Infraorder: Enarthronota Grandjean, 1947
Superfamily: Cosmochthonioidea Grandjean, 1947
Family: Cosmochthoniidae Grandjean, 1947
Genus: Cosmochthonius Berlese, 1910
Subgenus: Cosmochthonius (Cosmochthonius) Berlese, 1910

Generic Diagnosis

Slightly convex in shape, notogaster with 3 transverse sutures, thereby subdivided into 4 shields; notogastral setae setiform, with more or less elongated cilia; setae of ‘e’ and ‘f’ long and erectile, resembling palm-leaves, setae of row ‘c’ arising on shield NA, row ‘d’ on shield NM, row ‘e’ found in transverse suture, seta f in third transverse suture, setae b and ps on shield PY; prodorsal setae and rows ‘h’ and ‘ps’ short or medium, densely ciliate or plumose; 10 pairs of genital, 4 pairs of anal and adanal setae present; claw formula of legs 2-3-3-3.

Cosmochthonius (Cosmochthonius) reticulatus Grandjean, 1947

(Plate -15, Figs. 1-2)

Colour : Yellowish Brown
Measurements : Length: 280 µm
             : Width: 152 µm
Dorsal Region (Fig.1)

Prodorsum

Prodorsum narrow, short and broadly conical with a ventrally curved rostrum, the latter without distinct teeth; prodorsal surface ornamented with large rounded foveoles; seta ro very thick, paint-brush in shape (Fig.1a), situated laterally on the prodorsum, seta le bifurcated to form a ‘T’ with a small posterior branch and a large anterior branch, thinner but resembles ro in nature, originating far beyond the rostrum (Fig.1b); seta in as long as ro, pyliform; seta ex small, thick and brush like; sensillus narrow at the base, progressively thickened along its length, clavate apically and densely setose at its tip; prodorsal surface covered with a thin layer of cerotegument.

Notogaster

Notogaster oval with a more or less straight anterior margin; small shoulder-like projection seen at the humeral region; hysterosoma divided into 4 segments by 3 transverse furrows, segment -I larger than segments -II and III but shorter than segment –IV, segment I carries 4 pairs of setae, setae c₁ and c₂ as long as cp, seta c₃ shorter than the other c setae; segment II bears 2 pairs of setae (d₁ and d₂), setae e₁ and e₂ very thick and long, inserted in the furrow separating segments I and II, seta f₁ longer than seta f₂ and originates from the third furrow, segment IV large, having marginally 4 short, thick pointed setae, all laterally compressed bearing long bristles laterally; notogastral ornamentation resembles that of prodorsum.
Ventral Region (Fig. 2)

Epimeres well separated, all epimeral setae bilaterally feathered, epimeral setal formula 3-2-3-4; each genital plate with 10 setae, arranged linearly in 2 rows, an inner row of 6 and an outer row of 4, all setae serrate; both anal and adanal plates with 4 pairs of setae; aggenital setae absent.

Legs

All legs hetero-tridactylous with claw formula: 2-3-3-3.

Materials examined

A single ♂ collected from the rotten leaves of the true mangrove plant, A. officinalis growing in the mangrove ecosystems of Nileswaram (12°26'46.89"N 75°12'63.16"E), Kasaragod (Dt) of North Kerala on 11.11.2011, coll. P.K. Syamjith.

Remarks

Cosmochthonius is a cosmopolitan genus erected by Berlese (1910) based on the type species, Hypochthonius lanatus Michael, 1885. Presently, this genus includes 37 valid species. Results of taxonomic studies based on comparison of morphological features of the present specimen supplemented with the analysis of its SEM images enabled to confirm the resemblance of the species with the known species, C. reticulatus described by Grandjean (1947) and redescribed by Pentinnen and Gordeeva (2005) in the following characters:
Description of Species

1. Number and nature of the notogastral grooves,
2. Nature of prodorsal and notogastral ornamentation,
3. Presence of humeral projection,
4. Nature of sensillus, prodorsal and notogastral setae and
5. Similarities in the epimeral setal formula and genital and ano-adanal chaetotaxy.

Superfamily: Lohmannioidea Berlese, 1916
Family: Lohmanniiidae Berlese, 1916
Genus: Annectacarus Grandjean, 1950

Generic Diagnosis

Genital plates without transverse suture; pre-anal plate narrow; anal and adanal plates fused, presence of 2 pairs of anal and 4 pairs of adanal setae and absence of pygidial neotrichy.

Annectacarus unilateralis Hammer, 1973
(Plate -16, Figs.1-2)

Colour : Light brown
Measurements : Length: 510 - 522 µm
: Width: 252-270 µm

Dorsal Region (Fig.1)
Prodorsum

Prodorsum punctate throughout, prodorsal surface ornamented with indistinct reticulate pattern; rostral border broadly incised antero-medially,

Studies on the Oribatid mites (Acari: Oribatei) Associated with Mangrove Ecosystems of North Kerala
seta *ro* strong, straight, bilaterally barbed, setae *le* and *in* finely barbed unilaterally, setae *exa* and *exp* present, both barbed; sensillus (*ss*) pectinate, bearing 14 branches on one side and 6-7 branches on the other side; interlamellar area ornamented with polygonally arranged punctations; a few area porosae found scattered on prodorsum.

**Notogaster**

Anterior border of notogaster straight while the posterior border rounded; notogaster possesses 22 pairs of unilaterally barbed (fringed) setae; setae *c₂* and *d₂* moderately long and barbed, setae *b₁*, *b₂*, *b₃* and *b₄* shorter and thinner than *c₂*,*d₂*; seta *f₁* similar to *c₂* and *d₂*; foveoles present on lateral and posterior borders of notogaster.

**Ventral Region** (Fig.2)

Infracapitulam bears 4 pairs of setae, seta *a* smooth, while setae *h*, *m₁* and *m₂* barbed and thick; epimeral neotrichy present with an epimeral setal formula of 6-4-3-4, setae *1a*, *2a*, *3a* short, seta *4a* little longer and finely barbed; genital plates bear 10 pairs of barbed setae, 4 pairs of laterally arranged and 6 pairs of mediadly arranged setae, lateral setae longer than the medial ones; pre-anal plate narrow with parallel sides; ano-adanal plates fused bearing 2 pairs of thinner, shorter, apparently bilaterally fringed anal hairs and 4 pairs of long, bilaterally fringed, adanal setae, adanal plates punctate while anal plates smooth; dense aggregates of punctuations present in some areas of the ventral plate; fissures *ia*, *ih*, *ip* and *ips* detected.
Description of Species

Legs

All legs monodactyous with punctations on all segments, arranged in a reticulated pattern; femur I stout with an antero-ventral keel and a ventral notch.

Materials examined

3♂♂ and 4♀♀ collected from the soil and litter samples of the mangrove ecosystems of Mankavu (11°14’7.69”N 75°48’13.52”E), Kozhikode (Dt.) on 19.3.2012, and Koduvalli (11°45’59.30”N 75°28’42.06”E), Kannur (Dt), North Kerala on 5.5.2011. coll. P.K. Syamjith.

Remarks

The present specimens resemble *A. unilateralis* described by Hammer (1973) from the Tonga Islands in the general appearance, nature of prodorsal setae and shape and nature of notogastral setae. It is the first report from the mangrove ecosystems of India, especially from Kerala.

Superfamily: Lohmannioidea Berlese, 1916

Family: Lohmanniidae Berlese, 1916

Genus: *Haplacarus* Wallwork, 1962

Generic Diagnosis

Genital plates without transverse suture; pre-anal plate broad; anal and adanal plates fused, 1 pair of anal and 4 pairs of adanal setae present; notogastral and epimeral regions without neotrichy.
Description of Species

*Haplacarus aureus* sp.nov.

(Plate -17, Figs.1-3)

Colour : Golden Yellow

Measurements : Length: 652 µm (650-720 µm)

: Width: 310 µm (302-352 µm)

Dorsal Region (Fig.1)

**Prodorsum**

Anterior border of prodorsum smooth, without any incision; all prodorsal setae barbed, seta *ro* directed forward, measures 75µm, inserted far behind the rostral tip; seta *le* long, inserted below the insertion point of *ro* and measures 94 µm, curved laterad; seta *in* long and thick measuring 110 µm, placed below the level of bothridium (*bo*); setae *exa* and *exp* measure 104 µm and 94 µm respectively, *exp* falcate; a band formed of small papillae runs between setae *in*; bothridium (*bo*) cup shaped; sensillus (*ss*) pectinate with 10-11 branches; prodorsal integument covered with small tubercles.

**Notogaster**

Notogaster elongated with wavy margins; microsculpture of notogaster comprised of small uniformly distributed golden coloured tubercles; 16 pairs of notogastral setae present, all thickened and weakly foliate; setae at the posterior margin slightly barbed; seta *ps₁* incurved with distal ends; 9
notogastral bands formed of clear areas present, of which 4 bands \( (S_2, S_3, S_5 \)
and \( S_6 ) \) interrupted/or medially broken.

**Ventral Region** (Fig.2)

Infracapitulum with 4 pairs of setae, \( a, h, m_1 \) and \( m_2 \), all setae foliate, thicker and slightly dentate; mentum ornamented with round tubercles medially; epimeral setal formula 3-1-3-4, all setae roughened, rather thick and with minute barbs, epimeral surface ornamented with small round tubercles, micropunctations; aggenital plates located at the antero-lateral corner of the genital field, genital plates without transverse suture, each plate carries 10 pairs of setae, paraxial row of 6 small, and antiaxial row of 4 elongate, thick setae; 1 pair of anal and 4 pairs of adanal setae inserted on the fused ano-adanal plates, all setae foliate with distinct barbs, anal setae thinner and smaller than the adanal ones; fissures \( ia, ip \) and \( ih \) detected in the normal positions.

**Legs**

All legs monodactylous; femora of all legs possess raised, rounded tubercles; chaetotaxy of leg I (Fig.3): 0-4-4-3-18, femur- I with a thick, foliate and barbed seta \( d \) and a smooth seta, \( l \); setae \( bv \) and \( v \) thick, foliate and barbed; genu –I bears two solenidia, \( \sigma_1 \) and \( \sigma_2 \), seta \( l' \) thick and barbed; tibia - I with a long solenidion \( \varphi \), setae \( xt_1 \) and \( xt_2 \) thick and barbed; tarsus –I carries 18 setae including 2 solenidia \( \omega_1 \) and \( \omega_2 \).
Description of Species

Materials examined

Holotype ♀; paratypes: 1 ♂ and 4♀ collected from the soil/litter samples of the mangrove ecosystems at Kottakkadavu, (11°8'15.99"N and 75°50'28.26"E.), Calicut (Dt) of North Kerala on 08.10.2013, coll. P.K. Syamjith.

Type repository

The type specimen will be deposited at the Zoological Survey of India (ZSI) Calicut, Kerala, India.

Etymology

The specific name is derived based on the beautiful, golden colour of the specimen.

