spp.). Adults were also found on *Yucca* sp. Only adults were found in these plants and were probably in some stage of diapause until warmer temperatures return.

Egg Parasitism.—Although *P. klugii* females guard their eggs, they were often parasitized by the wasp *Telenomus pachycoris* (L.) (Scelionidae). More than 25 egg masses were collected in the field but because only 10 of these masses were complete and collected with the mother, it was only possible to use these 10 for analysis of parasitism. Of these 10 masses, two of them were not parasitized at all. The proportion of eggs attacked varied from zero to 88.5% with a mean of 38.98 ± 8.85 ($n = 10$). Most of the time the eggs that were parasitized were the ones on the edges of the mass. Eggs in the center of the mass were the least frequently parasitized. It was noticed that the eggs that were covered by the rear end of the female's body were more often parasitized than the ones near the head; however, no statistical analysis was performed because the females sometimes changed position. Male parasitoids usually emerged earlier than females and remained at the egg mass waiting for the females to emerge. Unparasitized eggs hatched at the same time as the parasitoids or not more than two days later. Females held under laboratory conditions occasionally laid more eggs on the top or side of the old ones; as soon as they were laid, female parasitoids oviposited in them. A few eggs managed to escape parasitoids and produced nymphs. Egg masses found in the field were arranged in regular masses and did not display different times of eclosion or parasitism, suggesting that females did not oviposit after egg eclosion under natural conditions.

Adult Parasitism and Predation.—Of the adults collected in the field and the ones deposited in the collections, a small proportion had eggs of tachinid fly, *Trichopoda pennipes* (Fab). Five males and two females were parasitized. The parasitoid eggs were usually found on top of a spiracle or on the margin of the scutellum. Males had only one egg, while one female bug had two eggs (on spiracles V and VII) and the other female had three eggs (on the border of the scutellum). However, only one adult parasitoid was obtained from each individual. The fly larva usually emerged through the genital opening when the bug was still alive, then pupated in the soil. The adult flies emerged 15 to 20 days later. The bugs died after parasitoid larvae emerged.

The spider *Peucetia viridans* Hentz (Oxyopidae) was commonly found nesting on *C. multilobus* and in a few occasions it was observed feeding on nymphs and adults of *P. klugii*.

Distribution.—This species has been reported several times as being present in Mexico, but with no exact locality. The records of the specimens studied in the present work, are as follows: MEXICO. CHIAPAS. El Chorreadero, Reserva del Ocote, Pijijiapan, El Porvenir, March, July, and December. DURANGO. Los Chirimollos, Km 250 Durango-Mazatlán, October GUERRERO. Venta Viga, Km 110 Coyuca de Catalán-Zihuatanejo, Km 6 Acapulco-Filo del Caballo, April-June September. HIDALGO. Tlacolula, 12 Km South of Ixmiquilpan, Km 30 Tasquillo-Huichapa, Yahalica, Huejutla, June, October, December. JALISCO. San Martín de Bolaños, Biology Station UNAM, A. Somitla, 26-27-XII-1992, HB, KB, 1 ♀. Sierra de Manantlán, August, October-December. MEXICO. Acamochitlán, El Zapote, San Mateo, November, December. MICHOACÁN. Morelia, Zirahúen, Tzintzuntzán, May, June, October. MORELOS. El Tepozteco, February. OAXACA. Chiltepec, Huajuapan de León, Pluma Hidalgo, Km 16 Miahuatlán-Puerto Escondido, Portillo del Rayo, Puente Nacional, Km 6 Oaxaca-Guelatao, Tlacolula, Hierve El Agua, Tultepec, February-November. PUEBLA. Necaxa, Hidroeléctrica de Tlalchichilco, Km 7 Pahuatlán-San Pablito, Pahuatlán, Lecho del Río, Xicotepec de Juárez, Planta Tepexic, Km 3 Xicotepec-Barranca de Patla, January, May-July. QUERÉTARO. Rancho Aztlán, 10 Km North of Querétaro, Higuerillas, June, August. QUINTANA ROO. Coba, Chetumal, Km 146 Chetumal-Cancún, March, May, October, November. SAN LUIS POTOSÍ. C. Bolivar, Los Sabinos, September. TAMAULIPAS. Gómez Farías, Rancho El Cielo, April. VERACRUZ. Coatzintla, Esquilon, Biology Station UNAM, Cabañas, Jalcomulco, Tlacolulan, Xalapa, January-December.

