© Entomologica Fennica. 20 December 1995

The parthenogenetic mite *Labidostomma luteum* (Acarina Actinotrichida: Labidostommidae) in Finland

Pekka T. Lehtinen & Ritva Niemi

Lehtinen, P. T. & Niemi, R. 1995: The parthenogenetic mite *Labidostomma luteum* (Acarina Actinotrichida: Labidostommidae) in Finland. — Entomol. Fennica 6:211–227.

Labidostommidae represents the only well sclerotized group of actinedid (prostigmatid) mites in Finland. This study confirms the presence of *Labidostomma luteum* Kramer, 1879 in southernmost Finland. This species has previously been reported in the nests of forest-dwelling singing birds without locality data, though the records were most probably based on misidentifications. Although it has not been found in arboreal nests, its known habitats in Finland indicate a wide ecological range within the SW archipelago. It has a patchy distribution and has been found in less than 8% of Berlese samples from suitable habitats in the SW archipelago. Only parthenogenetic populations of this species have been reported from Central Europe, with a limited area of bisexual populations in southern France. The 44 Finnish parthenogenetic populations have been mainly found in the SW archipelago on 29 islands. We report two mainland records from Sauvo in SW Finland with a widely separated record from Ylämaa, SE-Finland. This review of the total range of the species is based on a parallel revisional study of Labidostommidae. All stages of the parthenogenetic *L. luteum* are redescribed and SEM micrographs are presented for the most important diagnostic characters. *L. luteum repetitor* Grandjean, 1942 is raised to specific rank, and *L. jacquemarti* Coineau, 1964 is considered its junior synonym.

Pekka T. Lehtinen & Ritva Niemi, Zoological Museum, University of Turku, FIN-20500 Turku, Finland

Received 11 January 1994, accepted 10 April 1995

1. Introduction

Labidostommidae comprises one of the few groups of large, heavily sclerotized prostigmatid mites and, as yet, the only such group ever reported from Northern Europe. The taxonomy and nomenclature of most European taxa of this group have been filled with errors, deviating opinions and obscurity. In this study, we use the family name Labidostommidae Oudemans, 1904 instead of Nicoletiellidae G. Canestrini, 1891.

Labidostomma luteum Kramer, 1879 is the most widespread species of this group in Europe and has reliably been recorded from Sweden by

Trägårdh (1904). However, our extensive study of the soil microfauna of Finland has revealed that this species has a limited range in Southern Finland as well.

Nordberg (1936) reported this species in his notorious study of the arthropod fauna of Finnish bird's nests. Similar to others of his species, no localities were separately given, but most of the material was reported to come from the Aland Islands. *L. luteum* was reported by him only in the nests of *Phylloscopus trochilus* and *Turdus philomelos*. Unfortunately, this material is no longer preserved, and the identifications of his mite material are known to have been mostly erroneous or uncertain (cf. Uusitalo 1993). We have analyzed the mite fauna of numerous bird's nests in SW Finland (> 100 nests from > 30 bird species). However, we detected no *L. luteum* in this microhabitat, except for specimens found in soil samples mixed with material from anatid and larid ground nests in the bird colonies of the archipelago. Labidostommids do not appear to belong to the regular fauna of bird's nests in Central and Western Europe, as no records were reported in the extensive study from England by Woodroffe (1953) or the material of 30 nests from Poland (Błoszyk 1980).

The coloration of most preserved labidostommid species is more or less identical: bright yellow with an insignificant greenish tinge. Live females are reddish orange, while live nymphs are light purplish or reddish lilac with a silky shine. The widely deviating coloration of living specimens fades totally within a few hours after preservation for some specimens, but the coloration of other specimens changes even more rapidly in alcohol. The reddish colour was known to C. L. Koch (1838), who named the species *Caligonus ruber*, as well as to Halbert (1915).

2. Parthenogenesis

L. luteum is known only by parthenogenetic, most probably thelytokous populations in most parts of its European range (Grandjean 1941, 1942a, Błoszyk 1980: map on p. 82; Bertrand 1980; 1981: map on p. 3). Błoszyk (1980) reported 84 samples from Poland, containing hundreds of females but no males, and also Vistorin (1978b) found only females in Austria. Only female have been reported for a closely related taxon, *L. franzi* Bertrand, 1983 from Spain, indicating that this taxon may be parthenogenetic as well, having probably evolved directly from a parthenogenetic population of *L. luteum*.

Until now, the males of *L. luteum* have been known only from a limited area around the Pyrenees and in southern and southeastern France. The northernmost locality with males is the metropolitan area of Paris (Bertrand 1981: map on p. 2).

In Finland, the only populations of the taxon are parthenogenetic. Although 51 samples were studied, no adult males were found. The pattern of anal and genital plates in nymphal stages of females are found to be similar to that of adult males, and therefore sexes of deutonymphs cannot be separated by superficial morphological study. Nymphs are mostly found in the autumn and late summer.

Oliver (1971), Suomalainen et al. (1987), and Wrensch et al. (1993) reviewed the detailed information available about parthenogenesis in mites. The cytological type of parthenogenesis, as well as the possible occurrence of polyploidy has not been investigated for most groups of soil mites, including Labidostommidae. The occurrence of several types of parthenogenesis has been confirmed in other prostigmatid groups (Regev 1974, Feiertag–Koppen 1976, Pijnacker et al. 1981, Ebermann 1982, Wrensch et al. 1993).

Wrensch et al. (1993) showed that the repeatedly claimed evolutionary dead-end of thelytoky is not valid for many groups of mites. In the case of *L. luteum*, this has led to several parthenogenetic forms usually considered separate taxa.

The geographic distribution of parthenogenesis in *L. luteum* fits well with the general pattern of parthenogenesis in peripheral populations of terrestrial arthropods as first noted in mites by Hurlbutt (1979), and generally discussed by Glesener & Tilman (1978) and Suomalainen et al. (1987). These authors gave several instances of lizards as well as European and Japanese insects. Athias-Binche (1980) reported instances of parthenogenesis in uropodid mites and noted its frequent occurrence among widespread species. However, she did not mention any uropodid species with widespread parthenogenetic populations and restricted bisexual populations.

Glesener & Tilman (1978) drew an analogy between northern peripheral and island populations.