Remarks:

Description of Species

possession of 4 incomplete notogastral bands in the new species easily separates it from the known species viz. *H. xavieri* (5 incomplete bands), *H. f oliatus*, *H. pairathi*, *H. pandanus* (3 incomplete bands each), *H. javensis*, *H. bhadurii*, *H. maharashtraensis*, *H. keralensis* (2 incomplete bands each), *H. porosus* (all the 9 bands complete) and *H. davis i* and *H. rugosus* (fused nature of the 2 incomplete bands). The possession of 10-11 branched sensillus of the present species helps its easy separation from other known species like *H. javensis* (8 branches), *H. bhadurii*, *H. maharashtraensis* (7 branches each), *H. rugosus* (12-14 branches); *H. porosus* & *H. xavieri* (14-15 branches each), *H. f oliatus*, *H. keralensis* and *H. pandanus* (10-12 branches each). The bright golden coloured, tuberculated body and falcate nature of seta *exa* are the unique features of the present species which help its segregation from all the known species and its erection as a new species under the genus *Haplacarus*.

**Superfamily: Lohmannioidea Berlese, 1916**

**Family: Lohmanniidae Berlese, 1916**

**Genus: Heptacarus** Piffl, 1963

**Generic Diagnosis**

Genital plates with transverse suture; anal and adanal plates fused, pre-anal plate broad; 2 pairs of anal and 5 pairs of adanal setae present; pygidium with neotrichy; 27 to 60 pairs of notogastral setae present; epimeral region with weak neotrichy.
**Heptacarus hirsutus** Wallwork, 1964

(Plate- 18, Figs.1-2)

**Description of Species**

**Colour**: Light brown

**Measurements**: Length: 510 - 550 µm  
Width: 246-252 µm

**Dorsal Region** (Fig.1)

**Prodorsum**

Rostrum broad, rounded; lateral margins of prodorsum produced into rather angular wings; seta *ro* slender and barbed, inserted close together dorsally; seta *le* also barbed, slightly longer and thicker than *ro*; seta *in* slender, finely barbed and as long as *le*, but resembles *ro*; 2 slender, finely barbed exobothridial setae (*exa* and *exp*) present on each lateral side of prodorsum; *bo* small, cup shaped, opened posterolaterally; *ss* pectinate with pectinations which become progressively longer towards the tip.

**Notogaster**

Notogastral bands absent; weak neotrichy in setal rows *c*, *d* and *e*, strong neotrichy present posterior to row *e*; all setae slender and richly barbed, moderately long, setae more elongated towards the posterior end of the notogaster; entire surface granulated.
Ventral Region (Fig.2)

Infracapitulam bears 4 pairs of setae, seta h pectinate, seta m₁ and m₂ barbed, but not pectinate; seta a longer than m₁ and m₂; epimeres I and II completely separated by the sejugal furrows, epimeral neotrichy absent, epimeral setal formula 3-1-3-4, all setae pectinate; pre-anal plate broad; genital plates divided by transverse suture, anterior half triangular and posterior half rectangular in shape; each plate bears 10 setae, paraxial row of 6 and antiaxial row of 4, antiaxial setae longer than the paraxials, all setae pectinate; aggenital plate triangular; ano-adanal plates fused bearing 2 pairs of slender, finely barbed anal and 5 pairs of pectinate adanal setae.

Legs

All legs monodactylous bearing a single stout claw; femora I-IV with well-developed ventral keels.

Materials examined

2 ♂♂ and 5 ♀ collected from the soil and litter samples of the mangrove ecosystems of Ezhome (12° 1’38.28”N and 75°17’0.72”E ) and Koduvalli (11°45’59.30”N and 75°28’42.06”E ) Kannur (Dt), North Kerala, India, on 16.01.2013, coll. P.K. Syamjith.

Remarks

The specimens examined presently resemble H. hirsutus described by Wallwork (1964) from Tchad Island in the nature and arrangement of
Description of Species

prodorsal, notogastral, genital, anal and adanal setae and in the presence of prodorsal wings. This forms the first report of the species from the mangrove ecosystems of India, especially from Kerala.

**Superfamily:** Lohmannioidea Grandjean, 1967

**Family:** Lohmanniidae Berlese, 1916

**Genus:** Javacarus Balogh, 1961

**Subgenus:** Javacarus (Javacarus) Balogh, 1961

**Generic characters**

Genital plates without transverse suture; anal and adanal plates fused, Pre-anal plate wide, anal setae absent; 4 pairs of adanal setae present; notogastral and epimeral regions without neotrichy.

**Javacarus (Javacarus) porosus** Hammer, 1979

(Plate –19, Figs.1-2; Plate- 20, Figs.1-6)

**Colour** : Brown

**Measurements** : Length: 650-702μm

Width: 335-350μm

**Dorsal Region** (Plate-19, Fig.1; Plate-20, Figs.1-3)

**Prodorsum**

Prodorsum triangular in shape, anterior border of rostrum entire; seta *ro* measures 96 μm in length, straight and inserted far below the rostral apex; lamellar seta (*le*) dentate, inserted laterally, below the insertion point of *ro*
and measures 118 μm; seta in 112 μm long, placed below the level of bothridium (bo); setae exa and exp measure 111μm and 86μm respectively, exp falcate in nature; all other prodorsal setae foliate with distinct midrib and faintly dentate in nature; a band runs in between setae in of either side; a pair of lateral ridges present; bo cup shaped; ss pectinate with 10 branches; integument covered with raised tubercles medially.

**Notogaster**

Lateral margins of notogaster parallel and posterior region globular; notogaster bears 16 pairs of lanceolate and dentate setae; dorsal setae short with more or less blunt tip, marginal setae (c₃,d₃,h₃,ps₂ and ps₃) longer and thinner towards tip; seta c₁ directed forwards, seta e₂ short; seta ps₁ slightly incurved; 9 complete, irregular notogastral bands present; tubercles present in between the bands, particularly at the posterior region (Plate-20, Fig.3); a few area porosae located in between setae d₂ and e₂.

**Ventral region** (Plate-19, Fig.2; Plate-20, Figs.4-6)

Intracapitulum with 4 pairs of setae a, h, m₁ and m₂ of which a and m₁ thin, m₂ and h thicker and dentate; epimeral setal formula 3-1-3-4, all setae roughened, rather thick and faintly dentate in nature; epimere-I bears a few area porosae, apodemes 1,2,3 and sejugal one (apo.sj) well developed; setae 1b, 3b and 4b thicker and longer than the others; genital plates without transverse suture, each plate carries 10 setae, paraxial row of 6 small, smooth setae and antiaxial row of 4 long, roughened setae; pre-anal plate with a postero-median projection; ano- adanal plates fused; anal setae absent; adanal
setae 4 pairs, all setae foliate and roughened in nature; ventral integument covered with faint tubercles, particularly at the lateral areas of genital and paraproctal plates; fissure $ip$ aligned near to the insertion point of seta $h_3$, base of all legs micropunctate; scattered cerotegument found adhered to the lateral regions of the ventral plate, exterior to the ano-adanal plate (Plate-20, Fig.5).

**Leg**

All legs monodactylous with a stout claw, all leg segments ornamented with small fine, raised micropunctations; chaetotaxy of leg I : 1-4-4(2)-4(1)-18(2), trochanter –I with a single roughened seta, femur I with thick and barbed setae $d$ and $l''$, genu –I bears 2 solenidia, $\sigma_I$ and $\sigma_2$, seta $l'$ thick and barbed, tibia -I with a long solenidion $\phi$ associated with seta $d$, setae $xt_I$ and $xt_2$ thick and barbed, tarsus –I carries 18 setae, of which solenidion $\omega_I$ thicker than $\omega_2$ and with a blunt tip. Setae ($ft$) thick and barbed and $pv''$, $s$, $m''$, $(p)$ and $(a)$ smooth.

**Materials examined**

3 ♀♀ collected from the soil and litter samples of mangrove ecosystems of Thalassery (11°45'18.12"N and 75°29'30.58"E) Kannur (Dt) on 5.5.2012 and 2♂♂ and 5♀♀ from the mangrove litters of Kallai (11°14'16.72"N and 75°47'14.12"E) Kozhikode (Dt) on 2.4.2014. North Kerala, India, coll. P.K. Syamjith.

**Remarks:**

The genus *Javacarus* was erected by Balogh (1961) with the type species, *J. kühnelti*. At present, this genus includes 8 valid species. The
Description of Species

Studies on the Oribatid mites (Acari: Oribatei) Associated with Mangrove Ecosystems of North Kerala

The present specimen examination shows close resemblance to *J. (J.)porosus* described by Hammer (1980) from Java in most of the features. However, the nature of the prodorsal integument, nature of the epimeral setae and possession of scattered cerotegument on the lateral areas of the ventral plate, lying exterior to the ano-adanal plates are some of the variations observed in the present specimen. The recovery of the species forms the first report on the presence of the genus in the mangrove ecosystems of Kerala, India.

**Superfamily: Eupthiracaroidea Jacot, 1930**

**Family: Eupthiracaridae Jacot, 1930**

**Genus: Acrotritia Jacot, 1923**

**Generic Diagnosis**

Prodorsum without median carina, but with one or 2 lateral carina, bothridial scale lies above bothridium; notogaster with 14 pairs of setae erect, barely rough; ventral plate with 6 genital (rarely 8-9) and 2 aggenital setae, situated one behind the other; genitoaggenital and anoanal plates completely fused, one interlocking triangle present.

**Acrotritia clavata** (Märkel, 1964)

*(Plate- 21 Figs.1-3; Plate-22, Figs.1-3)*

Color: Dark brown

Measurement:

- Length of Aspis: 230- 263 µm
- Width of Aspis: 168 - 182µm
- Length of Notogaster: 392- 480µm
- Width of Notogaster: 366- 399µm
Studies on the Oribatid mites (Acari: Oribatei) Associated with Mangrove Ecosystems of North Kerala

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**Dorsal Region** (Fig.1)

**Prodorsum**

**Aspis** (Plate- 21 Fig.1a; Plate-22, Fig.2)

Prodorsum with a pair of lateral carina; setae on aspis more delicate than those of other species of the genus, the posterior most pair conspicuously long and somewhat curved; length of setae range as: in > le > ro > ex; lamella incised medially and placed above bothridium; exobothridial setae small; sensilli with a narrow stalk and clubbed head, rough, almost smooth(Plate -22, Fig2); bothridium not distinctly spiral in top view, but appears as a distinctly spiral structure in semi-oblique view; entire prodorsal surface punctated (Plate-21, Fig.1a).

**Notogaster**

Notogaster with 14 pairs of fine, short, rigid setae, without sign of shagreen appearance, setae c1 and c2 considerably remote from anterior margin, setae c3 closer to margin; opening of latero-opisthosomal gland distinct; 5 lyrifissures and 2 vestigial setae present on both sides, situated typically for the genus; it appears ornamented with punctations under higher magnification (400x).

**Ventral Region** (Plate- 21, Fig.2; Plate-22, Fig.3)

Infracapitulum with seta h longer than their mutual distance; palps 3-segmented with a setal formula of 2-2-7, palp tarsus carries a single
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solenidion ($\omega$); epimeral setal formula 3-1-3-3, all setae smooth and setiform; genito- aggenital plates almost smooth, genital plates carry 6 pairs of small, fine setae, 2 pairs of short, smooth aggenital setae, inserted one behind the other; 3 pairs of anal (an$_{1-3}$) detected, of which seta an$_3$ the smallest; 3 pairs of long, setiform adanal setae, ad$_1$ inserted conspicuously far from ad$_2$ and ad$_3$.

Legs

All legs monodactylous with strong claw, chaetotaxy of leg I (Pate-21, Fig.3): 3-2(2)-4(1)-15(1)

Materials examined

10 ♂♂ and 8 ♀♀ recovered from the dead pneumatophores/decaying barks of the mangrove plant, A. marina growing in the mangrove ecosystems of Kadalundi – Vallikkunnu community reserve (11° 7'34;13"N and 75°49'51;17"E), Calicut (Dt) of North Kerala on 12.01.2012, coll. P. K. Syamjith.

