

REDESCRIPTION OF *COSMOCHTHONIUS FOLIATUS* SUBIAS, 1982
AND SUPPLEMENTS TO THE DESCRIPTIONS OF
C. RETICULATUS GRANDJEAN, 1947 AND *C. LANATUS* (MICHAEL, 1885)
(ACARI: ORIBATIDA: COSMOCHTHONIIDAE)

Ritva PENTTINEN¹ & Elena GORDEEVA²

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COSMOCHTHONIUS,
COSMOCHTHONIIDAE,
TAXONOMY, SYNONYMY,
MEDITERRANEAN REGION,
CEROTEGUMENT, INTEGUMENT

SUMMARY: The species *Cosmochthonius foliatus* Subias, 1982 is redescribed. The transverse ridge with cerotegumental collar is proposed as the most noticeable diagnostic feature of *C. foliatus*. The structure of the integument of the species is illustrated with Scanning Electron Micrography (SEM). The descriptions of *C. reticulatus* Grandjean, 1947 and *C. lanatus* (Michael, 1885) are complemented by data based on SEM analysis. Two species are synonymised; *C. trivialis* Sergienko, 1991 is confirmed as the junior synonym of *C. reticulatus*, and *C. novus* Sergienko, 1991 is considered a junior synonym of *C. lanatus*.

ZUSAMMENFASSUNG: Die Art *Cosmochthonius foliatus* Subias, 1982 ist regeschrieben. Die transversale Bördeln mit Cerotegumen ist die wahrnehmbarste diagnostische Charakter von *C. foliatus* vorgeschlagen worden. Die Struktur von Integument der Arten ist durch die SEM Fotos dargestellt worden. The Beschreibung des Arten *C. reticulatus* Grandjean, 1947 und *C. lanatus* (Michael, 1885) ist durch die Daten ergänzt worden, die auf dem SEM Studieren basieren. Zwei Arten sind synonymisiert gewesen; *C. trivialis* Sergienko, 1991 ist als das Juniorsynonym von *C. reticulatus* und *C. novus* Sergienko, 1991, als das Junior-synonym von *C. lanatus* bestätigt worden.

The species, *Cosmochthonius foliatus* Subias, 1982, *C. reticulatus* Grandjean, 1947 and *Cosmochthonius lanatus* (Michael, 1885) are found in the Mediterranean region (BALOGH & MAHUNKA, 1983; GIL ET ALL. 1991; GORDEEVA, 1980; GRANDJEAN, 1947, 1962; PEREZ-IÑIGO, 1989; SERGIENKO, 1991, 1994; SUBIAS, 1982). These species are quite similar to each other. They are small and their prodorsal and notogastral setae are brush-shaped, plumose or ciliate. The cuticle is netlike, and the two former species have a thick cero-

tegument. The authors, AYYILDIZ & LUXTON (1990), GRANDJEAN (1947, 1962) and SUBIAS (1982) consider the pattern of the integument as one of the specific characters. However the identification of these species is not easy. GRANDJEAN (1947, 1962) illustrated the integument of *C. reticulatus* without cerotegument and emphasized the pattern of the cuticle whereas SUBIAS (1982) demonstrated the cerotegument of *C. foliatus* and considered the cerotegumental bands as a species-specific character. Information about the inte-

1. Zoological Museum, University of Turku, FIN-20014 Turku, Finland. E-mail: ritniemi@utu.fi

2. Karadag Natural Reserve, Ukrainian National Acad. Sci., P.O. Kurortnoe, Feodosia, 98188, Crimea, Ukraine. E-mail: elgordva@crimea.com

gument of *C. lanatus* is scarce and authors focus mainly on description of the alveoli of cuticle.

To date, descriptions of these species are based on study by light microscope, and the complex structure of the integument is not easy to recognize using this method. In the present work, species are examined by Scanning Electron Microscopy (SEM). The structure of the integument of three species is presented with and without cerotegument. Other characters of the species are also revealed by SEM micrographs. The species *C. foliatus* is redescribed, and descriptions of *C. reticulatus* and *C. lanatus* are completed. Diagnoses are presented for the three species.

MATERIAL AND METHODS

The study was based on the type material (*C. foliatus* Subias, 1982, *C. lanatus* (Michael, 1885), *C. trivialis* Sergienko, 1991 and *C. novus* Sergienko, 1991) and on the fresh material collected in the Mediterranean region. Information about the sampling locality has been listed in context of the descriptions of the species.

In descriptions, the setal nomenclatures and other characters follow the terminology of GRANDJEAN (1962). Specimens were studied by Scanning Electron Microscope (SEM, JEOL JSM-5200). Measurements were made by digital image recording system for the Scanning Electron Microscope (SemAfore 3).

Cosmochthonius foliatus Subias, 1982
Figs. 1-16.

Cosmochthonius foliatus: Subias, 1982
Cosmochthonius foliatus: Ruiz & Subias, 1984
Cosmochthonius foliatus: Ruiz et al., 1986
Cosmochthonius foliatus: Minguez & Subias, 1986
Cosmochthonius foliatus: Arillo et al., 1988
Cosmochthonius foliatus: Perez-Iñigo, 1988
Cosmochthonius foliatus: Perez-Iñigo, Jr., 1990
Cosmochthonius foliatus: Ruiz et al., 1991
Cosmochthonius foliatus: Gil, Subias & Candelas, 1991
Cosmochthonius lanatus: Perez-Iñigo, 1969
Cosmochthonius lanatus: Minguez, 1981

Cosmochthonius lanatus: Sergienko, 1987
Cosmochthonius reticulatus: Sergienko, 1994

Material examined. *Cosmochthonius foliatus* Subias, 1982, type material, University of Madrid, Spain.

SPAIN, Sierra de Mira (E Spain), L. S. Subias and A. Arillo leg., 5 exx (Subias & Arillo, 2000).

Mallorca, Soller, moss and litter on hill, 13.7.2000 Ritva Niemi leg. 1 ex (on SEM-stub) ZMT (Zoological Museum of Turku). Andalucia, Sitio de Calahonda, *Pinus picea* forest, 6.6.1997, Ilari E. & Tauno Sääksjärvi leg., 16 exx, [ACA.ORI.PAL 0.021]ZMT. Andalucia, Sevilla, Jerez, *Cistus* litter, 14.9.2003, Ritva Penttinen leg., 34 exx, [ACA.ORI.PAL 0.052]ZMT. Andalucia, Grazalema Puerto de la Paloma, *Quercus* litter, 14.9.2003, Ritva Penttinen leg. 10exx, [ACA.ORI.PAL 0.049]ZMT. Andalucia, Sevilla, Jerez, *Pistacia* litter, 14.9.2003, Ritva Penttinen leg., 5 exx, [ACA.ORI.PAL 0.053] ZMT. Andalucia, Sevilla, Jerez, leaves litter, 14.9.2003, Ritva Penttinen leg., 26 exx, [ACA.ORI.PAL 0.050] ZMT.

UKRAINE, Crimea, Karadag, Karagach, *Quercus pubescens*, 50-60m a.s.l., 19.7.1994 E. Gordeeva leg., 1 ex, ZMT. Crimea, Karadag, Karagach *Quercus pubescens*, 50-60m a.s.l., 3.9.1995, E. Gordeeva leg. 3 exx, ZMT. Crimea, Karadag, Hat of Monomakh, *Q. pubescens*, 50-60m a.s.l., 5.8.1994 Ritva Niemi & E. Gordeeva leg., 3 exx, ZMT. Crimea, Karadag, Karagach *Q. pubescens*, 50-60m a.s.l., 19.7.1994 E. Gordeeva leg. 10 exx, ZMT. Crimea, Karadag, Karagach *Q. pubescens*, 50-60m a.s.l., 3.9.1995, E. Gordeeva leg., 3 exx, ZMT. Crimea, Karadag, Hat of Monomakh, *Q. pubescens*, 50-60m a.s.l., 5.8.1994 Ritva Niemi & E. Gordeeva leg., 3 exx, ZMT.

CANARY ISLANDS, Tenerife (North) Playa de Benijo, shore slope 14.1.1997 S. Koponen leg., 2 exx, ZMT.