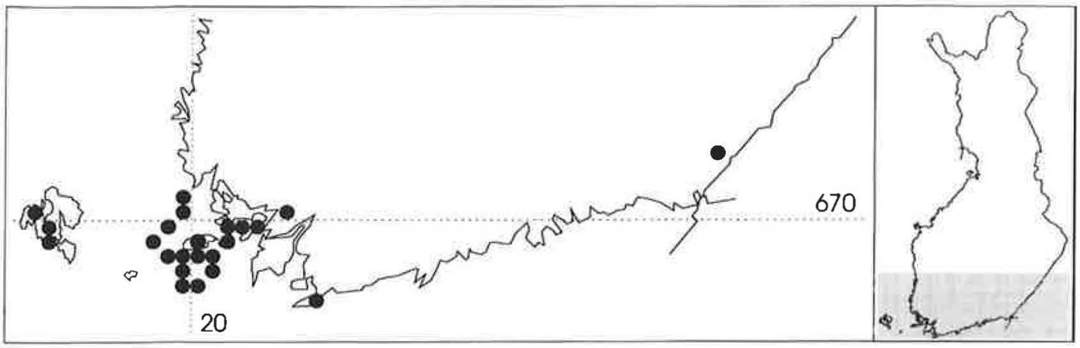

Fig. 1. Finnish records of *Labidostomma luteum.*

In the case of the SW archipelago of Finland, we are dealing with peripheral populations that are both northern and on small islands. The same archipelago (see range of *L. luteum* in Fig. 1) includes the only bisexually reproducing Finnish populations of *Proteroiulus fuscus* (Am Stein) (Diplopoda: Blaniulidae) and *Trichoniscus pusillus* (Brandt) (Isopoda: Trichoniscidae) (Palmén 1946, 1949b, Peitsalmi 1981, and P. T. Lehtinen: unpublished data), while only parthenogenetic populations are present there for the following: the millipeds *Nemasoma varicorne* C. L. Koch (Nemasomatidae), *Archiboreoiulus pallidus* (Brade-Birks) (Blaniulidae) and *Polyxenus lagurus* (Polyxenidae) (Palmén 1949b, PTL: unpubl.), the chilopods *Lamyctes fulvicornis* Meinert (Henicopidae) and *Geophilus proximus* C. L. Koch (Geophilidae) (Palmén 1949a, PTL: unpubl.), the mites *Veigaia nemorensis* (C. L. Koch) (Gamasida, Veigaiaidae), *Trachytes aegrota* (C. L. Koch), *T. minima* Trägårdh, *Discourella modesta* (Leonardi), *Urodiaspis tecta* (Kramer), *Microcylliba minima* (Kramer), and *Uropoda orbicularis* (Müller) (Gamasida: Polyaspididae & Uropodidae; PTL: unpubl.), as well as *Dilta hibernica* (Carpenter) (Thysanura: Machilidae; PTL: unpubl.). The bisexually reproducing populations of some of these species reach the southern parts of Scandinavia (Enghoff 1976, 1978), while those of most other species are restricted to Central or even Southern Europe (Vandel 1928, Brolemann 1930, Schubart 1934, Bregetova 1961, Athias-Binche 1980, PTL: unpubl.).

3. Total range

Since *L. luteum* has often been confused with other labidostommids, most published data on this species must be considered unreliable. It has been repeatedly reported by the name *Labidostomma/ Nicoletiella denticulata* (Schrank, 1776) (Oudemans 1904, Thor 1931, Vitzthum 1943). These authors either knew only one or two (Vitzthum 1929) Central European species or used the obscure specific name *denticulata* for the most widespread species. Halbert (1915) used the name *Nicoletiella cornuta* (Canestrini & Fanzago, 1877) for his material from Ireland, but some of his specimens were labelled by Berlese as *Labidostomma rubrum* (cf. Castagnoli & Pegazzano 1985). Feider & Vasiliu (1969) first grouped *L. luteum* together with its synonyms and phylogenetic relatives, and also clearly separated *L. cornutum* and *L. lyra* (Willmann, 1932) (using the name *N. denticulata*). Unfortunately, their discussion on types of nominal genera was contrary to all the facts and also to the Code.

Nicoletiella vejdovskyi Štorkán, 1938 (Czechoslovakia; first synonymized by Błoszyk 1980) and *Labidostomma luteum elongatum* Grandjean, 1942 (S France) are well described synonyms for *L. luteum*. The problems associated with the old names *Caligonus ruber* C. L. Koch, 1838 (lowlands of Germany) and *Acarus denticulatus* Schrank, 1781 (lowlands of Austria) can only be solved by an application to ICZN. C. L. Koch (1842) transferred *C. ruber* to *Raphignathus* Dugès, 1834, but the legends to figures 27 (actually *Caligonus piger*, not *R. ruber*) and 28 (actually *R. ruber*) were mistakenly changed in the plate V.

The records from North Europe have escaped the notice of many Central European authors. Luxton (1966, 1981) reported *Labidostomma* sp. from salt marshes and beech forests in Denmark, though this species certainly represented *L. luteum* as already stated by Schuster (1986). Thor (1931) listed *L. denticulata* (Schrank, 1776) from Norway and Sellnick (1940) from Iceland. These records, too, refer to *L. luteum*, as the former species is known to have a much more southern range in the mountains of eastern Central Europe and the Balkans (Štorkán 1938, Willmann 1956, Vistorin 1978a,Błoszyk 1980). Thor's record was not listed by Mehl (1979) in the checklist of Norwegian mites. The single record from Sweden (Södertälje, area adjacent to the SW archipelago of Finland) and an obscure record from Finland were noted in the introduction. The records from North Europe were not known to Bertrand (1981), yet he is the only author to ever mention the presence of males.

Confirmed records show that *L. luteum* is widespread in continental France, Switzerland, and Germany (C. L. Koch 1838, Kramer 1879, Oudemans 1906, Vitzthum 1929, Štorkán 1938, Schweizer & Bader 1963, Vistorin 1978a, Błoszyk 1980, Bertrand 1981 and Schuster 1986), while its range in Austria is restricted to the northernmost part of the country (Vistorin 1978a). Thus, Kühnelt's (1953) record from Carinthia is a misidentification of *L. lyra*. All old records from Italy refer to misidentification of other species of this genus, mostly *L. repetitor* Grandjean, 1942 (Berlese 1883, 1887, G. Canestrini 1885, Castagnoli & Pegazzano 1985), but even *L. integrum* Berlese, 1911, while no confirmed records are known south of the Alps or from the Balkans.

Michael (1880, 1888) and George (1883) have reported this species from Great Britain, though it appears to be rare (authors´ personal observations). Halbert's (1915) record was from seashore habitats of Ireland, corresponding ecologically to the majority of Finnish populations.

Womersley (1935) recorded *L. luteum* from New Zealand, but this was a misidentification of *Atyonella fictiluteum* (Atyeo & Crossley, 1961), as shown by the authors of that species.

4. List of confirmed records from Finland

The records are mapped using a uniform grid system (27°E) with 10 × 10 km squares (Fig. 1).

664:28 Hanko, Tvärminne, Östra Vindskär, moss (*Dicranum*) in pine forest 14.5.1992, PTL & RN: 2 ♀

664:28 Hanko, Tvärminne, Östra Vindskär, litter of pine forest 14.5.1992, PTL & RN: 2 ♀

664:28 Hanko, Tvärminne, Östra Vindskär, alder thicket with *Dryopteris* 14.5.1992, PTL & RN: 1 ♀

665:19 Korppoo, Aspö, Vidskär, litter of aspen, 13.5.1993, PTL: 3 ♀

665:20 Korppoo, Björkö, maritime deciduous forest (*Betula pubescens, Juniperus, Alnus glutinosa*), 26.6.1980, PTL: 2 + 5 brown ♀

666:19 Korppoo, Aspö, Ormskär, heap of reed and kelp with *Lasius* spp., 1.8.1984, PTL: 3 ♀

666:21 Nauvo, Berghamn, Ådö, Hundskär, litter of deciduous forest (ash, chokecherry, alder & honeysuckle), 24.7.1983, PTL: 12 ♀

666:21 Nauvo, Berghamn, Ådö, Hundskär, rotten base of ash and alder, 24.7.1983, PTL: 2 ♀

667:18 Korppoo, Kälö, Kråkskär, carpets of *Empetrum*, 24.6.1980, PTL: 10 (brown) ♀

667:18 Korppoo, Kälö, nest of *Lasius niger* in decaying reed 28.6.1987, PTL: 3 ♀

667:18 Korppoo, Kälö, litter of juniper and heather between rocks 15.5.1994, PTL: 1 ♀

667:19 Korppoo, Brunskär, Stor-Hästö, in litter, 30.6.1985, PTL: 2 ♀

667:19 Korppoo, Brunskär, Stor-Hästö, litter of ash-alder-aspen grove, 30.6.1985, PTL: 28 ♀

667:20 Korppoo, Kalgarholm, Hattskär, litter and moss under *Prunus padus*, 13.6.1986, PTL: 24 ♀, 1 T

667:20 Korppoo, Kalgarholm. Hattskär, litter and moss under *Prunus padus*, 9.10.1993, PTL: 75 ♀, 4 P

667:20 Korppoo, Kalgarholm, Hattskär, litter and moss under *Prunus padus*, 20.9.1994, PTL: 93 ♀, 3 T, 5 D, 2 P, 2 L