Remarks

The present specimen very closely resembles A. clavata described by Märkel, 1964 from Peru in the general morphology, nature and arrangement of prodorsal, notogastral, genital, anal and adanal setae. However, the prodorsal ornamentation shows slight variation. This forms the first report of the genus from the mangrove ecosystems of Kerala, India.
Superfamily: Phthiracaroidea Perty, 1841
Family: Phthiracaridae Perty, 1841
Genus: Hoplophorella Berlese, 1923
Subgenus: Hoplophorella (Hoplophorella) Berlese, 1923

Generic Diagnosis

Members are characterized by 15 pairs of notogastral setae, 9 pairs of genital setae, 5 pairs of ano-adanal setae, 3 pairs of median anal (an$_1$-an$_3$) inserted adjacently on inner margin of anoanal plates and 2 pairs of lateral setae (ad$_1$ & ad$_2$).

*Hoplophorella (Hoplophorella) vitrina* (Berlese, 1913)

(Plate- 23, Figs.1-3)

Color: Pale Yellow

Measurements:

Length of Aspis: 225- 255 µm

Width of Aspis: 105 – 120µm

Length of Notogaster: 465- 480µm

Width of Notogaster: 255- 315µm

Dorsal Region (Fig. 1)

Prodorsum

Prodorsum with 2 pairs of lateral carinae, one on each side of the prodorsum; aspis almost triangular with a blunt rostral apex; seta *ro* thick and slightly curved inwards and inserted slightly away from the rostral apex,
Description of Species

phylliform, lanceolate and smooth with well discernible midrib; seta \textit{le} the longest among the prodorsal hairs; seta \textit{in} small, smooth and spine like and inserted inner to seta \textit{le}; seta \textit{ex} minute and placed posterior to \textit{bo}; comparative lengths of the prodorsal hairs follows the order \textit{le} > \textit{ro} > \textit{in} > \textit{ex}; sensillus elongate, phylliform with distinct midrib, directed forward, the head portion excepting the midrib appears hyaline; the median surface of prodorsum punctated and posterior surface with varying number of vertical striations (Fig.1a).

Notogaster

Notogaster slightly convex, integument sculptured with micropunctations intermingled with round foveoles, more prominent at dorsal aspect, but feeble, sparsely arranged on medio- lateral regions; notogaster bears 15 pairs of foliate setae with distinct midrib and clear hyaline boundary and of varying size, the midrib, under higher magnification seems to possess fine ramifications, seta \textit{d}1 the longest and \textit{e}2 the shortest.

Ventral Region

Rutellum broad and stout with 3 well developed notches, the central notch smaller than the lateral ones; length of infracapitular setae varies in the order \textit{h} < \textit{m} < \textit{a}; chelicerae stout and punctate; epimeral setal formula 1-0-1-1, all setae smooth and pointed; each genital plate rectangular in outline, ornamented with foveoles and carries 4 pairs of smooth, thin setae along the inner margin inserted equidistantly (Fig.2); each broad and short aggenital plate carries one minute seta \textit{ag}1; ano-adanal plates rectangular and short,
resembling the genital plate, each ano-adanal plate carries 3 anal and 2 adanal setae along the median border, seta \(ad_1\) resembles the notogastral setae while seta \(ad_2\) resembles the anal setae, smooth and thin (Fig.3).

**Legs**

Legs monodactylous with a thick empodial claw on each tarsal segment.

**Materials examined**

1♂ and 2♀♀ recovered from the soil samples collected from the mangrove areas of Thalassery, (11°75'55.94"N 75°49'13.81E) Kannur (Dt.) of North Kerala on 16.05.2011, coll. P.K. Syamjith.

**Remarks**

The genus *Hoplophorella* erected by Berlese (1923). The present specimen on comparison with 90 known species of the subgenus shows very close resemblance to the species *Hoplophorella (H.) vitrina* (Berlese, 1913) in the external features and in the nature and arrangement of prodorsal, notogastral, genital, anal and adanal setae.

**Infraorder: Holosomata Grandjean, 1969**

**Superfamily: Crotonioidea Thorell, 1876**

**Family: Trhypochthoniidae Willmann, 1931**

**Genus: Afronothrus Wallwork, 1961**

**Generic Diagnosis**

4 pairs of genital setae; aggenital setae absent; sensilli short; notogaster with 15 pairs of setae, the posterior ones being much longer than anterior;
fissure *ip* large and transverse; 2 pairs of adanal hairs, anal hairs lacking or virtual (1 pair); tarsi tridactyl.

*Afronothrus arboreus* Ramani & Haq, 1992

*(Plate -24, Figs.1-2)*

Colour : Transparent to pale brown

Measurements : Length: 525µm (515-540 µm)

: Width: 285 µm (285-300 µm)

**Dorsal Region** (Fig. 1)

**Prodorsum**

Prodorsum triangular and gradually broadening downwards with lateral excrescence on either side of the bothridia; rostrum round, blunt and without any incisions; seta *ro* inserted at the rostral apex, narrow, tapering, flexible and roughened; a pair of lateral ridges present on either side of the prodorsum in between seta *ro* and bothridia, with thickened anterior halves; lamella absent; seta *le* stiff, erect, roughened, longer than their mutual distance; seta *in* longest among the prodorsal setae, inserted very near to *bo*; each bothridium with a circular opening; *ss* short stalked with a spherical, smooth head projecting laterad; seta *ex* absent; integument of the prodorsum distinctly porose.
Notogaster

Notogaster more or less oval with a slightly wavy dorsosejugal suture; notogaster with 15 pairs of setae of varying size, setae $c_1$, $c_2$ and $c_3$ of equal length, seta $d_2$ very small and $h_2$ and $ps_2$ very long, equal in size and tapering terminally, $f_2$ and $ps_2$ roughened, insertions of setae $f_2$ and $h_3$ visible ventrally, $h_1$ thick, heavily barbed and with prominent insertion point, $h_2$ and $h_3$ oppose each other in direction, $ps_1$ and $ps_2$ with prominent insertion points, $ps_3$ located ventrally; a transverse furrow with 2 or 3 distal branches present in between dorsosejugal suture and above the level of setae $c_2$ and $c_3$; another well developed transverse furrow present between the insertions of $cp$ and $d_1$ anteriorly and $e_1$ and $e_2$ posteriorly, which merges with the polygonal reticulations on present on the lateral sides of the notogaster; fissure $ia$ placed obliquely, below the insertion of $c_3$; $im$ located similarly in the median furrow; $ip$ resembles $im$ but longer, located near to seta $h_j$; lateroabdominal gland ($gla$) located below the middle of the notogaster; posterior and posterolateral margins of the notogaster more strongly chitinized than the mid dorsal regions; notogastral integument ornamented with polygonal reticulations from posterior to the median furrow.
Ventral Region (Fig. 2)

Labiogenal articulation diarthric type; mentum broad and porose in nature; rutellum broad, non-sclerotized and with 3-4 notches; infracapitulam with smooth setae $a$, $m$ and $h$, $a$ longest, $m$ shortest and $h$ of intermediate length; epimeral boundaries clearly separated and all setae smooth and of varying size; epimeral setal formula 3-1-3-2; setae 1$b$ and 3$b$ long, 1$a$, 2$a$ and 4$c$ very short and 1$c$, 3$a$, 3$c$ and 4$b$ intermediate in size; genital and anal plates contiguous, the former being broader anteriorly and narrow posteriorly, 4 pairs of smooth genital setae ($g_1–g_4$) arranged close to the inner margin of the genital plates, setae $g_1$ and $g_2$ inserted anteriorly, one behind the other, $g_3$ placed slightly middle of the plate and $g_4$ located posteriorly; seta $ag$ absent; anal plate narrow, each plate carrying a single smooth seta; 2 pairs of smooth adanal setae ($ad_1$ and $ad_2$) present; lyrifissure $iad$ located slightly above the level of fissures $ian$ and $ips$ and above the level of fissure $iad$; $ih$ seen far above, lateral to the genital plates.

Legs

All legs tridactylous and homodactylous, chaetotaxy of leg I: 1-6-4-7-8; all leg segments except the trochanter bear large round foveoles irregularly on all segments except trochanter.
Materials examined

2♀♀ collected from the tidal debris left after high tide at Kadalundi – Vallikkunnu Community reserve, Kozhikode (Dt.), Kerala, India on 13.08.2014 coll. P K. Syamjith.

Remarks

The genus Afronothrus was erected by Wallwork (1961) with A. incisivus as the type species from Ghana. Presently the genus includes only 2 valid species including the type species. The specimen examined during the current study shows close resemblance to the second valid species under the genus viz. A. arboreus, an arboreal species described by Ramani and Haq, 1992 recovered from the coconut palm foliage at the Calicut University Campus, Kerala, South India in the nature of setae, $ro$, $le$, $f_2$ and $ps_2$, absence of lamellae, clearly spherical nature of sensillus, thick and densely barbed nature of seta $h_1$ and the stiff nature of setae $h_3$ and absence of polygonal reticulations on the ventral plate. This forms the second report of the species from Kerala and is the first information on the occurrence of the species in the mangrove ecosystems.

Superfamily: Nothroidea, Grandjean, 1954
Family: Trhypochthoniidae, Willmann, 1931
Genus: Archegozetes, Grandjean, 1931

Generic Diagnosis

Bothridium present; rostral setae removed from each other; members possess 7 pairs of genital setae, 2 pairs of adanal setae and monodactylosous legs.
Description of Species

*Archeogzetes longisetosus* Aoki, 1965

(Plate- 25, Figs.1-2)

- **Colour**: Yellowish Brown
- **Measurements**: Length: 760-790 µm, Width: 522-568 µm

**Dorsal Region** (Fig. 1)

Body narrow anteriorly and broad posteriorly; integument appears densely punctate, soft, weakly sclerotized.

**Prodorsum**

The anterior end of the prodorsum pointed; 3 pairs of barbed prodorsal setae present; seta *ro* setiform, inserted far below the rostral tip; setae *le* and *in* moderately flagellate; *bo* bell shaped; *ss* long, flagellate with small barbs; scattered groups of area porosae located at the interlamellar area, in between setae *in*.

**Notogaster**

Notogaster more or less oval in outline, the actual size determined by presence or absence of eggs within the viscera; 15 pairs of ciliated, barbed setae of varying size present, all heavily barbed distally and lesser at proximal ends; laterally, lateroabdominal gland (*gla*) present at the region of setae *e2*, *f2* and *h2* as a dark brown spot, the glandular opening seen very close to the insertion point of *f2*; notogastral fissures *ia*, *im*, *ip* and *ih* clearly visible, *ia* located near *c3*, *im* between *d3* and *e2* and *ip* near seta *h2*. 
Description of Species

Ventral Region (Fig.2)

Infracapitular setae 3 pairs, anterior \(a\) and posterior \(h\) setae longer than the smooth \(m\) seta; epimeral region separated from the infracapitulum by a transverse sub-mental plate (\(spm\)); anterior region of which lined by the entire mentotectum; epimeres I and II separated from epimere III by a sejugal furrow, epimeral setal formula 3-1-3-3; 7 pairs of ciliated genital setae present, anterior 4 pairs \((g_1-g_4)\) inserted very close together at the anterior half of the genital plate and the posterior 3 pairs \((g_5-g_7)\) aligned more widely; each anal plates carries 2 short barbed setae; adanal plates with 3 pairs of barbed setae, length of which decreases from \(ad_1-ad_3\); lyrifissures \(ian\) and \(ips\) located on the ventral plate.

