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The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

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**REDESCRIPTON OF EVIPHIS CULTRATELLUS (BERLESE)**

**(ACARI: EVIPHIDIDAE)**

by Gen TAKAKU*

**INTRODUCTION**

*Eviphis cultratellus*, originally described as a species of *Copriphis* (Berlese, 1910), was redescribed by RYKE & MEYER (1957) on the basis of the deutonymph and adults. The species is known from Java, Egypt (Berlese, 1910), India (OUDEMANS, 1915; BHATTACHARYYA, 1971), South Africa (RYKE and MEYER, 1957), Zaire (SHOEMAKE & KRANTZ, 1966) and northern Japan (TAKAKU et al., 1994). Like other congeners, the description of the species was based on the deutonymph, female and male, and there is no information on the morphology of larvae and protonymphs.

In the present study, the larval and protonymphal instars of *Eviphis cultratellus* are described for the first time. This is the first description of the larva in the genus *Eviphis*. The protonymph was only known previously in *Eviphis ostrinus* (Koch) (KARG, 1965).

Female and male adults of *E. cultratellus* were collected from the body surface of the dung beetle *Copris ochus* Motschulsky, which were collected at Hokkaido Agricultural Experiment Station in Sapporo, northern Japan. The mites were cultured under conditions of 16L8D photoperiod and 20 ± 1°C in cow dung on moistened wheat bran. Larvae and protonymphs were obtained from this culture. These specimens were fixed with 70% ethyl alcohol and mounted in gum-chloral medium. Observations and measurements were made with a phase-contrast microscope. Illustrations were prepared with the aid of a drawing apparatus.

In the following description, dorsal chaetotaxy and terminology of body parts follow LINDQUIST & EVANS (1965), EVANS & TILL (1979) and KRANTZ (1978), except for the following terms: macroeupathidia (MASAN, 1994); apical placoid sensillum (EVANS, 1984); and peg-like seta (EVANS, 1992), for a thick and distally rounded seta on the ventral surface of the deutonymph and adult.

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*Acarologia*, t. XXXVIII, fasc. 4, 1997.
The material examined will be deposited in the zoological collection of the Graduate School of Science, Hokkaido University and in the Acarology Collection of Oregon State University.

**FAMILY EVIPHIDIDAE BERLESE, 1913**

**Genus Eviphis** Berlese, 1903

**Eviphis cultratellus** (Berlese, 1903)

*Copriphis cultratellus* Berlese, 1910: 261.

*Eviphis mullani*: Oudemans, 1915: 137 (in part, deutonymph only), figs. 56-60.


**Larva:** Length of idiosoma, 261–359 μm (302.8 ± 31.2 μm, n = 12); width at level of coxae III, 204–269 μm (231.6 ± 19.2 μm, n = 11). Living specimens white in color.

Dorsum (Fig. 1): Idiosoma oval; dorsum with indistinct podonotal shield, distinct pygidial shield, and two pairs of mesonotal shields; dorsal pores absent. Podonotal shield with 9 pairs of setae; setae j1, j3 and z2 slightly pilose; long setae j4, z4, z5 and s4 sparsely pilose; setae j5 and j6 minute and simple. Two pairs of mesonotal shields without setae. Pygidial shield with three small fossae anteriorly, a rectangular fossa medially, and three large fossae posteriorly; with 3 pairs (j2, Z4 and Z5) of long simple setae. With four pairs of dorsolateral setae (z6, s6, r6 and S3); all of the dorsolateral setae long and simple, except for short slender setae r6.

Venter (Fig. 2): Tritosternum developed. Ventral shields and pores absent. Venter with 3 pairs of sternal setae (s1-3), 2 pairs of preanal setae (Jv1, Jv2), 1 pair of paranal setae, a long postanal seta, and 2 pairs of marginal setae (Jv5, Zv2) laterad from anus; all of the setae simple. Simple setae S4 and S5 inserted posterolaterad from anus. Cribrum, cribral gland apertures, peritreme and stigma absent.

