


A New Genus and Species of Mite (Acarina: Podapolipidae) Associated with the Coccinellid *Cycloneda sanguinea*

R. W. HUSBAND

Adrian College, Adrian, Michigan 49221

ABSTRACT

*CoccoPoliPolipus*, new genus, is erected for *C. macfarlanei*, new species, which is associated with *Cycloneda sanguinea* (L.) (Coleoptera: Coccinellidae). All stages are described. Keys to genera of Podapolipidae and species of *CoccoPoliPolipus* are provided. New combinations are described. New combinations of *C. solanophila* (Cooreman) and *C. hippodamiaca* (McDaniel & Morrill).

The purpose of this study is to (1) remove, from *Tetrapolipus*, some species formerly considered to be in this genus and (2) describe a new genus and species of mite from the coccinellid beetle, *Cycloneda sanguinea* (L.). Mites were examined, measured, and illustrated using a Wild-Heerbrugg phase-contrast microscope with a drawing attachment.

When the 1st generic key to Podapolipidae was made (Husband and Sinha 1970), it was difficult to find characteristics which were common to the 5 known species of *Tetrapolipus*. Specimens from *C. sanguinea* key to *Tetrapolipus* but have 2 instead of 4 legs in the adult female. Further investigation indicated that the specimens from the coccinellid represent a new species showing affiliation with species presently included in *Tetrapolipus*.

The genus *Tetrapolipus* was erected by Berlese (1911) to accommodate *T. batocercus* (Berlese 1910). Four species were added: *T. blattae* (Oudemans 1911), *T. rhynchopteri* Ewing (1924), *T. hippodamiaca* McDaniel & Morrill (1969), and *T. solanophila* (Cooreman 1952). The 1st 3 species are mentioned are similar in that a conspicuous solenidion is found on tibia I of the larviform female of each species. These species have either very long chelicerae or 3 conspicuous solenidia on tarsus I. In contrast, larviform females of *T. solanophila*, *T. hippodamiaca*, and the new species lack tibial solenidia, have only 2 tarsus I solenidia, and chelicerae are relatively short. Adult females of the 1st 3 species either lack a tectum or the tectum is not elongate-ovoid. An elongate-ovoid tectum is present in adult females of *T. solanophila*, *T. hippodamiaca*, and the new species. The greatest differences between the 2 groups of species occur in males. The male of *T. batocercus* has a very short middorsal aedeagus and has one spine on each of tibiae I, II, and III. The male of *T. blattae* is unknown. The male of *T. rhynchopteri* has a very long aedeagus which extends over the gnathosoma. *T. rhynchopteri* lacks tibial spines. On the other hand, males of *T. hippodamiaca* and the new species have aedeagi which extend over the posterior ¼ of the propodosoma. Each of the 2 last-mentioned species has a combination of one spine on tibia I and 3 spines on tibiae II and III. Thus, it is concluded that the designation of a new genus is appropriate to accommodate *T. solanophila*, *T. hippodamiaca*, and the new species described here.

*CoccoPoliPolipus*, n. gen.

The genus has the following characteristics: Gnathosoma of larviform female, male, and adult female narrow, no more than ¼ the width of idiosoma. Chelicerae moderately developed in all forms. Pedipalps reduced. Tectum above gnathosoma of adult female. Propodosoma of larviform female with 3 pairs of setae, anterior 2 pairs much reduced, posterior pair normal. Male with 4 pairs of propodo-
somal microsetae. Idiosoma of adult female smooth, without setae, 0–4 anterior lobes. Metapodosoma of male and larviform female with 3 pairs of setae; 3rd pair may be situated on a separate plate. Male with aedeagus middorsal, extending anteriorly over the posterior ¼ of propodosoma. Setae sacrales on a separate plate in larviform female, plate and setae lacking in male. Opisthosomal setae of larviform female very long; accessory setae short, inconspicuous. Male and larviform female with 3 pairs of legs, adult female with 1–2 pairs of legs. Male with a single spine on tibia I, tibia II and III each with 3 spines; larviform female without tibial spines. One long and one short solenidion on tarsus I of male and larviform female. Leg I of adult female with a subterminal or terminal hook and dorsal spine, dorsal seta usually present on femur I: leg II, if present, with 2 terminal spines. All species are associated with the beetle family Coccinellidae. Type species: Coccipolipus macfarlancei, n. sp.