Legs

All legs monodactylous.

Materials examined

2♀♀ recovered from the litter samples collected from the mangrove ecosystems at Thalassery (11°45'18.12"N 75°29'30.58"E), Kannur (Dt.) on 16.01.2013, North Kerala, India, coll. P.K. Syamjith.

Remarks

The present specimen very closely resemble \(A.\)longisetosus described by Aoki (1965) from Japan in the nature and arrangement of prodorsal hairs, possession of 15 pairs of notogastral setae, 7 pairs of genital setae, nature of sensillus etc. and hence was assigned to the same species. This forms the new
Description of Species

report of the species in the mangrove ecosystems of India, especially from Kerala.

Infraorder: Desmonomata

Superfamily: Carabodoidea Koch, 1837

Family: Carabodidae Koch, 1837

Genus: Carabodes Koch, 1835

Subgenus: Carabodes (Klapperiches) Mahunka, 1979

Generic Diagnosis

Members possess 4 pairs of genital and 10 pairs of spatuliform notogastral setae; distance between genital and anal plates shorter than the length of genital plates; epimeral setal formula 1-1-3-3; seta ad₁ post-anal, ad₂ and ad₃ in para-anal position.

Carabodes (Klapperiches) penicillus (Mahunka, 1998)

(Plate 26, Figs.1-3)

Colour : Yellowish Brown

Measurements : Length: 360 µm (330-376 µm)

Width: 165 µm (150-180 µm)

Dorsal Region (Fig.1)

Prodorsum

Rostrum broadly rounded, lamellae narrow, running marginally, broad, lamellar setae simple, arched mediad, seta ro thin and in penicillate; lamellar

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surface smooth, seta le thin, simple, inserted at the lamellar tip; interlamellar region postulate distinctly; ss moderately long, directed outwards, capitulum calyciform, open laterally.

**Notogaster**

Dorsosejugal suture straight, entire surface tuberculate; 10 pairs of small stumpy, penicillate notogastral setae present; lyrifissures im and gland gla in typical lateral position.

**Ventral Region** (Fig.2)

Infracapitulum diarthric type, infracapitular setae 3 pairs; mentum and coxisternal region foveolate medially and laterally; ventral plate ornamented with tubercles; epimeral region relatively larger than the ano-genital area, thereby genital and anal openings appearing on the posterior half of the body, near the anal opening; epimeral setae minute, epimeral setal formula 1-1-3-3; 4 pairs of genital, 1 pair of aggenital, 2 pairs of anal setae, seta ag thickened and ciliate, located near the postero-lateral border of the genital plates; setae ad, penicillate, like notogastral setae.

**Legs**

All legs monodactylous with a single, strong sickle-shaped claw, foveoles on abaxial surfaces of femora I-IV (Fig.3).
Description of Species

Materials examined

3♂♂ and 6♀♀ recovered from the tidal debris left after high tide at the mangrove ecosystems of Kadalundi- Vallikkunnu community reserve (11°7'38.43"N 75°49'54.55"E) Kozhikode (Dt) on 13.08.2014 and 1♂ and 3♀♀ from the mangrove litters of Ezhome (12°02'57.54"N 75°27'71.60"E), Kannur (Dt) on 16.01.2013, North Kerala, India, coll. P.K. Syamjith.

Remarks

The present species of *Carabodes* collected from the Kadalundi Vallikkunnu community reserve shows very close resemblance to *K. penicillus* (Mahunka, 1998) described from St. Lucia (Antilles) Island in the possession of 10 pairs of penicillate notogastral setae, nature of pustules on notogaster and in the shape of sensillus. It is the first report from the mangrove ecosystems of India, especially from Kerala.

**Superfamily: Ameronothroidea Willmann, 1931**

**Family: Selenoribatidae Schuster, 1963**

**Genus: Selenoribates Stenzke, 1961**

**Generic Diagnosis**

Small sized intertidal mites; cerotegument granular; short or minute interlamellar setae; lamellar ridges present but short; sensillus flagelliform and long; pedotectum I small but robust, pedotectum II absent; 14 pairs of...
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Description of Species

notogastral setae; obvious depressions on anterior part of notogaster; epimeral setal formula 1-0-1-1; genital plates with 3-4 pairs of setae; aggenital setae absent; 2-3 pairs of adanal setae; 1-3 pairs of anal setae; legs monodactylyous, claws with one or 2 proximoventral teeth.

Selenoribates mangrovius sp.nov.

(Plate -27, Figs.1-3a)

Colour: Dark brown
Measurements: Length: 278 µm (278-308 µm)
Width: 163 µm (163-178 µm)

Dorsal Region (Fig. 1)

Prodorsum

Rostrum rounded, rostral apex with cerotegument; seta ro short; prodorsal ridge/ lamellar ridge present; setae le and in very short and simple; seta ex minute; lamellar ridges short, not reaching insertion point of seta in; bothridial cup large; ss flagelliform and long (53µm) (Fig.1a); tutorium small but weakly developed; prodorsal surface with granular cerotegument.

Notogaster

Notogaster rounded in dorsal view, concave in lateral view; anterior notogastral margin complete; notogaster lacks any horn-like projections at the anterior border; 3 notogastral depressions on anterior part of notogaster.
its longitudinal ridges reaching above setae $la$ and $da$; 14 pairs of notogastral setae present, all smooth except $da$- dp, the latter two slightly serrate; 5 pairs of lyrifissures present, $ia$ posterior to $c_2$; lateral abdominal gland opening ($gla$) located next to seta $la$; posterior margin of notogaster densely covered by thick cerotegument.

**Ventral Region** (Fig. 2)

Labiogenal articulation diarthric type; infracapitulam with setae $a$, $m$ and $h$; all setae simple, long and smooth; epimeral setal formula 1-0-1-1, all setae smooth, seta $1b$ long, reaching trochanter III, setae $3b$ and $4a$ short; pedotectum I small, but well developed, pedotectum II absent; discidium developed as a conical ridge between acetabula III and IV; a granulated small, sternal cavity present on epimere I and level of apodeme III; a dark coloured insertion of tendon $\beta$ located adjacent to anterior corners of genital opening; genital plates with 3 pairs of setae, 2 pairs arranged longitudinally at anterior region and 1 pair at the posterior margin; aggenital seta absent; anal plates triangular bearing 2 pairs of simple setae, inserted at the anterior and posterior regions of anal plates; 3 pairs of short and simple adanal setae ($ad_1$–$ad_3$) present; lyrifissure $iad$ in paranal position, obliquely arranged, adjacent to anterior corners of anal plates.

**Legs**

All legs monodactyrous, all tarsi with a hook-like claw bearing a prominent proximoventral tooth and a minute proximodorsal tooth (Fig. 3a);
all femora possess ventral carinae; chaetotaxy of leg I (Fig. 3): 0-3-2(1)-3(2)-17(2) tibia I with long solenidion $\varphi_1$.

**Materials examined**

Holotype ♀; paratypes: 4♂♂ and 5♀♀ from the mangrove litter samples at Ezhome of North Kerala on 08.10.2013, coll. P.K. Syamjith.

**Type repository**

The type specimen will be deposited at the Zoological Survey of India (ZSI) Calicut, Kerala, India.

**Remarks**

The genus *Selenoribates* was erected by Strenzke (1961) based on the type species *S.foveiventris*. This genus comprises littoral oribatids with marine-associated habitats, especially those from the intertidal and coastal regions. At present, the genus includes 10 valid species described from various countries viz. *S.foveiventris* Strenkze, 1961; *S.mediterraneus* Grandjean, 1966; *S.ghardaquensis* Abdel-Hamid, 1973; *S.elegans* Pfingstl, 2013; *S.quasimodo* Pfingstl, 2013; *S.satanicus* Pfingstl, 2013; *S.arotroventer* Pfingstl, 2015; *S.asmodaeus* Pfingstl, 2015; *S.niccus* Pfingstl, 2015 and *S.divergens* Pfingstl, 2015. The present new species, *S. mangrovius* can be distinguished from the known species like *S.divergens, S.asmodaeus* and *S.arotroventer* described from the coasts of the Red Sea and Indo-Pacific...
region by the possession of flagelliform sensillus, simple notogastral setae, short prodorsal ridges and oblique disposition of iad. The large size of the species (278-308/163-178μm) easily differentiates it from *S.ghardagensis* (198-218/119-139μm) along with the possession of other features like presence of 3 pairs of genital and adanal setae as well as 2 pairs of anal setae. Presence of 14 pairs of simple notogastral setae of the new species easily differentiates it from *S. arotroventer* and *S. niccus* (15 pairs of branched setae in both). The possession of 3 pairs of adanal setae and a single dorsal tooth on leg claws clearly distinguishes the new species from *S. mediteraneus* and *S. foveiventris* (2 pairs of adanal setae and toothless condition of leg claw in both). Larger size of the body, possession of 3 pairs of adanal setae and a single ventral tooth on leg claws separate the new species from *S.elegans* (200-203; 108/122μm). Possession of the following character combination detected in the new species clearly separates it from all the known species and assign it as a new taxon under the genus:

1. Larger body size (278-308 / 163-178μm)
2. Complete nature of dorsosejugal suture
3. Presence of short lamellar ridge
4. Absence of strongly projecting horn-like structures at the anterior border of notogaster

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5. Presence of 2 pairs of anal setae

6. Presence of a single dorsal and ventral tooth each on leg claws.

**Etymology**

The specific name derived from the nature of habitat of the species namely the mangrove ecosystem of North Kerala, India.

**DESCRIPTION OF NEW GENUS**

Superfamily: Ameronothroidea Willmann, 1931

Family: Fortuyniidae Hammen, 1963

Genus: *Holocarinozetes* gen. nov.

Type species: *Holocarinozetes epimeratus* gen. nov. sp. nov.

**Diagnosis**: Small sized (274-300 µm in length), dark brown coloured, highly sclerotized intertidal mites; cerotegument thin and granular; tutorium present; interlamellar setae short and conspicuous; lamellar ridges demarcating rostrum; sensillus clavate, spinose apically; notogaster with 15 pairs of setae; lenticulus present; van der Hammen’s organ with specific cuticular channels; a pair of strongly projecting longitudinal carinae running along the entire lateral borders of epimeres I to IV; epimeral setation 3-1-2-2; genital setae 4 pairs; aggenital setae 1 pair, anal setae 2 pairs and adanal setae 3 pairs; all legs monodactylous with hook-like claws.
Generic Diagnosis

Dark brown coloured intertidal mites; mean length 300µm, mean width 195µm; lamellar ridges conspicuous and long, extending up to end of prodorsum; cuticle of notogaster showing specific obvious tuberculated pattern; 15 pairs of very short and blunt notogastral setae; on ventral side, a characteristic pair of ventral carinae running longitudinally from epimeres I to IV; genital plates with 4 pairs of setae.

*H. epimeratus* gen.nov.sp.nov.

