Chapter VII

DESCRIPTION OF SPECIES

Superfamily : Mesoplophoroidea Van der Hammen, 1959.

Sensillus setiform with unilateal short branches of varying number. Aspis with 4 pairs of smooth or finely ciliate setae. Notogaster convex with 8 pairs of smooth or pectinate setae. Ventral plate with 9-10 pairs of setae. Genital plate with 6 pairs of setae and anal plate with 4 pairs (rarely 3 pairs) of setae. Anal and genital openings round, separated from each other by a wide bridge.

*Apoplophora pantotrema* (Berlese, 1913)

(Plate-4, Figs.1-7)

**Colour** : Dark brown  
**Measurements** : Length of Aspis : 210-252 \( \mu \)m  
Width of Aspis : 140-182 \( \mu \)m  
Length of Notogaster : 280-378 \( \mu \)m  
Width of Notogaster : 182-252 \( \mu \)m

**Dorsal Region** (Figs.1-2)

Prodorsum triangular with a pointed rostrum with its tip turned downwards. Seta *ro* 82 \( \mu \)m long, thick, inserted far behind the rostral
apex. Seta _le_ resembles _ro_ in length and appearance while _in_ short, 41 µm long and thicker than _ro_ and _le_. Seta _ex_ short, measuring 37 µm. Sensillus setaceous and barbed unilaterally, the basal barbs short which progressively increase towards the apex. Bothridial opening circular. All prodorsal setae unilaterally barbed. Prodorsal integument porose.

Notogaster convex with 8 pairs of unilaterally barbed setae. Setal length increases towards posterior region. Notogaster ornamented with foveoles, arranged in a reticulate and often irregular pattern.

**Ventral Region** (Figs. 3-7)

Infracapitulum (Fig.3) with 3 pairs of smooth setae. Rutella with 3-4 well developed dendites. Epimeral setal formula 2-1-2-2, (Fig.4) all setae smooth. Epimeral surface porose. Genital plates (Figs. 5 & 7) triangular with 6 pairs of smooth setae, 3 of which arranged vertically, one below the other, while the other 3 setae arranged linearly in a longitudinal row. Four anal setae (Fig. 6 & 7) present on each anal plate, all barbed unilaterally.

**Legs**

All legs monodactylous.

**Materials Examined**

Twelve specimens recovered from soil samples collected from the Botanical garden (Site-4a) of the Calicut University Campus, Kerala, India, collected by Shiji. M.T on 10-09-2002.
Remarks

The present specimen shows close resemblance to *A. pantotrema* (Berlese 1913) described from Java, except in the size of notogastral and anal setae and possession of epimeral setal formula of 2-1-2-2.

**Superfamily: Phthiracoidea Perty, 1841**

**Family: Phthiracaridae Perty, 1841**

**Genus: Hoplophthiracarus Jacot, 1933**

Body surface usually covered with concavities. Dorsal region of prodorsum not fused with lateral region. Furrows usually present on back of prodorsum. Lamellar setae usually very short. Sensillus usually ‘histicinus’ type. Seta $c_1$ on the notogaster shorter than the distance between setae $c_1$ and $d_1$. Nine pairs of genital setae present. Adanal setae inserted away from the paraxial margin and seta $ad_1$ longer than the anal setae. All setae on the ano-adanal plate normal.

*Hoplophthiracarus pakistanensis* Hammer, 1977

(Plate- 5, Figs.1-7)

Colour : Brown

Measurement : Length of Aspis : 196-238μm

Width of Aspis : 168 -182μm

Length of Notogaster : 392-462μm

Width of Notogaster : 366-399μm
**Dorsal Region** (Fig. 1 & 2)

Dorsal and lateral regions of aspis long and narrow, lateral carina reaches the sinus. Well marked furrows present on the back of aspis (Fig.2). Sensillus long with narrow pedicel and a distal club, the latter with a hyaline membrane. Seta ro thick and rough with pointed tip. Seta le short and thick. Seta in robust, serrated.

Notogaster with 15 pairs of normal, robust setae covered with spines. Seta c3 inserted near the anterior margin, c1 further away and c2 far away. Notogastral integument porose.

**Ventral Region**

Gnathosomal setae (Fig.3) 3 pairs, all roughened, a the longest. Gnathosomal region ornamented with foveoles. Chelicerae (Fig.4) well developed with 2-3 teeth on the fixed digit and 3-4 teeth on the movable digit. Epimeral setal formula 1-1-1-1. All setae smooth. Genital setae 6 (4+2): 3, all setae smooth (Fig.5). Ano-adanal plate with thick punctations laterally. Anal setae 2 pairs and of smooth nature (Fig.6). Adanal setae 3 pairs, all of which roughened, seta ad2 longest. Seta ad3 shortest.

**Legs**

All legs monodactylous. Chaetotaxy of leg I (Fig. 7): 1-4-4-5-17.

**Materials Examined**

Fifteen specimens collected from soil and litter samples of Botanical Garden (Site 4a), Calicut University Campus, Kerala, India collected by Shiji. M. T. on 02-06-2003.
Remarks

The present specimen resembles *Hoplophiracarus pakistanensis* (Hammer, 1977) collected from Pakistan in all characters except in the nature of rostral and anal setae.

**Superfamily : Phthiracoidea Perty, 1841**

**Family : Phthiracaridae Perty, 1841**

**Genus : Atropacarus Ewing, 1917**

**Subgenus : Hoplophorella Niedbala, 1986**

Fifteen pairs of gastronotic setae present. As a general rule, only 2 lyrifissures present, *ia* and *im*. Members possess 9 pairs of genital setae and 5 pairs of setae on the fused ano-adanal plate. Seta *ad* \(_2\) inserted slightly away from the paraxial margin.

*Atropacarus (Hoplophorella) sensillatus* sp. nov.

(Plate-6, Figs.1-8)

**Colour** : Pale yellow

**Measurements:** Length of Aspis: 238 \(\mu\)m (210-238 \(\mu\)m)  
Width of Aspis: 154 \(\mu\)m (140-154 \(\mu\)m)  
Length of Notogaster: 434 \(\mu\)m (420-434 \(\mu\)m)  
Width of Notogaster: 308 \(\mu\)m (294-322 \(\mu\)m)
Dorsal Region (Fig. 1 & 2)

Prodorsum

Aspis (Fig. 2) bifurcate in nature with deep incision. Seta ro thick, curved inwards. Seta le short and spiniform. Seta in lanceolate and veined. Sensillus long with a short pedicel, inflated in the middle. Head of ss hyaline with irregular margin and with distinct midrib.

Notogaster

Notogaster with 15 pairs of clubbed and roughened setae (Fig. 3). Posteriorily, notogaster produced into a caudal appendage. Notogastral integument heavily porose.

Ventral Region

Infracapitulum (Fig. 4) with 3 pairs of thin, smooth setae, h shortest and a and m more or less equal. Infracapitulum porose. Chelicerae (Fig.5) with 3-4 well developed teeth and setae cha and chb almost equal in size. Rutella with broad well developed dendites. Epimeral setal formula 1-0-1-1 (Fig.6). Seta 1a much longer and thicker than the other setae, setae 1a and 3a roughened. Genital plate porose with foveoles. Genital setal formula 7 (4+3) : 2 (Fig. 7). Ano-adanal plate with 2 pairs of smooth anal setae and 3 pairs of adanal setae. Seta ad2 foliate with spines, seta ad3 shortest.

Legs (Fig. 7)

All legs monodactylous. Chaetotaxy of leg I (Fig. 8):1-4-4-6-18. Trochanter I with a single, thin seta. Genu I with 2 solenidia σ1 and σ2.
Seta $d$ closely associated with $\sigma_1$. Setae $xt_1$ and $xt_2$ on tibia I barbed. Setae ($tc$) thick, barbed and with curved tip. Seta $s$ smooth. Setae ($u$) and $pv'$ barbed.

**Materials Examined**

Holotype ♀: Paratypes; 17 ♀♀ collected from soil and litter samples from site 3a at Ayanikkad, Calicut (Dt), Kerala, India, collected by Shiji. M.T on 21-10-2002.

**Remarks**

The subgenus *Atropacarus* (*Hoplophorella*) was erected by Niedbala (1986) based on the type species, *A. (Hoplophorella) cucullatum*. The present specimen in comparison with 23 known species of the subgenus revealed some resemblance to *A. (H.) floridae* described by Jacot (1933) and *A. (H.) scapellata* described by Aoki (1965) in various characters. But it possesses some character deviations from the above 2 species and hence is assigned to a new taxon. It differs from *A. (H.) floridae* by the nature of notogastral setae and lanceolate nature of interlamellar setae. The present species differs from the *A. (H.) scapellata* by the possession of 7(4+3) : 2: arrangement of genital setae and nature of notogastral setae.

The unique features of the species are as follows:

1. Clubbed and roughened notogastral setae.
2. 7 (4+3): 2 arrangement of genital setae
Superfamily: Hypochthonoidea Balogh, 1961
Family: Hypochthoniidae Berlese, 1910
Genus: Eohypochthonius Jacot, 1938

Fourteen pairs of notogastral setae present. Seta $e_1$ and $e_2$ reduced and represented only by their alveoli. Shoulder without humeral tubercles.

Eohypochthonius payyoliensis sp. nov.