The following 2 species are reassigned to Coccipolipus: Tetrapolipus solanophilae Cooreman and T. hippocodami McDaniel & Morrill.

Key to Genera of Podapolipidae

1. Terminal opisthosomal setae shorter than ⅔ width of idiosoma or absent.......................... 2
   Terminal opisthosomal setae at least as long as ⅔ the width of idiosoma.......................... 3

2. Aedeagus present, 3–4 pairs of legs............ males
   No aedeagus, 0–3 pairs of legs............adult females

Key to Larviform Females

1. Tibiae I, II, III each with 0–1 spines............ 2
   Tibiae I, II, III each with 2 or more spines............................................. Ovacarus

2. Caudal accessory setae conspicuous, elongate, slightly pectinate, or well separated from long opisthosomal setae. .............................................. 3
   Caudal accessory setae inconspicuous, or absent......................................................... 7

3. One solenidion on tibia I................................................. 4
   No solenidion on tibia I................................................. Podapolipoides

4. Gnathosoma longer than broad; palp ca. ⅔ the width of gnathosoma.......................... 5
   Gnathosoma as broad as long; palp less than ⅔ width of gnathosoma.......................... 6

5. Usually one seta on coxa IV; length of accessory setae less than 2 times the distance between accessory setae; proximal solenidion on tarsus I longer than ⅔ length of distal solenidium.......................... 7
   Two setae on coxa IV; length of accessory setae less than 2 times the distance between accessory setae; proximal solenidion on tarsus I less than ⅔ length of distal solenidium............................................. Dorsipes

6. Length of tibia I solenidion equal to or greater than width of tibia I............................ Tetrapolipus
   Tibia I solenidion equal to or less than ⅔ width of tibia I........................................... T. rhynchophori

7. Tarsus I with 2 solenidia.......................... 8
   Tarsus I with 3 solenidia.......................... 9

8. Solenidia on tarsus I nearly equal in length............................................. Bakerpolipus
   Posterior solenidion on tarsus I about half as long as anterior solenidium.................. Coccipolipus

9. Length of setae scapulares externae (s.sc.c.) at least half the width of idiosoma.............. 10
   Length of s.sc.c. much less than half the width of idiosoma........................................ Archipolipus

10. No spines on tibia I, II, III; length of setae humerales externae (s.h.c.) less than width of femur III.............................................. Podapolipus

11. Spines on tibiae I, II, III; s.h.c. much longer than width of femur III......................... Locustacarus

Key to Males

1. Four pairs of legs.......................... 2
   Three pairs of legs.......................... 4

2. Aedeagus middorsal; no spines on tibiae II, III.. 3
   Aedeagus posterior; spine on tibiae II, III.................................................. Archipolipus

3. From Scarabaeeidae............................................. T. rhynchophori
   From Carabidae............................................. Dorsipes

4. Aedeagus posterior.......................... 5
   Aedeagus middorsal or anterior..................... 6

5. Spines on tibiae II, III; s.h.c. present, or absent..................................................... Ovacarus
   No spines on tibiae; s.sc.c. long, conspicuous...................................................... Entarsopolipus

6. Aedeagus opening anterior, near the gnathosoma. 7
   Aedeagus opening near anterior of propodosoma or near posterior of propodosomal plate. 9

7. Length of s.h.c. less than ⅔ width of idiosoma.......................... 8
   Length of s.h.c. at least ⅔ width of idiosoma.......................... 9

8. Aedeagus extends freely over gnathosoma; no spine on tibiae I.................................. Tetrapolipus
   Aedeagus terminates immediately posterior to gnathosoma; at least tibia I with one spine........................................ Podapolipus

9. One or more spines on each of tibiae I, II, and III......................................... Bakerpolipus
   Two or more spines on each of tibiae II and III......................................... Tetrapolipus

10. One spine on each of tibiae I and II.......................... 11
   Two solenidia on tarsus I, posterior solenidium ca. ⅔ the length of anterior one......... Coccipolipus
   Three solenidia on tarsus I, distal solenidium nearly equal in length....................... Podapolipoides

Key to Adult Females

1. With 1–3 pairs of legs.......................... 2
   Without legs............................................. Archipolipus