(Plate- 28, Figs.1-2b; Plate- 29, Figs.1, 2A-D; Plate- 30, Figs.1-6)

Colour : Dark brown

Measurements : Length: 300 (276-300µm)

Width : 195 (180-195µm)

**Dorsal Region** (Plate-28, Fig.1; Plate-30, Figs.1-3)

**Integument:** Colour dark brown, cuticle of notogaster with irregular depressions forming a tuberculated pattern (Plate-28, Fig.1b; Plate- 30, Fig.5) cerotegument thin and granular.

**Prodorsum:**

Rostrum rounded in dorsal view, clearly separated from the prodorsum by a narrow ridge, seta *ro* simple; lamellar ridges conspicuous and long, lamellar surface ornamented with small granules; seta *le* very short and
inconspicuous; seta in 15-18 µm long, thin and smooth; a single pair of minute exobothridial setae (ex) present on either lateral sides; bothridia small, cuticular bothridial cups opened laterally; sensillus with smooth stem, capitulum clavate and barbed/spinose apically, as shown in (Plate-28,1a; Plate-30, Fig.1a)

Notogaster

Rounded in dorsal view, convex in lateral view; dorsosejugal suture complete and arched; lenticulus appears as a median rectangular light spot, near to anterior margin of notogaster (Plate-30, Fig.1); integument of notogaster with small, irregular circular depressions, forming tuberculated pattern (Plate-30, Fig.5); 2 pairs of convex parallel ridges (hump like projections) run along the entire length of notogaster on either side (Plate-30, Fig.1); entire surface of the notogaster including the ridges tuberculated (Plate-30, Fig.1&2); 15 pairs of bristle like setae, c1–3, da, dm, dp, la, lm, lp, h1–3, p1–3 and 5 pairs of lyrifissures arranged on notogaster as shown in (Plate-29, Fig.1).

Lateral Region (Plate-29, Fig.1; Plate-30, Fig.2)

Cerotegument finely granular; tutorium present; pedotectum I weakly developed, pedotectum II represented by a plate- like ridge; Van der Hammen’s organ modified, consisting of three combined parts, first major canal connected outside by a small slit, starting at the lateral part of

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dorsosejugal suture and reaching posterior of bothridium and running ventral
to the area between acetabula II and III, second and third canals start near the
bothridial opening and diverge towards the acetabula III and IV respectively
(Plate-30, Figs. 2&4)

**Ventral Region** (Plate- 28, fig.2; Plate- 30, Fig. 6)

Infracapitulum diarthric type with 3 pairs of setae \((h,m,a)\); epimeral
sertation 3-1-2-2, setae 1b and 3b about twice longer than the remaining setae;
a characteristic pair of ventral carinae run longitudinally from epimeres I to
IV (Plate-30, Fig. 6) which diverge laterally beyond leg IV; epimeral surface
tuberculated; genital plates broader anteriorly, each plate bears 4 smooth
setae, seta \(g_1\) minute, located at anteriormost margin of the genital plate, \(g_2\) &
\(g_4\) located paraxially, \(g_3\) arranged at lateral margins of the genital plates; and
ano-genital openings located adjacentily, both surrounded by strongly
sclerotized cuticle; two obvious points of black pigmentation, representing
insertion of tendon “\(\beta\)” (Grandjean 1966) adjacent to corners of genital
orifice; one pair of simple aggenital setae, located laterad of ano-genital
plates; 2 pairs of short and simple anal setae, arranged in a longitudinal row; 3
pairs of simple adanal setae \((ad_1,3)\) located; adanal fissure \(iad\) obliquely placed
between \(ad_2\) and \(ad_3\) nearer to the former.
Description of Species

Legs (Plate- 29, Fig.2A-D)

All legs monodactylous with long hook like smooth claws without proximoventral tooth; all segments heavily sclerotized; femur I with a strong ventral carina and granulated cuticle; on tarsus-I with long solenidion ($\varphi_1$) long and slender while $\varphi_2$ short and slender, famulus ($\epsilon$) placed near to $\omega_2$; chetotaxy of leg I: 0-4-2(1)-2(2)-18(3); II: 3-1(1)-2(1)-17(1), solenidion $\omega_2$ short and slender; III: 2-1(1)-3(1)-17(0); IV: 2-2-3(1)-14(0).

Etymology

The generic name and species epithet of the new taxon are derived from the presence of 2 conspicuous longitudinal carinae running along the entire length of the epimeral plates from epimere I-IV.

Remarks

The family Fortuyniidae was erected by Van der Hammen (1963) based on the type genus Fortuynia and with the type species, F. yunkeri. The family of Fortuyniidae represents a thalassobiontic group and presently it comprises 3 genera viz. Alismobates Luxton 1992, Circellobates Luxton, 1992 and Fortuynia. Members of this family are distributed transoceanically and dwell in intertidal habitats of tropical and subtropical coasts. A comparison of the characters present in the specimen collected during the
current study enabled to erect another new genus *viz.* *Holocarinozetes* under
the family Fortuyniidae based on characters like,

1. Presence of Van der Hammen’s organ

2. Presence of lenticulus

3. Similarities in the setation of genital, anal and adanal regions.

However, the possession of the following character combinations
clearly demarcates the present specimens from the members of all the
previously described genera and to assign them to a new genus *viz.*
*Holocarinozetes* under the family Fortuyniidae.

The new genus keeps its identity separate from all the congeneres of
the family based on the following unique features:

1. Possession of a pair of distinct ventral carinae running along the entire
   length of epimereal area (epimeres I to IV)

2. Presence of 2 pairs of conspicuous convex, hump-like parallel ridges
   on notogaster.

3. Presence of distinct interlamellar ridges

4. Possession of 15 pairs of bristle like setiform setae.

5. Small size of the body (250-300)µm
Materials examined

Holotype ♀; Paratypes: 5♀♀ and 9♂♂ from the intertidal mangrove ecosystem at Kadalundi (11° 7'54.89"N 75°49'44.55"E), upper eulittoral zone (leaf litter of A. marina and A. ilicifolius) on 24.02.2011. coll. P.K. Syamjith.

Type repository

The type specimen will be deposited at the Zoological Survey of India (ZSI) Calicut, Kerala, India.

Key to the known and new of genera of Fortuyniidae

1. Sensillar capituli smooth and membraneous; genital plates with 5 pairs of setae ..................................................Fortuynia van der Hammen, 1960

Sensillar capituli conspicuously barbed; genital plates with 4 pairs of setae .................................................................2

2 (1). Hysterosoma oval in shape; epimeron 3 pierced with 2 conspicuous, annulated pores .............................................Circellobates Luxton, 1992

Hysterosoma globular in shape; epimeron 3 not pierced with annulated pores ........................................................................................................................................3

3 (2) No characteristic pair of ventral carinae on epimeral area; no convex, hump-like projections on notogaster; 14 pairs of notogastral setae ...

..................................................................................................................Alismobates, Luxton, 1992
Description of Species

A Characteristic pair of ventral carinae running longitudinally from epimere I to IV; presence of 2 pairs of conspicuous convex, hump-like parallel ridges on the notogaster; 15 pairs of notogastral setae.............................................Holocarinozetes gen.nov.

Superfamily: Limnozetoidea Thor, 1937
Family: Austrachipteriidae Luxton, 1985
Subgenus: Lamellobates (Lamellobates) Hammer, 1958

Generic Diagnosis

The members possess broad, plate like and closely situated lamellae and the anterior borders of which are without free tips; the interlamellar area small; presence of 2 pairs of anal and 2 pairs of adanal setae.

Lamellobates (Lamellobates) molecula (Berlese, 1916)
(Plate-31, Figs. 1-2)

Color : Light brown
Measurement : Length: 280-305 µm
                         Width: 190 – 206µm

Dorsal Region (Fig.1)

Prodorsum

Rostrum broadly pointed; seta ro very long, reaching far beyond the tip of the rostrum, unilaterally feathered; lamellae broad and plate like, the

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median sides of which stiffened by a chitinous thickening, ending posteriorly in a median knob in between, lamellae lack distal tips, slightly asymmetrical, left inner cuspides completely rounded, the right one with a short, sharp apex, both outer cuspis comparatively short, narrow and sharply pointed; seta le thick and well barbed; seta in setiform, long, reaching the tip of le; ss with a slender stalk and clubbed, barbed head.

**Notogaster**

Notogaster broadest slightly below the middle; anterior border marked by a highly convex dorsosejugal suture; 9 pairs, thin, long, setae bearing small barbs inserted on the notogaster, seta $p_3$ absent; fissure $ia$ located on pteromorph, $im$ medially and $ip$ aligned posteriorly.

**Ventral Region** (Fig. 2)

Infracapitulum with 3 pairs of setae $a$, $m$ and $h$, all simple; epimeral setae short and smooth; epimeral setal formula 3-1-2-2; 6 pairs of genital setae, $g_1$ - $g_3$ located at the anterior margins of the genital plate, $g_3$ - $g_6$ located laterally; aggenital seta ($ag$) inserted poseriolateral to the genital plate; 2 pairs of anal setae present of which $an_1$ inserted posteriorly, and $an_2$ anteriorly; 2 pairs of adanal setae ($ad_1$ and $ad_2$) situated para-anally; fissure iad closely apposed to antero-lateral corner of each anal plate.
Description of Species

Leg

All legs monodactylous.

Materials examined

11 ♀♀ collected from a mangrove ecosystem at Pazhayangadi, Kannur (Dt.), Kerala, India on 25. 05. 2012. coll. P.K .Syamjith.

Remarks

The present species of Lamellobates collected from a mangrove forest of Pazhayangadi, Kannur (Dt.) of North Kerala shows very close similarities with Lamellobates (L.) molecula described by Berlese (1916) in the presence of broad, asymmetrical lamellar plates and the nature and arrangement of 9 pairs of notogastral hairs and the ventral features.

Superfamily: Limnozetoidea Thor, 1937

Family: Austrachipteriidae Luxton, 1985

Genus: Lamellobates Hammer, 1958

Subgenus: Lamellobates (Paralamellobates) Bhaduri & Raychaudhuri, 1968

Lamellobates (Paralamellobates) bengalensis Bhaduri & Raychaudhuri, 1968

(Plate-32, Figs.1-2)

Color : Light brown

Measurement : Length: 245-290μm

           Width: 176-192μm
**Description of Species**

**Dorsal Region** (Fig. 1)

Rostrum pointed with slightly concave sides, seta \textit{ro} unilaterally barbed; lamellae broad, plate like with free anterior tips, outer tips being longer than the inner ones; seta \textit{le} stout and roughened; seta \textit{in} long and barbed; \textit{ss} projects forward, bearing short spines on the head; dorsosejugal suture convex; notogaster with 9 pairs of simple setae; fissures \textit{ia}, \textit{im} and \textit{ip} present on the notogaster.

**Ventral Region** (Fig. 2)

Labiogenal articulation diarthric type; mentum broad and somewhat rectangular; setae \textit{h} and \textit{m} smooth and almost equal in size. seta \textit{a} smooth but shorter; epimeral setal formula 3-1-2-2, all setae smooth; genital plates broad anteriorly, bearing 6 pairs of smooth setae; aggenital setae (\textit{ag}) smooth; anal plates carry a single pair of smooth setae; 2 pairs of adanal setae detected, fissure \textit{iad} placed at the anterolateral corner of the genital plate.

**Leg**

All legs monodactylyous.

**Materials examined**

2♂♂ and 3 ♀♀ collected from a mangrove ecosystem at Olipram kadavu, 11° 7’41.40"N 75°51’50.72"E (Dt.), Kerala, India on 25. 05. 2012. coll. P.K. Syamjith.