667:20 Korppoo, Kalgarholm, Kulmo, within a decaying aspen 12.5.1994 PTL: 1 ♀

667:21 Nauvo, Berghamn, main island, nests of *Lasius niger* & *L. flavus* under stones, 6.7.1985, PTL: 2 ♀

668:10 Jomala, Ramsholm, in decaying stumps of oak, 12.6.1985, PTL: 2 ♀

668:17 Houtskari, Jungfruskär, in moss (*Hylocomium, Rhodobryum & Rhytidiadelphus*), 29.5.1990, RN: 10 ♀

668:18 Korppoo, Lövskärs Hummelskär, dry meadow (*Geranium lucidum, Allium scorodoprasum, Origanum vulgare*) 4.6.1995, PTL: 1 ♀

668:20 Korppoo, Wattkast, nest of *Lasius flavus* under stone, 25. 6.1985, PTL: 10 ♀

668:20 Nauvo, Koum, Koumholmen, wet sphagnum and grass on brookside, 27.7.1985, PTL: 2 ♀, 1 D

668:20 Nauvo, Koum, Koumholmen, in nest of *Formica (Serviformica) fusca* under stones, 23.7.1985, PTL: 2 ♀

668:20 Nauvo, Koum, Koumholmen, S slope with stones and ants' nests, 7.10.1993, PTL: 1 ♀, 2 D

668:20 Nauvo, Koum, Strandbyviken - NE, nest of *Lasius niger*, 17.5.1983, PTL: 1 ♀

668:22 Nauvo, Sandö, Draget, beach and seashore vegetation 26.6.–11.10.1970 PTL: 2 ♀

669:10 Jomala, Ingby, in litter of aspen-pine-spruce forest with calcareous soil (*Cypripedilum*), 12.6.1985, PTL: 11 ♀

669:10 Jomala, Prästgården, Iriskärr, moss and wet litter of

alder stump, 12.6.1985, PTL: 2 ♀
669:18 Houtskari, Björkö, Nåtaholm, litter of hazel, 9.7.1985, PTL: 1 ♀
669:18 Houtskari, Fiskö, Sandskär – NW, stumps of rowan and pine, 9.7.1985, PTL: 2 ♀
669:18 Houtskari, Hyppeis, Rostmansskär, litter of hazel, 9.7.1985, PTL: 2 ♀
669:22 Nauvo, Seili, SE-part, *Juniperus* litter, 16.8.1991, RN: 1 ♀
669:22 Parainen, Ålö, Strandby, Kalkholm, *Galium album* stand on *Plagiomnium ellipticum*, 26.6.1982, PTL: 2 ♀
669:22 Parainen, Sydmo/Tennäs, islet of Lund, stone bed with *Angelica litoralis* and nests of *Aythya fuligula*, 24.7.1981, RN: 31 ♀, 4 D
669:22 Parainen, Sydmo/Tennäs, islet of Lund, stone bed with *Angelica litoralis* and nests of *Aythya fuligula*, 19.9.1982, PTL: 25+5 brown ♀, 3 D
669:22 Parainen, Sydmo/Tennäs, islet of Lund, stone bed with nest of *Somateria mollissima*, 6.12.1991, PTL: 1 ♀
669:22 Parainen, Sydmo/Tennäs, islet of Lund, mold between stones, 3.10.1993, PTL: 7 ♀
669:22 Parainen, Sydmo/Tennäs, islet of Lund, old nest of *Larus canus* on gravel, 3.10.1993, PTL: 7♀, 10 T, 7 D, 1 P
669:23 Parainen, Ålö, Sydmo, Ippostträsk–W, within decaying alder 21.5.1994 PTL: 3 ♀
669:24 Parainen, Kirjalaö, Bläsnäs, nests of *Lasius niger, L. flavus, Formica fusca* & *Camponotus ligniperda* along margin of a gravel pit close to the seashore, 19.4.1983, PTL: 30 ♀
669:24 Parainen, Lemlaxö, Siggnäs, ash-maple-chokecherry-alder grove, 15.6.1994, PTL: 3 ♀
670:09 Hammarland, Sålis, Bredmosse, in litter of calcareous swamp (*Myrica gale*, grass & *Sphagnum*), 16.7.1983, PTL: 3 ♀ 1 D
670:19 Korppoo, Åvensor, Kirmoudden, Juniper slope with grass and moss (numerous ants), 25.8.–25.10.1968, PTL: 1 ♀
670:19 Korppoo, Åvensor, Kirmoudden, Juniper bushes, 20.9.1976, PTL: 7 ♀
670:19 Korppoo, Åvensor, Kirmoudden, southern slope with limestone rocks 25.8–25.10.1968, P. Häkkilä: 1 ♀
670:19 Korppoo, Åvensor, Kälklot, flower meadow 11.6.1994 PTL: 2 ♀
670:19 Korppoo, Åvensor, Kälklot, decaying reed and shore meadow 11.6.1994 PTL: 2 ♀
670:26 Sauvo, Kavalo, stumps of pine and spruce (*Lasius* and *Myrmica* spp.), 22.5.1983, PTL: 1 ♀, 1 D
671:19 Korppoo, Åvensor, Kirmoudden, slope in grove, 30.7.1966, PTL: 4 ♀
674:55 Ylämaa centrum 4 km NE, moss, lichen, and litter of dry pine forest, 13.8.1985, PTL: 48 ♀, 9 D

5. Habitats of *L. luteum* in Finland

Our study showed no clear-cut habitat preference for *L. luteum* in Finland. Especially in the middle and outer zones of the archipelago, where this species has been recorded from a wide range of soil types with variable microclimates, ranging from dry barren stone beds to wet sphagnum. Błoszyk (1980) listed *L. luteum* from a wide variety of habitats, but unfortunately he did not give any information about microhabitats. However, both of the continental records, as well as many records from the inner archipelago and larger islands are connected with an abundance of ants. Some of the most numerous populations have been extracted from nests of *Lasius* spp., either in soil, under stones, or under the bark of tree stumps. The only record from SE Finland was not extracted from an ant nest, though several species of *Lasius, Formica (Serviformica)*, and *Myrmica* were abundant in that very warm habitat.

An intensive search for this species in a classic locality in December resulted in only one female specimen from a very large sampling through 13 funnels. The sample was taken from frozen soil to a depth of 5–10 cm. This sample seems to indicate that *L. luteum* hibernates in cracks or crevices deeper in the soil.

During mapping of Finnish soil Arthropoda, the authors screened through more than one thousand Berlese samples of Finnish soil and ground layer habitats, ca. 600 of them within the range of *L. luteum.* Altogether 51 samples from 44 different localities on 29 islands, and two widely separated localities on the Finnish mainland included *L. luteum.* With this background information, we can conclude that the range of *L. luteum* in the archipelago is not absolutely continuous, although this species may be present on some islands out of all the 10 × 10 km squares.

L. luteum has been found by us only in a small minority of funnel samples from habitats sometimes suitable for it. The majority of ant nests anayzed so far did not have *L. luteum*, even though some of the most numerous populations were found in that habitat.