(Plate-7, Figs. 1-5)

Colour : Yellowish brown
Measurements: Length: 296$\mu$m (Range 288-300$\mu$m)
Width : 124$\mu$m (Range 124-128$\mu$m)

Dorsal Region (Figs. 1 & 2)

Prodorsum

Rostral tectum with 3 teeth, 2 placed close together and one far anterior. Seta $ro$ 40$\mu$m long, forwardly directed, situated far beyond the rostral margin, foliate, smooth and straight. Seta $le$ 40$\mu$m, long resembles $ro$ in appearance, but directed backwards. Seta $in$ measures 24$\mu$m, foliate, arising more or less at the level of $bo$. Both setae $exa$ and $exp$ foliate, $exp$ minute in appearance. Sensillus ($ss$) (Fig. 2) pectinate with 10 branches on one side and 5 on the other side. Lateral crests present and directed forwards. Median crests arise from the median region of prodorsal band, which diverge anteriorly and meet the insertion of $le$. Several downwardly
directed branches connected together forming a network present on the prodorsum in between prodorsal band and dorsosejugal suture. Posterolateral walls of the prodorsum produced into shoulder like downward outgrowth, one on each side. Prodorsal integument bears fine punctation.

**Notogaster**

Notogaster elongate and cylindrical. A prominent transverse furrow present on the notogaster medially. Another furrow present anteriorly, above setae $c_1-c_3$, below dorsosejugal suture. Sixteen pairs of foliate notogastral setae of varying size present on notogaster. Setae $e_1$ and $e_2$ represented only by alveoli and seen in the notogastral furrow. Posteriormost setae flexed ventrad. Notogastral integument finely punctate.

**Ventral Region (Fig.3)**

Infracapitular setae 4 pairs $a$, $m_1$, $m_2$ and $h$, all thin, simple and smooth. Seta $a$ longer than $m$ and $h$. Chelicerae (Fig.4) with 3-4 sharp teeth on each digit. Seta $cha$ minute. Seta $chb$ long, thin and smooth. Epimeral setal formula 3-1-3-4. All setae thin, smooth and of varying size. Setae $1a$, $2a$, $3a$ and $4a$ longer than others.

Anogenital setae thin and simple. Genital plates with transverse suture, almost medially. Each plate carries 10 setae, 5 on anterior and 5 on posterior halves. Two anal and 3 adanal setae present. The length of adanal setae increases posteriorly. Whole ventral plate bears punctations.
Legs

All legs monodactylous with a stout claw. Leg segments bear punctations arranged in a zigzag manner. Chaetotaxy of leg I (Fig. 5) 0-5-5-5-20. Femur I carries 5 thin setae. Genu I carries single solenidion $\sigma$. Tibia I bears 2 solenidia, $\varphi_1$ and $\varphi_2$ along with 3 other setae. Tarsus I carries 20 setae including 2 solenidia $\omega_1$ and $\omega_2$; of which $\omega_1$ stout and blunt. A famulus ($\varepsilon$) seen in between $\omega_1$ and $\omega_2$.

Materials Examined

Holotype: ♀, Paratypes; 25♀♀ collected from soil and litter samples from site, 3b at Ayanikkad, Calicut district, Kerala, India, collected by Shiji. M. T. on 15-09-2003.

Remarks

The genus *Eohypochthonius* was erected by Jacot (1936) based on the type species, *E. gracilis* from North Carolina, USA. The present new species can be easily separated from *E. gracilis* by the possession of a shoulder like lateral downward outgrowth from the postero lateral side of prodorsum. By the absence of translamellar line, highly reduced setae $e_1$ and $e_2$ represented by alveoli, nature of lateral crest, presence of median crest, presence of cilia like structures forming a network between dorsosejugal suture and prodorsal band, the present species can be clearly distinguished from *E. crassisetiger* Aoki, 1959 and the nature of notogastral and prodorsal ornamentation of the present new species enables its separation from *E. gracilis gracilis*, Jacot, *E. africanus*, Mahunka, 1978, *E. (Eohypochthonicus)*

The unique characters of the present species are listed below:

1. Shoulder like lateral outgrowth from the postero-lateral wall of prodorsum.
2. Presence of cilia like structures forming a network between dorsosejugal suture and prodorsal band.
3. Presence of median crest.
4. Punctated nature of prodorsal and notogastral integument.

**Superfamily : Hypochthonoidea** Balogh, 1961

**Family : Hypochthoniidae** Berlese, 1910

**Genus : Malacoangelia** Berlese, 1913

Sixteen pairs of notogastral setae. Setae $e_1$ and $e_2$ placed on intercalary sclerite of transverse suture, smaller than the remaining setae. Notogastral setae slightly dilated like a blade. A lenticulus present, behind seta $c_1$.

**Malacoangelia hygricola** sp. nov.

(Plate-8, Figs. 1-4)

**Colour** : Light brown

**Measurements** : Length : 432 μm (Range 420-436 μm)

**Width** : 292 μm (Range 290–294 μm)
Dorsal Region (Fig. 1)

Prodorsum

Rostrum flat with horn like projections laterally. Seta $ro$ situated marginally, leaf like with distinct veins. Seta $le$ with distinct unbranched midrib. Seta $in$ foliate, curved upwards and inserted near $bo$. Seta $exp$ simple, thinner and shorter than other prodorsal setae while $exa$ foliate. Seta $ss$ unilaterally barbed and bifurcated at its tip. Distinct median and lateral ridges present on prodorsum as shown in Fig. 1. Prodorsal integument ornamented with short spine like outgrowths.

Notogaster

Notogaster transparent, broad and ornamented with spine like structures. Sixteen pairs of notogastral setae present, all foliate with distinct midrib except $e_1$ and $e_2$. The latter two setae comparatively small and inserted on the transverse ridge. Lenticulus with double layered outer wall and characteristic striations. An anterior ridge runs above the level of lenticulus on notogaster. Lateral ridges present on notogaster, below the transverse ridge. Posteriormost notogastral setae with ‘T’ shaped midrib and hyaline body.

Ventral Region (Fig. 2 & 4)

Infracapitulum (Fig. 4) bears 4 pairs of thin and smooth setae, $a$, $m_1$, $m_2$, and $h$. Epimeral setal formula 3-1-3-4. All setae short, thin and smooth. Ano-genital plate longer than wide. Each genital plate carries 10 setae, 4 long setae inserted in antiaxial row and 6 small setae in paraxial row, all
setae simple and thin. Ano-adanal plate carries 2 pairs of thin and smooth anal setae and 3 pairs of smooth, adanal setae. Seta $ad_2$ longer than $ad_1$ and $ad_3$. Ventral plate ornamented with spiny configuration.

**Legs**

(Fig. 3)

All legs monodactyloous. Chaetotaxy of leg I (Fig.4) 0-6-4-5-21. Setae $d$, $bv$, $v$’’ and $l$’ on femur I foliate with distinct midrib. Genu I with a single, small solenidion $\sigma$, all other setae foliate. Tibia I bears 2 solenidia $\varphi_1$ and $\varphi_2$. $\varphi_1$ thick and short. $\varphi_2$ thin and elongate. Setae $xt_1$ and $xt_2$ foliate. Solenidia $\omega_1$ and $\omega_2$ present on tarsus I in addition to 18 other setae and a famulus. $\omega_1$ thick with a blunt tip. Famulus ($\xi$) present, near $\omega_3$. Setae ($u$), $m$’’ and $n$’ faintly barbed. All leg segments bear reticulations.

**Materials Examined**

Holotype ♀: Paratypes 17♀♀ collected from soil samples of site 3b at Ayanikkad, Calicut (Dt.), Kerala, India, collected by Shiji M. T. on 06.09.2003.

**Remarks**

Berlese (1913) erected the genus *Malacoangelia* with *M. remigera* as type species based on the presence of 16 pairs of notogastral setae, $e_1$ and $e_2$ on intercalary sclerite of the transverse suture and smaller than the remaining ones, ‘T’ shaped rostral setae and a transverse lenticulus behind seta $c_1$. Chakrabarti et al. (1972) erected *M. remigera indica* as a subspecies from West Bengal, India. Another species viz., *M. similis* was also reported
from India by Sarkar and Subias (1972). The present species can be easily distinguished from the type species by the possession of median and lateral ridges, nature of lenticulus, prodorsal hairs and sensillus, horn like projections on the prodorsum and incomplete antero lateral ridges on the notogaster. The new species differs from *M. remigera indica*, by the presence of median and lateral ridges on the prodorsum, the bifurcated nature of sensillus and the nature of rostral setae. The present species can be easily separated from the *M. similis* by the unilaterally barbed nature of sensillus, prodorsal and notogastral ornamentation and nature of *le, ro and lenticulus*.

The unique characters of the species include the double walled nature of lenticulus, nature of median ridge on prodorsum and nature of sensillus.

**Superfamily:** Cosmochthonoidea Grandjean, 1947  
**Family:** Comochthoniidae Grandjean, 1947  
**Genus:** Cosmochthonius Berlese, 1910

**Generic Diagnosis**

Notogaster subdivided by three transverse sutures into 4 shields. Seta c arising on shield *Na*, seta d on shield *Nm*, seta e in furrow 2, seta f in furrow 3, setae h and ps on shield *PY*. Prodorsal setae as well as setae h and ps short or medium long, densely (pencillately) ciliate or plumose. Setae c and d simpler, though still densely ciliate. Setae e and f very long and
usually rigid. Sixteen pairs of notogastral setae present, seta *ps* shifted to ventral side. Ten pairs of genital, four pairs of anal and four pairs of adanal setae present. Epimeral setal formula 3-2-3-4 claw formula of legs 2-3-3-3.