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Studies on the Oribatid mites (Acari: Oribatei) Associated with Mangrove Ecosystems of North Kerala
Remarks

The present specimen closely resembles *L. (P.) bengalensis* erected by Bhaduri & Raychaudhuri, 1968 from West Bengal, India in the general morphology including the presence of broad lamellar plates, nature and arrangement of prodorsal, notogastral and ventral setae.

**Superfamily: Oripodoidea Jacot, 1925**

**Family: Oribatulidae Thor, 1929**

**Genus: Phauloppia Berlese, 1908**

**Generic characters**

Lamella indistinct; lamellar seta situated closer to interlamellar setae than to rostral setae; sensillus short and clubbed; 14 pairs of notogastral setae present; genital plates with 4 pairs of setae.

*Phauloppia kadalundiensis* sp.nov.

(Plate- 33, Figs.1-4)

*Colour*: Reddish Brown

*Measurements*: Length: 384 µm (380-390 µm)

*Width*: 256 µm (250-275 µm)

**Dorsal Region** (Fig. 1)

**Prodorsum**

Broad, all prodorsal setae long and distinctly barbed; seta *ro* long, barbed, measuring 51µm in length and inclined inwards; lamella indistinct

Studies on the Oribatid mites (Acari: Oribatei) Associated with Mangrove Ecosystems of North Kerala
Description of Species

(faint), seta le erect and somewhat thicker, smaller than ro and measures 40µm in length; seta in very long (114µm), roughened, inserted close to anterior notogastral margin; the integument of the dorsal surface near bo and in roughened by transverse wrinkling; seta ex fine, barbed and measures 14 µm in length, area near seta ex contains numerous microtuberculated projections; ss capitulate with granulated head; a pair of area porosae (Aj) located behind the insertion point of setae in.

Notogaster

Anterior border of notogaster slightly convex; 14 pairs of notogastral setae present, all setae very fine, almost smooth, slightly barbed and of varying in size (11-15µm) and shape as figured; setae c₁ and c₂ located close together; 5 pairs of oval to round area porosae present, Aa the largest, A₁ located far away from Aa, A₄ small, situated just near to the insertion point of seta h₁; lyrifissure im long, situated in between dm and lm; ip, ih, ips clearly visible; lateral abdominal gland (gla) well developed; surface of notogaster not evenly smooth, but scattered with small granules (at 40x magnification).

Ventral Region (Fig. 2)

Infracapitulum possesses 3 pairs of simple setae a, m and h, seta h long reaching nearer to seta a; epimeral setal formula : 3-1-3-3, setae small and setiform, 4a, 4b and 4c longer, setae 1c,3c and 4c located laterally;
Description of Species

Genital plates pentagonal in shape, as long as wide, carrying 4 pairs of small, smooth, and setiform setae; 1 pair of aggenital, 2 pairs of anal and 3 pairs of adanal setae present; adanal fissure \( (iad) \) arranged obliquely, close to anal margin.

Legs

All legs hetero-tridactylous; chaetotaxy of leg I(Fig. 4): 0-4-3(1)-4(2)-19 (2), trochanter - I bears one barbed seta; femur-I carries 4 setae, genu-I carries 3 setae including 1 solenidion, \( \sigma \); tibia –I bears 6 setae including 2 solenidia \( \varphi_I \) and \( \varphi_2 \), tarsus –I bears 19 setae including 2 solenidia \( \omega_I \) and \( \omega_2 \) and a famulus \( \varepsilon \).

Etymology

The specific epithet of the new taxon is derived from the name of the type locality i.e. the Kadalundi- Vallikkunnu community reserve.

Materials examined

Holotype ♀; paratypes : 2♂♂ and 3♀♀ recovered from the dead twigs and leaves of \( A. \ marina \) from the Kadalundi- Vallikkunnu community reserve mangrove (11° 7’54.89”N and 75°49’44.55”E), Calicut (Dt) of North Kerala on 17.11.2011, coll. P.K. Syamjith.
Description of Species

Type repository

The type specimen will be deposited at the Zoological Survey of India (ZSI) Calicut, Kerala, India.

Remarks

Berlese (1908) erected the genus *Phauloppia* with *Oppia conformis* as the type species. As per the most recent Oribatid catalogue (Subias, 2015), 25 species have been enlisted under the genus, of which 4 species are listed as “sp. inq.” and hence excluded from the comparison made during the present study. On comparison with the remaining 21 valid species, the present species resembles the other known species of the genus in the shape and size of the body as well as the nature of the sensillus. However, the presence of 5 pairs of area poroasae in the new species helps to distinguish it from all the known species of the genus with the exception of *P. adjecta* which possesses 5 pairs of area porosae. Possession of 14 pairs of notogastral setae of the present species clearly separates it from known species like *P.tuberosa* Fujikawa, 1972 and *P.incomperta* Pérez-Íñigo & Peña, 1996 (both possess 13 pairs of notogastral setae each). The new species resembles *P.adjecta* described by Aoki and Ohkubo (1974) in sharing characters like 5 pairs of area porosae, 14 pairs of notogastral setae, 4 pairs of genital, 2 pairs of anal and 3 pairs of adanal setae. However, the following character deviations observed in the
present species clearly segregate it from *P. adjecta* and erect it as a new species under the genus *Phauloppia*.

1. Presence of 5 pairs of intact, oval shaped area porosae on the notogaster, in which *Aa* not divided unlike *P. adjecta* in which the *Aa* divided in to *Aa_1* & *Aa_2*.

2. Barbed nature of prodorsal setae.

3. Presence of transversely arranged wrinkles on the integument at the interlamellar area.

4. Seta *in* being extremely long.

5. Presence of 14 pairs of short, setiform setae on notogaster unlike the long, flagelliform setae of *P. adjecta*.

6. Presence of numerous microtuberculated projections at the exobothridial surface.

**Superfamily: Oripodoidea Jacot, 1925**

**Family: Hemileiidae J. & P. Balogh, 1984**

**Genus: Siculobata Grandjean, 1953**

**Subgenus: Siculobata (Siculobata) Grandjean, 1953**

**Generic Diagnosis**

Anterior border of notogaster straight; pteromorphae absent; notogaster with 4 pairs of sacculi and 10 pairs of setae; sensilli short, capituli usually
capitate; with or without aggenital setae (1 pair if present); genital plates with 4 pairs of setae; 2 pairs of anal setae; 3 pairs of adanal setae; tarsi I-III short; solenidia of tibiae III and IV ending in a small round vesicle, tridactyrous, median claw somewhat stouter than others.

_Siculobata (Siculobata) malabarica_ Ramani & Haq, 1998

_(Plate 34, Figs.1-3b)_

**Colour** : Light to dark Brown

**Measurements** : Length: 370 µm (330-375 µm)

Width: 240 µm (220-275 µm)

**Dorsal Region** (Fig.1)

**Prodorsum**

Rostrum rounded, ending in a pointed tip and with 2 incisions; seta _ro_ long, barbed, thin, sharply pointed and directed anteriorad; lamella sheath-like originate from the base of bothridium, seta _le_ inserted at the tip of the lamella, somewhat thicker than _ro_, bearing short spines and ending in a blunt tip; _ro_ and _le_ connected by prolamellar ridge; seta _in_ longest, outwardly directed and situated far behind _le_; a pair of area porosae (Al) situated either side of the lamellae and exterior to them, almost at the level of _in_; seta _ex_ absent; sensilli and bothridia almost covered by anterior notogastral border. sensillus (_ss_) club-shaped with a short stalk, roughened capituli; small punctations located on the prodorsal surface, near and exterior to the lamella.
Notogaster

Spherical and broadest medially; anterior border demarcated from the prodorsum by a straight dorsosejugal suture; integument of the notogaster smooth and without ornamentation; posterior end of the notogaster slightly incurved; 10 pairs of simple, thin setae showing size differences present on the notogaster; 4 pairs of saculi with varying size and shape arranged on the notogaster; Sa near the insertion point of seta te, S₁ located at almost level of seta ms, S₂ placed slightly behind r₃ and S₃; lyrifissure im located at the middle of notogaster, below and exterior to seta ti.

Ventral Region (Fig.2)

Labiogenal articulation diarthric type; infracapitulum with setae a, m and h, setae h and m roughened, m slightly smaller than h, seta a thick, stout and having fine, long barbs; apodemata II, III and sujugal apodeme well developed; apodeme II kidney shaped; epimeral area smooth, epimeral setal formula 3-2-2-3, all setae smooth, barbed and stouter except seta Ic.

Genital plates broad anteriorly and narrow posteriorly, 3 pairs of smooth genital setae (g₁–g₃), g₁ situated anteriorly, g₂ and g₃ placed posteriorly; seta ag present, inserted one on either side of the genital plate posteriolaterally; anal plates elongate having 2 pairs of smooth setae (an₁ and an₂), located equidistantly from the middle, 3 pairs of anal setae (ad₁–ad₃) located, ad₁ situated posieriorly, ad₂ laterally, slightly above insertion of seta
Description of Species

$an_1$ and $ad_3$ anterolaterally; lyrifissure $iad$ in para-anal position, obliquely arranged, below seta $ad_3$ and slightly above the level of seta $an_2$.

Legs

All legs tri- and heterodactylous, tibia III and IV with solenidia ending in a small vesicle (Figs. 3a & 3b); femora I and II stout, thick and swollen; chaetotaxy of leg I: 0-5-3(1)-6(2)-19(2).

Materials examined

3 ♀ ♂ collected from the dead spikelets of grass plant, M. javanicus at Kadalundi –Vallikkunnu Community reserve (11°7'37.51"N 75°49'54.64"E., Kozhikode (Dt.), Kerala, India on 16.09.2014 coll. P K. Syamjith.

Remarks

The characters present in the present specimens show very close similarity to the species $S. (S.)$ malabarica erected by Ramani and Haq (1998) from the coconut palms of Kerala, South India in the possession of 3 pairs of genital setae, presence of 2 well developed rostral incisions and 4 pairs of sacculi on notogaster. It is the first report on the genus from the mangrove ecosystems of India, especially from Kerala.
Description of Species

Superfamily: Oripodoidea Jacot, 1925

Family: Scheloribatidae, 1933

Genus: Scheloribates Berlese, 1908

Subgenus: Scheloribates (Scheloribates) Berlese, 1908

Generic Diagnosis

Rostrum is without any apophyses; 10 pairs of notogastral setae present; 4 pairs of genital setae; 4 pairs of sacculi; legs tridactylyous.

Scheloribates (Scheloribates) praeincisus interruptus (Berlese, 1916)
(Plate- 35, Figs.1-2)

Colour: Dark Brown
Measurements: Length: 569-620 µm
Width: 390-435 µm

Dorsal Region (Fig.1)

Prodorsum

Rostrum triangular with a blunt apex; of the 4 pairs of prodorsal setae, (ro, le, in, ex), in the longest; prolamellar line absent; translamellar line interrupted medially; sensillus (ss) with a weakly barbed, clavate head; seta ex weakly barbed.
Description of Species

**Notogaster**

Notogaster large, spherical in outline posteriorly; 10 pairs of notogastral setae, mostly represented by alveoli; 4 pairs of sacculi (Sa, S1, S2 and S3) detected on the notogaster; fissures ia, im, and ip clearly visible.