6. Life cycle

In spite of intensive collecting and the use of Berlese funnels in the SW archipelago of Finland, most samples from spring and early summer included only adult females of *L. luteum.*

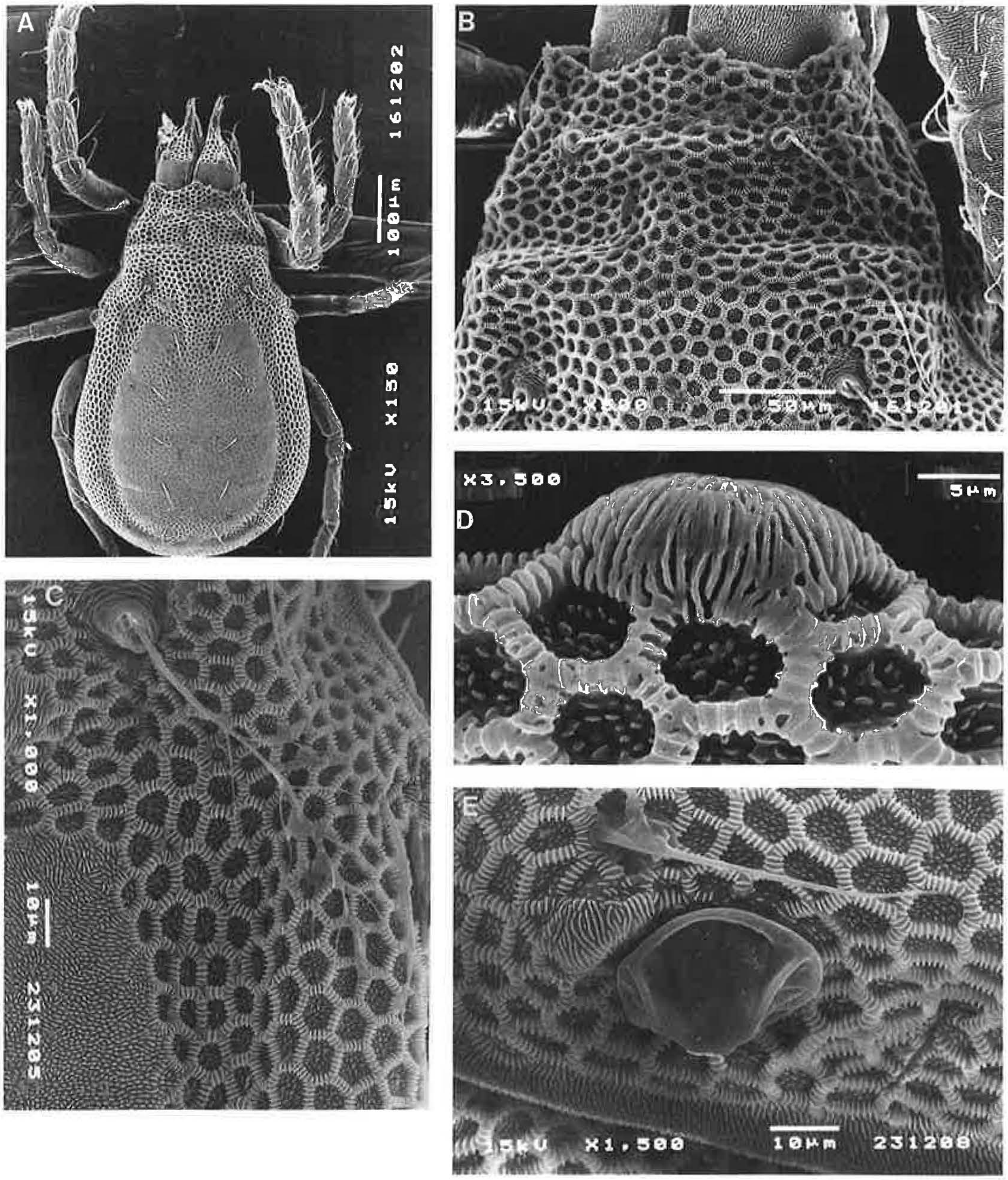

Fig. 2. *Labidostomma luteum* adult (A), anterior part of idiosoma (B), posterior sensillus (C), anterior eye (D), and lateral eye, pustule, lyrifissure and seta *gr* (E).

The majority of nymphs were collected in September–October. However, some females certainly hibernate, as an inactive female specimen was found in frozen soil in December.

The maximum length of the life cycle of *L. luteum* has not been measured by direct observations, but Vistorin (1978b) counted up to 509 days for other species of *Labidostomma*.

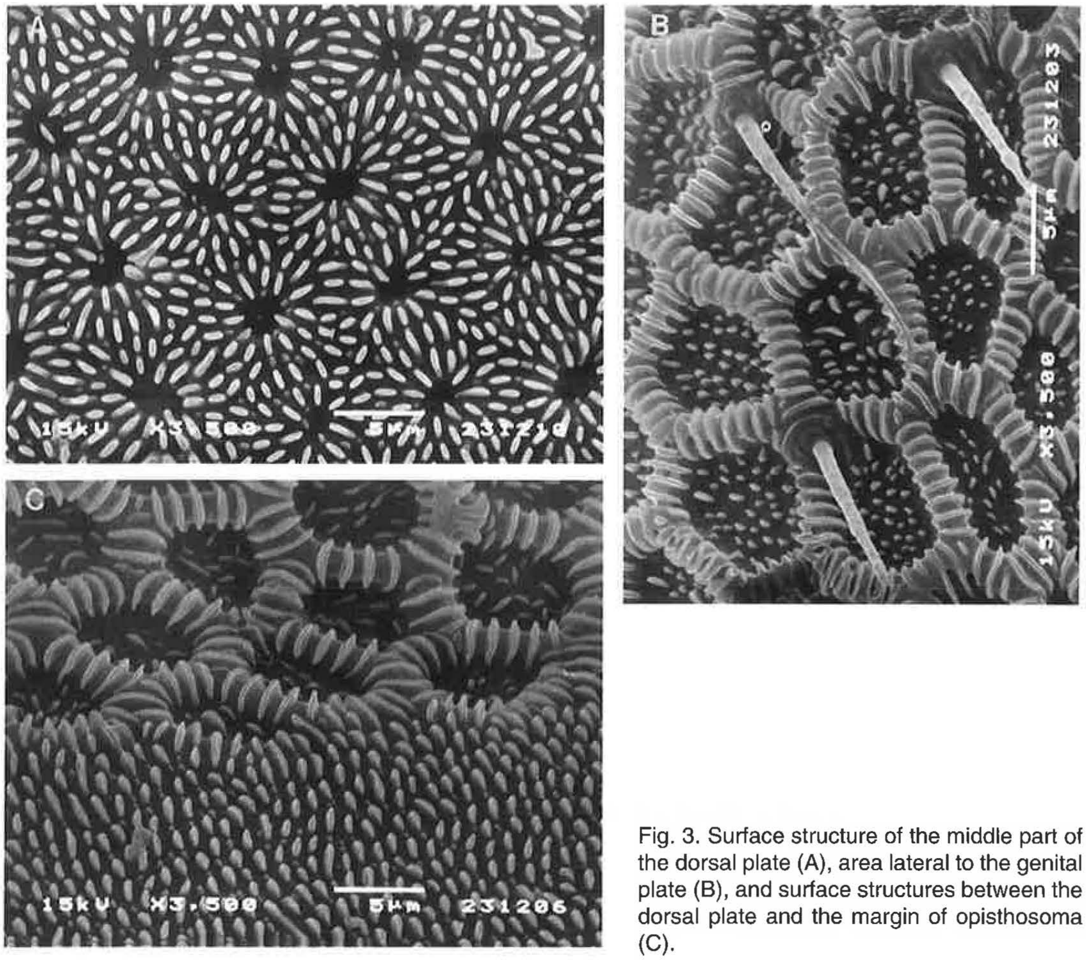

Fig. 3. Surface structure of the middle part of the dorsal plate (A), area lateral to the genital plate (B), and surface structures between the dorsal plate and the margin of opisthosoma (C).

The life cycles of two bisexually reproducing species of *Labidostomma* (*N. denticulata* sensu Vistorin and *N. cornuta*) were studied by Vistorin (1978b). He found all stages throughout the year in Austria, although nymphal stages were rare in May and June. He also found that the protonymphs of these two species lived a maximum of 210/103 days, deutonymphs 195/172 days and tritonymphs 306/247 days, while the whole life cycle may reach up to three years.