Gnathosoma (Figs. 3–7): Weakly sclerotized. Only two pairs of long simple hypostomal setae present; palpcoxal seta absent; deutosternal groove indistinct; venter with 7 rows of denticles (Fig. 3). Palpal chaetotaxy of trochanter, femur and genu 0-4-5 (Fig. 4); palpal trochanter with a triangular projection; anterolateral setae of femur and genu slightly thickened and bifid. Palp tarsus with a bifurcated apotele and a macroepathidium (Fig. 5). Tectum (Fig. 6) lanceolate and dentate. Chelicera with long slender shaft; fixed digit of chelicera (Fig. 7) with a low tooth proximally, a pointed tooth distally and a terminal hook; distal end of the digit with an apical placoid sensillum; movable digit with two pointed teeth and a terminal hook.

Legs: All tarsi with ambulacra and a pair of claws. Segments of each leg with some pilose setae, except coxae and trochanters of all legs, which have only smooth setae. Leg chaetotaxy as follows (coxæ; trochanter; femur; genu; tibia):

- **Leg I:** 0, 0/1, 0/1, 0; 1, 0/1, 0/1, 1; 2, 2/1, 2/1, 2; 1, 2/1, 2/1, 1.
- **Leg II:** 0, 0/1, 0/1, 0; 1, 0/1, 0/1, 1; 2, 1/1, 2/0, 1; 1, 2/0, 2/0, 1; 1, 1/1, 2/1, 1.
- **Leg III:** 0, 0/1, 0/1, 0; 1, 0/1, 0/1, 1; 1, 2/1, 1/0, 0; 1, 2/0, 2/0, 1; 1, 1/1, 2/1, 1.

Leg length (except ambulacrum; n = 14): Leg I, 286–318 μm (305.4 ± 11.2 μm); leg II, 233–273 μm (258.4 ± 12.5 μm); leg III, 241–269 μm (257.3 ± 9.6 μm).

**Protonymph:** Length of idiosoma, 363–559 μm (440.5 ± 54.9 μm, n = 26); width at level of coxae IV, 257–437 μm (324.6 ± 44.7 μm, n = 26). Length of podonotal shield, 273–298 μm (289.9 ± 6.0 μm, n = 26); width at level of seta s4, 224–265 μm (248.7 ± 10.2 μm, n = 26). Length of opisthonal shield, 67–118 μm (89.2 ± 13.2 μm, n = 26); width at level of setae S3, 224–265 μm (250.3 ± 8.9 μm, n = 26). Living specimens white in color.

Dorsum (Fig. 8): Idiosoma oval; dorsum with podonotal shield and opisthonal shield; mesonotal shield absent. Podonotal shield without ornamentation, with 11 pairs of setae and 3 pairs of small pores; all setae pilose or slightly pilose. Opisthonal shield with 11 pairs of setae; setae J3, J4, Z3 and Z4 minute and simple; setae J5 minute and bipectinate; other opisthonal setae long and pilose. Lateral margin of dorsum with 4 pairs of long pilose setae, one pair of minute bipectinate setae (r6) and 2 pairs of pores.
Figs. 1–7: *Eviphis culraterellus* (Berlese, 1910), larva.

Venter (Fig. 9): Tritosternum developed. Venter without any shields; st1-3, 5, setae Jv1 and Jv2 short and simple; setae Jv5 and Zv2 slightly pilose; with a pair of simple paranal setae and a slightly pilose postanal seta; Jv5 and postanal seta longer than other ventral setae. Cribrum distinct, expanding around the postanal seta; cribral gland apertures indistinct. Peritreme short, but distinct, located between coxae III and IV; stigma located laterad of coxae IV.

Gnathosoma (Figs. 10–14): Weakly sclerotized. Three pairs of hypostomal setae and a pair of palpcoxal setae present; deutosternal groove with 6 rows of denticles (Fig. 10). Palpal chaetotaxy of trochanter, femur and genu 1-4-5 (Fig. 11); single anterolateral seta (al) of femur thick, and that of genu thick and bifid. Palp tarsus with a bifurcated apotele and a pair of macroeupathidia (Fig. 12). Tectum (Fig. 13) lanceolate and dentate. Chelicera with long slender shaft; fixed digit of chelicera (Fig. 14) with two pointed teeth and a terminal hook; distal end of the digit with an apical placoid sensillum; movable digit with two pointed teeth and a terminal hook.

Legs: All tarsi with ambulacra and a pair of developed claws. Segments of each leg with some pilose setae, except coxae and trochanters of all legs and femur III, which have only smooth setae.

Chaetotaxy of leg I, II and III of protonymph as in larva except for that of femur II (1, 2/1, 2/1, 1); chaetotaxy of leg IV as follows (coxa; trochanter; femur; genu; tibia).

