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A NEW SPECIES OF THE GENUS *HOLOSTASPELLA* (ACARI, MACROCHELIDAE) FROM NORTHERN JAPAN

BY Gen TAKAKU *

**HOLOSTASPELLA SCATOPHILA N. SP.**

**ONTOGENY JAPAN**

**ABSTRACT** : A new species of macrochelid mite assignable to the *Holostaspella caelata* species-group is described on the basis of adult female and immature stages associated with the dung beetle, *Copris ochus*. This is the first record of this species-group from Japan, and the first description of immature stages of the *caelata* group.

**INTRODUCTION**

The macrochelid mite genus *Holostaspella* Berlese, originally described as a subgenus of *Holostaspis* Kolenati (Berlese 1904), currently comprises some 30 species. In Japan, this genus has been represented by only three species, namely *H. bifoliata* (Trågårdh) (Ishikawa 1968), *H. moderata* Berlese (Ito 1970) and *H. ornata* (Berlese) (Ishikawa 1980). In this paper, a fourth species which was collected on the dung beetle, *Copris ochus* Motschulsky (Coleoptera, Scarabaeidae) in northern Japan, is described as new to science.

**MATERIALS AND METHODS**

The dung beetle *Copris ochus* is subsocial, and paired beetles bury dung of herbivorous mammals and then prepare some small masses (= 'dung balls') for their larvae. The mites used in the present study were collected from the body surface of adult beetles or from dung balls.

mites were fixed in 70 % alcohol and dissected under a stereoscopic microscope (Krantz 1978).

Each body part was then mounted in gum-chloral fluid. Observations were made with a phase-contrast microscope and a scanning electron microscope, and figures were drawn with the aid of a drawing apparatus. In this paper, dorsal chaetotaxy and terminology of body parts follow Halliday (1987), Evans and Till (1979) and Krantz (1967). The type specimens will be deposited in the collections of the National Science Museum, Tokyo, the Zoological Institute, Faculty of Science, Hokkaido University (ZIHU); C.S.I.R.O., Canberra, Australia; and Oregon State University.

**FAMILY MACROCHELIDAE VITZTHUM, 1930**

(Japanese name: *Haedani-ka*)

**Genus Holostaspella Berlese, 1903**

(Japanese name: *Kuchinagahaedani-zoku*)

*Holostaspis* (*Holostaspella*) *Berlese, 1904 : 241.*

*Holostaspella Berlese 1910 : 248 (without definition of the genus).*

*Division of Biological Sciences, Graduate School of Science, Hokkaido University, Sapporo, 060, Japan.

**FIG. 1-4**: *Holostaspella scatophila* sp. nov., female (holotype).

1. — Dorsum. 2. — Dorsal setae Z₃. 3. — Venter. 4. — Peritreme and peritrematic shield.

**Holostaspella scatophila** sp. nov.

(Japanese name: *Daikoku-kuchinagahaedani*, new)

**FEMALE** (HOLOTYPE, ZIHU-960):

Length of dorsal shield, 548 μm; width at level of seta s₆, 321 μm. Body surface yellowish-brown and partly soiled.
Dorsum (Fig. 1, 2) : Dorsal shield (Fig. 1) oval, entirely covering idiosoma. Slight transverse line posterior to setae \( j_2 \). Most of the dorsal shield from the level of setae \( j_3 \) to posterior margin of the shield ornamented with sculptured ridges. Center of the shield smooth; longitudinal band along setae of the \( j-j \) series broadly and irregularly sculptured by many rounded ridges; lateral margin of the shield ornamented with punctures. Dorsal shield bearing 28 pairs of setae and 18 pairs of pores; setae \( j_1 \) on anterior projection expanded and bipectinate; setae \( z_1 \) very short and smooth; setae \( j_4 \) short and smooth; setae of dorsal hexagon (\( j_5, j_6 \) and \( z_5 \)) simple, and shorter than surrounding setae; setae \( z_6 \) slightly bipectinate, longer and thicker than the setae of dorsal hexagon; setae \( j_2 \) slightly, and \( j_5 \) entirely bipectinate. Other dorsal setae thick and bipectinate, as setae \( z_3 \) (Fig. 2); \( Z \) and \( S \) series setae long, but not reaching insertions of the setae behind them.