*Cosmochthonius zanini* Penttinen, *et al.*, 2003  
(Plate- 9, Figs. 1-2)

**Colour** : Brown  
**Measurements** : Length: 359 µm – 372 µm  
Width : 197 µm – 201 µm

**Dorsal region** (Fig. 1)  
Dorsal region of body except the dorsosejugal suture, covered by thick cerotegument with irregular pores and big holes and having reticulate appearance. Cerotegument denser on transversal sutures. Cuticle on dorsal side of body with foveolae, where as cuticle on dorsosejugal region with thin longitudinal lines.

**Prodorsum** (Fig.1)  
Prodorsum covered by cerotegument, denser on margins. Rostrum round with a blunt apex. Transverse cuticular ridge present in between bothridia (*bo*), at the base of prodorsum. Seta *ro* phylliform, brush shaped with bi or trifurcate bristles. Setae *le* and *in* biramous with bi-or trifurcate bristles. Seta *exa* dorsoventrally flattened, round and brush shaped with bi-
or trifurcate bristles. Seta exp short and barbed. Sensillus long, fusiform with longitudinal rows of bristles.

**Notogaster** (Fig. 1)

Notogaster oval in shape with wary margins. All notogastral plates (Na, Nm, Nm2, PY) covered by thick cerotugument, denser on the transverse sutures and lateral margins, forming a ridge like appearance. Sixteen pairs of notogastral setae present. First notogastral plate Na with 4 pairs of setae, c1, c2, c3 and cp and second plate Nm1 with 2 pairs of setae, d1 and d2. Setae c and d thin and ciliate. Setae c1 (52 \( \mu m \)) < c2 (55 \( \mu m \)) = c3. Distance between c1-c1 (31\( \mu m \)) > c1-c2 (21\( \mu m \)) = c2-c3. Seta d1 (34 \( \mu m \)) <d2 (52\( \mu m \)) and d1-d1 (9\( \mu m \))<d1-d2 (26 \( \mu m \)). Setae e and f bipectinate and inserted on narrow, transverse intercalary sclerites between the plates Nm1-Nm2 and Nm2 – PY respectively. Seta e1 (149 \( \mu m \)) and e2 (143\( \mu m \)) longer than f1 (139\( \mu m \)) and f2 (104\( \mu m \)). The distance e1-e1 (11 \( \mu m \)) < e1-e2 (12 \( \mu m \)), where as f1-f1 (19 \( \mu m \))> f1-f2 (12 \( \mu m \)). Setae h and p, except ps3 phylliform and thick with bi or trifurcate bristles. Setae h1, h2, h3 and ps1 close to the margin, whereas setae ps2 and ps3 located ventrally.

**Ventral region** (Fig. 2)

Infracapitulum with 4 pairs of setae, a, h, m1 and m2. Setae h long, slender and biramose. Setae a and m also biramose. Labiogenial articulation diarthric. Epimeral setal formula 3-2-3-4, setae long slender and biramose.
Genital plates with 10 pairs of setae, biramose, 6 pairs of setae close to median line and 4 pairs farther off as show in Fig.2. The anal and adanal plates with 4 pairs of setae each, anal setae thick and densely ciliate than the adanal setae. All anal state of equal size, where as adanal setae $ad_1$ the longest and $ad_4$ the shortest.

Legs

Leg 1- bidactylous, II-IV tridactylous.

Material Examined

Three specimens collected from the soil and litter samples, at the premises of quarters, Calicut University Campus, Kerala, India collected by Shiji. M.T on 05-03.2006.

Remarks

The present specimen shows resemblance with the known species, $C. zanini$ Penttinen et al., 2003 in most of the characters and hence fixed so.

Superfamily: Lohamannoidea Grandjean, 1967

Family: Lohmanniidae Berlese, 1916

Genus: Annectacarus Grandjean, 1950

Annectacarus hammerae Shiji et al., 2007
(Plate-10, Fig. 1-6)

Colour : Brown

Measurements : Length : 516 µm (Range: 507-516µm)
Width : 258 µm (Range: 256-270µm)

Dorsal Region (Fig.1 & 2)

Prodorsum

Rostral tectum entire. Seta ro measures 70µm, barbed bilaterally, inserted at the rostral tip. Seta le 98µm long, unilaterally barbed, in 70µm long, inserted near bo and barbed. Both exa and exp barbed and each measures 98µm. Lamellae on either side produced into condyles near insertion point of exa. Sensillus (ss) (Fig.2) pectinate with 14 branches on one side and 6-7 short branches on the other side. Lateral margin of prodorsum bears foveoles of semilunar nature. The region between lamellae carries polygonated punctations. Few area porosae scattered on prodorsum, particularly between bo.

Notogaster

Notogaster cylindrical with a rounded posterior margin. It bears punctations arranged polygonally. A few area porosae seen on the notogaster, in between setae c1 and c2 on either side. Notogaster with 24 pairs of long unilaterally barbed setae. Median setae c1, d1 and e1 short and roughened. Seta f1 placed medio-laterally than other median setae. Pygidial neotrichy present. Fissure im present near the insertion point of e2 on either
side of the notogaster. Foveoles of semilunar nature seen on lateral and posterior borders of notogaster.

**Ventral Region** (Fig. 3)

Infracapitulum (Fig. 4) with 5 pairs of setae. Seta \( a \) smooth and foliate. Setae \( m_1, m_2, m_3 \) and \( h \) barbed. Chelicerae (Fig. 5) stout with 2-3 stout teeth on each digit, \( chb \) about 3 times longer than \( cha \). Epimeral setal formula 5-4-3-3. Setae \( 1a, 2a, 3a \) and \( 4a \) small and smooth while other setae barbed. Epimeral region ornamented with polygonated punctations. Fissure \( ia \) seen on lateral side of epimere III. Genital plates without transverse suture. Each genital plate carries 10 barbed setae, arranged in 2 rows of 6 short paraxial and 4 long antiaxial setae. Pre-anal plate narrow with a postero-median projection. Anal and adanal plates fused. Four pairs of long adanal setae and 2 pairs of small anal setae present, all barbed in nature.

**Legs**

All legs monodactylous. All leg segments with punctations arranged polygonally. Chaetotaxy of leg I (Fig.6) represented by formula 0-5-5-5-18. Trochanter I with a tooth like structure. Femur I with a dorsal notch, a tooth and a keel in ventral position. All setae on femur I barbed. Genu I bears a solenidion \( \sigma \), closely associated with seta \( d \). Tibia I bears 2 solenidia \( \varphi_1 \) and \( \varphi_2 \), the latter longer than the former. Tarsus I with 2 solenidia, \( \omega_1 \) and \( \omega_2 \), \( \omega_1 \) stout with blunt tip. Seta \( ft' \) barbed, seen closely associated with \( \varphi_1 \). Setae \( p \), \( s \) and \( m \) smooth. Setae \( tc \), \( a \) and \( pv' \) barbed. Tarsus I ends in a pretarsus and claw, the latter with a ventral tooth.
Materials Examined

Twenty six specimens collected from soil and litter samples of premises of Ladies Hostel (Site 4b), Calicut University Campus, Kerala, India collected by Shiji. M. T. on 19-07.2002.

Remarks

The present specimen resembles *A. hammerae* described by Shiji *et al.*, 2007 from Kerala in all respects.

Superfamily : Lohmannoidea Grandjean, 1967

Family : Lohmanniidae Berlese, 1916

Genus : *Annectacarus* Grandjean, 1950

*Annectacarus nortoni* sp. nov.

(Plate-11, Figs.1-4)

Colour : Yellowish brown

Measurement : Length – 533μm (Range – 497-577μm)

Width – 333μm (Range- 279-306 μm)

Dorsal Region (Fig. 1)

Body elongated with broadly conical anterior and round posterior ends. Microsculpture of integument includes reticulated polygons with fine punctations.
**Prodorsum**

Anterior margin of rostral tectum entire, without incision. All prodorsal setae distinctly barbed. Setae *ro* 79\(\mu\)m long, uniformly barbed, inwardly curved, inserted on a ridge, slightly behind the anterior margin of rostrum. Seta *le* unilaterally barbed, inserted below the level of *ro* and measures 111\(\mu\)m. Seta *exa* unilaterally barbed and 93\(\mu\)m long. Seta *exp* roughened unlike setae *ro* and *in*. Seta *in* inserted close to the cup shaped *bo*, uniformly barbed and measure 93\(\mu\)m. Sensillus (*ss*) pectinate with 13-15 long branches on the lower surface (Fig.3) and 4-6 short barbs on the upper surface. Three area-porosae seen at the interlamellar region, between setae *in*, but below their level.

**Notogaster**

Notogaster cylindrical and elongate with pygidial neotrichy. Notogastral setae 24 pairs with pronounced size variation. Setae *c₁*, *d₁* and *e₁* short, narrow and smooth, each measuring 22\(\mu\)m in length. All other notogastral setae long and unilaterally barbed. A few area porosae arranged in the form of an incomplete band below the insertion point of seta *d₂* (in paratypes). Fissure *im* located near the insertion of seta *e₂*.