Description (Adult)

Color: light brown

Measurements. Mean length and width: 279 × 160 µm (n = 8, Spain); 292 × 168 µm (n = 9, Ukraine,) *Lengths and widths according Gil et al. (1991);* 300-325 × 155-170 µm, 300-315 × 155-165 µm, 280-305 × 139-156 µm

Integument. Almost whole dorsal surface of body covered by thick netlike cerotegument (Figs. 1-2). Cerotegument with most regular pattern on prodorsum; on area between interlamellar setae (*il*) and lamellar setae (*la*) and on notogaster, especially on pygidium (*PY*). Relief of cerotegument follows structure of underlying cuticle, comprising rounded foveae (5-7 µm) with interscalares (0.7-1.5 µm) giving a net-like pattern to upper cerotegument (Figs. 6 & 7). Meshes with thinner cerotegument resemble polygonal sieves (Figs. 2 & 6), whereas meshes with thick cerotegument are fused and swollen with big pore in middle (Figs. 1 & 5).

Longitudinal bands formed by cerotegument exist on pygidium in those specimens with thick cerotegument. Dense cerotegumental, transversal band on base of prodorsum and on posterior of notogastral segments (*NA*, *NM₁* and *NM₂*). Transverse region almost without cerotegument present anterior to *NA*. Two broad, symmetrical depressions and one semicircular depression on posterior of pygidium (FIG. 3). Cerotegument folded on lateral region of notogaster (Fig. 15). Ventral side of notogaster overlaid by thin and uneven cerotegument lacking regular pattern.

Prodorsum. Rostrum separated by semicircular, concave line (*fa*) from rest of prodorsum (FIG. 8). Anterior part of rostrum curved ventrally with triangular peak with 2-3 very small teeth on top and with 2-3 rows of longitudinal slots on margin (FIG. 9). Posterior of rostrum flat, with low, longitudinal carina medially, (FIG. 8). Transversal ridge between lamellar setae serves as border line between rostrum and flat, medial part of prodorsum (Figs. 1, 3 and 8). Ridge is without cerotegument.

Narrow, transverse ridge present on posterior of prodorsum, covered by round-angled cerotegumental “collar” (Figs. 1-4). In lateral view collar looks like shed providing protection over dorsosejugal scissure. Cuticle of scissure thin without pattern; folded basally and trapeze-shaped medially (FIG. 4).

All prodorsal setae, except posterior exobothridial setae (*exp*), brush shape, branched or foliate. Rostral setae (*ro*) elongate and foliate (Fig. 8), with margins bristle-shaped, and upturned borders giving impression of channel. Lamellar setae bifurcate with long cilia; their anterior branches longer and stronger than

posterior branches (FIG. 10). *Il* laterally compressed, narrow and curved; dorsal sides with forked bristles (FIG. 11). Setae *exp* short and pectinate whereas anterior exobothridial setae (*exa*) laterally compressed with bristles on margins (Figs. 12). Sensillus (*ss*) with long stalk and wide brush shape head (Figs. 1 and 2).

Notogaster. Notogastral seta *c*, *d*, *e* and *f* simple, not widen. Setae *c* and *d* plumose with secondary barbs on margins; dorsally covered by short cilia (Fig. 13). Both setae groups *c* and *d* laterally compressed. Setae *c₁* as long as *c₃*, but shorter than *c₂*; setae *c₂* as long as *c_p*. Distance between setae *c₁* - *c₁* = *c₁* - *c₂* = *c₂* - *c₃*. Setae *d₁* shorter than setae *d₂* and as long as setae *c₁*. Distance between setae *d₁* - *d₁* = ½(*d₁* - *d₂*).

Erectile setae *e* and *f* plumose; their cross-section round. Dorsally *e* and *f* covered with minute cilia. Lateral hairs of *e₁* and *e₂* on base as long as 1.5 times diameter of stem whereas hairs of setae *f₁* and *f₂* twice longer than diameter of their stem (Fig. 14). Hairs denser near base of setae and their length decreases distally on setae.

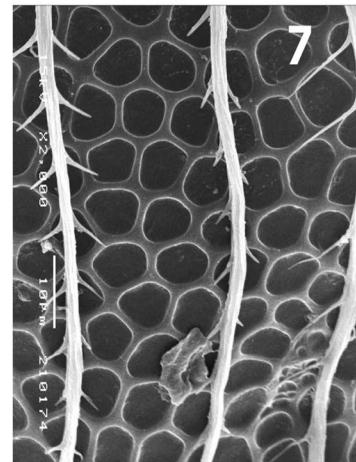
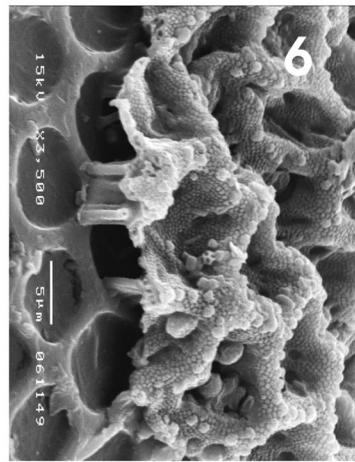
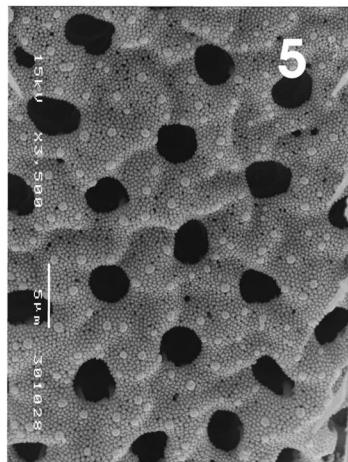
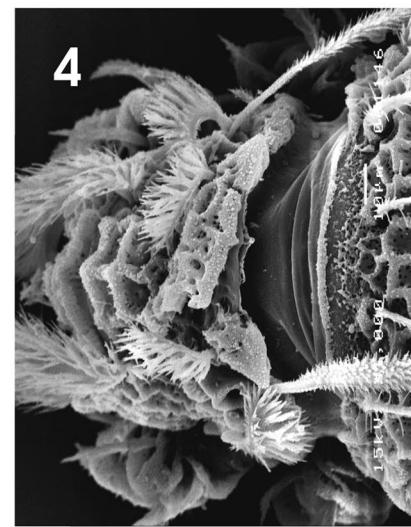
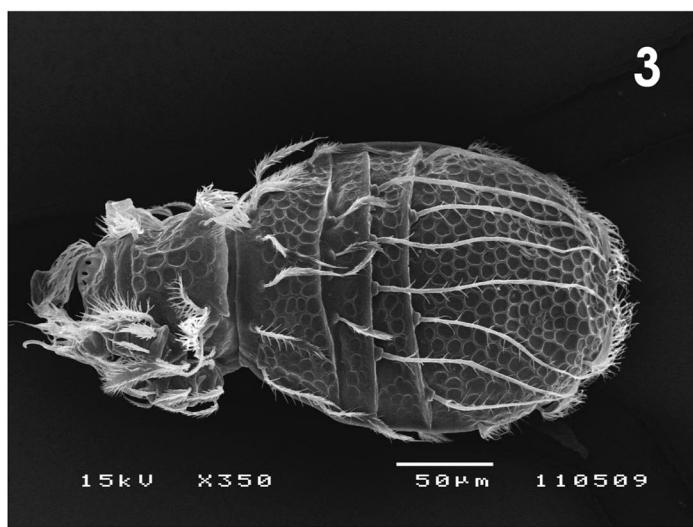
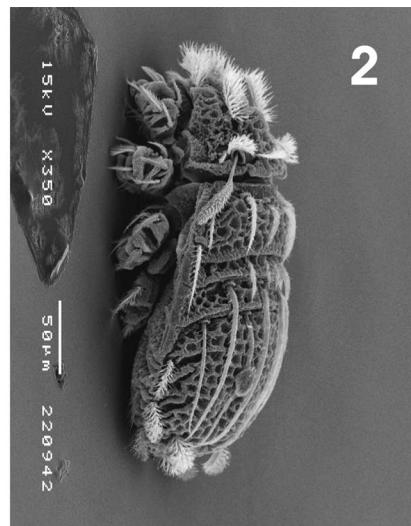
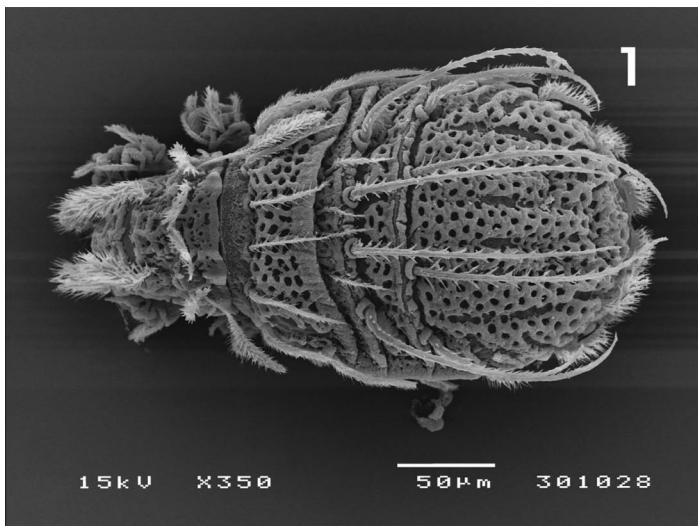
Setae *e₁* as long as setae *e₂*. Setae *f₁* longer than *f₂*. Distance between setae *e₁* - *e₁* as long as *e₁* - *e₂*. Distance between *f₁* - *f₁* is 1.5 times longer than *f₁* - *f₂*.