Venter (Fig. 3, 4) : Tritosternum well developed. Sternal shield longer than wide (122 \( \mu \)m long, 102 \( \mu \)m wide at level of coxa II), with three pairs of smooth short setae and two pairs of small pores; anterior margin of the shield with a row of pits; surface of the shield strongly sculptured; \( \text{linea angulata (l. ang.) and linea oblique anteriores (l. o. a.) distinct; l. ang. strongly convergent medially, forming anterocentral ridge; each exterior side of the ridge and each side of l. o. a. sculptured; the sculpture weak at posterior region of the ridge. Arched posterior area produced by linea oblique posteriores (l. o. p.) strongly sculptured except for somewhat weakly punctured medial region.}

Metasternal shields elongate, each with a pore at anterior edge and a smooth short seta posteriorly. Endopodal shield weakly sculptured. Epigynial shield slightly punctate, with a pair of smooth short setae mediolaterally, a pair of sclerites laterally, and a pair of pores at posterolateral sides.

Ventrianal shield oblong (173 \( \mu \)m long, 116 \( \mu \)m wide), bearing three pairs of preanal setae, a pair of paranal setae and a postanal seta; all the setae smooth and short except postanal seta, which is bipectinate distally; anterior, lateral and central region of the shield sculptured; cribrum broad, located posterior to postanal seta. Opisthogaster with two pairs of postcoxal pores, a pair of long metapodal shields and ten pairs of bipectinate setae.

Peritreme (Fig. 4) curved terminally; peritrematic shield not fused with exopodal shield.

Gnathosoma (Fig. 5-7) : well developed; hypostomal groove (Fig. 5) with five rows of deutosternal teeth, and each row with 14-25 teeth; three pairs of hypostomal setae and a pair of deutosternal setae present; all setae smooth and long; palpal chaetotaxy of trochanter, femur and genu 2-5-6; claws on palpal tarsus with three distinct tines. Tectum (Fig. 6) apparently trifid; lateral processes broaden distally, with their base irregularly serrate; central element bifurcated distally and with many spicules. Fixed digit of chelicera (Fig. 7) with a medial large tooth, a very small tooth, a distal \( \text{pilus dentilis} \) and a thin dorsal seta ; movable digit with a large tooth medially; arthrodial processes strongly pilose and not surpassing the tip of movable digit.

Legs (Fig. 8, 9) : Tarsus I without ambulacrum; tarsi II to IV with well-developed ambulacra. Segments of each leg with bipectinate setae, except coxa, trochanter, tibia, tarsus I and coxa IV, which have only simple setae. Genu IV with six setae, all setae bipectinate except simple anteroventral seta. Femur II with two protuberances laterally and ventrally (Fig. 8); some insertions of dorsal setae on femur, genu and tibia II raised (Fig. 9). Tarsi II to IV with spinose setae, particularly thick setae on terminal point of tarsus II (Fig. 9).

Leg chaetotaxy as follows (trochanter; femur; genu; tibia).

\[
\begin{align*}
\text{Leg I} & : 1,1/2,0/1,0; 2,3/1,2/3,2; 2,3/1,2/1,2; 2,3/2,2/1,2. \\
\text{Leg II} & : 1,0/1,0/2,1; 2,3/1,2/2,1; 2,3/1,2/1,2; 2,2/1,2/1,2. \\
\text{Leg III} & : 1,0/2,0/1,1; 1,2/1,1/0,1; 1,2/1,2/0,1; 1,1/1,2/1,1. \\
\text{Leg IV} & : 1,1/2,0/1,0; 1,2/1,1/0,1; 1,2/1,2/0,0; 1,1/1,2/1,1. \\
\end{align*}
\]

Leg length (except ambulacrum) : Leg I, 336 \( \mu \); leg II, 380 \( \mu \); leg III, 323 \( \mu \); leg IV, 427 \( \mu \).

Michael's organ (Fig. 10) : Each membranous sacculus connected broadly; surface of cornu sclerotized; spermatheca indistinct.
FIG. 5-10: Holostaspella scatophila sp. nov., female (holotype).
DEUTONYMPH (PARATYPE, ZIHU-961):

Length of dorsal shield, 396 \( \mu \text{m} \); width at level of seta \( r3 \), 234 \( \mu \text{m} \). Living animal white in color, probably due to gut contents.

Dorsum (Fig. 11): Holodorsal shield (Fig. 11) narrowed anteriorly, ornamented with irregular reticulations, a little weaker in the center of dorsal hexagon; curved distinct ridges posterior to setae \( Z2 \); insertions of dorsal marginal setae raised and lateral margin uneven; anterior projection indistinct. Dorsal shield bearing 28 pairs of setae; \( j1 \) short and strongly bipectinate; \( z1 \) smooth and longer than \( j1 \); setae \( j6 \) and \( z5 \) weakly bipectinate and shorter than surrounding setae; \( J5 \) short and entirely bipectinate; other dorsal setae strongly bipectinate; marginal setae long, but most not reaching insertions of setae behind in same series. Setae on surrounding integument short, fine and bipectinate.