**Ventral region** (Fig. 2)

Infracapitulum bears 4 pairs of barbed setae, *a*, *h*, *m₁* and *m₂*. Epimeral neotrichy present and setae show size variation. Epimeral setal formula 7-4-3-4. Paraxial and a single pair of antiaxial setae on epimere I short and smooth, while the remaining setae long and barbed. A few porose
areas of varying size arranged on epimal region as shown in fig. 2. Genital plate entire, bearing 10 pairs roughened setae arranged in two rows, 6 pairs of short setae arranged paraxially and 4 pairs of long setae inserted antiaxially. Pre-anal plate narrow with a slight median concrescence posteriorly. Two pairs of short anal and 4 pairs of long adanal setae present on the fused ano-adanal plates, all setae finely barbed. Fissure in, ip and in located ventrally.

**Legs (Fig. 4)**

All legs monodactylous and punctated. Chaetotaxy of leg I represented by the formula 0-5-5-5-18. All setae except l on femur I barbed. Seta $l'$ smooth and comparatively small. Genu I bears 2 solenidia $\sigma_1$ and $\sigma_2$, the latter longer than the former. Seta $l'$ of genu I smooth and thin while $l''$ thick and barbed. Tibia I bears a long solenidion $\varphi$, a thin and smooth seta $l'$, and barbed setae $d$, $xt_1$ and $xt_2$. Tarsus I with 18 setae including 2 solenidia $\omega_1$ and $\omega_2$; $\omega_3$ thick and blunt; $pv'$, $pv''$ and $ft'$ barbed, others smooth.

**Material Examined**

Holotype ♀; paratypes 9♀♀ collected from soil and litter samples from Janakikadu, Mullankkunnu, Calicut, Kerala, India on 30.01.2006.

**Remarks**

Grandjean (1950) erected the genus *Annectacarus* with *A. micronatus* as the type species. The present specimen can be separated from *A. mucronatus* Grandjean, 1950 by the absence of notogastral line between the
setae $h_1$ and comparatively short nature of setae $c_1$, $d_1$ and $e_1$. The new species differs from *A. africanus* Balogh, 1961 by the barbed nature of neotrichial setae and the possession of 24 pairs of notogastral setae instead of 21 in *A. africanus*. The unilaterally barbed nature of notogastral setae in the new species separates it from *A. insculptus* and *A. sejugatus* Wallwork, 1962, the latter two species possess bilaterally barbed notogastral setae. The absence of notogastral bands in the present species helps to separate it from *A. insculptus* which possesses the bands. The epimeral setal formula (7-4-3-4) of the present species distinguishes it from *A. unilateralis* Hammer, 1973 (7-5-3-3). The possession of 4 pairs of infracapitular setae distinguishes the new species from *A. longisetosus* Bhattacharya *et al.*, 1974 which possesses 7 pairs of infracapitular setae. The possession of 24 pairs of notogastral setae and larger and thicker nature of seta $f_1$ differentiate it from *A. parallelus* Berlese, 1916, *A. hainanenisis* Hu and Wang (1990) and *A. eksteenii* Coetzee, 2001 (all these possess 21 pairs of notogastral setae and $f_1$ and $c_1$ are of equal size). The possession of 24 pairs of notogastral setae distinguishes the present species from *A. mahabaeus* Corpuz-Raros, 1979 which possesses 21 pairs of notogastral setae. The longer and unilaterally barbed nature of notogastral setae with the exception of the short and smooth median setae $c_1$, $d_1$ and $e_1$ distinguishes the new species from *A. granditrichosus* Sengbusch, 1984. The new species differs from *A. krachan* Mahunka, 1995 by the possession of 24 pairs of notogastral setae compared to the 18 pairs in the latter. The possession of epimeral setal formula (7-4-3-4) in the new species makes it distinct from *A. wallworki* Clement and Haq, 1991 in which
the epimeral setal formula is 6-4-3-3. The absence of notogastral bands and the possession of 24 pairs of unilaterally barbed notogastral setae distinguishes the new species from *A. aoki* Jaikumar *et al.*, 1994, which possess 18 pairs of bilaterally barbed notogastral setae. The present specimen is separated from the known Indian species, *A. trivandricus* Haq, 1978 by the epimeral setal formula 7-4-3-4 (5-4-3-4 in *A. trivandricus*), absence of aggenital plate, absence of incision at the anterior margin of rostral tectum and the sensillus with 4-6 small barbs on the upper side and 13-15 long branches on the lower-side.

The unique combination of features of the present species by which it keeps identity separate from all known species of the genus *Annectacarus* are:

1. Possession of 24 pairs of unilaterally barbed notogastral setae.
2. Epimeral setal formula of 7-4-3-4.
3. Smooth nature of median setae *c₁*, *d₁* and *e₁*.

**Superfamily : Lohmannnoidea Grandjean, 1967**

**Family : Lohmanniidae Berlese, 1961**

**Genus : Cryptacarus Grandjean, 1950**

Cryptacarus keralensis Shiji et al., 2007

(Plate-12, Figs. 1-6)

Colour : Golden yellow
Measurements : Length : 369 µm (Range 360-377 µm)
               Width : 160 µm (Range 155-164 µm)

Dorsal Region (Fig.1 & 2)

Prodorsum

Rostral tectum broadly round. Seta ro highly branched and inserted far below the rostral apex, directed anteriorad. Seta le inserted slightly below and exterior to the insertion of ro, on the lateral ridge. Seta le resembles ro in appearance, but distinctly shorter. Seta in also bilaterally branched and inserted very near to bo. Setae exa and exp almost of equal size and resemble other prodorsal hairs in appearance. Sensillus (Fig. 2) pectinate with 15-16 long branches on one side and 7-9 small branches on the other side. Prodorsum bears lateral spiny outgrowths above the level of insertion of exa. Prodorsum carries tubercles of varying size and inner punctations except at the extreme lateral margins. Prodorsal area lying just above the dorsosejugal suture bears feebly developed foveoles.

Notogaster

Notogaster cylindrical with parallel and wavy margins. Posterior margin of notogaster rounded with an irregular, more or less wavy outline. Notogastral integument bears closely set polygonal tubercles of varying size and nature, which often contain fine punctations. All notogastral setae
bilaterally branched. Pygidial neotrichy prominent with comparatively short setae.

**Ventral Region** (Figs. 3-5)

Infracapitulum (Fig. 4) bears 5 paris of setae $a, m_1, m_2, m_3$ and $h$. Seta $a$ thin and barbed while others bilaterally branched. Mentum bears polygonal tubercles with punctations. Rutella with prominent dendites and concavities. Chelicerae (Fig. 5) well developed with pronounced teeth. Seta $chb$ long while $cha$ minute. Epimeral setal formula 6-4-4-4, all setae branched. Epimeral surface bears foveolae and punctations. Genital plates divided by a transverse suture into an upper smaller and a lower larger plate. Each half carries 3 setae in paraxial and 2 setae in antiaxial position. All setae short slightly branched. Aggenital plates triangular. Pre-anal plate narrow with posteromedian region projecting downwards. Ano-adanal suture feebly developed. Anal setae 2 pairs, branched. Adanal setae 4 pairs, branched and longer than the anal setae. Ano-adanal plates bear punctations. Fissure $ih$ more or less transverse. Ventral plate lying exterior to genital and anoadamnal plate foveolated variously.

**Leg** (Fig. 6)

All legs monodactylyous. Chaetotaxy of leg I (Fig. 6) 1-4-5-5-19. Reticulations and punctations seen on all leg segments. Femur I with a ventrally extended keel and a dorsal notch. Setae $d, l', l'', v''$ present on femur I. Seta $l'$ thin and feebly barbed, others branched. On Genu I solenidioi $\sigma_1$ and $\sigma_2$ closely associated with seta $d$. Tibia I bears long solenidion $\phi$, 2 branched setae $xt_1$ and $xt_2$. Seta $d$ smooth. Solinidia $\omega_1$ and $\omega_2$ present on
tarsus I. Setae $p\nu'$ and $p\nu''$ branched, ($a$) barbed and others smooth. Famulus ($\varepsilon$) close to $\omega$. Claw with a ventral tooth

**Materials Examined**

Ten specimens collected from soil and litter samples at the area of mixed vegetation (Site 3a), Ayanikkad, Kerala, India, collected by Shiji. M. T. on 24.09.2002.

**Remarks**

The present specimen shows close resemblance to *Cryptacarus keralensis* Shiji, *et al.*, 2007 collected from Kerala in all characters

**Superfamily** : Lohmannoidea Grandjean, 1947  
**Family** : Lohmanniidae Berlese, 1916  
**Genus** : Haplacarus Wallwork, 1962

**Generic Diagnosis**

Genital plates without transverse suture. Anal and adanal plates fused Pre-anal plate wide. One pair of anal and 4 pairs of adanal setae present. Notogastral and epimeral regions without neotrichy.

*Haplacarus keralensis* Haq *et al.*, 1984  
(Plate-13, Figs.1 & 3)

**Colour** : Yellowish brown  
**Measurement** : Length : 660 $\mu$m – 676 $\mu$m  
Width : 314 $\mu$m – 345 $\mu$m
Dorsal region (Fig.1)

Body elongated with conical anterior and round posterior ends. Body ornamented with uniformly distributed papillae and fine, punctations except in places of notogastral bands.