Setae *h₁₋₃* and *p₁₋₃* elongate, laterally compressed with long bristles on margins (FIG. 15).

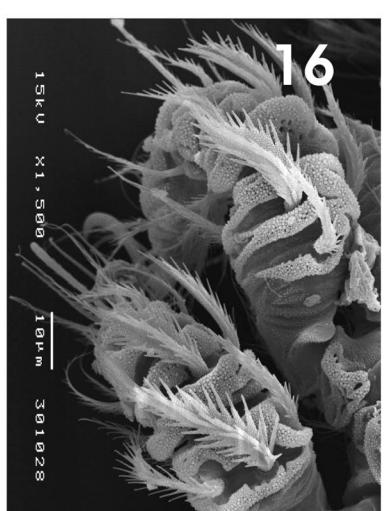
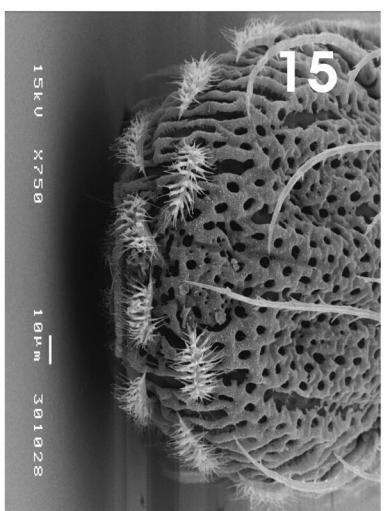
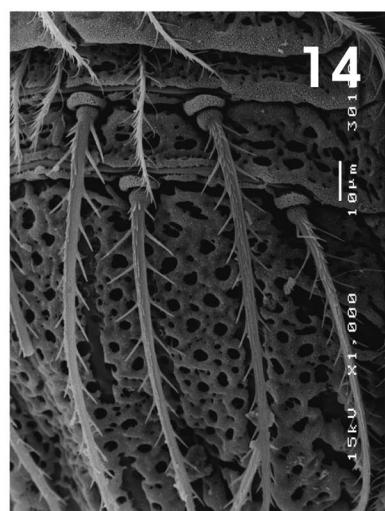
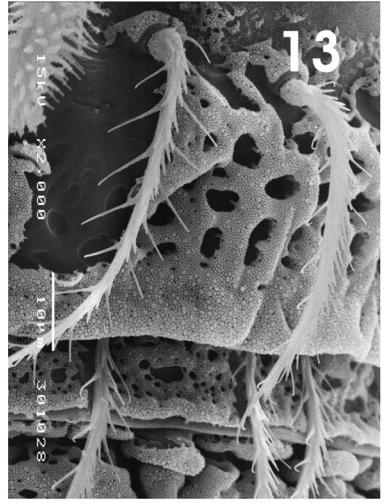
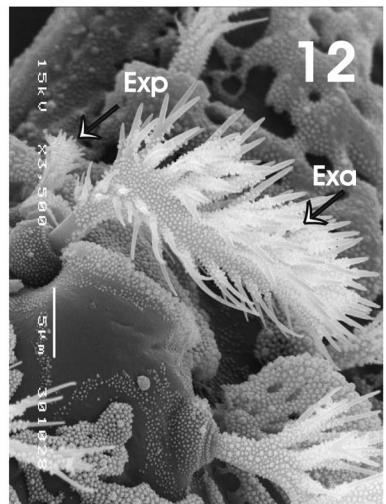
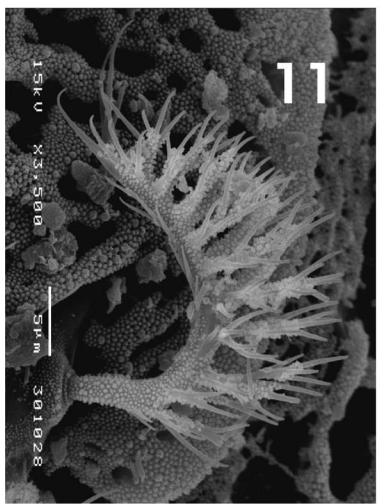
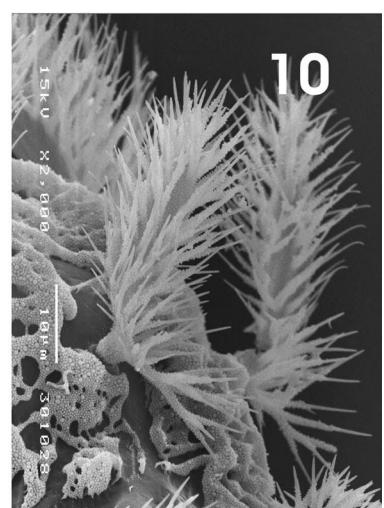
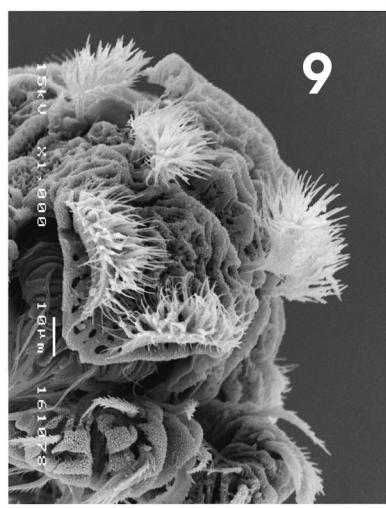
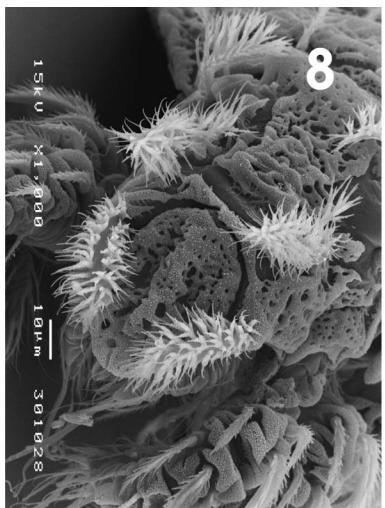
Ventral side. Formula of epimeral setae I - IV: 3-2-3-4. Genital plate with 10 setae and both anal- and aggenital plate with 4 setae.

Legs. Claws (I-IV): 2-3-3-3. Dorsal (*d*) and lateral setae (*l*) wide and strong with small spines along middle line. Ventral setae (*v*) narrow and pectinate (Fig. 16).