Venter (Fig. 12): Tritosternum well developed; laciniae finely pilose. Intercoxal shield oblong (179 \( \mu \text{m} \) long, 100 \( \mu \text{m} \) wide at level of pore 2), slightly concave at anteromedial margin and convex posteriorly; the shield ornamented with weak irregular reticulations, and smooth in the central region; with four pairs of smooth setae and three pairs of pores. Integument between the intercoxal shield and anal shield with four pairs of smooth setae. Anal shield somewhat hexagonal and longer than wide (81 \( \mu \text{m} \) long, 63 \( \mu \text{m} \) wide), with a pair of smooth paranal setae, a bipectinate postanal seta and a pair of small pores at posterolateral margin of the shield; lateral sides of anus and posterior region of the postanal seta with broad cribrum. Many bipectinate setae on integument surrounding anal shield.

Stigmata located laterad of coxae IV; peritremes sinuous, thin, bent posteriorly and connected to stigmata terminally.

Gnathosoma (Fig. 13-15): Weak and not sclerotized. Hypostomal groove slight and with five dentate rows of deutosternal teeth; each row with 13-24 teeth; three pairs of hypostomal and a pair of deutosternal setae smooth; palpal chaetotaxy of trochanter, femur and genu 2-5-6. Tectum (Fig. 14) without lateral processes, central process bifurcated distally, bifurcated portion with some spicules, and base of the process serrate. Fixed digit of chelicera (Fig. 15) with a tooth medially, a small tooth and a \( pilus dentilis \) distally, and a slightly serrate dorsal seta; movable digit with two small teeth medially; arthrodidal processes strongly pilose.

Legs (Fig. 16): Tarsi II to IV with ambulacra. Segments of each leg with some bipectinate setae, except coxa and trochanter I, which have only smooth setae. Genu IV with six strongly bipectinate setae. Femur II (Fig. 16) with a small protuberance ventrally; on femur and genu II, some insertions of setae raised. Tarsi II to IV with thick, spinose setae. Leg chaetotaxy of deutonymph as in adult female.

Leg length (except ambulacrum): Leg I, 306 \( \mu \text{m} \); leg II, 292 \( \mu \text{m} \); leg III, 243 \( \mu \text{m} \); leg IV, 348 \( \mu \text{m} \).

PROTONYMPH (PARATYPE, ZIHU-962):

Length of idiosoma, 320 \( \mu \text{m} \); width of idiosoma at level of seta \( s3 \), 200 \( \mu \text{m} \). Length of podonotal shield, 193 \( \mu \text{m} \); width of podonotal shield at level of seta \( s4 \), 190 \( \mu \text{m} \). Length of opisthonotal shield, 125 \( \mu \text{m} \); width of opisthonotal shield at level of setae \( Z1 \), 118 \( \mu \text{m} \). Living animal white in color like deutonymph.

Dorsum (Fig. 17): Dorsal shield (Fig. 17) divided medially and weakly ornamented with irregular reticulations. Podonotal shield narrowed anteriorly, but without anterior projection as adult female; the shield with 11 pairs of setae; setae \( j1 \) very short and entirely bipectinate; setae of dorsal hexagon slightly bipectinate; other podonotal setae strongly bipectinate.

Opisthonotal shield narrower than podonotal shield and narrowed posteriorly; antero-central margin of the shield somewhat concave and posterior margin irregularly convex; distinctive sclerotized ridge posterior to setae \( Z4 \); shield ornamented with weak and irregular reticulations, and bearing eight pairs of strongly bipectinate setae. Dorsal integument with six pairs of strongly bipectinate setae.

Venter (Fig. 18): Tritosternum well developed. Intercoxal shield located from anterior level of coxae II to posterior level of coxae III, weakly defined, convex posteriorly and longer than wide (140 \( \mu \text{m} \) long, 90 \( \mu \text{m} \) wide at level of pore 2); with
three pairs of setae, two pairs of pores, and without ornamentation or reticulation. All setae smooth and long.

Integument between intercoxal shield and anal shield bearing three pairs of smooth setae. Anal shield circular and somewhat longer than wide (49 μm long, 38 μm wide); shield with a pair of smooth paranal setae and a distally bipectinate postanal seta; anus located centrally; postero-lateral margin ornamented with cribrum. Two pairs of bipectinate short setae located on lateral integument of anal shield.

Peritreme faint, bent at posterior point and connected to stigma at a position lateral to coxae IV.