7. Redescription of the parthenogenetic *L. luteum*

7.1. Female

The female of *L. luteum* has been described by Štorkán (1938: 445 figs. 7–10 as *N. vejdovskyi*), Błoszyk (1980: 68 figs. 2–5) using light microscopy. Both sexes were described by Bertrand (1981) with some SEM micrographs. None of them presented a detailed comparison of *L. luteum* with diagnostic characters of *L. lyra* and *L. cornutum*, two frequently confused species.

The original description of the North American *Nicoletiella fergusoni* was based on SEM micrographs (Robaux 1977). Some details of *L. cornutum* and *L. lyra* (under *N. denticulata*) were photographed with SEM by Vistorin (1980). However, SEM micrographs of *L. luteum* have not been published.

Adult female (terminology according to Grandjean). The coloration of the preserved Finnish female specimens consists of two different types. The great majority of specimens are bright yellow as are most preserved labidostommids. However, three

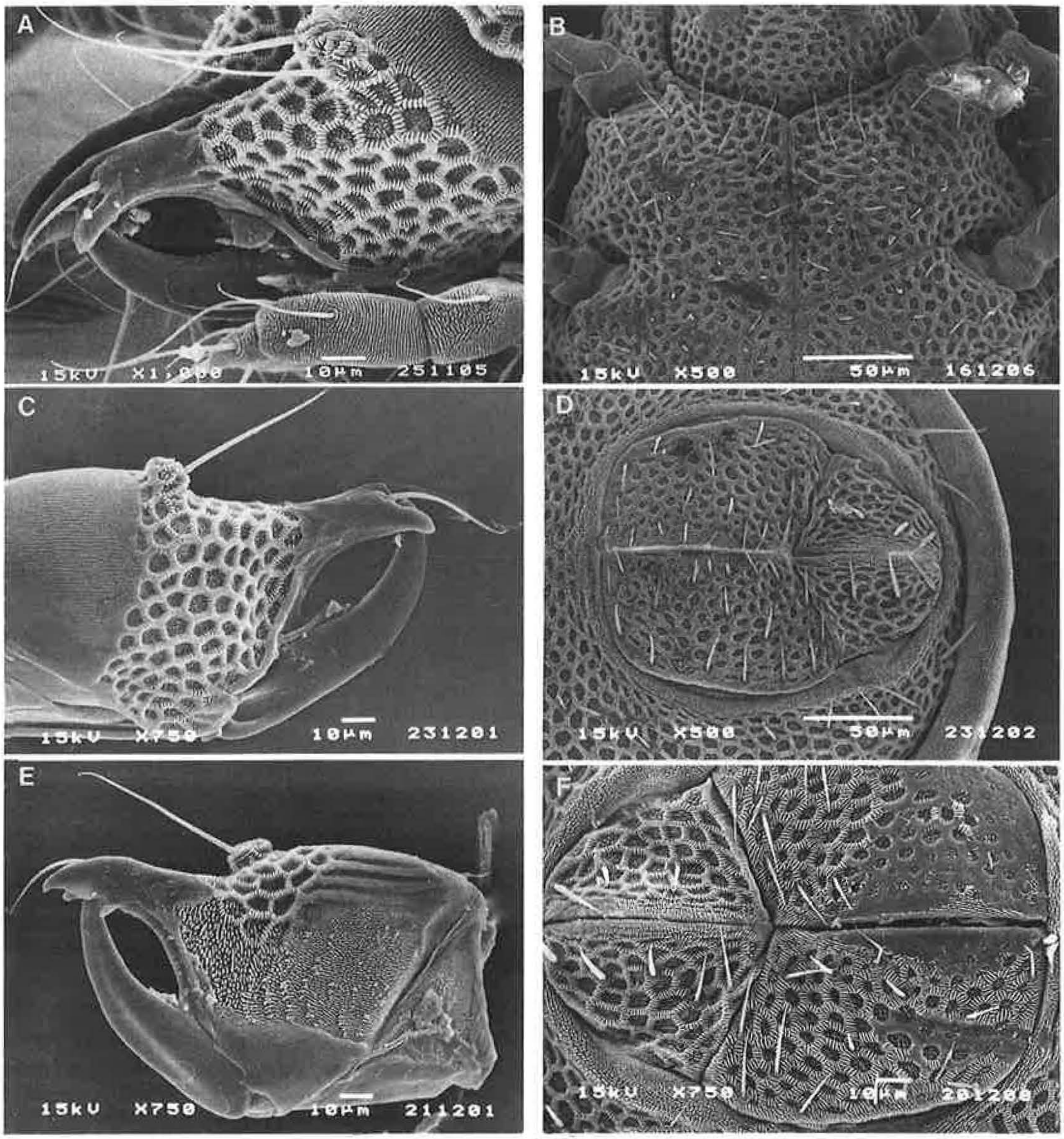

Fig. 4. Chelicerae, lateral view (A), right chelicera, lateral view (C) and mesial view (E), epimeral plate I of adult (B), and genital and anal plates (D & F).

populations included dark, uniformly coloured, greenish brown specimens. These dark specimens were in the minority in one of the populations studied, in the majority in another and the only type in a third population. Although all these populations live in the archipelago, they are spatially separated from each other. Most probably we are dealing with a case of balanced polymorphism. Details of the ultrastructure of the parthenogenetic *L. luteum* are presented in SEM micrographs (Figs. 2–9).

Differential diagnosis. Adult females of *L. luteum* are differentiated from *L. lyra, L. cornutum,* and *L. integrum* by the contour of the front margin of the body (Fig. 2A), entirely different patterns of the dorsal and ventral reticulation (Figs. 2A–E, 3A–C & 8D), chaetotaxy of the genital plate (Table