Remarks. Specimens of *C. foliatus* with thick cerotegument have longitudinal, cerotegumental bands on the pygidium. Between these there are depressions where the erectile setae lie when in rest position. These bands and depressions are considered species-specific characters in the description of *C. foliatus* (Subias, 1982). Our SEM studies of numerous specimens of *C. foliatus* demonstrate that these bands are a common feature only on those specimens with thick cerotegument. Similarly, these bands are only found on specimens of *C. reticulatus* with thick cerotegument (see below). The thickness of cerotegument probably depends on the age of the specimens, living



Figs. 1-7. *Cosmochthonius foliatus*. 1, 2, 3. — Dorsal view (cerotegument removed in Fig. 3). 4. — Dorso-sejugal suture. 5, 6. — Cerotegument of specimens of the figs. 1 & 2 (respectively). 7. — Cuticle of the foveae on pygidium.



Figs. 8-16. *Cosmochthonius foliatus*. 8.—rostrum. 9.—Top of rostrum. 10.—Lamellar setae. 11.—Interlamellar setae. 12.—Exobothrial setae. 13.—Setae C_1 & C_2 . 14.—Setae e & f . 15.—Posternal part of pygidium.

conditions and other physico-chemical factors. SEM studies also showed that the epicuticle of pygidium under these bands of cerotegument was the same throughout and those ridges and depressions were absent (Fig. 3). It seems that the cerotegumental bands are agglomerations accomodating the erectile setae, and cannot be considered diagnostic at the species level.

The transverse ridge with cerotegumental collar is a conspicuous character of *C. foliatus*. It is absent from other species of the genus *Cosmochthonius* we have examined, and we propose it as a diagnostic character of the *C. foliatus*.

SERGIENKO (1994) recorded *C. reticulatus* from the Odessa region (Ukraine) and from the steppe of the Kerch peninsula, Crimea. She illustrated the article with drawings (her Figs. 15./3-8) and figure 3 illustrates the prodorsum with cerotegumental collar. Because this collar is diagnostic for *C. foliatus*, we suggest that these records are of *C. foliatus*, not *C. reticulatus*.

Diagnosis. Body with netlike thick cerotegument, except anterior of NA almost without cerotegument. Cuticle with shallow, rounded and sub-equal foveae. Prodorsum posteriorly with transverse ridge with cerotegumental collar. Cuticle of dorso-sejugal suture thin, without pattern. Basal part of this area folded; trapeze-shaped medially. Notogastral setae; $c_1 = c_3 < c_2$; $c_2 = c_p$; $d_1 = c_1 < d_2$; $e_1 = e_2$ and $f_1 > f_2$. The setae *d* and *l* on legs strong and wide.

Cosmochthonius reticulatus Grandjean, 1947

Figs.17-28.

Cosmochthonius reticulatus, Grandjean, 1947
Cosmochthonius reticulatus: Grandjean, 1962
Cosmochthonius reticulatus: Balogh & Mahunka, 1983

Cosmochthonius trivialis, Sergienko, 1991
Cosmochthonius trivialis: Sergienko, 1994

Material examined. CYPRUS, Akamas forest, *Calycotome* litter, 14.4.1997, Ritva Niemi leg., 40 exx, [ACA.ORI.PAL .042]ZMT. Cape Drepanon, seaside meadow maccia vegetation, 14.4.1997, Ritva Niemi leg., 44 exx, ACA.ORI.PAL 0.044] ZMT. Pafos-N, coral-bay, bush litter, 12.4.1997, Ritva Niemi leg., 8

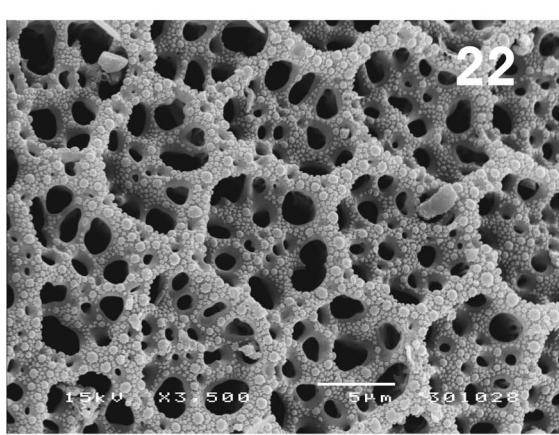
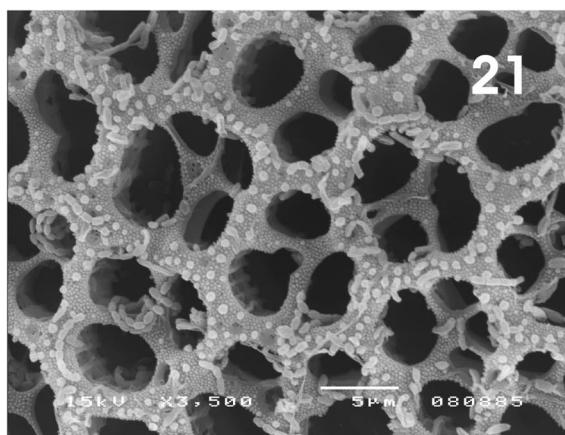
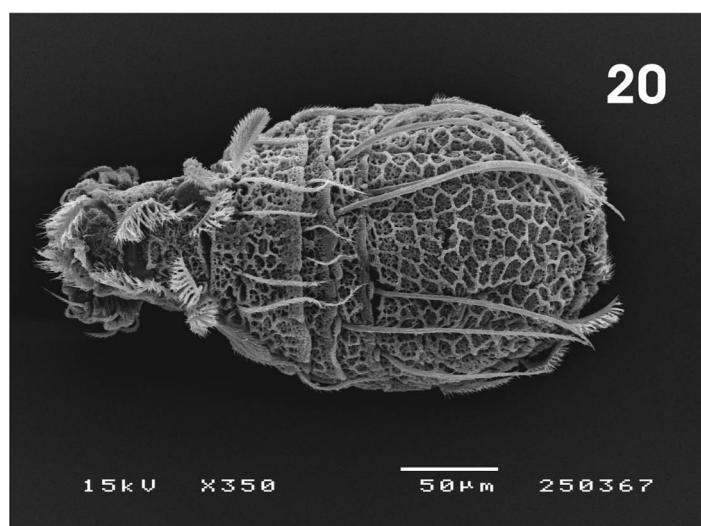
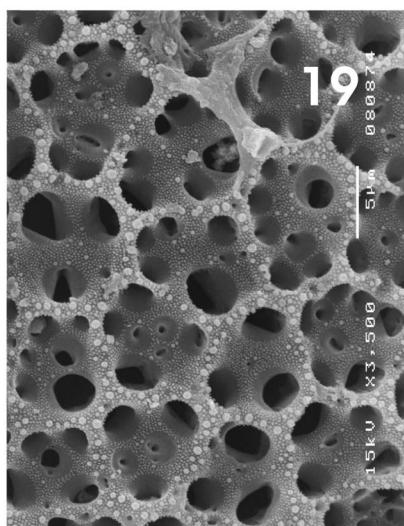
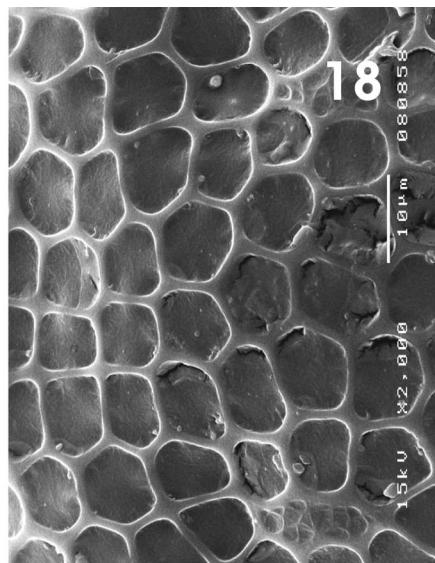
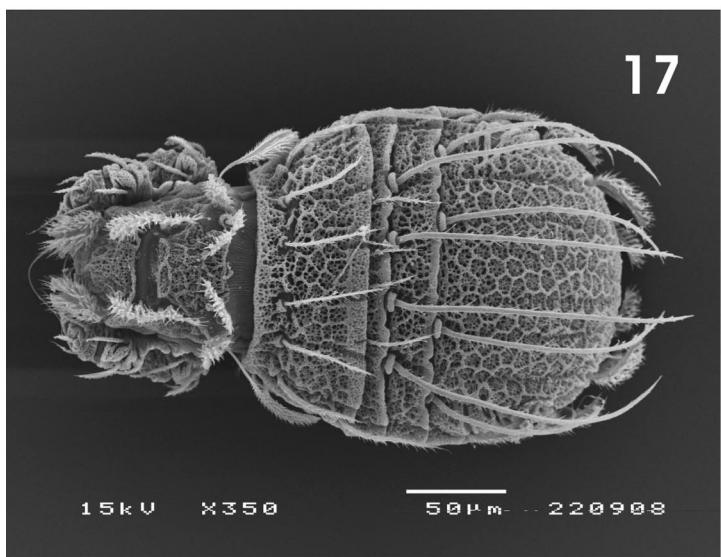
exx, [ACA.ORI.PAL 0.046] ZMT. Paramali, *Orosma* sp. & *Schropularia* litter, 17.4.1997, Ritva Niemi leg., 133 exx, [ACA.ORI.PAL 0.043]ZMT.