Gnathosoma (Fig. 19-21) : weak and not sclerotized; hypostomal groove slight, but with five distinct rows of deutosternal teeth, and each row with 12-23 teeth; three pairs of hypostomal setae and a pair of deutosternal smooth setae; palpal chaetotaxy normal for protonymphs of the family, namely chaetotaxy of palptrochanter, femur, genu 1-4-5; palpal claws with three tines. Lateral processes of tectum (Fig. 20) absent; central process bifurcated distally and bifurcated region with a few spicules; base of tectum serrate. Fixed digit of chelicera (Fig. 21) with a small tooth medially, a somewhat broad tooth, a short pilus dentilis distally and a dorsal seta; movable digit with two small teeth.

Legs : Tarsi II to IV with ambulacra. Segments of each leg with some bipectinate setae, except...
FIG. 17-21: Holostaspella scatophila sp. nov., protonymph (paratype).  

coxa I to IV, trochanter I and III, and tarsus I, which have only smooth setae. Genu IV with five setae, all bipectinate. Femur II without protubercane. Tarsi II to IV with fifteen spinose setae.

Leg chaetotaxy as follows (trochanter; femur; genu; tibia).

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

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

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

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

Leg length (except ambulacrum): Leg I, 237 μm; leg II, 214 μm; leg III, 173 μm; leg IV, 290 μm.

Male and larva: Not collected.

Type-series: Holotype: Female, Hokkaido Agriculture Experimental Station, Sapporo, Hokkaido, Japan, August 1988, ex Copris ochus, T. HAMATSU and G. TAKAKU leg. Paratypes: 5 females, same data as the holotype; 1 female, 7 August 1990, S. SAITO and G. TAKAKU leg., other data same as the holotype; 3 females, 1 deutonymph and 2 protonymphs, locality as above, 7 August 1990, ex cattle dung balls produced by pairs of Copris ochus, G. TAKAKU leg.

Habitat: H. scatophila was collected from the
body surface of adults of scarabaeid dung beetle *Copris ochus* Motschulsky, and from buried dung balls produced as food for broods by the adult beetles.

Distribution: *H. scatophila* has been recorded only from the type locality.

**Other specimens**

Female: In addition to the holotype, nine specimens were examined. Dorsal setae *j1* are always bipectinate; setae *z1* minute and smooth; setae *j4* smooth or slightly bipectinate; setae of dorsal hexagon always smooth and shorter than surrounding dorsal setae; setae *z6* thicker than dorsal hexagonal setae and slightly bipectinate; setae *j2* smooth or slightly serrate and setae *j5* always serrate entirely; other dorsal setae thick, strongly bipectinate as in holotype female; dorsal marginal setae long, but most not reaching insertions of setae behind in the same series.

Femur II may have one or two protuberances and some ridges of insertions on femur, genu and tibia. Other character states are similar to holotype.

Measurements (n = 10): Dorsal shield: Length, 548-629 μm (̄x = 584.8 ± 26.4 μm) width, 313-355 μm (̄x = 335.7 ± 13.4 μm). Sternal shield: Length, 118-129 μm (̄x = 123.1 ± 3.9 μm); width, 101-112 μm (̄x = 107.2 ± 3.1 μm). Metasternal shield: Length, 26-35 μm (̄x = 29.2 ± 2.9 μm); width, 9-14 μm (̄x = 11.3 ± 1.4 μm). Ventrianal shield: Length, 171-208 μm (̄x = 189.1 ± 12.8 μm); width, 116-141 μm (̄x = 127.9 ± 8.3 μm).

Protonymph: In addition to the paratype, only one specimen was examined. This specimen is similar to the paratype protonymph, but the hypostomal groove has only four rows of deutosternal teeth, rather than five.

**Remarks**

*H. scatophila* can be assigned to the *H. caelata* species group, as it shares the following characters with the known species of the group: 1) dorsal shield ornamented with heavily sculptured ridges; 2) sternal shield with anterocentral ridge formed by *l. ang.*; 3) metasternal shield oval and free from surrounding sclerites; 4) ventrianal shield with three pairs of preanal setae, longer than wide and ornamented with sculpture. This is the first record of the *caelata* group from Japan.

*H. scatophila* has distinctively sculptured ornamentation (= *crista posterior erecta* (c. p. e.)) on the sternal shield. This character state distinguishes it from the other species, except for *H. orientalis* Roy, which also has a distinct c. p. e. (ROY 1989). Perhaps *H. orientalis* collected in India is the most closely related species to *H. scatophila*. In addition to the sternal shield with distinctive c. p. e., these two species share the following features: 1) dorsal shield ornamented with strongly sclerotized ridges; 2) ventrianal shield much longer than wide and strongly punctate. However, most of the dorsal z-Z and r-S series setae of *H. scatophila* are distinctly bipectinate, while most of these setae are apparently smooth in *H. orientalis*.