2. With 3 pairs of legs.......................... 3
   With 1–2 pairs of legs.......................... 6

3. Width of gnathosoma less than ⅔ width of propodosomal plate........................................ 4
   Width of gnathosoma greater than ⅔ width of propodosomal plate.............................. Tarsopolipus

4. Tibial spines absent.......................... 5
   Tibial spines present............................................. Ovacarus

5. Proximal solenidion on tarsus I at least ⅔ length of distal solenidium; solenidion on tarsus II nearly equal to spine on tarsus II.............................. Dorsipes
   Proximal solenidion on tarsus I less than ⅔ length of distal solenidium; solenidion on tarsus II less than ⅔ length of spine on tarsus II.............................. Entarsopolipus

6. Posterior lobes of idiosoma, if present, not bifurcate............................................. 7
   Posterior lobes bifurcate............................................. Podapolipoides

7. Idiosoma elongate or if nearly spherical, then reticulate tectum usually present........ 8
   Idiosoma spherical, smooth; gnathosoma without tectum............................................. Locustacarus

8. With 1 pair of legs; 0–2 anterior lobes.......................... 9
   With 2 pairs of legs, or if one pair, then with 4 anterior lobes.................................. 10

9. Idiosoma ovate and reticulate, lobes absent............................................. Bakerpolipus

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2 Tetrapolipus rhynchophori represents a new genus which will be described when more data are collected. Males of this species have been discovered recently in Brazil by Dr. Carlos Flechtmann.
Idiosoma elongate, smooth, if reticulate, then with a pair of anterolateral lobes .......... Podapolipus

10. Two pairs of legs; propodosoma ⅜ width of metapodosoma, usually a distinct unit anterior to metapodosoma. T. rhynchophorae
One pair of legs: if 2 pairs, then propodosoma not a distinct unit anterior to a larger metapodosoma. 11
11. Distinct ovoid tectum, usually with a long seta on femur 1 ............... Cocciopolus
Tectum absent, seta on femur 1 absent. Tetrapolipus

Key to Species of Cocciopolus

1. Dorsal aedeagus, tibial spines present, opisthosomal setae absent (males) ........... 2
Aedeagus and tibial spines absent, with or without long opisthosomal setae (females) .... 3
2. Coxa III pore contiguous with seta base; setae verticales internae (s.v.i.) as near to setae verticales externae (s.v.e.) as to each other .......... macfarlanei
Coxa III pore separated from coxa III seta by a distance nearly equal to distance between coxae III; distance between s.v.i. distinctly less than the distance between s.v.i. and s.v.e. ............... bipodamiae
3. Opisthosomal setae present, long; 3 pairs of legs (larviform females) ............... 4
Opisthosomal setae absent; 1–2 pairs of legs (adult females) .................. 6
4. Two metapodosomal plates; setae dorsales (s.d.) very short ............... 5
Three metapodosomal plates; s.d. very long, extending past posterior margin of idiosoma .......... solanophilae
5. Claws on legs II and III with one tine, well sclerotized; coxa II setae farther removed from the midline than coxa I setae by about the diameter of the circle at the base of setae .......... bipodamiae
Claws on legs II and III 2-tined, not well sclerotized; coxae II setae nearly twice as far from the midline as coxae I setae .......... macfarlanei
6. Two pairs of legs: 0–2 anterior idiosomal lobes lateral to gnathosoma .......... macfarlanei
One pair of legs; 4 anterior lobes lateral to gnathosoma .......... macfarlanei
7. Terminal sucking disc and hooked spine on leg 1; tectum not tongue-like; one conspicuous spine on tarsus II; idiosoma with one pair of bulges .......... solanophilae
No sucking disc on leg 1; tectum tongue-like; 2 spines on tarsus II; idiosoma with an anterior and posterior pair of bulges .......... bipodamiae

Cocciopolus macfarlanei, n. sp.

C. macfarlanei is distinguished from other Cocciopolus by characteristics used in the preceding key. Table 1 gives ranges and means of measurements of the adult female, larviform female, male, and egg.

**FEMALE.** (Fig. 1, 2).—**Gnathosoma.**—Longer than wide, well sclerotized; tectum slightly longer than wide. Chelicerae smooth, ca. ⅜ width of gnathosoma. Stigmatic on slender processes, dorsolateral to gnathosoma.