GREECE, Crete, Rethimnon, Mixorouma, *Cypressus* litter, 17.4.1998, Ritva Niemi leg., 13 exx, [ACA.ORI.PAL 0.038]ZMT. Rethimon, Prinos, *Pistacia* litter, 17.4.1998, Ritva Niemi, RN leg., [ACA.ORI.PAL 0.026]ZMT. Agia Galini, Mandres, *Pistacia* litter, 18.4.1998, Ritva Niemi leg., c.100 exx, [ACA.ORI.PAL 0.035]ZMT. Agia Galini, Oros Kedros, *Pistacia* litter, 23.7.2001, Ritva & Sara Niemi leg., 65 exx, [ACA.ORI.PAL 0.039]ZMT. Irakleion, Marathos, *Salvia* litter, 18.4.1998, Ritva Niemi leg., 7 exx, [ACA.ORI.PAL 0.040]ZMT. Malinia d., Selinari, Agios Georgios, *Spartium junceum* litter, 17.4.1998, Ritva Niemi leg., 3 exx, [ACA.ORI.PAL 0.027]ZMT. Agios Nikolaus Lasithiou d. Pachia seashore, *Pistacia* litter, 17.4.1998, Ritva Niemi leg., 2 exx, [ACA.ORI.PAL 0.028]ZMT. Rethimon, Prinos, *Salvia triloba* litter, 17.4.1998, Ritva Niemi leg., 9 exx, [ACA.ORI.PAL 0.030]ZMT. Sitia district, near to Palekastro, seashore slope, *Cistus* litter, 17.4.1998, Ritva Niemi leg., 13 exx, [ACA.ORI.PAL 0.034]ZMT. Lefka Ori, Omalos mountains, *Quercus* litter, 19.4.1998, Ritva Niemi leg., 11 exx, [ACA.ORI.PAL 0.033]ZMT.

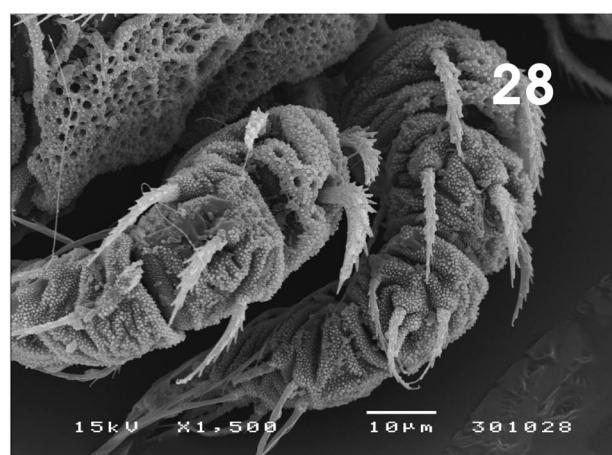
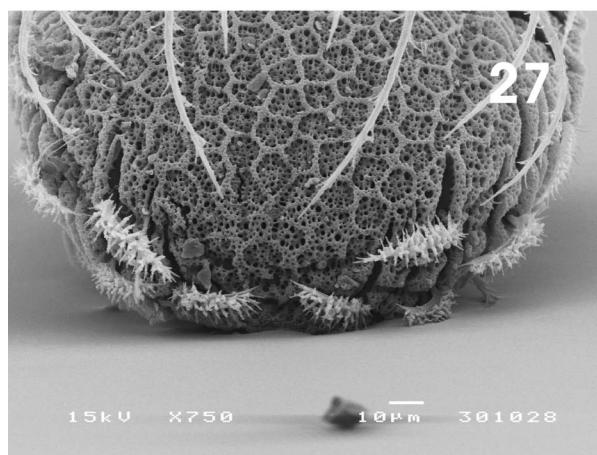
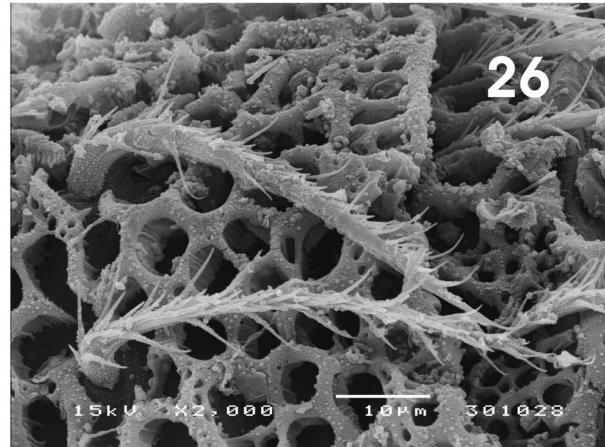
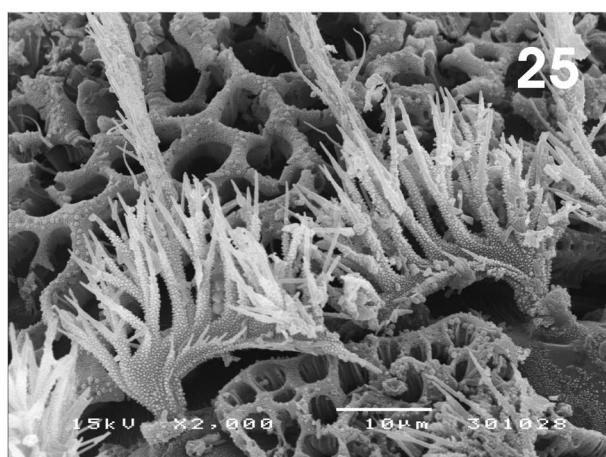
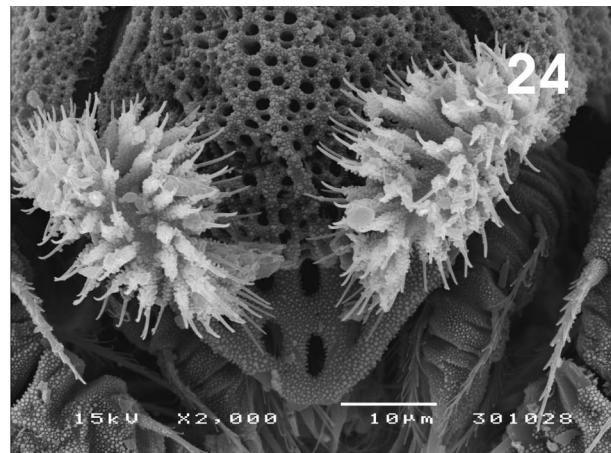
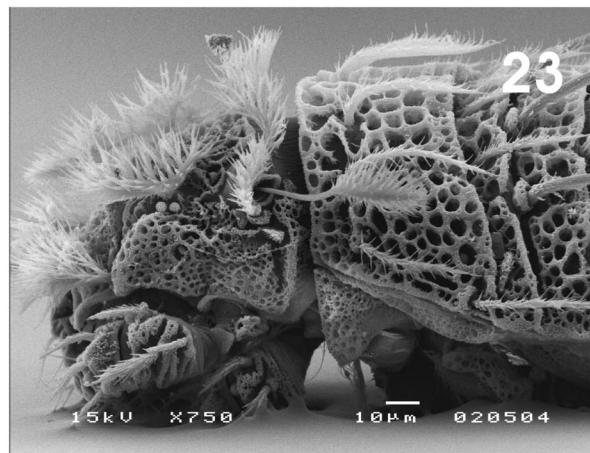
UKRAINE, Crimea, Karadag,, 50-60m a.s.l., *Quercus pubescens* litter 3.9.1995, E. Gordeeva & Ritva Niemi leg., 2 exx, [ACA.ORI.PAL 0.055]ZMT. Crimea, E., New World, *Juniperus exelsa* and *Fetuca* sp., 6.7.1970, E. Gordeeva leg., 7 exx, [ACA.ORI.PAL 0.054]ZMT.