Prodorsum

Prodorsum roughly triangular. Rostral tectum smooth and entire. All prodorsal setae foliate and serrated except seta exa, the latter being smooth. Seta ro inserted far below the anterior end of the rostrum, and directed forward. Seta le inserted below the level of rostral seta. Seta in long, thick and directed downwards. Seta exa long and smooth. Seta exp sickle shaped. Bothridium (bo) cup shaped. Sensillus (ss) pectinate with 10-13 branches. Prodorsum with a band which extends between the insertions of seta exp. A few area porosae located near the median excrescence of lamellar ridge, below the insertion point of le.

Notogaster

Notogastral papillae arranged along the margin provide a wavy appearance. Sixteen pairs of notogastral setae present, all foliate and serrated. Seta ps1 curved inwards, distally. Ten notogastral bands present, of which s1, s2, s4 and s9 incomplete. Notogaster ornamented with uniformly distributed papillae.
Ventral Region (Fig. 2)

Infracapitulum with 4 pairs of setae. Seta \( a \) smooth while setae \( m_1, m_2 \) and \( h \) thick and roughened. Area porosae present on the mentum between the insertion points of setae \( h \). Epimeral setal formula 3-1-3-3. Setae \( 1a, 1c, 3b, 3c \) and \( 4c \) comparatively thick foliate and weakly barbed. The triangular aggential plate located anterolateral to each genital plate. Genital plates with 10 pairs of setae, each plate with 4 pairs of smooth and thick antiaxial setae and 6 pairs of roughened and thin paraxial setae. Pre-anal plate broad with a posteromedian projection. Anal and adanal plates fused, bearing one pair of anal and 4 pairs of adanal setae. Anal setae smooth and smaller than the thick, foliate and weakly barbed adanal setae. Fissures \( ia, im \) and \( ih \) located ventrally. Area porosae located on the ventral plate, as figured.

Legs

All legs monodactylyous.

Material Examined

Thirteen specimens collected from soil and litter samples from Botanical garden, Calicut University Campus, Kerala, India, collected by Shiji. M.T on 17.06.2006.

Remarks

The present specimen resembles \( H. keralensis \) described by Haq et al. (1984) in most of the characters. However, the number of incomplete bands and the epimeral setal formula show variation.
Superfamily : Lohmannoidea Grandjean, 1967  
Family : Lohmanniidae Berlese, 1916  
Genus : Javacarus Balogh, 1961  


*Javacarus porosus* Hammer, 1980  
(Plate-14, Figs.1-5)

Colour : Brown  
Measurements : Length : 658-700µm  
Width : 336-350µm  

**Dorsal Region** (Fig. 1)  

Prodorsum more or less triangular in outline. Anterior border of rostrum entire. Seta *ro* measures 98 µm, straight and inserted far below the rostral apex. Seta *le* inserted laterally below the insertion point of *ro* and it measures 126 µm. Seta *in* 112µm, placed below the level of *bo*. Setae *exa* and *exp* present, each measuring 112 µm and 84 µm respectively. Seta *exa* falcate in nature. All other prodorsal setae foliate with distinct midrib and faintly dentate. A band extends between setae *in*. A pair of lateral ridges present. Bothridium (*bo*) cup shaped. Sensillus (*ss*) pectinate with 8-10 branches. Prodorsum bears tubercles except on the lateral region.
Lateral margins of notogaster parallel, and posterior region rounded. Notogastral setae 16 pairs foliate and slightly roughened. The dorsal setae short with more or less dull tip, while the marginal ones longer and thinner at the tip. Seta $c_1$ directed forwards. Seta $e_2$ short. Seta $ps_1$ slightly incurved. Nine notogastral bands formed of bead like structures present, all bands complete, but very irregular. Between the bands tubercles present, especially at the posterior region. A few area porosae seen in between setae $c_1$ and $c_2$.

**Ventral Region** (Fig.2)

Intracapitulum (Fig.3) bears 4 pairs of setae $a$, $h$, $m_1$, and $m_2$. Setae $a$, $h$ and $m_1$ thin, all setae faintly dentate. Chelicerae (Fig.4) well developed with stout pronounced teeth. Seta $chb$ longer than $cha$. Pedipalp 5 segmented. Palpal chaetotaxy represented by the formula 0-1-0-1-8.

Epimeral setal formula 3-1-3-4, all setae roughened. Epimere I bears few area porosae. Genital plates without transverse suture. Each genital plate carries 10 setae, paraxial row of 6 small, smooth setae and antiaxial row of 4 elongate roughened setae. Pre-anal plate wide with a postero-median projection. Anal and adanal plates fused. Anal setae absent. Four pairs of adanal setae present, all foliate and roughened. A few area porosae seen lateral to the ano-genital region. Fissure $ip$ present near the insertion point of $h_3$. 
Leg (Fig.5)

All legs monodactylous. Chaetotaxy of leg I represented by the formula 1-4-4-4-18. All leg segments with fine punctations. Trochanter-I bears a single roughened seta. Setae $d$ and $l''$ on femur I thick and barbed; others smooth. Genu-I bears 2 solenidia, $\sigma_1$ and $\sigma_2$. Seta $l'$ thick and barbed. The solenidion $\varphi$ on tibia-I long and seen in close association with seta $d$. Setae $xt_1$ and $xt_2$ thick and barbed. Tarsus -I carries 18 setae including $\omega_1$ and $\omega_2$. $\omega_1$ thicker than $\omega_2$ and with a blunt tip. Setae ($ft$) thick and barbed and $pv''$, $s$, $m''$, $(p)$ and $(a)$ smooth.

Materials Examined:

Seven specimens collected from soil and litter samples of site 4b, Ladies Hostel premises, Calicut University Campus, Kerala, India, collected by Shiji. M.T on 10.10.2002.

Remarks:

The present specimens resemble $J.$ porosus described by Hammer (1980) from Java in most of the characters. However, the nature of prodorsal and notogastral setae shows slight deviation.

Superfamily : Lohmannoidea Grandjean, 1967
Family : Lohmanniidae Berlese, 1916
Genus : Meristacarus Grandjean, 1934

Genital plates without transverse suture. Anal and adanal plates separated. Pre-anal plate wide. Anal setae absent. Four pairs of adanal

**Meristacarus unilateralis sp.nov.**

(Plate-15, Figs. 1-7)

Colour : Dark brown

Measurements : Length: 980µm (Range: 938-980µm)

Width : 532µm (Range: 504-574µm)

**Dorsal Region** (Fig. 1)

**Prodorsum**

Rostrum entire and more or less pointed anteriorly. All prodorsal setae long, barbed with pointed tip, barbs absent at the extreme tip. Seta *ro* 154µm long and inserted on a transverse ridge. Seta *le* measures 210µm, seen laterally on the lamellar ridge. Lateral sides of prodorsum lying exterior to lamellar ridge heavily porose. Setae *exa* and *exp* present, measuring 126µm and 168µm respectively. Seta *in* 168µm long, inserted more or less at the level of *bo*. Sensillus possesses a central rachis and bears 18 branches, the length of which decreases towards the apex (Fig.2). Basal portion of *ss* devoid of any branches. A distinct prodorsal band extends between the 2 bothridial cups, formed of single, double and often triple layers of porose foveoles. Prodorsal integument porose and bears irregularly arranged area porosae. Single or clustered foveoles of smooth nature also present. Lateral borders of prodorsum bear tooth like projection, arranged on either side.
Notogaster

Nine notogastral bands, composed of small foveoles arranged in single, double or occasionally triple layers seen on notogaster. Bands 4 and 5 connected medially forming loops as shown in Fig.1, bands 8 and 9 arched anteriorad. Circular area porosae of varying size irregularly scattered or aggregated on the notogaster. Sixteen pairs of notogastral setae of varying size present on notogaster. Median setae, $c_1$, $d_1$, $e_1$ and $f_1$ small while lateral setae comparatively longer. Seta $e_1$ inserted more interior than the other median setae. Distance between $e_1$-$e_1$ less than that of $c_1$-$c_1$ and $d_1$-$d_1$. All notogastral setae slightly foliate, bearing barbs unilaterally except at the extreme base and tip (Fig.3) Fissure im seen near the insertion of seta $e_2$.

Ventral Region (Fig.4)

Infracapitulum (Fig.5) porose and bears scattered area porosae. Setae $h$, $m_1$ and $m_2$ almost equal in size. Seta $a$ the smallest of infracaptitular setae. All setae feebly barbed. Chelicerae (Fig.6) well developed with 3-4 teeth on the fixed digit and 2-3 teeth on the movable digit. Seta $cha$ minute while $chb$ elongate, smooth and slender. Pedipalp 5 segmented (Fig.5) with a chaetotaxy of 0-1-0-2-10.