**Idiosoma.**—Egg-shaped, smooth; 4 nearly equal anterolateral lobes; conspicuous ventral genital opening.

**Legs.**—One pair; hooked, mesal, ventral tarsal spine; 2 dorsal tarsal spines; one stout, long, dorsal femoral seta.

**MALE.** (Fig. 3, 4).—**Gnathosoma.**—Width ca. ⅜ that of idiosoma; nearly as long as wide; dorsal and ventral setae short. Pedipalps reduced, conspicuous

<table>
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<th>Character</th>
<th>Range</th>
<th>Mean</th>
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<td><strong>Adult female</strong> (n = 11)</td>
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<td>Idiosoma length</td>
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<tr>
<td>Gnathosoma width</td>
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<td>Tectum width</td>
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<td>Leg II*</td>
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<td>Leg III*</td>
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<td><strong>Larviform female</strong> (n = 12)</td>
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<td><strong>Egg</strong> (n = 10)</td>
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<tr>
<td>Width</td>
<td>79-119</td>
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</table>

* Measured from center of mesal margin of coxa to apex of pulvillus.
Table 2.—Leg chaetotaxy of male and larviform female of *C. macfarlanei*.

<table>
<thead>
<tr>
<th>Leg</th>
<th>Femur</th>
<th>Genu</th>
<th>Tibia</th>
<th>Tarsus*</th>
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<tr>
<td>I</td>
<td>1—0</td>
<td>1—1</td>
<td>1—1</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>1—0</td>
<td>1—0</td>
<td>1—1</td>
<td>2 s, 2 so</td>
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<td></td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1 sp</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2 s, 2 sp</td>
</tr>
</tbody>
</table>

*Because of difficulty in assigning a position to terminal setae, a different designation is used to indicate tarsal setae. The following abbreviations apply: s = seta, so = solenidion, sp = spine.

III spine with 1, 2, or 3 tines. Most tibial and tarsal setae shorter than in larviform female.

**Larviform Female** (Fig. 5, 6).—Gnathosoma.—About ⅓ width of idiosoma; ventral and dorsal setae very short. Pedipalps 2-segmented, one short seta on each segment. Cephalothorax smooth, more than ⅓ width of gnathosoma.

*Propodosoma.—Propodosomal plate semilunar; 2 pairs of setae; length of s.s.c.e. nearly equal to width of idiosoma.*

*Metapodosoma.—Plates I and II fused; 3 pairs of microsetae.*

*Opisthosoma.—Plate I oval, bearing one pair of short setae. Terminal plate triangular, bearing one pair of short caudal accessory setae and one pair of opisthosomal setae longer than length of idiosoma.*

*Sternum.—Coxal plates 1 and 2 fused mesially, separated from plate 3 by nonsclerotized integument. Coxae 3 separated by nonsclerotized integument. Each coxal plate with a short seta, pores well separated from setae.*

**Legs.**—Shorter than width of idiosoma; chaetotaxy as in Table 2. No spines on tibiae. Most tibial and tarsal setae longer than in male. Lightly sclerotized opposable claws on legs II and III each with 2 tines.

**Egg.—**One to 5 oval eggs in various stages of development observed within the body of the adult female.

**Type Data.**—Holotype, δ; 26 9, 16 8 and 31 larviform female paratypes, Glasshouse Crops Research Institute, Littlehampton, England, April 1968; collector B. Gurney; from a laboratory culture of the coccinellid beetle *C. sanguinea*. The holotype is deposited in the British Museum (Natural History).

Paratypes are to be distributed to each of the following: Adrian College, Adrian, Mich.; Bernice P. Bishop Museum, Honolulu, Hawaii; British Museum (Natural History), London, England; Canadian National Collection, Entomology Research Institute, Ottawa; University of Georgia, Athens; Acarology Laboratory of the Ohio State University, Columbus; L’Institute Royal des Sciences Naturelles, Bruxelles, Belgium; Hebrew University, Jerusalem, Israel; Le Museum National d’Histoire Naturelle, Paris, France; Institute of Zoological Research, Potchefstroom, South Africa; Research Station, Canada Department of Agriculture, Winnipeg; Snow Entomological Museum, Lawrence, Kansas; South Australian Museum, Adelaide, Australia; National Museum, Adelaide, Australia; National Museum of Natural History, Washington, D. C.; Universitetes Zoologiske Museum, Copenhagen, Denmark; Zoological Institute of the Academy of Sciences, Leningrad, USSR; Zoologisches Institut der Universität Freiburg, Germany; Instituto Sperimentale per la Zoologia Agraria, Firenze, Italy.