SPAIN, Andalucia, Zahara de la Sierra 500m a. s.l. *Quercus* litter 14.9.2003, Ritva Penttinen leg.11 exx [ACA.ORI.PAL 0.047]ZMT Canary Islands, Lanzarote Haria/Teguise border, 500 m a.s.l., litter (mainly *Euphorbia*), 23.2.2004, Seppo Koponen leg., 1 ex, [ACA.ORI.PAL 0.082]ZMT. Lanzarote Haria, *Tamariscus* litter, 23.2.2004, Seppo Koponen leg., 2exx [ACA.ORI.PAL 0.081]ZMT.

ITALY, Firenze Boboli park, *Cupressus* litter, 9.7.1992, Matti Uusitalo leg., 18 exx, [ACA.ORI.PAL 0.060]ZMT. Sardinia, Monte Traessu, drying pit 19.5.1999, M. Yli-Pietilä leg. 1 ex, (SEM stub) ZMT, Sardinia The Castello Malaspina, litter under ivy and agave, 20.5.1999, M. Yli-Pietilä leg., 3 exx, (SEM stub) ZMT.



Figs. 17-22. *Cosmochthonius reticulatus*. 17. — Dorsal view (specimen from Spain). 18. — Cuticle with foveae on Py. 19, 21 & 22. — Cerotegument on Py. 20. — Dorsal view (specimen from Ukraine).



Figs. 23-28. *Cosmochthonius reticulatus*. 23.—Prodorsum, lateral view. 24.—Rostrum. 25.—Interlamellar setae. 26.—Setae c_1 and c_2 . 27.—Posterial part of pygidium. 28.—Legs I and II.

TURKEY Marmaris Armutalan, slope 300m a.s.l., *Pinus* litter, 19.5.1995, Mauno Yli-Pietilä leg., 2 exx [ACA.ORI.PAL 0.076] ZMT. Marmaris Icmeler, slope of mount, *Pinus* litter, 8.6.1995, R. Niemi & E. Gordeeva leg., 2 exx [ACA.ORI.PAL 0.078] ZMT. Marmaris Icmeler, slope of mount, litter of deciduous trees, 8.6.1995, Ritva Niemi & E. Gordeeva leg., 11 exx [ACA.ORI.PAL 0.075] ZMT. Marmaris Turunc, moss, lichen and grass, 5 m a.s.l., 18.5.1995, Ritva Niemi leg., 1 ex [ACA.ORI.PAL 0.072] ZMT. Marmaris Icmeler, on top of mount, lichen, moss & litter, 3.6.1995, Ritva Niemi & E. Gordeeva leg., 3 exx [ACA.ORI.PAL 0.073] ZMT. Marmaris Icmeler, on top of mount, litter of *Inula* sp., 8.6.1995, Ritva Niemi & E. Gordeeva leg., 1 ex [ACA.ORI.PAL 0.074] ZMT.

Description. (Adult)

Color: yellowish.

Measurements. Mean length and width: 299 × 173 µm (n= 2, Spain); 289 × 165 µm (n= 4, Sardinia); 277 × 153 µm (n= 4, Crete); 287 × 172 µm (n=11, Rhodes); 279 × 168 µm (n= 3, Turkey); 266 × 152 µm (n= 15, Cyprus); 291 × 159 µm (n= 4, Ukraine). Length: 300-340 µm (GRANDJEAN, 1947).

Integument. Body covered by thick, reticular cerotegument dorsally (Figs.17 & 20). Posterior margins of segments *NA*, *NM₁* and *NM₂* with transverse bands with close-textured cerotegument. Anterior of segment *NA* covered by thick, continuous cerotegument (cf. *C. foliatus*). Longitudinal, cerotegumental bands present on specimens with thick cerotegument (Figs. 17 & 20). Two shallow symmetrical depressions and one shallow semicircular depression present (Figs.18 & 20). Cerotegumental folds present laterally on notogaster (FIG. 27). Body covered by thin and uneven cerotegument ventrally.

Netlike pattern of cerotegument most regular on *PY*, with meshes of net hexagonal, concave with sparse, big pores or with many pinholes (Figs. 21 & 22). Structure of meshes of whitish (young?) specimens more closed (FIG. 19). Cerotegumental structure reflects shape of underlying cuticle. Foveae (5-9 µm) with interscalares (0.5-1.2 µm) on cuticle polygonal or hexagonal shaped (FIG. 18).

Prodorsum. Rostrum curved ventrally, without dis-

tinct teeth (FIG. 24). Two-three rows of elongated slots on margin. Cerotegument thin, granulated in this region whereas structure porous on both sides of line *fa*. Strong, transverse ridge, without cerotegument present between setae *la* (FIG. 17). Cerotegument between setae *il* and *la* netlike. Ridge with cerotegumental collar on posterior of prodorsum absent. Dorsosejugal scissure wide, cuticle with thin, longitudinal furrows. All prodorsal setae similar to those of *C. foliatus* (Figs.17, 23-25).

Notogaster. Notogastral setae similar in shape to those of *C. foliatus* (Figs. 17, 23, 26, 27). Setae *c₁* and *c₂* as long as *c_p*, setae *c₃* shorter than other *c* setae. Distance *c₁* - *c₂* shorter than distance of setae *c₁* - *c₁* and distance *c₁* - *c₁* as long as *c₂* - *c₃*. Setae *d₁* shorter than setae *d₂* which shorter than *c₃*. Distance between *d₁* - *d₂* is 2.5 times distance *d₁* - *d₁*. Long, erectile setae *e* and *f* plumose; dorsally covered with minute cilia; cross-section of setae round. All setae equally thick. Setae *e₁* as long as setae *e₂* whereas *f₁* longer than *f₂*. Lateral, secondary hairs denser at base of setae, shorter distally. Basal barbs of *e₁* and *e₂* 1.5 times longer than diameter of stem whereas barbs of *f₁* and *f₂* about as long as setal diameter. Distance between setae *e₁* - *e₁* as long as *e₁* - *e₂* and distance between *f₁* - *f₁* 1.5 times longer than *f₁* - *f₂*. Setae *h₁₋₃* and *p₁₋₃* elongate, laterally compressed with long bristles laterally (FIG. 27).

Ventral side. Epimeral setal formula I-IV: 3-2-3-4. Genital plate with 10 setae and both anal- and aggenital plates with 4 setae.

Legs. Claws (I-IV): 2-3-3-3. The dorsal (*d*) and lateral setae (*l*) strong, but not wide (FIG. 28). Ventral setae (*v*) narrow and pectinate.

Remarks. In the description of this species by Grandjean (1962) setae *e₂* are thinner than setae *e₁*, but based on our SEM studies there are no clear difference between them. However, geographical variation in lengths of secondary hairs on erectile setae was evident.

Diagnosis. Whole body, including anterior of segment NA, covered with netlike cerotegument. Cerotegument reticulate, especially on pygidium. Foveae of cuticle shallow and polygonal or hexagonal. Cerotegumental collar absent. Cuticle of dorsosejugal scissure wide, with narrow, longitudinal furrows. Notogastral setae; *c₁* = *c₂* = *c_p* > *c₃*; *d₁* < *d₂* < *c₁*; *e₁* =

e_2 and $f_1 > f_2$. Setae d and l of legs strong, not wide.