Leg IV: 0, 0/1, 0/0, 0; 1, 1/1, 0/1, 0; 1, 2/0, 1/0, 0; 1, 2/0, 2/0, 0; 1, 1/1, 2/1, 1.

Leg length (except ambulacrum): Leg I, 310-367 μm (342.8 ± 14.4 μm, n = 25); leg II, 265-339 μm (304.0 ± 19.8 μm, n = 26); leg III, 257-339 μm (302.0 ± 18.9 μm, n = 26); leg IV, 302-408 μm (358.5 ± 28.8 μm, n = 26).

Deutonymph: Length of dorsal shield, 653–759 μm (716.7 ± 24.9 μm, n = 37); width at level of coxae IV, 539–620 μm (578.8 ± 19.9 μm, n = 37). Living specimens reddish-yellow in color.

Dorsum (Fig. 15): Idiosoma nearly hemispherical. Dorsal shield entirely covering idiosoma; posterior region of the shield ornamented with some transverse lines and irregular weak reticulations; shield with 29 pairs of dorsal setae and 20 pairs of pores; setae j1 and z2 short spine-like; central setae (setae j4-6, z5-6, J2-5) simple and minute; marginal setae (setae r2-6, S2-5) thick and lanceolate; setae Z5 lanceolate or paddle-like; other dorsal setae simple.

Venter (Fig. 16): Tritosternum well developed. Presternal region striated, and ornamented with minute granules. Sternoventral shield longer than wide; length of the shield 265–306 μm (287.7 ± 8.6 μm), width at level of coxae II 126–143 μm (135.9 ± 3.7 μm) (n = 37); anterior region of the shield ornamented with small granules; shield bearing 5 pairs of sternal setae and 3 pairs of pores; st1 simple, and st2-5 thick and distally rounded (peg-like). Two or three pairs of platelets located posterior of sternoventral shield. Anal shield usually longer than wide; length of the shield 118–159 μm (149.6 ± 8.9 μm), width at level of paranal setae 124–139 μm (134.1 ± 4.0 μm) (n = 37); shield with a pair of paranal setae and a postanal seta, the postanal seta thick and lanceolate; cribrum distinct, expanding around the postanal seta; cribral gland apertures located laterad of paranal setae. Opisthogaster with one pair of metapodal shields and 9 or 10 pairs of setae; marginal 4 or 5 setae thick. Peritreme and peritrematic shield developed; posterior end of the shield with a pore; stigma located between coxae III and IV.

Gnathosoma (Figs. 17–21): Well developed and sclerotized. Three pairs of hypostomal setae and a pair of palpcoxal setae present; deutosternal groove with 5 rows of denticles and a posterior transverse ridge without denticles (Fig. 17). Palpal chaetotaxy of trochanter, femur and genu 2-5-6 (Fig. 18); anterolateral setae of femur and genu thick; al of genu bifid and al2 of genu spatulate; anteroventral seta of trochanter bifid and slender. Palp tarsus with a bifurcated apotele and a pair of macroeupathidia (Fig. 19). Tectum (Fig. 20) lanceolate and dentate. Chelicera with long slender shaft; fixed digit of chelicera (Fig. 21) with a robust double tooth, a distal small tooth and a terminal hook; distal end of the digit with an apical placoid sensillum; movable digit with two pointed teeth and a terminal hook.

Legs: All tarsi with ambulacra and a pair of claws. All setae of each leg simple except for posteroventral peg-like setae of coxae II and III. Leg chaetotaxy as follows (coxa; trochanter; femur; genu; tibia).
Figs. 8-14: Eviphis cultratellus (Berlese, 1910), protonymph.

Figs. 15–21: *Eviphis cultratellus* (Berlese, 1910), deutonymph.

Leg I: 0, 0/1, 0/1, 0; 1, 0/1, 1/2, 1; 2, 3/1, 2/3, 2; 1, 3/2, 2/1, 2; 1, 3/2, 2/1, 2.

Leg II: 0, 0/1, 0/1, 0; 1, 0/1, 0/2, 1; 2, 3/1, 2/2, 1; 2, 3/1, 2/1, 2; 2, 2/1, 2/1, 2.

Leg III: 0, 0/1, 0/1, 0; 1, 1/1, 0/2, 0; 1, 2/1, 1/0, 1; 1, 2/1, 2/1, 1; 1, 1/1, 2/1, 1.