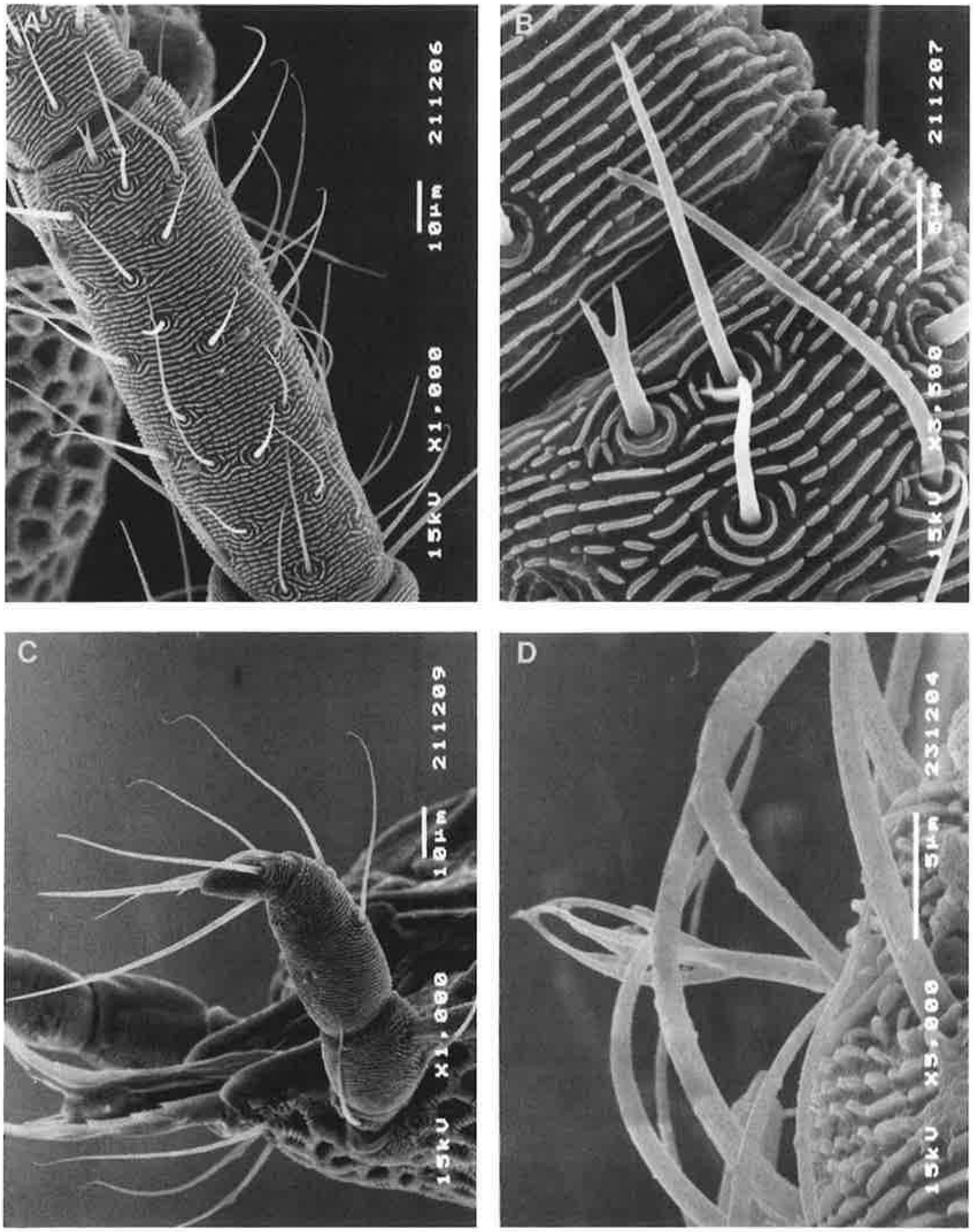

Fig. 5. Tarsus II (A), seta *k"* (B), palp (C), and famulus (D).

1, Fig. 4D & F), modifications of the chelicerae (Fig. 4A, C & E), as well as the ultrastructure of sensory hairs on the body (Fig. 2C) and legs (Fig. 5A–D). The hair *k"* close to the distal margin of tibia I is twisted.

L. luteum is differentiated from the Mediterra-

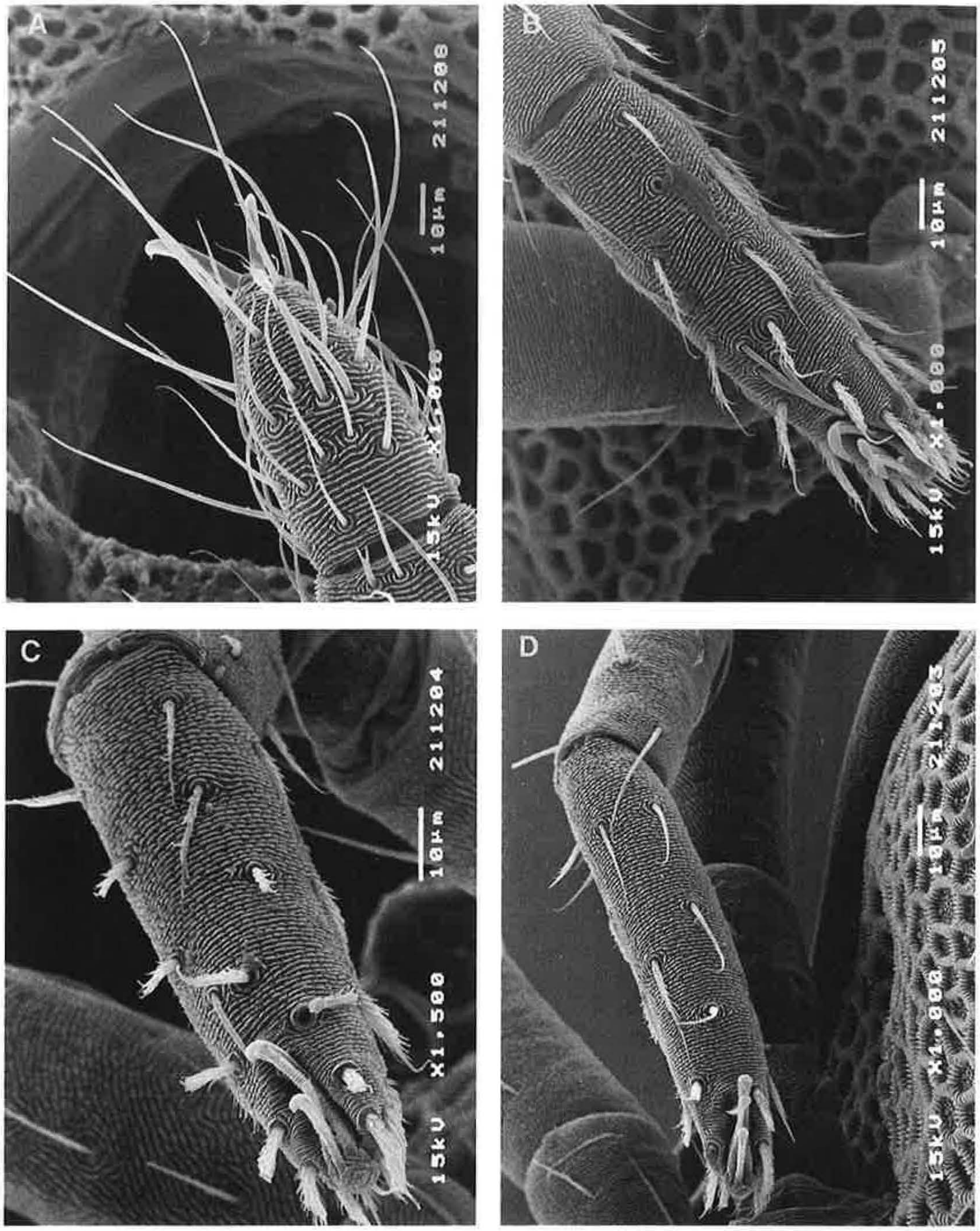

Fig. 6. Dorsal view of tarsus I (A), tarsus II (B), tarsus III (C), and tarsus IV (D).

nean *L. repetitor* Grandjean, 1942 by the presence of only one pustule behind the lateral eye and by the structure of the branched sensillae. Such differences warrant that *L. repetitor* be raised to specific rank and considered a senior synonym of *L. jacquemarti* Coineau, 1964.