*H. scatophila* is very similar to two species of the *caelata* species group, i.e. *H. caelata* Berlese and *H. foai* Berlese, in the ornamentation of dorsal shield and the condition of dorsal setae. It may be distinguished from these two species by the following character states: most of the dorsal marginal setae strongly bipectinate and long, but not reaching insertions of setae behind them; ornamentation of sternal shield and c. p. e. distinct; ventrianal shield much longer than wide (Table 1).

<table>
<thead>
<tr>
<th></th>
<th>Dorsal Shield</th>
<th>Ventrianal Shield</th>
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<tbody>
<tr>
<td></td>
<td>Length (μm)</td>
<td>Width (μm)</td>
</tr>
<tr>
<td><em>H. caelata</em></td>
<td>598 ± 14.22</td>
<td>368 ± 16.88</td>
</tr>
<tr>
<td>Berlese, 1910</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>H. foai</em></td>
<td>381 ± 30.56</td>
<td>353 ± 22.57</td>
</tr>
<tr>
<td>Berlese, 1910</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>H. scatophila</em></td>
<td>584.8 ± 26.4</td>
<td>335.7 ± 13.4</td>
</tr>
<tr>
<td>Takaku, sp. nov.</td>
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</table>

Table 1: Measurements (mean ± S.D.) of *H. scatophila* sp. nov. (female) and closely related species (female) of *H. caelata* species-group (measurements of *H. caelata* and *H. foai* are cited from FILIPPONI and PIRAZZANO 1967).

There are only a few descriptions of immature stages of the genus *Holostaspella*, i.e. larva, proto-
nymph and deutonymph of *H. bifoliata* (Tragärdh) (KRANTZ 1967) and protonymph of *H. pentalineatus* Krauss 1970). The deutonymph of the present species differs from that of *bifoliata* as follows (corresponding conditions of *bifoliata* in parentheses): Holodorsal shield not incised laterally (incised laterally); dorsal setae $zl$ smooth (spinose-plumose); ventral surface with weakly sclerotized plates (un sclerotized, except for a series of four small, sclerotized, median platelets); lateral elements of tectum absent (lateral elements of tectum well separated from central element). The protonymph of *H. scatophila* virtually identical with that of *bifoliata*, and I could not discriminate between the protonymphs of the two species. The protonymph of *scatophila* differs from that of *pentalineatus* in that all the setae on the dorsal shield are plumose. The dorsal shield of the protonymph of *pentalineatus* has some pairs of smooth setae.

All of the known members of the *caelata* species group have been collected on scarabaeid dung beetles of the genera *Copris* and *Heliocopris* (Table 2). Adults and immature stages of *scatophila* have been collected only on and around *Copris ochus*. Since the mites have been found not only on the body surface of the beetle, but also on the dung balls buried by the beetles, the association between the mites and the beetles might be more than mere phoresy. Until now, however, no detailed study has been made of this association.

<table>
<thead>
<tr>
<th>Species of <em>H. caelata</em> group</th>
<th>Localities</th>
<th>Host Species</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>H. caelata</em> Berlese, 1910</td>
<td>South Africa</td>
<td><em>Copris hamadryas</em></td>
</tr>
<tr>
<td><em>H. foai</em> Berlese, 1910</td>
<td>Java</td>
<td><em>Copris</em> sp.</td>
</tr>
<tr>
<td><em>H. orientalis</em> Roy, 1989</td>
<td>Thailand</td>
<td><em>Heliocopris bucephalus</em></td>
</tr>
<tr>
<td><em>H. similis</em> Krantz, 1967</td>
<td>India</td>
<td><em>Heliocopris bucephalus</em></td>
</tr>
<tr>
<td><em>H. scatophila</em> Takaku, sp. nov.</td>
<td>South Africa</td>
<td><em>Heliocopris faunus</em></td>
</tr>
<tr>
<td><em>H. stenaspis</em> Krantz, 1967</td>
<td>Philippines</td>
<td><em>Heliocopris gigas</em></td>
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<tr>
<td><em>H. similis</em> Krantz, 1967</td>
<td></td>
<td><em>Heliocopris faunus</em></td>
</tr>
<tr>
<td><em>H. similis</em> Roy, 1989</td>
<td></td>
<td><em>Heliocopris gigas</em></td>
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TABLE 2 : Localities and host of the known members of the *H. caelata* species-group (data cited from BERLESE 1910, KRANTZ 1967 and ROY 1989).

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