Epimeral surface porose and with scattered area porosae. Epimeral setal formula 3-1-3-3. Seta $1b$ thicker and more barbed. Seta $2a$ small and roughened. Seta $3a$ smaller than $3b$ and $3c$. Setae $4a$, $4b$ and $4c$ almost equal in size. Fissure $ia$ seen laterally, exterior to epimere III.
Genital plates entire, bearing 10 pairs of roughened setae, arranged in two rows, an antiaxial row of 4 and paraxial row of 6 setae. Antiaxial setae comparatively longer than the paraxial setae. The distance between $g_1$-$g_2$ comparatively greater than that of the remaining setae. Pre-anal plate narrow with a median posterior projection. Ano-adanal setal formula 0+4. Adanal setae heavily barbed and their length increases posteriorly. Ventral plate lying exterior to ano-genital plate ornamented with scattered area porosae. Fissure $ip$ visible on the ventral plate as represented in Fig. 4

Legs

All legs monodactylous with a stout claw. Integument of all legs heavily punctate and porose. Chaetotaxy of leg I (Fig. 7) 0-5-5-5-19. Femur I carries 4 setae, all of which barbed in various degrees. Femur I carries a well developed notch dorsally and a keel ventrally. Seta $l'$ of femur I thick and longer than others. Genu I bears 2 solenidia ($\sigma_1$ and $\sigma_2$). Seta $d$ thin, smooth and seen closely associated with $\sigma_2$. Seta $l''$ of genu I long, thick and barbed. Tibia I carries a long whip like solenidion ($\varphi$). Seta $d$ coupled with $\varphi$. Seta $xt_1$ thicker and longer than $xt_2$. Seta $l'$ barbed. Tarsus I carries 19 setae, including 2 solenidia $\omega_1$ and $\omega_2$. $\omega_1$ stout and blunt while $\omega_2$ sharply pointed. A famulus ($\varepsilon$) seen closely associated with $\omega_1$. All setae except $s$ and ($p$) barbed variously. Seta ($tc$) and ($u$) basally stout and with hooked tips. Seta ($pv$) somewhat plumose.
Materials Examined

Holotype ♀: paratypes 13 ♀♀ collected from soil samples of coffee plantation (Site 6), Wayand district, Kerala, India collected by Shiji. M. T on 29.11.2002.

Remarks

The genus *Meristacarus* was erected by Grandjean (1934) with *M. porcula* as the type species from central America. The genus presently contains 15 species erected from various countries: including India. The present new species on comparison with the other known species of the genus shows similarities with the 2 known Indian species, *M. wynadensis* described by Haq and Clement (1991) and *M. degradatus* Haq and Jaikumar (1993) in the general appearance and body ornamentation as well as arrangement of body setae. However, the species can be easily separated from *M. wynadensis* based on the presence of the following features.

1. Differences in the number, nature and arrangement of notogastral bands.

2. Unilaterally barbed nature of notogastral setae.

3. Presence of 18 branches on the sensillus.

4. Barbed nature of infracapitular and epimeral setae.

5. Difference in the nature and arrangement of genital setae.

6. Difference in leg chaetotaxy.
The new species appears distinct from *M. degradatus* in the following features.

1. Nature of sensillus
2. Unilaterally barbed nature of notogastral setae.
4. Smaller nature of seta c1.
5. Epimeral setal formula of 3-1-3-3.
6. Genital setal formula 6+4 and porose nature of genital integument.

Based on the possession of above combination of features, the species has been assigned to the status of a new one, *viz.*, *M. unilateralis*. The unique features of the new species include:

1. Difference in the nature and arrangement of notogastral bands.
2. Unilaterally branched nature of notogastral setae.
3. Difference in the nature and arrangement of genital setae.

**Superfamily**: Lohmannoidea Grandjean, 1967

**Family**: Lohmaniidae Berlese, 1916

**Genus**: *Papillacarus* Kunst, 1959

**Generic diagnosis**


**Papillacarus baloghi sp. nov**

(Plate-16, Figs.1-6)

Colour : Reddish brown

Measurement : Length: 577 μm (Range 532–578 μm)

Width : 269 μm (Range 268–311 μm)

**Dorsal Region**

Body elongated with conical anterior and round posterior ends. Microsculpture of the integument consists of reticulum of polygons with fine punctations.

**Prodorsum**

Anterior margin of rostrum undulating. Sclerotized angular process present on lateral borders of prodorsum. All prodorsal setae spinose except at the base and distal portion. Seta exp slightly longer than others. Bothridium (bo) cup shaped. Sensillus (ss) pectinate with 15-17 cilia on the lower surface and 3-4 barbs on the upper surface (Fig.5). Prodorsal transverse band with round ends, seen just below the interlamellar setae. A clear area devoid of punctations located below the band, between the latter and the dorsosejugal suture.

**Notogaster**

Notogaster cylindrical with almost parallel lateral margins. Dorsosejugal region lying just below the suture demarcated by closely set
transverse wrinkles, resembling a band like structure. Notogaster bears one complete and 4 incomplete bands. Notogastral neotrichy present, especially at the posterior region, total number of notogastral setae 60. Setae $c_1$, $d_1$ and $e_1$ short and sparsely barbed. Seta $f_1$ longer than the anterior dorsocentrals. Pygidial neotrichial setae mostly unilaterally barbed, rarely bilaterally barbed. Submarginal and marginal setae of notogaster similarly shaped as prodorsals. Notogaster bears spiculate papillae, numerous on the posterior region.

**Ventral region** (Figs.2-4)

Infracapitulum with 5 pairs of setae, $a$, $h$, $m_1$, $m_2$ and $m_3$ (Fig. ). Seta $a$ simple others asymmetrically barbed. Infracapitulum densely punctate. Chelicerae (Fig.3) stout with 2-3 teeth on each digit. Seta $cha$ 3 times longer than $chb$. Rutellum stout, bearing 3-4 dendrites (Fig.4). Epimeral surface densely punctate with setal neotrichy. Epimeral setal formula 9-4-3-4. Setae of $a$ series and $1d$ short, fine and smooth. Other setae bilaterally but asymmetrically barbed. Genital plates divided unequally by a transverse suture into anterior and posterior sections, each section with 5 pairs of setae. Paraxial setae barbed, while antiauxial setae smooth. Aggenital plate triangular. Pre-anal plate narrow, small and posteriorly bifid. Anal and adanal plates separate, 2 pairs of anal and 4 pairs of adanal setae present, all unilaterally barbed. Fissures $ia$, $im$ and $ih$ located ventrally. Ventral plate including the genital and anal plates densely punctate.
Legs

All leg segments monodactylous and punctate. Chaetotaxy of leg I, 1-4-5-5-16. Femur I with ventral keel. All setae spinose. Genu I bears 2 solenidia $\sigma'$ and $\sigma''$, the latter longer than the former. Seta $l''$ and $d$ of genu spinose while $l'$ smooth. Tibia 1 bears one solenidion $\varphi$ and 4 setae, of which setae $l'$ and $xt_1$ smooth and $d$ and $xt_2$ spinose. On tarsus 1, 2 solenidia $\omega_1$ and $\omega_2$ present. The former with blunt tip while the latter tapering distally. Most of the tarsal setae smooth. Claw stout.

Material Examined

Holotype ♀; paratypes 21 ♀♀ collected from soil and litter samples taken from a wet area near the kitchen yard, Ayanikadu, Calicut, Kerala, India collected by Shiji. M.T on 15.06.2005.

Remarks

The species of the genus *Papillacarus* Kunst 1959 are divided into two groups by the nature of setae $c_1$, $d_1$ and $e_1$. The present specimen belongs to the group of species with $c_1$, $d_1$ and $e_1$ short and barbed. Though the new specimen shows resemblance with *P. aciculatus* Berlese, 1904, *P. pseudoasciculatus* Mahunka, 1980, *P. ondrias* Mahunka, 1974 in general nature and certain features, various differences could be noticed as described below:
It differs from *P. asiculatus* Berlese, 1904 by the presence of notogastral bands, spinose nature of prodorsal and notogastral setae, possession of epimeral setal formula of 9-4-3-4 instead of is 8-4-3-4 of *P. asiculatus*. The present specimen differs from *P. pseudoasiculatus* Mahunka, 1980 by the presence of notogastral bands, epimeral setal formula of 9-4-3-4 compared to 8-4-3-4 in *P. pseudoasiculatus*, nature of sensillus, seta $e_2$ more than half as long as $f_2$ and the spinose nature of prodorsal and notogastral setae. The new specimen can be distinguished from *P. ondriasi* Mahunka, 1974 by the presence of equally long setae $c_1$, $d_1$ and $e_1$, the length of which increase in sequence in *P. ondriasi* Mahunka, 1974. Moreover, the spinose nature of the prodorsal and notogastral setae and the symmetrically ciliate nature of neotrichial setae also enable to distinguish the new species from *P. ondriasi* Mahunka, 1974.

The possession of the following combination of characters enables to distinguishes the new species from the various other known species of the genus:

1. Spinose nature of prodorsal and notogastral setae
2. Epimeral setal formula 9-4-3-4.
3. Presence of notogastral bands
4. Presence of equally long setae $c_1$, $d_1$ and $e_1$
Superfamily: Epilohmannoidea Grandjean, 1969
Family: Epilohmanniidae Oudemans, 1923
Genus: Epilohmannia Berlese, 1910

Postero-hysterosomatic articulation dichoid. Ano-genital region schizogastric type (i.e., genital and anal plates separated by a straight line). Eight pairs of genital setae arranged in 2 longitudinal rows (5+3).