Leg IV: 0, 0/0, 0/0, 0; 1, 1/1, 0/2, 0; 1, 2/1, 1/0, 1; 1, 2/1, 2/0, 1; 1, 1/1, 2/1, 1.

Leg length (except ambulacrum): Leg I, 359–457 μm (403.3 ± 25.1 μm, n = 35); leg II, 351–432 μm (404.2 ± 18.4 μm, n = 37); leg III, 367–465 μm (417.9 ± 25.1 μm, n = 37); leg IV, 441–563 μm (499.4 ± 29.6 μm, n = 37).

Female: Length of dorsal shield, 832–938 μm (907.6 ± 25.3 μm, n = 30); width at level of coxae IV, 685–775 μm (744.2 ± 20.2 μm, n = 30). Living specimens red in color.

Dorsum: Shape and ornamentation of dorsal shield, number of dorsal setae as in deutonymph.

Venter (Fig. 22): Tritosternum well developed. Presternal region striated, and ornamented with minute granules. Sternal shield longer than wide; length of the shield 171–206 μm (193.1 ± 6.9 μm), width at level of coxae II 147–163 μm (154.1 ± 4.7 μm) (n = 30); anterior region of shield ornamented with small granules; shield with slight reticulated ornamentation, 3 pairs of sternal setae, and 2 pairs of pores; st1-2 simple and slender, st3 peg-like. Metasternal shield with one pore and one peg-like seta. Genital shield narrow, with a pair of peg-like setae. Three pairs of small platelets located posterior of genital shield. Anal shield longer than wide; length of the shield 200–228 μm (216.1 ± 8.6 μm), width at level of paranal setae 165–198 μm (185.9 ± 7.3 μm) (n = 30); shield with a pair of paranal setae and a lanceolate postanal seta; cribrum distinct, expanding around the postanal seta; cribral gland apertures located laterad of paranal setae. Opisthogaster with 1 pair of metapodal shields and 10 pairs of setae; marginal 4 pairs of setae thick or lanceolate. Peritreme and peritrematic shield well developed; the shield wide, and with a pore at posterior end; stigma located between coxae III and IV.

Gnathosoma (Fig. 23): Well developed and sclerotized. Three pairs of hypostomal setae and a pair of palpcoxal setae present; deutosternal groove with 5 rows of denticles and a posterior transverse ridge without them. Palpal chaetotaxy of trochanter, femur and genu 2-5-6; anterolateral setae of femur and genu thick; al1 of genu bifid and al2 of genu spatulate; anteroventral seta of trochanter bifid and slender. Palp tarsus with bifurcated apotele and a pair of macroeupathidia. Tectum lanceolate and dentate. Chelicera with long slender shaft; fixed digit of chelicera (Fig. 23) with a robust double tooth, one or two small distal teeth and a terminal hook; distal end of the digit with an apical placoid sensillum; movable digit with two pointed teeth and a terminal hook.

Legs: All tarsi with ambulacra and a pair of developed claws. All setae of each leg simple except for posteroventral peg-like setae of coxae II and III. Leg chaetotaxy of adult female as in deutonymph.

Leg length (except ambulacrum): Leg I, 412–563 μm (505.2 ± 27.5 μm, n = 28); leg II, 457–530 μm (502.8 ± 22.1 μm, n = 30); leg III, 490–563 μm (535.0 ± 19.0 μm, n = 30); leg IV, 620–694 μm (658.9 ± 20.4 μm, n = 30).

Male: Length of dorsal shield, 792–898 μm (840.4 ± 25.4 μm, n = 39); width at level of coxae IV, 636–702 μm (667.9 ± 16.7 μm, n = 39). Living specimens red in color.

Dorsum: Shape and ornamentation of dorsal shield, numbers of dorsal setae as in deutonymph.

Venter (Fig. 24): Tritosternum well developed. Presternal region striated and ornamented with minute granules. Sternoventral shield longer than wide; length of shield 310–351 μm (332.7 ± 8.6 μm), width at level of coxae II 139–153 μm (146.2 ± 3.2 μm) (n = 39); anterior region of the shield ornamented with small granules; genital orifice situated medially on anterior margin of shield; shield ornamented with slight reticulation and bearing 5 pairs of setae and 3 pairs of pores; st1-2 simple and slender, st3-5 peg-like; a semicircular plate located posterior of and adjacent to sternoventral shield. Anal shield usually longer than wide; length of the shield 163–220 μm (196.7 ± 12.4 μm), width at level of paranal setae 169–196 μm (182.5 ± 6.8 μm) (n = 39); the shield with a pair of simple paranal setae and a lanceolate postanal seta; cribrum distinct, expand-
FIGS. 22–25: *Eviphis cultratellus* (Berlese, 1910), adult.