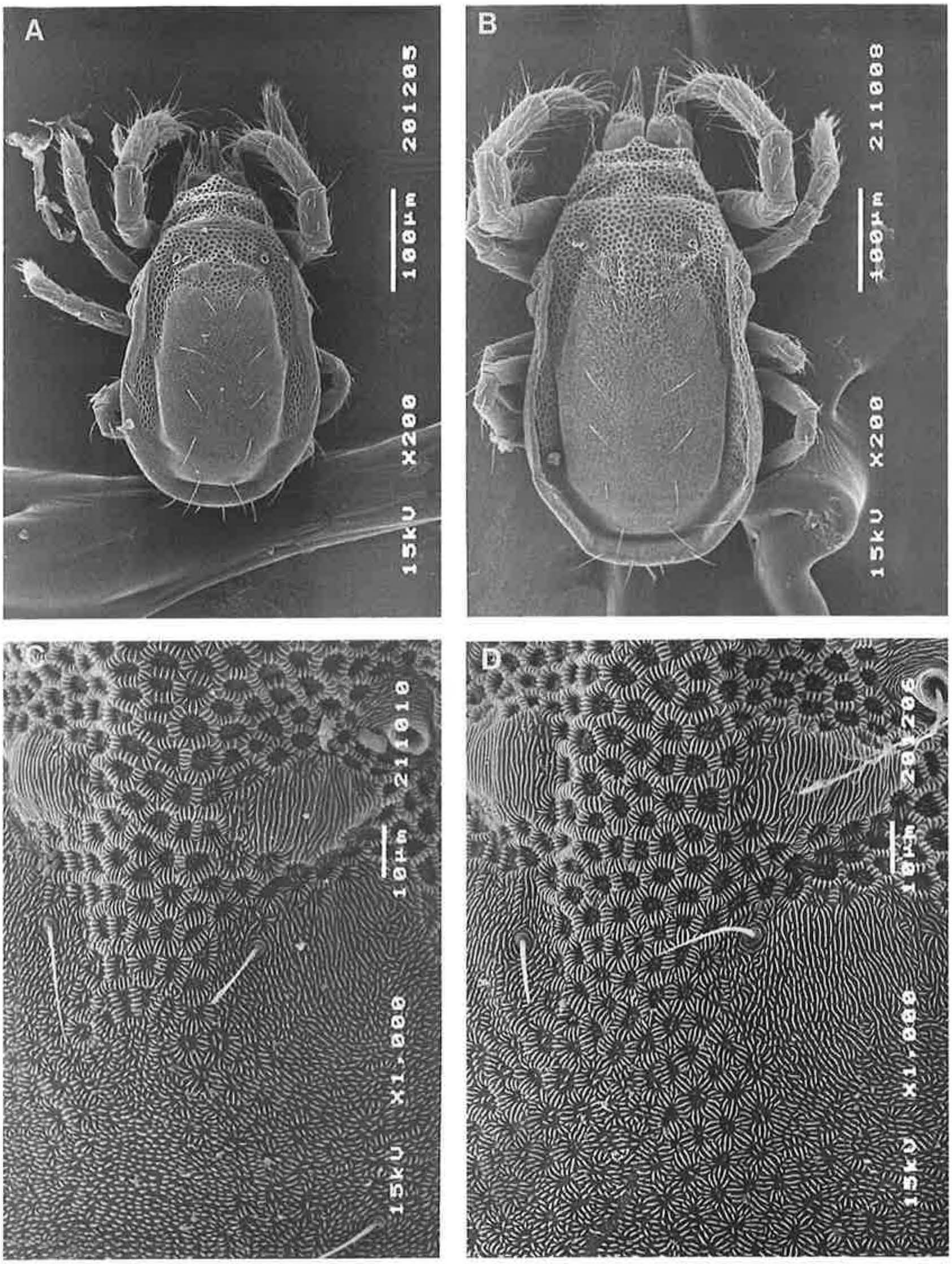

Fig. 7. Deutonymph; dorsal side (A) and surface structure of the central plate (C), tritonymph; dorsal side (B), and surface structure of the central plate (D).

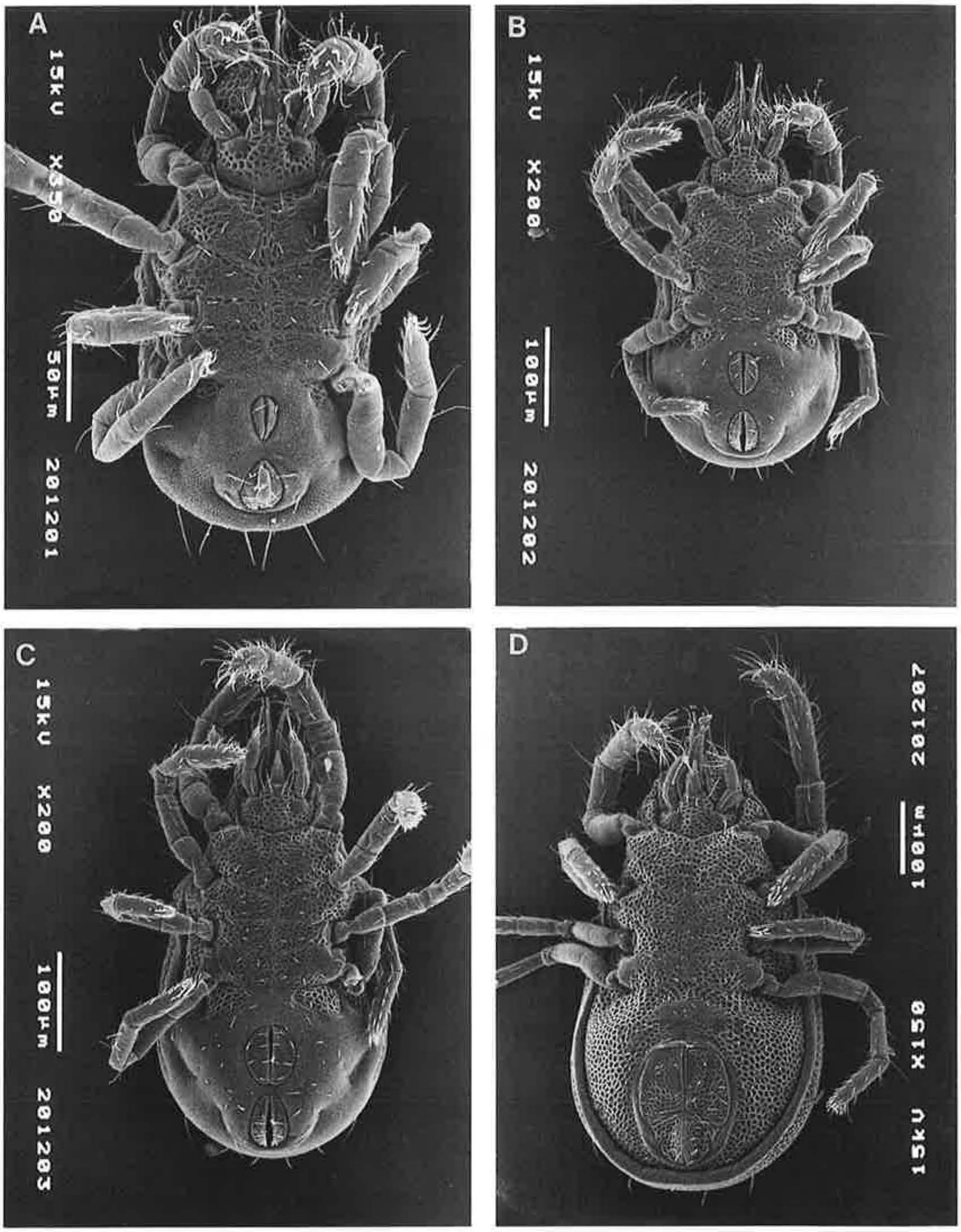

Fig. 8. Ventral side of protonymph (A), deutonymph (B), tritonymph (C), and adult (D).

Measurements. Total size 560 × 295 µm. Length of the body is given without chelicerae.

Dorsal side. The anterior margin of the idiosoma has triangular lateral corners, as do most of the European *Labidostomma* spp., with the exception of *L. integrum*. These corners are slightly less acute