**Ventral Region** (Fig. 2)

Infracapitulum diarthric type, infracapitular setae 3 pairs; epimeral setae roughened, show size variation, epimeral setal formula 3-2-3-2; 4 pairs of smooth genital setae present, 1 pair of aggenital (ag), 2 pairs of anal setae (an1 and an2), 3 pairs of adanal setae present; fissure iad para-anal in position.

**Legs**

All legs hetero-tridactylyous in nature.

**Materials examined**

2♂♂ and 2♀♀ recovered from the soil/litter samples under the mangrove plant, *E. agallocha* at Pazhayangadi (12°1'36.90"N 75°16'24.05"E), Kannur (Dt) on 13.08.2012 North Kerala, India, coll. P.K. Syamjith.

**Remarks**

The present specimen shows very close resemblance to *S. (S.) praecincus interruptus* described by Hammer (1972) from Fiji Island in the
Description of Species 124

possession of 10 pairs notogastral setae, nature of prodorsal setae and shape of sensillus. Hence, it is assigned to the same species.

Superfamily: Oripodoidea Jacot, 1925
Family: Oripodidae Jacot, 1925
Genus: Protoripoda Balogh, 1970

Generic Diagnosis.

Members possess 10 pairs of notogastral setae, 4 pairs of sacculi, 4 pairs of genital setae, 1 pair of aggenital setae, 2 pairs of anal setae and 3 pairs of adanal setae. Ano-adanal setae non-flagellate; legs tridactylous.

Protoripoda (Protoripoda) trifoliatus sp.nov.
(Plate-36, Figs.1-3)

Colour : Reddish Brown
Measurements : Length: 435 µm (435-465 µm)
               Width: 240 µm (240-255 µm)

Dorsal Region (Fig. 1)

Prodorsum

Rostrum widely conical, seta ro measures 60µm, barbed, incurved (Fig.1a); lamella robust, arranged marginally, connected by a linear translamella at cuspides, seta le 56µm in length, spinose apically with cilia arranged in longitudinal rows (Fig.1b); seta in of 52µm length, inserted close
to the anterior notogastral margin, phylliform, broadened towards distal apex (Fig.1c); seta $ex$ not detected; $ss$ with a clavate head, surface of which bears small barbs (Fig.1d); bothridial cup and base of $ss$ covered by pteromorphal bridge; entire prodorsal surface ornamented with small round foveoles.

**Notogaster**

Dorsosejugal suture more or less straight; a pair of distinctly developed lateral ridges run anteriorad along the notogaster to meet the dorsosejugal suture; 10 pairs of long and robust notogastral setae present; 4 pairs of sacculi ($Sa, S_1, S_2, S_3$) detected, $Sa$ situated in between setae $te$ and $ti$, $S_1$ just near to $ms$, $S_2$ located behind the insertion point of seta $r_2$, $S_3$ placed posteriorad, near to the insertion of seta $r_1$; lyrifissure $im$ and lateral abdominal glands (gla) clearly visible and well developed; antero-lateral and posterior margins of notogaster marked with large foveoles, giving a wavy appearance to the notogaster border.

**Ventral Region** (Fig. 2)

Infracapitulum diarthric type with 3 pairs of barbed setae, $h$ longer than $m$ and $a$; epimeral setal formula 3-1-2-3, setae of varied shape and size, setae $1b$ and $3c$ barbed and long, setae $4a, 4b, 4c$ short and smooth; entire surface of mentum and epimeres ornamented with foveoles; pedotecta I and II directed slightly forwards; discidium well developed.
Description of Species

Genital plates rooftop anterior portion and concave posterior; 4 pairs of small genital setae, 2 located anteriorly and 2 located posteriorly; 1 pair of small aggenital setae located mid-way between the genital plates and anal plates; anal plates with 2 pairs of short, smooth setae; 3 pairs of short and simple adanal setae inserted outside the anal opening, \( ad_1 \) located posterior of anal opening, \( ad_2 \) laterad of anal opening, \( ad_3 \) above the level with anterior border of anal opening; adanal fissure (iad) aligned obliquely, close to the anal plate margin; the integument of the ventral plate including that of the ano-adanal plates sculptured with punctations and foveoles.

Legs

Tarsi of all legs possess 3 claws, medial one hardly stronger than the lateral ones; leg I (Fig.3) characterized by a chaetotaxy of 1-4-3(1)-3(1)-20(2); trochanter- I bears 2 barbed setae; femur-I carries 4 setae, of which dorsal setae \( d \) and \( l'' \) strongly barbed; tibia with extremely long solenidion \( \varphi_1 \) of leg I with filiform end; all leg segments ornamented with foveoles.

Etymology

The species epithet of the present new taxon is derived from the name of the mangrove associate plant species, \( D. trifoliata \), with which the new species showed very close association.

Materials examined

Holotype ♀; paratype: 2♂♂ and 4♀♀ from the dead floating barks of \( D. trifoliata \) at Kadalundi- Vallikkunnu community reserve mangrove
Description of Species

(11° 7'37.51"N and 75°49'54.64"E)), Calicut (Dt.) of North Kerala on 07.10.2012, coll. P.K. Syamjith.

Type repository

The type specimen will be deposited at the Zoological Survey of India (ZSI) Calicut, Kerala, India.

Remarks

The genus *Protoripoda* was erected by Balogh (1970) with the type species, *P. (P) woolleyi*. The genus presently includes 7 valid species viz. *P. (P.) elongata* (Oudemans, 1915); *P. (P.) incurva* (Berlese, 1916); *P. (P.) woolleyi* Balogh, 1970; *P. (P.) insularis* Balogh, 1970; *P. (P.) flagellata* Choi, 1994; *P. (P.) lineata* Mahunka, 2009 and *P. (P.) nasuta* Mahunka, 2009. The new species, *P. (P.) trifoliata* resembles the known species of the genus in the possession of 10 pairs of notogastral setae, 2 pairs of anal setae, 3 pairs of adanal setae and tridactylocous legs. However, it keeps its identity separate from all the 7 known species by the long and robust nature of notogastral setae, and the presence of prominent foveoles on the dorsal and ventral surfaces of the body, including the legs. The unique character combinations observed in the present species which help to segregate it from all other known species and erect it as a new taxon are the following:

1. Prodorsum with barbed, spinose setae.

2. Prodorsal surface with variably shaped foveoles.

3. Presence of linear translamellar lines.
4. Notogaster bears a strong, longitudinal ridges/carina and entire surface decorated with small round foveoles.

5. Long and barbed nature of epimeral setae 1b and 3c.

**Superfamily: Oripodoidea**

**Family: Protoribatidae J. & P. Balogh, 1984**

**Genus: Protoribates Berlese, 1908**

**Subgenus: Protoribates (Protoribates) Berlese, 1908**

**Generic Diagnosis**

5 pairs of genital setae, 10 pairs of notogastral setae; Epimeral setal formula 3-2-1-3; 2 pairs of anal; 2 pairs of adanal setae, \(ad_2\) and \(ad_3\) in para-anal position.

*Protoribates (Protoribates) capucinus* Berlese, 1908

*(Plate-37, Figs.1-3)*

- **Colour**: Yellowish Brown
- **Measurements**: Length: 393-415\(\mu m\)
  - Width: 244-255\(\mu m\)

**Dorsal Region** *(Fig.1)*

**Prodorsum**

Rostrum ends with a round tip, which appears darker than the surroundings; lamellae broad and located laterally, seta \(le\) barbed and as long as their distance; seta \(in\) shorter and barbed unilaterally; \(ss\) with a long, thin stalk and a lanceolate, barbed head *(Fig.1a).*
Description of Species

Notogaster

Anterior border of notogaster straight, antero lateral borders produced into large pteromorphae, which bent downward; 10 pairs of very small and thin notogastral setae present; 4 pairs of small round, equally sized area porosae (Aa, A1 - A3) present, A1 located medially associated with seta ms, A2 behind seta r2 and A3 near seta p1; integument of notogaster ornamented with small punctations.

Ventral Region (Fig.2)

Infracapitulum diarthric type with 3 pairs of smooth, setae (a, m and h); epimeral setal formula 3-2-1-3; 5 pairs of genital, 1 pair of aggenital, 2 pairs of anal and 3 pairs of adanal setae present, all smooth; seta ad3 located at the anterolateral corner of the anal plate, ad2 at the posterolateral corner of anal plate and ad1 postanal in position, ad1 and ad2 long while ad3 short.

Legs

All legs monodactylous, chaetotaxy of leg I (Fig.3): 5-2(1)- 4(2)- 17(2)

Materials examined

2♂♂ and 3♀♀ recovered from the decayed leaves of A. ilicifolius growing in the mangrove ecosystems of Kadalundi-Vallikkunnu community reserve (11°7'54.31"N and 75°49'44.80"E) of Kozhikode (Dt). on 15.05.2012; 1♂ and 3♀♀ collected from the mangrove litters of Ezhome (12° 1'38.28"N and 75°17'0.72"E) Kannur (Dt) on 17.01.2013. coll. P.K. Syamjith.
Remarks

The present species of *Protoribates* resembles *P. (P.) capucinus* (Berlese, 1908) described from the dead leaves, near mangroves of Corolevu, Fiji Islands, in the general shape and size of the body, nature of prodorsal, notogastral, anal, genital and adanal setae. This forms the first report of the species from the mangrove ecosystems of India, especially from North Kerala.

**Superfamily: Oripodoidea Jacot, 1925**

**Family: Haplozetidae Grandjean, 1936**

**Genus: Indoribates Jacot, 1929**

**Subgenus: Indoribates (Indoribates) Jacot, 1929**

**Generic Characters**

Lamellae present, translamella absent; pteromorphae movable; dorsosejugal suture complete; notogastral setae 10 pairs; 4 pairs of sacculi; genital plates with 5 pairs of setae; 1 pair of aggenital, 2 pairs of anal and 3 pairs of adanal setae present.; legs monodactylyous.

*Indoribates (Indoribates) punctulatus* (Sellnick, 1925)

(Plate-38, Figs. 1-3c; Plate-39, Figs.1-3)

Colour : Dark brown

Measurements : Length: 690-765 μm

Width: 450-480 μm

**Dorsal Region** (Plate-38, Fig.1; Plate-39, Fig.1)
Description of Species

**Prodorsum**

Rostrum broad, seta *ro* long, curved inward and finely barbed; lamellae rather broad bearing light furrow on their entire length, seta *le* thick, stiff and barbed, longer than *ro*; seta *in* longer than *le*; seta *ex* present; sensillus flagelliform, moderately long, but slightly incrassate apically with its outer margin armed with barbs (Plate-38, Fig.1a; Plate-38, Fig.1); entire prodorsal surface covered with round foveoles.