...ing around the postanal seta; cribral gland apertures located laterad from paranal setae. Opisthogaster with 1 pair of metapodal shields and 9 pairs of setae; marginal 3 or 4 pairs of setae thick or lanceolate. Peritreme and peritrematic shield well developed; shield wide and with a pore at posterior end; stigmata located between coxae III and IV.

Gnathosoma (Fig. 25): Well developed and sclerotized. Three pairs of hypostomal setae and a pair of palpcoxal setae present; deutosternal groove with 5 rows of denticles and a posterior ridge without them. Palpal chaetotaxy of trochanter, femur and genu 2-5-6; anterolateral setae of femur and genu thick; all1 of genu bifid and all2 of genu spatulate; anteroventral setae of trochanter bifid and slender. Palp tarsus with bifurcated apotele and a pair of macroeupathidia. Tectum lanceolate and dentate. Chelicera with long slender shaft; fixed digit of chelicera (Fig. 25) with a large tooth proximally, a distal tooth and a terminal hook; distal end of the digit with an apical placoid...
sensillum; movable digit with a large tooth, a terminal hook and a short spermatodactyl distally.

Legs: All tarsi with ambulacra and a pair of claws. All setae of each leg simple except for posteroventral peg-like setae of coxae II and III. Leg chaetotaxy of adult male as in deutonymph.

Leg length (except ambulacrum): Leg I, 473–555 μm (505.9 ± 17.4 μm, n = 34); leg II, 449–555 μm (508.6 ± 20.0 μm, n = 39); leg III, 481–571 μm (542.9 ± 26.0 μm, n = 39); leg IV, 620–726 μm (688.3 ± 28.4 μm, n = 39).

Material Examined: Twenty larvae and 29 protonymphs extracted from laboratory culture stock initiated by females and males collected at Hokkaido Agricultural Experiment Station, Sapporo, Hokkaido, Japan, 2 Sept. 1994; 7 deutonymphs, 12 females and 12 males, Hokkaido Agricultural Experiment Station, Sapporo, Hokkaido, Japan, 2 Sept. 1994, G. Takaku leg. ex Copris ochus; 10 deutonymphs, 11 females and 13 males, 31 Aug. 1992, other data as above; 6 deutonymphs, 7 females and 14 males, 5 Aug. 1991, other data as above; 14 deutonymphs, 31 Aug. 1993, extracted from cow dung other details as above.

Habitat: Deutonymphs and adults of E. cultratellus were collected from the body surface of adults of the scarabaeid beetles Geotrupes auratus Motschulsky, Copris ochus Motschulsky, Onthophagus lenzii Harold and Liatongus phanaeoides (Westwood) in Japan. They were also extracted from cow dung collected in northern Japan. Habitats of the larva and protonymph are unknown.

Distribution: E. cultratellus has been recorded from Java, India, Egypt, South Africa, Zaire and Japan (Hokkaido).

Remarks and Discussion

The deutonymph and adults of E. cultratellus show the following characters: 1) idiosoma arched; 2) chelicera with long slender shaft; 3) 6 setae on trochanter I; 4) two ventral setae on genu III. According to Dr. M. Castagnoli (personal communication), the type material of E. cultratellus in the collection of the Berlese Acarotheca showed the same states. However, characters 3) and 4) do not agree with the diagnostic characters of the genus Eviphis, and correspond instead to those of the genus Copriphis. Unlike E. cultratellus, other known species of the genus Eviphis have 5 setae on trochanter I and only one ventral seta on genu III (Evans & Till, 1979; Karg, 1993). Hence, it is necessary to redefine the deutonymph and adults of the genus Eviphis as follows (corresponding states of the genus Copriphis in parentheses): Idiosoma arched (not arched but slightly convex); chelicera with long slender shaft (chelicera normal); trochanter I with 5 or 6 setae (with 6 setae); genu III with 1 or 2 ventral setae (with 2 ventral setae); palpatars with two long macroeupathidia (same); peritrematic shield strongly developed posterior to coxae IV (same).