*Epilohmannia pallida pacifica* Aoki, 1965

(Plate-17, Figs.1-6)

Colour: Brown
Measurement: Length: 340-348 μm
Width: 123-139 μm

**Dorsal Region** (Fig.1)

Prodorsum elongated, broader posteriorly with a maximum width at the level between bo. Seta ro short 20 μm long fine and barbed, the left seta being inserted anteriorly than the right one. Seta le measures 32 μm, longer than ro and sparsely barbed. Seta in more than twice longer than ro, barbed, measuring 44 μm. Setae exa and exp short, more or less equal in length. Sensillus (Fig.2) with a fusiform head, bearing stout barbs.

Dorsosejugal suture more or less straight. Fourteen pairs of barbed notogastral setae present, posterior setae curved ventrally. Notogastral integument finely punctate.
Ventral Region (Fig.3)

Infracapitulum (Fig.4) stenarthric type. Infracapitular setae 3 pairs, barbed. Seta a more elongate than m and h. Chelicerae (Fig.5) well developed with 3-4 teeth on the movable digit and 2-3 teeth on the fixed digit. chb longer than cha. Epimeral setae thin and slightly barbed. Epimeral setal formula 3-1-3-3. Setae 1a, 2a, 3a and 4a shorter than 1b, 3b, 3c, 4b and 4c.

Seta 1c smallest among the epimeral setae. Epimere I bears lateral ridges. Each genital plate more or less rectangular, bearing a transverse ridge. Each plate bears 7 barbed setae, arranged in 2 rows, 4 paraxial and 3 antiaxial in position. Aggenital setae 4 pairs, barbed, ag4 elongate. Anal aperture longer than the genital aperture. Three anal and 3 adanal setae present, all barbed and length of which increases posteriorly. Ventral plate ornamented with fine punctations and scattered foveoles.

Legs

All legs monodactylous. Chaetotaxy of leg I (Fig.6) 1-3-5-6-16. Trochanter I bears a single barbed seta. All setae on femur I barbed. Genu I bears 2 solenidia, α1 and α2, the latter shorter than the former. Seta d closely associated with α2. Tibia I carries a single long solenidion ϕ. Tarsus I carries 16 setae including 3 solenidia ω1, ω2 and ω3. ω1 stout and blunt. Setae (p) eupathidic, s smooth while setae (u) and (a) thick and barbed. All leg segments punctated.
Materials Examined

Seventeen specimens collected from soil and litter samples of Botanical Garden (Site 4a), Calicut University Campus, Kerala, India, collected by Shji. M. T on 13.01.2003.

Remarks

The present specimens resemble *E. pallida pacifica* erected by Aoki (1965) in all respects.

*Epilohmannia pallida indica* Bhattacharya and Banerjee, 1980

(Plate-18, Figs.1-5)

Colour : Brown

Measurements : Length: 336-348μm

Width : 151-159 μm

Dorsal Region (Fig.1)

Prodorsum broad with a maximum width at the level between bo. Prodorsal integument bears fine punctations. Seta *ro* short, 20 μm long and barbed, the left seta being inserted anterior to that of right one. Seta *le* 28μm in length and barbed. Seta *in* the longest of prodorsal hairs reaching 44μm. Setae *exa* and *exp* shorter than other prodorsal setae, each measures 12μm in length. Sensillus (*ss*) (Fig.2) distally thickened to form a spindle, bearing barbs
Dorsosejugal suture more or less straight. Posterior margin of notogaster rounded. Notogastral integument with fine punctations. Fourteen pairs of barbed notogastral setae present.

**Ventral Region** (Fig.3)

Rutella short, robust and slightly keeled on the lateral surface. Infracapitulum stenarthric type. Infracapitulum bears 3 pairs of setae viz., $a$, $m$ and $h$, a thicker and longer than others. Chelicerae (Fig.4) well developed with 3-4 teeth on the movable digit and 2-3 teeth on the fixed digit, $chb$ longer than $cha$. Epimeral setal formula 3-1-3-3, all setae thin and barbed, seta $3a$ with prominent insertion point. Epimere I with a connecting ridge. Genital plate more or less rectangular, each plate a little broader posteriorly and bears a transverse ridge which runs on the entire ventral plate. Eight setae present on each plate, all barbed and arranged in two rows, 5 paraxial and 3 antiaxial in position. Three anal and 3 adanal setae present, all barbed and length of which increases posteriorly. Ventral integument wrinkled with fine punctations.

**Legs**

All legs monodactylous. Chaetotaxy of leg I (Fig.5) 1-3-5-6-16. Trochanter I bears a single barbed seta. All setae on femur I barbed. Genu I bears 2 solenidia, $\sigma_1$ and $\sigma_2$, the latter shorter than the former. Tibia I carries a single long solenidion $\phi$. Tarsus I carries 16 setae including 3 solenidia $\omega_1$, $\omega_2$ and $\omega_3$, $\omega_1$ stout and blunt. Setae ($p$) eupathidic. Seta $s$ smooth, setae ($u$) and ($a$) thick and barbed. All leg segments punctated.
Materials Examined

Fourteen specimens collected from soil and litter samples of Site 4a, Botanical Garden, Calicut University Campus, Kerala, India, collected by Shiji M. T. on 29-11-03.

Remarks

The present specimen resembles *E. pallida indica* erected by Bhattacharya and Banerjee (1980) in all respects.

**Superfamily: Nothroidea Grandjean, 1954**

**Family : Tryhypochthoniidae Willmann, 1931**

**Genus: Allonothrus Van der Hammen, 1953**

Exoskeleton heavily sclerotised. Sluggish in nature. Prodorsum with varying number of ridges. Lamellar setae very conspicuous. Areolae present on the hysterosoma. Dorsal hairs leaf or fan shaped. Adults without seta *f1*. Number of adanal, anal and aggenital setae represented by the formula 3,2,0 respectively. Genital plates broad and without sutures. Sensillus resembles that of *Nothrus*.

*Allonothrus sinicus* Wang Hu-Fu and Norton (1988)

(Plate-19, Figs. 1&2)

Colour : Golden yellow

Measurements : Length: 492-504μm

Width : 246-254μm
Dorsal Region (Fig.1)

Prodorsum

Prodorsum triangular with a pointed rostral apex. Lateral margin of prodorsum with 2-3 small teeth. Two pairs of ridges also present on prodorsum. Lateral ridge extended from the middle of the prodorsum to the base of seta ro. Median ridge diverging posteroiad, well separated anteriorly. Seta ro tapering and barbed, measuring 42μm. Setae le and in foliate, distally rounded, heavily barbed and measure 70μm and 56μm respectively. Sensillus clavate, serrated, with a median ridge.

Notogaster

Broad and ornamented with areolae of polygonal appearance. Fifteen pairs of foliate barbed notogastral setae present. Setae d1, d2 and e1 fan shaped, truncated distally, others rounded. Seta f1 absent. Fissures ia and im located as shown in Fig.1. Aperture of the lateral abdominal gland represented by a very distinct, chitinised ring, just above seta f2.

Ventral Region (Fig.2)

Gnathosoma with 3 pairs of setae, a, h, and m. Seta m short and spiny. Gnathosomal region porose. Epimeral setal formula 3-1-3-3,. all setae smooth. Genital setae 7 pairs, g1-g3 barbed, g6 and g7 well spaced. Anal plate bears 2 pairs of lanceolate setae. Three pairs of adanal setae present, broad, all densely barbed.

Legs

All legs tridactylyous.
Materials Examined

Nineteen specimens collected from the soil and litter samples of Site 4b, Ladies Hostel premises, Calicut University Campus, Kerala, India, collected by Shiji M.T on 10.10.2002.

Remarks

The present specimen resembles *Allonothrus sinicus* described by Wang Hu-Fu and Norton (1988) from Japan in all respects.

*Allonothrus keralensis* sp. nov.  
(Plate-20, Figs.1-6)

Colour : Reddish brown

Measurements: Length: 644 µm (Range 616-686 µm)  
Width : 350 µm (Range 336-364 µm)

Dorsal Region (Fig. 1)

Prodorsum

Prodorsum triangular with a pointed rostral apex. Seta *ro* barbed, simple, 42µm long. Seta *le* heavily barbed, club shaped, longer among prodorsal setae, 98µm long. Seta *in* smallest, measuring 35µm, leaf like, placed on a transverse ridge. Seta *ex* absent. Sensillus rod like with a slightly swollen roughened head. A pair of thin but chitinised lateral ridges present, which extends from the middle of the prodorsum to the lateral margins. Central ridges narrow and placed in between lateral ridges. Inner ridge present having a shape as shown in the Fig.1. A transverse ridge
present, other than prodorsal band, in between \( b_0 \). Prodorsal integument heavily porose.

**Notogaster**

Broad and ornamented with areolae of polygonal appearance. Fifteen pairs of fan shaped, barbed notogastral setae present, of which \( c_2 \) the smallest. Seta \( f_1 \) absent. Aperture of the lateral abdominal gland represented by a very distinct chitinised ring, just above seta \( f_2 \). Fissure \( i_a \) located near the insertion point of \( c_2 \), \( i_m \) located above the insertion point of seta \( e_2 \).