Discussion

Pachycoris species are very similar to each other although few differences exist among their genitalia. These similarities have led to confusion among some species including *P. klugii* which has been identified as *Pachycoris torridus* (Scopoli) on several occasions. *Pachycoris torridus* also occurs in Mexico, although it is quite rare, and is more commonly found in South America. The two can be distinguished because *P. klugii* has a longer scutellum and the head of the parameres are longer than in *P. torridus* (Eger, pers. comm.). The great variability in the number of spots and the different colors on the pronotum and scutellum of *P. klugii* has caused confusion with this species, resulting in the description of different varieties of *P. torridus*, such as *P. torridus* var. *decorata* Perty, *P. torridus* var. *aguila* H.S. These findings may suggest that a revision of the genus is needed.

In 1934, Hussey described the guarding behavior of *P. torridus* in Paraguay. His observations were mainly anecdotal. He did not describe the immature stages or the adult. Although the behavior of *P. torridus* described by Hussey (1934) is very similar to the one described in the present study for *P. klugii*, there are some differences. The host plant, *Sapium haematospermum* Múll. Arg., was different but belongs to the same family (Euphorbiaceae). Percent parasitism was much lower than we observed, being 15% for *P. torridus* and about 38% for *P. klugii*.

Similar guarding behavior has been recorded for *P. stallii* Uhler, which is species also found on the west coast of Mexico and feeds on a species of *Croton* (Williams et al. 2001). Hussey (1934) mentioned that *P. fabricii* (L.), a species found on a number of Caribbean Islands, also exhibits this guarding behavior. Grimm (1996, 1999) has also reported the maternal care of *P. klugii* and found that this species feeds exclusively on *J. curcas.* These records, suggest that species of *Pachycoris* are subsocial and restricted to Euphorbiaceae.

In this study, the life cycle of *P. klugii* was more or less synchronized with that of its host plant. Adults appear on *C. multilobus* usually between March and April, when the plant starts producing new shoots. The bugs feed on stems, leaves, flower or fruit, so food resources are always present. Also, *C. multilobus* (at least in Los Tuxtlas) seems to produce flowers and fruit at different times of the year (pers. obs.)

Grimm & Somarriba (1998) in Nicaragua, did not find an alternative host. They found that the life cycle of this bug is closely related to the fruiting cycle of the host plant. This probably was due to the fact that *P. klugii* preferred to feed on developing and ripe fruit. The system in that study was a plantation, so reproduction of the host plant was synchronized, facilitating the observation of host phenology.

In this study females collected in the field oviposited only once, except in two cases, where females laid more eggs above those that were parasitized. Grimm & Somarriba (1998) reported that each female oviposited on average 2.4 masses. Size of the egg masses may explain this differences in the two studies. In Los Tuxtlas, females laid masses of around 81.4 eggs, while in Nicaragua the egg masses had only 29.7 eggs. The size of leaf surface available may play a role in the size of egg masses. Mexican bugs in our study were smaller than the bugs from Nicaragua (Grimm & Somarriba 1998) suggesting that there may be nutritional differences between the two plant species.

As with many pentatomids (Brailovsky et al. 1992) and other scutellerids (Walt & McPherson, 1972), first instar nymphs of *P. klugii* remained near the eggs. Staying under the mother's body may help them escape predation. All nymphal stages remained together and on the same plant where they were born, probably increasing the chances of finding food or a mate. They may also escape predators and parasitoids because of their large numbers. While guarding its young, the mother may be an easier target for predators or parasitoids.

According to Wilson (1979) guarding behavior is limited to species that live in very harsh environments in which there is a great variability in the abundance of resources, drastic climatic conditions, or that are submitted to high predation or parasitism. For *P. klugii*, its host plant in Mexico is abundant year around, so there is no variation in the abundance of food resources. In Nicaragua it seems that the bug is synchronized with the phenology of its host plant, and numerically respond when fruit is available. This species is found in the tropics, where climatic conditions do not vary in a great scale. So if we observe this behavior in terms of Wilson's (1979) statements, the only probable evolutionary explanation for the guarding behavior of this species is the egg parasitism and the females guard the eggs to avoid losing their young.

Acknowledgments

I gratefully acknowledge Dr. Joe Eger (Dow AgroSciences) for his comments regarding this manuscript and for checking some specimens of *P. klugii*. I also thank Dr. James O'Hara (Canadian National Collection) for identifying the tachinid parasitoid. I wish to thank three anonymous reviewers for helpful comments on the manuscript.

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