The present species is distinguished from other species of the genus by the following combination of characters: 1) dorsal shield with 29 pairs of setae in deutonymph and adult; 2) marginal dorsal setae thick and lanceolate in deutonymph and adult; 3) st3, metasternal setae, genital setae, posteroventral setae (pv) of coxae II and III thick and distally rounded (peg-like) in female; 4) st3-5, pv of coxae II and III peg-like in male; 5) st2-3, pv of coxae I and III thick round-headed in deutonymph; 6) 3 pairs of small platelets located posterior of genital shield (female) or sternoventral shield (deutonymph).

The first description and illustration of the protonymph was that for E. ostrinus (Koch) (Karg, 1965). The protonymphs of E. cultratellus and E. ostrinus are similar in the number of dorsal setae and ornamentation of most of the setae, but the protonymph of the present species differs from that of ostrinus as follows (corresponding states of ostrinus, illustrated by Karg, in parentheses): dorsal setae j5 (j4) and j6 (j5) long and pilose (minute simple); most of the dorsal pilose setae long, for example, setae J2 (J1) long and surpassing posterior margin of dorsum (not as long and not surpassing).

Table 1 shows the conditions of various characters in the four postembryonic stages of E. cultratellus. During the process of ontogeny, some noteworthy changes appear. Development from larva to protonymph was accompanied by 1) a decrease in number of dorsal shields, 2) an increase in number of dorsal...
Morphological character | Larva | Protonymph | Deutonymph | Adult
--- | --- | --- | --- | ---
Range of length of idiosoma (µm) | 261-359 | 363-559 | 653-759 | 832-938 (female) 792-898 (male) 685-775 (female) 636-702 (male)
Range of width of idiosoma (µm) | 204-269 | 257-437 | 539-620 | short and lanceolate
Number of dorsal shields | 6 | 2 | 1 | 1
Number of dorsal setae | 18* | 27 | 29 | 29
Form of marginal dorsal setae | long and pilose or simple | long and pilose | short and lanceolate | short and lanceolate
Number of opisthogastric setae | 4 pairs | 4 pairs | 9 or 10 pairs | 9 pairs (female) 10 pairs (male)
Number of macroeupathidia | indistinct | short | well developed | well developed
Shape of peritreme | | | | |
Palpal chaetotaxy of trochanter, femur and genu | 0-4 | 1-4-5 | 2-5-6 | 2-5-6
Number of opisthogastric setae | 1 pair | 3 pairs | 3 pairs | I pair
Number of hypostomal setae | 2 pairs | 3 pairs | 3 pairs | I pair
Number of palpcoxal setae | 0 | 1 pair | 1 pair | 1 pair

*The number of dorsal setae of larva includes S4 and S5, which are inserted on the ventral surface.

**Table 1:** Synoptic list of external morphological characters in each stage of *Eviphis curvatellus* (Berlese).

setae, macroeupathidia, hypostomal setae, palp-trochanter setae and palpcoxal setae, and 3) emergence of a short peritreme. Development from protonymph to deutonymph was accompanied by 1) a decrease in the number of dorsal shields, 2) an increase in the number of dorsal setae, opisthogastric setae and palp-trochanter setae, and 3) acquisition of a well-developed peritreme and lanceolate marginal dorsal setae. Finally, from the deutonymph to the adult, the genital shield (female) or the genital orifice (male) and spermatodactyly of the male develop.

There are two types of deutonymphs, differentiated by the number of opisthogastric setae: one type was characterized by nine and the other by ten pairs of setae. This probably indicates sexual dimorphism, because adult females were found to always have ten pairs, and adult males invariably had nine pairs. If this interpretation is correct, it is the first record of sexual dimorphism of the deutonymph stage in the genus *Eviphis.*

**ACKNOWLEDGEMENTS**

I wish to express my sincere gratitude to Dr Haruo Katakura (Hokkaido University) for his critical reading of the manuscript and for his useful advice. I sincerely thank Professor G. W. Krantz (Oregon State University) and an anonymous reviewer for their valuable comments and correction of my English. I am indebted to Dr M. Castagnoli (Istituto Sperimentale per la Zoologia Agraria) for observations on type material in the Berlese Acarotheca. This study was supported in part by a Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, Science and Culture (No. 06740637).

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