Remarks.—Specimens of the host species of *C. macfarlanei*, the coccinellid beetle *C. sanguinea*, were collected from eggplants at Curepe, Trinidad, West Indies. Many specimens of *C. macfarlanei* were found under the elytra by Miss Gurney. Adult females were most common. Female mites outnumbered male mites by a ratio of more than 10 to 1. *C. macfarlanei* appears to be specific to *C. sanguinea*. An abundance of the fungus *Laboulbenia* sp., was also found on the host beetles. Other species of Coccinellidae from the West Indies observed by Miss Gurney lacked both the fungus and mites. She obtained the original stock of beetles from F. J. Simmonds of the Commonwealth Institute of Biological Control.

The species is named in honor of Donald Macfarlane in recognition of his contributions to the field of acarology.

**DISCUSSION**

So few of the existing mites of the family Podapolipodidae have been described that it is difficult to determine relationships. In addition, the grouping of related species based upon characteristics found in the adult female often gives a different grouping than one based upon characteristics found in either males or larviform females. In my opinion, the adult female, which is most degenerate, is the least helpful in determining generic position. The male has the most useful set of characteristics. Of course, all stages should be considered when proposing generic relationships.

*Coccipolipus* is most closely related to *Bakerpolipus*, *Tetrapolipus*, and *Podapolipoides*. In *Tetrapolipus*, the mesal solenidion of tarsus I is reduced. Both *Bakerpolipus* and *Coccipolipus* lack a mesal solenidion on tarsus I. This solenidion is well developed in *Podapolipoides* and is present in most other Podapolipodidae. Male *Coccipolipus* have 3 spines on tibia II.
Biology of *Agathis gibbosa* (Hymenoptera: Braconidae),
A Primary Parasite of the Potato Tuberworm

JOHNSON A. ODEBIYI AND EARL R. OATMAN
Department of Entomology, Division of Biological Control, University of California, Riverside 92502

ABSTRACT

*Agathis gibbosa* (Say), a primary, solitary, larval endoparasite of *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae), was studied under laboratory conditions of 26.7 ± 1°C and 50 ± 2% RH. The egg is deposited in any of the ganglia along the ventral nerve cord of the host larva. The parasite larva develops in the body cavity, emerging after the host larva has spun its cocoon and then feeds externally on the host larva for 1 to 2 days before spinning its own cocoon inside that of its host. There are 3 instars, the first being mandibulate and the other two hymenopteriform. Total developmental time from egg to adult ranged from 16 to 22 days; average, 18 days. The duration of each developmental stage was: egg 3.5 days, 1st stage 3.5 days, 2nd stage 1 day, 3rd stage 3 days, prepupa 2 days, and pupa 3 days. Adult emergence was stimulated by light, and copulation occurred within a few minutes to several hours later. Males mated several times, females only once. Unmated females produced only males, mated females both males and females. There is essentially no pre-oviposition period. Without food and water, adults died within 2.6 days; with both honey and water, males lived an average of 12.6 days and females 18 days. The highest average daily production of progeny among 10 mated females was 40.5. The females had an average ovipositional period of 9 days and produced an average of 288.3 adult progeny. Longevity of the mated females averaged 10.8 days and the sex ratio (♂:♀) of their progeny averaged 1.9:1.

*Agathis gibbosa* (Say), a parasite of *Phthorimaea operculella* (Zeller), is native to North America. It was described originally by Say in 1836 as *Bassus gibbosus*. All the known hosts are larvae of Lepidoptera. Most of them belong to the genera *Phthorimaea* and *Mompha*, including *P. operculella*, *P. glochinella* (Zeller), *Mompha stellella* (Busck), and *Mompha* sp. Other hosts are *Coleophora* sp., *Papaipema nebris var. nitellos* (Gueneé), and *Strobisia iridipennella* (Clements) (Muesebeck et al. 1951, Krombein 1958).

The present study was concerned with basic

REFERENCES CITED

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