Synonymy. SERGIENKO (1991) has described the species *Cosmochthonius trivialis* from Ukraine. The investigation of the type material showed that the species has the same characters as *C. reticulatus*. SEM examination of a paratype specimen also confirmed that characters are identical (FIG. 20). Therefore we considered *Cosmochthonius trivialis* Sergienko, 1991 a junior synonym of *Cosmochthonius reticulatus* Grandjean, 1947.

Cosmochthonius lanatus (Michael, 1885)

Figs. 29-40.

Hypochthonius lanatus, Michael, 1885: 396; 1888: 541

Cosmochthonius lanatus: Willmanm, 1931: 101

Cosmochthonius domesticus Grandjean, 1947: 354

Cosmochthonius lanatus: Subias, 1982

Cosmochthonius lanatus: Ayyildiz & Luxton, 1990

Description. (Adult)

Color: whitish - yellow

Material examined. *Cosmochthonius lanatus* (Michael, 1885), type material, Michael Collection of British Museum (Natural History, London, UK).

Cosmochthonius novus Sergienko, 1991, type material, University of Kiev, Ukraine.

FINLAND, Kylmäkoski, 678:32, litter on floor of the horse barn 29.3.1992, Ritva Niemi leg., 52 exx ZMT. Finland, Kylmäkoski, 678:32, insulating material of barn, 15.8.1992, Ritva Niemi leg., 125 exx ZMT. Finland, Kylmäkoski, 678:32, dry manure on box stall, 15.8.1992, Ritva Niemi leg., 39 exx ZMT. Finland, Lappi Tl, Ala-Kieri, 678:21, insulating material of barn, 24.2.1992, M. Yli-Pietilä leg., 31 exx ZMT. Finland, Parainen Koikulla, 669:23, litter in old wooden house, 3.4.1992, Ritva Niemi leg., 3 exx ZMT. Finland, Rymättylä Saloranta, 6712:215, bat faeces indoors, 18.5.1990, A. Karhilahti, V. Rinne, & R. Niemi, 3 exx, ZMT. Finland, Rymättylä Saloranta, 6712:215, in old nest of *Vespa vulgaris* (indoors) 18.5.1990, A. Karhilahti, V. Rinne & R. Niemi, 50 exx ZMT. Finland, Turku, 671:24, University of Turku, between the floor boards, 13.5.1992, P.T. Lehtinen, 2 exx ZMT. Finland, Turku Kurala

Kylämäki, 671:24, litter on floor of barn, 10.4.1992, R. Niemi & V. Rinne, 14 exx ZMT

ITALY, Firenze, Boboli park, *Cupressus litter*, 9.7.1992, Matti Uusitalo leg., c.80 exx ZMT.

Measurements. Mean length and width 267 × 149 μm ($n = 11$, Finland). Lengths 310 μm & 330 μm , widths 155 μm & 165 μm (type material after AYYILDIZ & LUXTON, 1990). 290-310 μm and 155-165 μm (after SUBIAS 1982).

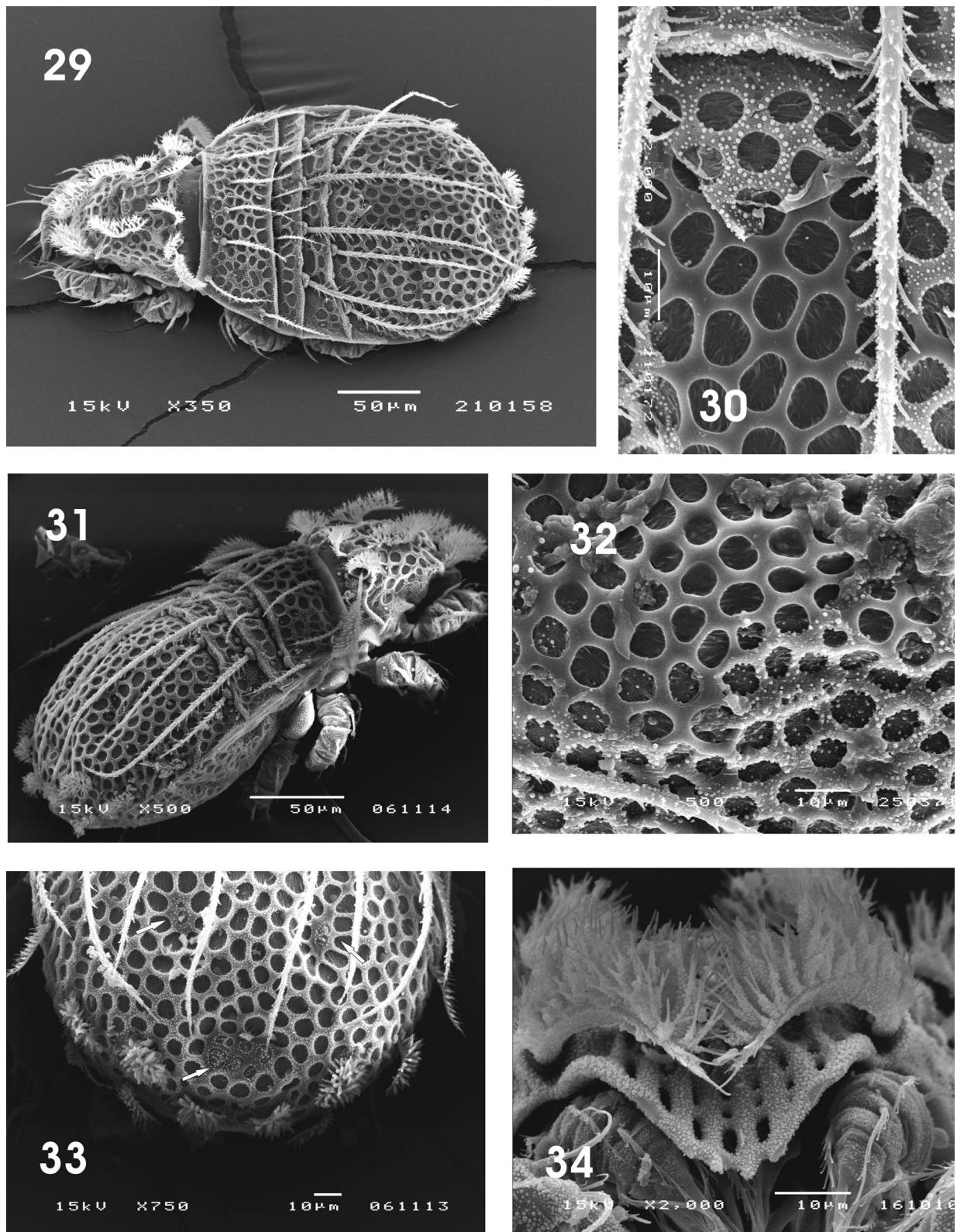
Integument. Body covered thin, granular, membrane-like cerotegument (FIG. 30). Underlying cuticle with foveae clearly visible because of thin cerotegument. Foveae present dorsally and on pleural plates; mainly round or oval and their sizes vary especially on pleural plates (FIG. 39). Single row of foveae on segment NM_1 and two rows on NM_2 (Figs. 29, 31 & 37). Largest foveae (6 - 10 μm) with interscalares (1,1 - 3,4 μm) on pygidium.

Prodorsum. Rostrum curved ventrally, with 4-5 pairs of longitudinal slots in 3-4 rows (FIG. 34). Prodorsal setae brush-shape, branched or foliate, except posterior setae exp short and pectinate (FIG. 35). Transverse ridge on basal part of prodorsum absent. Dorsosejugal scissure wide with striated cuticle (FIG. 36).