**Ventral Region** (Fig. 2)

Infracapitulum (Fig.3) bears 3 pairs of setae. Seta \( a \) smooth, \( m \) shortest and spiny while \( h \) longest, thick and barbed. Gnathosomal region porose. Chelicerae (Fig.4) with 4 teeth on the fixed digit and 3-5 teeth on the movable digit. Seta \( c_h b \) barbed and longer than the smooth seta \( c_h a \). Epimeral seta formula 3-1-3-3. Setae \( 1a, 1c, 2a, 3a, 4b \) thick and shorter than the barbed setae \( 1b, 3b \) and \( 4a \). Setae \( 3c \) and \( 4c \) foliate and barbed. Fifteen pairs of barbed genital setae (Fig. 5) the length of which decreases posteriorly and the posteriormost 2 pairs appear roughened and well spaced. Two pairs of anal setae present, \( a_n_1 \) roughened, \( a_n_2 \) smooth. Three pairs of adanal setae, all roughened and foliate. Anal and adanal fissures located as shown in Fig.2. Genital and anal plates with small punctations. Lateral region of the ventral plate heavily porose with less sclerotised foveoles.
Legs

All legs tridactylous with three claws. Leg I with a chaetotaxy of (Fig.6), 2-6-6-6-13. Trochanter I bears 2 foliate barbed setae. All setae on femur I foliate, barbed, vary in size. Genu I bears a single solinidion $\sigma$. Seta $l'$ thin and smooth, seta $v'$ thick and smooth, all other setae foliate and barbed. Tibia I bears long solenidion $\varphi$. Setae $v'$ thick and smooth, while others foliate and barbed. Tarsus I with a short solinidion $\omega$ which ends in a blunt tip. Setae $s, m', pv'$ smooth, all other setae roughened.

Materials Examined

Holotype ♀; paratypes 35 ♀♀ collected from soil and litter samples of site 4b of Ladies Hostel premises, Calicut University Campus, Kerala, India collected by Shiji, M.T. on 17.09.02.

Remarks

The present species differs from *A. russelous* Wallwork (1960) in having 15 pairs of genital setae instead of 13-14 in *A. russeolous* and in the nature of adanal setae. The new species can be easily distinguished from *A. monodactylous* Wallwork (1960) by the possession of tridactylous legs and 15 pairs of genital setae. Presence of strongly curved lateral ridge, 10 pairs of genital setae and smooth nature of adanal setae are the characters which distinguish *A. indicus* Bhaduri and Chaudhuri (1968), from the new species. The new species shows close resemblance to *A. giganticus* Haq (1978) by the presence of 3 ridges on the prodorsum, nature and arrangement of setae $le$ and $in$ as well as in the notogastral, anal and adanal setae and tridactylous
legs. However by the possession of the following unique features, the new species distinctly stand separate from *A. giganticus* as well as other known species.

1. Fifteen pairs of barbed genital setae
2. Comparatively thinner nature of lateral ridge on the prodorsum.
3. Nature of median and inner ridges on the prodorsum.
4. Presence of 2 transverse ridges on the prodorsum between *bo*.

**Superfamily :** Nothroidea, Grandjean, 1954

**Family :** Trhypochthoniidae, Willmann, 1931

**Genus :** *Archegozetes*, Grandjean, 1931

**Generic Diagnosis**

Bothridium present. Rostral setae removed from each other. Seven pairs of genital setae. Two pairs of adanal setae. Legs monodactyl.

*Archegozetes longisetosus* Aoki, 1965

(Plate- 21, Figs.1-3)

Colour : Reddish brown with yellow tinge

Measurements : Length: 835-985 μm

Width : 495-587 μm

**Dorsal region** (Fig 1)

Body narrow anteriorly and very broadly spherical posteriorly. Both anterior and posterior ends conical. Body ornamented with dense punctuation.
**Prodorsum**

Prodorsum triangular with a pointed rostral tectum and a broad base. Prodorsal setae 3 pairs, all of which barbed. Seta ro setiform with its distal quarter smooth, measuring 131 µm and inserted far below the rostral tip. Setae le and in somewhat flagellate 177µm and 262 µm in length respectively and ciliated from base to tip, densely ciliated towards their apex. Bothridium (bo) bell shaped. Sensillus (ss), 185 µm long, flagellate with very small barbs. A group of area porosae present at the interlamellar area, in between the setae in. Prodorsum laterally bulged, at the level of bothridium.

**Notogaster**

The notogaster more or less oval shaped and its shape generally determined by the presence of egg mass within the viscera. Notogaster bears 15 pairs of flagellate-setaceous and barbed setae of varying length as follows:

\[ c_1, c_2 - 185 \, \mu m; \, c_3 - 93 \, \mu m \]
\[ d_1, d_2 - 154 \, \mu m; \, d_3 - 185 \, \mu m \]
\[ e_1, e_2 - 93 \, \mu m \]
\[ f_2 - 46 \, \mu m \]
\[ h_1, h_2, h_3 - 124 \, \mu m \]
\[ ps_1, ps_2, ps_3 - 139 \, \mu m \]
All notogastral setae scarcely barbed proximally and heavily barbed distally. Latero abdominal gland (Age) seen as a round dark brown spot on either side of the notogaster, near setae $e_2$, $f_2$ and $h_2$. The glandular opening (gla) located very close to the point of insertion of seta $f_2$. Lyrifissures $ia$, $im$ and $ip$ visible dorsally, $ia$ near $c_3$, $im$ between $d_3$ and $e_2$ and $ip$ near $h_2$.

**Venter** (Fig.2)

Infracapitulum bears setae $a$, $m$ and $h$. Seta $m$ very small while $a$ and $h$ smooth and long, $a$ being thicker and longer than $h$. A transverse submental plate ($smp$) separates the infracapitulum from the epimeral region. Epidermal setal formula 3-1-3-3. Setae $1b$, $3b$, and $4b$ smooth and long and others rough and short. Seven pairs of ciliated genital setae present, of which the anterior four pairs ($g_1$-$g_4$) located very close together and the remaining 3 pairs ($g_5$-$g_7$) widely separated. Anal plates longer than broad, each of which bears 2 short barbed setae. Adanal plates extend anteriorly towards the genital area. Three pairs of adanal setae present, all barbed and their length decrease from $ad_1$-$ad_3$. Lyrifissures $ian$ and $iad$ located on the ventral plate.

**Legs**

All legs monodactylous (Fig.3). Chaetotaxy of leg I- 1-6-5-6-20. All setae barbed, except setae ($ft$) ($tc$) and ($p$) which are smooth. Trochanter-I possesses a tooth like structure. Genu I- with 2 solinidia, $\sigma_1$ longer than $\sigma_2$. Solinidia ($\varphi_1$) on tibia I, coupled with $xt_2$. Tarsus I bears 3 solenidia $\omega_1$, $\omega_2$ and $\omega_3$. $\omega_1$ thick and blunt, as long as $\omega_3$ and about two third as long as $\omega_2$. 
Material Examined

Sixteen ♀♀♀ collected from soil and litter samples from a rubber plantation, Mullankunnu, Calicut, Kerala India, collected by Shiji. M.T on 23.07.05.

Remarks

The present specimen agrees with *A. longisetosus* Aoki, 1965 in all characters and hence fixed so.

**Superfamily : Nothroidea Berlese, 1885**

**Family : Malaconothridae Berlese, 1916**

**Genus: *Trimalaconothrus* Berlese, 1916**

**Generic Diagnosis**


*Trimalaconothrus duoaculeus* Yamamoto et al., 2004.

(Plate-22, Figs. 1 & 2)

**Colour** : Yellowish brown

**Measurements**: Length: 600-652 µm

Width : 303-345 µm
Dorsal Region (Fig. 1)

Prodorsum

Rostrum narrow and rounded anteriorly. All prodorsal setae thin and smooth. Seta le inserted near prodorsal margin. Interlamellar setae longer than setae ro and le. Seta exa very short and thin. Lamellar ridge conspicuous, extending anteriorly to the base of rostral seta. Interlamellar ridge present at the posterior part of prodorsum. A median oblique ridge present posterior to in and ex. ss and bo absent. Prodorsal integument finely punctate.

Notogaster

Postero-lateral side of notogaster gently swollen. Fifteen pairs of notogastral setae present, all setae smooth and thin. Relative lengths of notogastral setae as follows: $h_2 > e_2 > ps_2 > h_1 > c_3 = cp = d_2 = f_2 = ps_1 > c_1 = c_2 = d_1 = e_1 = ps_3 = h_3$. Two pairs of faint, parallel longitudinal ridges present on notogaster. A transverse ridge present posteriorly on notogaster just infront of setae $ps_1$, where notogaster shows a deep concavity. Notogastral integument finely punctate.

Ventral Region

Infracapitulum with a single pair of thin and smooth seta. Epidermal setal formula 3-1-2-3; all setae short, thin and smooth. Genital plates with 7-8 pairs of thin, short and smooth setae. Anal plates bear a single pair of
minute setae. Adanal plates with 3 pairs of short and smooth setae. Ventral integument finely punctate.

Legs

All legs tridactylous.

Material Examined

Nine ♀♀ collected from the soil and litter samples of Botanical garden, Calicut University Campus, Kerala, India, collected by Shiji. M.T on 24.01.2007.

Remarks

The present specimen shows close resemblance to *T. duoaculeus* Yamamoto *et al*, 2004 described from South Africa, except in the presence of transverse prodorsal band and possession of 7-8 pairs of genital setae.