**Notogaster**

Dorsosejugal suture complete; notogaster a little longer than broader and its anterolateral borders produced into short pteromorphae pitted basally; anterolateral regions strongly bent ventrad; 10 pairs of long, thin, curly setae (Plate-38, Fig.1; Plate-39, Fig.1) and 4 pairs of conspicuous sacculi present on notogaster; lyrifissure *im* located just above seta *r*3; lateroabdominal gland (*gla*) well developed; integument micro punctate and foveolate;

**Ventral Region** (Plate-38, Fig.2; Plate-39, Fig.3)

Infracapitulum diarthric type; seta *a* smooth, *m* and *h* barbed (Plate-39, Fig.2); epimeral setal formula 3-1-3-2, all setae moderately long and barbed; genital plates carry 5 pairs of barbed genital setae (*g*1-*g*5) (Plate-39, Fig.3), seta *g*1 projecting beyond 3*a*; each genital plate micropunctated; one pair of barbed aggenital setae present, which appear smaller than the epimeral setae; anal plates pitted, bearing 2 pairs of anal setae, both strongly barbed and longer than the aggenital setae; 3 pairs of adanal setae (Plate-38, Figs.3a-3c;
Plate-39, Fig.3) present, \( ad_3 \) barbed and pre-anal in position while \( ad_1 \) and \( ad_2 \) thick, stiff, long, strongly barbed, post-anally located in a line at the posterior border of the ventral plate; lyrifissure \( iad \) adanal in position; discidium developed as a pointed tooth; pedotectum I well developed; ventral plate ornamented with foveoles and pits of larger size than those of anal plates.

**Legs**

All legs monodactylous, tarsus II with 3 strong spines; femur II with very strong keel.

**Materials examined**

2♂♂ and 4♀♀ collected from the dead barks of the mangrove associate plant, \( C.\text{crista} \) present in the mangrove ecosystems of Brahmasampadam (11° 7'35.36"N 5°52'8.46"E), Malappuram (Dt.) of North Kerala on 4.12.2013, coll. P.K. Syamjith.

**Remarks**

The genus *Indoribates* was erected by Jacot, (1929) based on the type species *Protoribates punctulatus*. The characters of the present specimen closely resembles those of *I. (I.) punctulatus* erected by Sellnick, 1925 from Java in the nature of prodorsal setae, sensillus, the presence of foveoles on notogaster, ventral characters, presence of ventral keel on femur II etc. and hence it is assigned to the same species. This forms the first report of the species from the mangrove ecosystems of India, especially from Kerala.
Superfamily: Oribodoidea Jacot, 1925
Family: Haplozetidae Grandjean, 1936
Genus: Trachyoribates Berlese, 1908
Subgenus: Trachyoribates (Rostrozetes) Sellnick, 1925

Generic Diagnosis

5 pairs of genital setae; 10 pairs of notogastral setae (exceptionally 14); dorsosejugal suture with 3 arches; legs monodactylous.

Trachyoribates (Rostrozetes) ovulum ovulum Berlese, 1908
(Plate-40, Figs.1-2)

Colour : Brown
Measurements : Length: 320-346 μm
Width: 242-250 μm

Dorsal Region (Fig. 1)

Prodorsum

Rostrum rounded and foveolated entirely; seta ro small, barbed and longer than seta le; seta in shorter than le, inserted just above the dorsosejugal suture; ss swollen, ciliated and with a brush–like head; seta ex not detected; prodorsal surface ornamented with large foveoles.

Notogaster

Dorsosejugal suture with 3 arches; 10 pairs of smooth, slender and simple notogastral present; pteromorphae short, entire surface graced with
hard, round foveoles, imparting a wavy appearance to the lateral and posterior margins; lyrifissures $ia$ and $im$ visible distinctly.

**Ventral Region** (Fig. 2)

Camerostome almost oval in shape; infracapitular setae 3 pairs, epimeral surface foveolated, epimeral setal formula 3-1-2-2, all setae, minute, simple and smooth; anogenital plates placed distantly; genital plates small with 5 pairs of simple, minute setae; aggenital setae 1 pair, simple, minute and short; anal plates rectangular in shape; 2 pairs of simple anal and 3 pairs of adanal setae detected; fissure $iad$ placed in between setae $ad_2$ and $ad_3$; the whole ventral surface foveolated in nature.

**Legs**

All legs monodactylyous.

**Materials examined**

2♂♂ and 3♀♀ recovered from the soil samples of the mangrove ecosystems of Ezhome (12°02'57.54"N 75°27'71.60"E) Kannur (Dt.) on 16.01.2013, North Kerala, India, coll. P.K. Syamjith.

**Remarks**

The genus *Trachyoribates* was erected by Berlese, (1908) based on the type species, *T. ovulum*. The present specimen collected from the mangrove ecosystems of Kadalundi shows very close resemblance to *T. (R.) ovulum ovulum* erected by Berlese (1908) in several features like the nature of
dorsosejugal suture, presence of foveoles on the dorsal and ventral surfaces, nature of prodorsal setae, shape of sensillus and similarities in the epimeral setal formula.

**Family: Haplozetidae Grandjean, 1936**

**Genus: Trachyoribates Berlese, 1908**

**Subgenus: Trachyoribates (Rostrozetes) Sellnick, 1925**

*Trachyoribates (Rostrozetes) nortoni* sp. nov.

(Plate -41, Figs. 1-3)

**Colour**: Brown

**Measurements**: Length: 320-346 µm

Width: 242-250 µm

**Dorsal Region** (Fig.1)

**Prodorsum**

Rostrum rounded and incised; seta *ro* short, smooth and measures 15µm (Fig.1b); seta *le* longer than seta *ro*, measuring 25µm and with serrated outer margin (Fig. 1c); seta *in* shorter than *le*, measuring 14µm (Fig.1d), inserted just above the dorsosejugal suture; *ss* swollen, incrassate and aciculate at its head (Fig.1a); seta *ex* not detected; prodorsum carries large foveoles.

**Notogaster**

Dorsosejugal suture with 3 arches; 10 pairs of notogastral setae present, all smooth, slender and simple; pteromorphae short, stumpy and curved ventrad; each pteromorph with characteristic anterior notch
ornamented with dense round foveoles; notogaster bears longitudinal undulating ridges, each ridge reaches the base of the pteromorph; entire notogastral surface ornamented with round foveoles irregularly, imparting a wavy appearance to the posterolateral margins.

**Ventral Region** (Fig.2)

Infracapitulum not alveolated; mentotectum carries closely set hard striae; infracapitular setae 3 pairs, all smooth; epimeral surface foveolated, epimeral setal formula 3-1-2-2, all setae simple and smooth; anogenital plates well separated; genital plates small, about half of the size of the anal plates, bearing 5 pairs of simple, minute setae; aggenital setae 1 pair, simple and short; anal plates rectangular, carrying 2 pairs of minute, simple, smooth setae \( (an_1 \text{ and } an_2) \), arranged along the lateral margin of the anal plates; 3 pairs of simple adanal setae detected, \( ad_1 \) post-anal in position, \( ad_2 \) para-anal and \( ad_3 \) at the anterolateral corner of the anal plate; fissure \( iad \) obliquely placed, in between setae \( ad_2 \) and \( ad_3 \); the whole ventral surface including anogenital plates and epimeres ornamented with round foveoles.

**Legs**

All legs monodactylous, chaetotaxy of leg I (Fig.3): 5-2(1)-2(1)-20(2), surface of femur I ornamented with large round foveoles.

**Etymology**

The new species is gratefully dedicated to Dr. Roy A. Norton, Professor (Rtd.), State University of New York, USA, who helped very much...
Description of Species

for the conduct of taxonomic studies by supplying all relevant literature for the identification of various species.

Materials examined

Holotype ♀; paratypes: 4♂♂ and 5♀♀ recovered from the soil/litter samples at Nileswaram (12°15'58.03"N 75° 7'13.61"E) Kasaragod (Dt.) of North Kerala on 26.05.2011, coll. P.K. Syamjith.

Type repository

The type specimen will be deposited at the Zoological Survey of India (ZSI) Calicut, Kerala, India.

Remarks

The genus *Trachyoribates* was erected by Berlese, 1908 based on the type species, *Oribata ampulla*. At present, this genus comprises 29 valid species. The present new species, based on the possession of 10 pairs of notogastral setae and striations on mentotectum can be easily differentiated from other known species such as *T.(R.)dimorphites* Higgins, 1966 (13 pairs of setae); *T.(R.)geminisetosus* Balogh and Mahunka, 1976 & *T.(R.)heterotrichous* Pérez-Íñigo and Baggio, 1991 (11 pairs of setae each); *T.(R.)pseudofurcatus* Balogh and Mahunka, 1968 (12 pairs of setae) and *T.(R.)pinguis* Balogh and Mahunka, 1978 (14 pairs of setae). The possession of 3 pronounced arches on the dorsosjugal suture of the present species easily separates it from single arched species like *T.(R.)bothulifer* Balogh and Mahunka, 1979; *T.(R.)polygonatus* Balogh and Mahunka, 1969; *T.(R.)
Description of Species


1. Elongated and spinose nature of sensillus
2. Absence of seta *ex*.
3. Presence of closely set thick striae at the base of the mentotectum.

**Superfamily: Galumnoidea Jacot, 1925**

**Family: Galumnidae Jacot, 1925**

**Genus: Galumna Heyden, 1826**

**Subgenus: Galumna (Galumna) (Heyden, 1826)**

**Generic Diagnosis**

Lamellar and sub lamellar lines well developed; lamellar setae inserted between lamellar lines (L) and sublamellar lines (S); notogatral setae
represented by 10 pairs of microsetae or alveoli; notogaster rounded posteriorly, with true porose areas; 6 pairs of genital setae; all legs tridactylous.

**Galumna (Galumna) paragibbula** Weigmann, 2011

*(Plate 42, Figs.1-2)*

**Colour** : Yellowish brown

**Measurements** : Length: 360-395µm

Width: 240-275 µm

**Dorsal Region** (Fig.1)

**Prodorsum**

Rostrum rounded in appearance; seta *ro* short, ciliated; seta *le* smooth, very short, near lamellal line, arises between lines *L* and *S*; seta *in* short, seta *ex* minute; *ss* moderately long, with slender fusiform, ciliated, head (Fig.1a).

**Notogaster**

Dorsosejugal suture medially broken; in middle between 2 porose areas *Ad* present near dorsophragma; notogastral setae represented by 10 pairs of alveoli in typical positions; 4 pairs of porose areas, *Aa* the largest, *A1*-*A3* rounded; pteromorphae well developed, movable and typical for the genus; lyrifissure *ia* located on pteromorph, *im* located just above the porose area, *A1*; opisthonotal gland opening (*gla*) located antero-laterally to *A2*; median centro-dorsal pore present.
**Ventral Region** (Fig.2)

Infracapitulum bears 3 pairs of minute, simple setae $a$, $m$ and $h$; Epimeral setal formula 1-0-2-1, all setae minute and simple; 6 pairs ($g_1$-$g_6$) of setiform, thin, smooth genital setae present, the first 3 pairs ($g_1$-$g_3$) located on anterior border of genital plates; one pair of aggenital ($ag$), 2 pairs of anal ($an_1$-$an_2$) and 3 pairs of minute adanal setae ($ad_1$-$ad_3$) present; adanal lyrifissure ($iad$) located lateral to the anal plate and seta $ad_3$.

**Legs**

All legs tridactylyous in nature.

**Materials examined**

3♂♂ and 1♀ collected from the soil samples of the mangrove ecosystems at Kadalundi –Vallikkunnu community reserve, (11°7'37.51"N 75°49'54.64"E) Calicut (Dts.) of North Kerala on 17.11.2011 coll. P.K. Syamjith.

**Remarks**

The present specimen of *Galumna* collected from the mangrove soils of Kadalundi shows very close affinity with *G. (G.). paragibbula* erected by Weigmann (2011) from the rocky areas of the coastal habitats of South-West Portugal in the nature of prodorsal and notogastral setae, medially indistinct nature of dorsosejugal suture and arrangement of area porosae. The present recovery of the species forms the first report of the species from India, especially from Kerala.