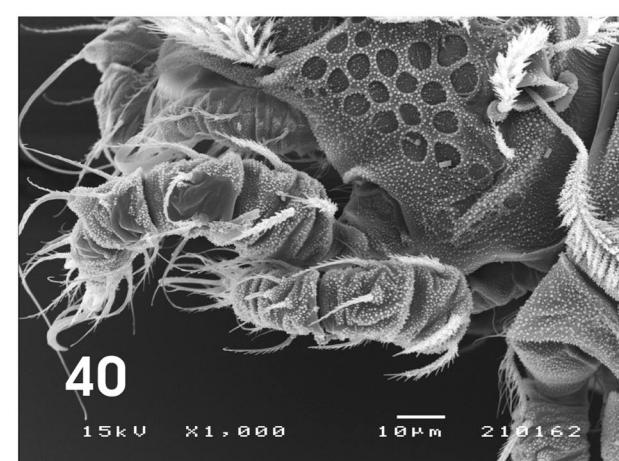
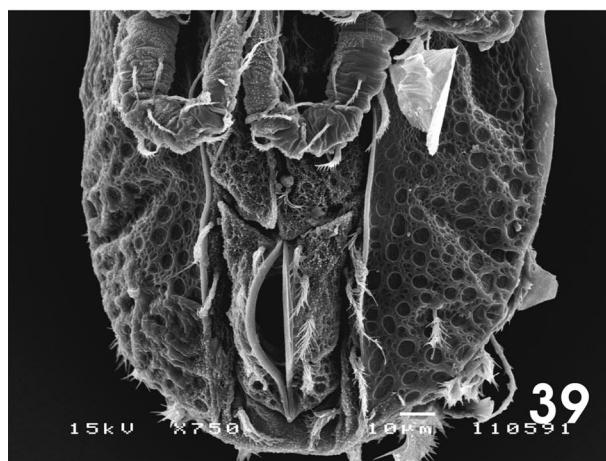
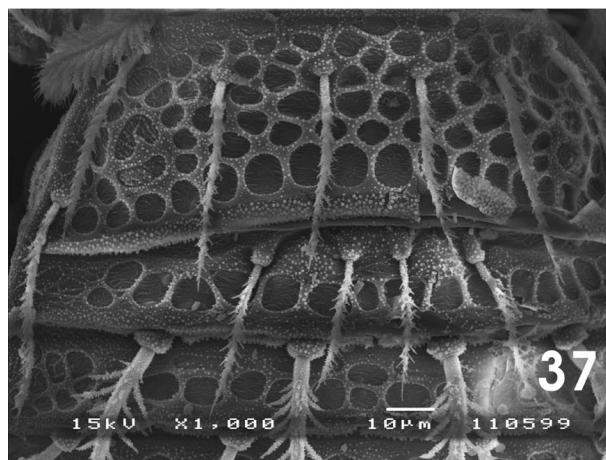
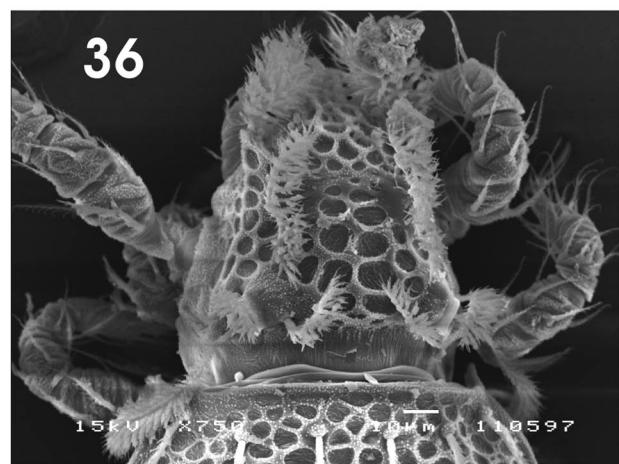
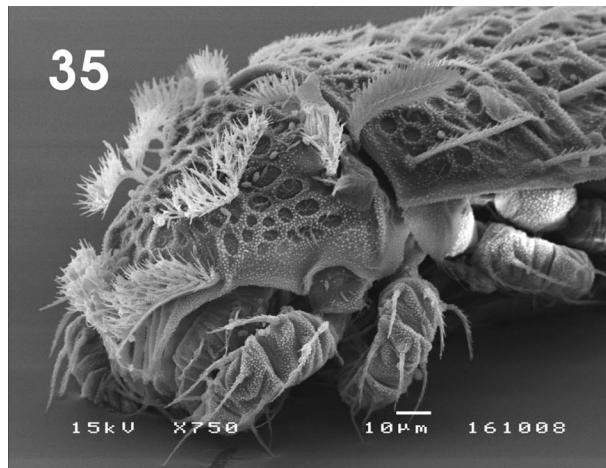
Notogaster. Notogastral seta c , d , e and f simple, not widen. Setae c and d plumose with secondary barbs short (shorter than in *C. reticulatus* or *C. foliatus*) (FIG. 37). Both setae groups (c and d) laterally compressed; covered by short cilia dorsally.

Setae c_1 as long as c_2 , c_3 and c_p . Distance $c_1 - c_1$ as long as $c_1 - c_2$ and shorter than distance $c_2 - c_3$. Setae c_3 closer to frontal margin of NA_1 than other c setae. Setae d_1 shorter than d_2 , which shorter than c_1 . Distance between $d_1 - d_2$ 1.5 times distance $d_1 - d_1$.

Erectile setae e and f long, plumose (Figs. 29-31); covered with minute cilia dorsally; cross-section round. All setae equally thick. Lateral hairs denser near base and sparser distally. Basal hairs of e_1 and e_2 1.5 times longer than diameter of setae whereas hairs of f_1 and f_2 about a half of diameter. Setae e_1 as long as setae e_2 . Setae f_1 about a half of length of setae e whereas setae f_2 about 1/3 of length of setae e . Distance between setae $e_1 - e_1 = e_1 - e_2$ and distance $f_1 - f_1$ 1.5 longer than $f_1 - f_2$. Setae h_{1-3} and p_{1-3} elongate, laterally compressed with long bristles laterally (FIG. 33).



FIGS 29-34. *Cosmochthonius lanatus*. 29. — dorsal view. 30. — Pygidium between setae e_7 (integument without cerotegument partly).



Figs 35-40. *Cosmochthonius lanatus*. 35. — Prodorsum, lateral view. 36. — Prodorsum, dorsal view. 37. — Frontal part of notogaster. 38. — Ventral part of proterosoma. 39. — Ventral side of hysterosoma. 40. — Legs I and II.

Two symmetrical depressions and one semicircular depression on posterial pygidium very noticeable (FIG. 33). Foveae (9-10) radially around openings of glands (?).

Ventral side. Formula of epimeral setae I-IV: 3-2-3-4. Genital plate with 10 setae and both anal- and aggenital plate with 4 setae (Figs. 38-39).

Legs. Claws (I-IV): 2-3-3-3. Setae *d*, *l* and *v* pectinate, not wide (cf. *C. foliatus*) (FIG. 40).

Remarks. GRANDJEAN (1950) noticed similarities between the descriptions of *C. lanatus* and the species, *C. domesticus* Grandjean, 1947. VAN DER HAMMEN (1952) considered *C. domesticus* Grandjean, 1947 as a synonym of *C. lanatus* whereas SUBIAS (1982) supposed *C. reticulatus* without cerotegument to be *C. lanatus* and *C. domesticus* to be a good species. Later AYYILDIZ & LUXTON (1990) confirmed *C. domesticus* as a synonym of *C. lanatus*.

Diagnosis. Cerotegument granular, membrane-like covering body. Cuticle with round or oval foveae dorsally and on pleural plates. The dorsosejugal scissure with striated cuticle. Notogastral setae; $c_1 = c_2 = c_3 = c_p$; $d_1 < d_2 < c_1$; $e_1 = e_2$ and $f_1 = \frac{1}{2}e$; $f_2 = \frac{1}{3}e$. Setae *d*, *l* and *v* pectinate, not wide.

Synonymy. SERGIENKO (1991) described the species *Cosmochthonius novus* from Ukraine. Our investigation of the type material showed this species to be *C. lanatus* and this was confirmed by SEM examination of the paratype (see FIG. 32). Therefore we consider *Cosmochthonius novus* Sergienko, 1991 as junior synonym of *Cosmochthonius lanatus* (MICHAEL, 1885).

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