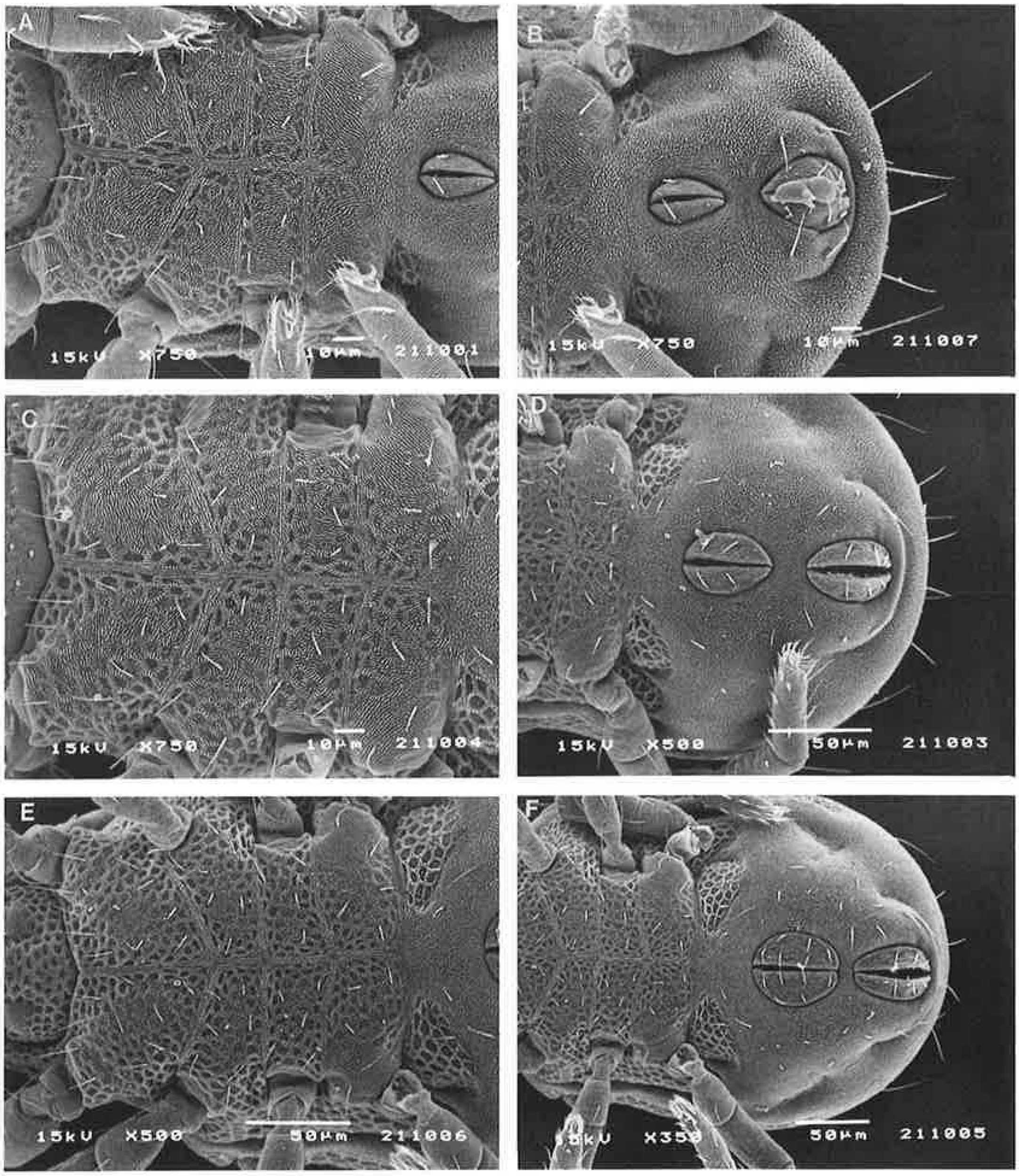

Fig. 9. The epimeral region and genital and anal plates of protonymph (A & B), deutonymph (C & D), and tritonymph (E & F).

than in *L. lyra* and *L. cornutum*, but especially when direct comparison is not possible, it is a poor diagnostic character. The sensillar region and all margins of the notogaster are throughout covered with pentagonal to hexagonal reticulations (Fig. 2A–E). There is a central plate with six pairs of simple setae and a different surface structure (Fig. 3A). There are paired transverse areas of furrowed structures behind the posterior sensillae (cf. Fig. 7C–D). The function of these spots is unknown, but the surface structure is more or less similar to the unpaired anterior eye (Fig. 2D), as well as the paired lateral eyes (Fig. 2E). The first and third pairs of sensillae are distinctly branched (Fig. 2B–

C), and the second pair of sensillae is simple, as in all known European species of *Labidostomma*. The first and third sensillae are similar to each other (cf. Coineau 1964: fig. 1). There is always a single pustule behind the lateral eyes.

Ventral side. The setation of epimerae and ventral plates is given in Table 1 and in Fig. 4B, D & E. In strict contrast to *L. lyra*, the area around the genital and anal plates is covered with pentagonal to hexagonal reticulations (Fig. 8D) except for a semilunar area in front of, but some distance from the genital plate. This area has an irregularly furrowed ultrastructure (cf. Fig. 7D). The genital and anal plates (Fig. 4D & F) are throughout reticulated with pentagons. The genital plate has a regular row of 7–8 marginal setae along the mesial margin and 10–13 more irregularly placed additional setae. The genital plate usually has three submarginal setae, as do all other *Labidostomma* spp., but sometimes the number of setae can rise as high as 4 or 5 (Fig. 4D & F).

Gnathosoma. The shape of the ventral plate of the gnathosoma is not essentially different from that of other *Labidostomma* spp. Błoszyk (1980: Fig. 4) included a partly misleading drawing, as the palpal trochanterae are partly covered by the margin of this plate. The cheliceral structure (Fig. 4A, C & E) is essentially similar to all *Labidostomma* spp., except that the enlarged base of the dorsal seta is relatively short in *L. luteum*. The complicated ultrastructure of the inner face (Fig. 4E) has not previously been described. The setation of the palpal segments (Fig. 5C) is also inaccurate in the drawing by Błoszyk (1980: fig. 4). The distal solenidion is characteristically curved around the tip of the palpal tarsus (Fig. 5C). For other species, see Bertrand (1982: figs. 2–3).

Leg structure. The surface of all leg segments is transversely furrowed. The ridges are usually discontinuous in the legs of adults (Fig. 5A, B & D), but at least in some specimens the ridges may be more or less continuous (Fig. 6A). There are two tarsal claws on leg I and three on legs II–IV (Fig. 6A–D). The inner faces of the latter are transversely furrowed (Fig. 6C). All setae on tarsus I are simple, while the normal hairs on tarsi II–IV are plumose. Tarsus I has a pair of closely placed solenidia (Fig. 6A), easily separated from the normal hairs by their relative thickness. Tarsus II has a group of three solenidia (Fig. 6 B) and tarsi III–IV a single solenidion in the same place. The famulus (Fig. 5D) has the shape of a candelabra, as in most species of *Labidostomma*, exluding the *integrum*-group. The exact shape may be characteristic for each species, but a reliable comparison is difficult, as the famulus is often distorted, dirty, or its position is not favourable for comparison. Tibia I (Fig. 5A) has a complex pattern of hairs and solenidia (cf. Grandjean 1941). The subdistal hair *k"* is forked in *L. luteum* (Fig. 5B).

Table 1. Chaetotaxy of *L. luteum*, *L. lyra* and *L. cornutum*.

	epimere I	II	III	IV	opistho-soma (v)	genital plate	anal plate
protonymph							
L. luteum	5	2	3	1	2 adanal	1	3
L. lyra	6–9	4–5	4	1	5–7	1	3
L. cornutum	5–7	4–6	4	1	5–7	1	3
deutonymph							
L. luteum	8–9	4	4	4	6	2	3
L. lyra	15–17	9–11	5	7	13–17	3–4	3
L. cornutum	15–17	9–11	5–6	7–9	13–16	3–4	3
tritonymph							
L. luteum	10–11	7	4–5	5–6	12	6	3
L. lyra	17–19	12–13	6	10	23–25	17–20	3
L. cornutum	15–18	9–14	5–7	8–9	24–27	14–18	3
adult							
L. luteum	20–21	12–14	8	12	16	17–18	3–5
L. lyra	16	9	5	9	30	23	3
L. cornutum	31	22	14	17	>30	>30	3

7.2. Juvenile stages

The larval stage of *L. luteum* is short-lived and seldom found. Grandjean (1942c) described and depicted this stage. The nymphal stages of *L. luteum* have never been properly described. According to Vistorin (1978b: 368), live nymphs of *L. cornutum* and *L. lyra* are yellow, while the nymphal stages of *L. luteum* are reddish with whitish zones. The protonymph measured ventrally (from the base of hypostome) is 230 × 135 µm, more or less whitish; the deutonymph is 325 × 195 µm, pale purplish when alive, whitish in preserved specimens; and the tritonymph is 440 × 230 µm, purplish when alive, sometimes with yellowish brown anterior half, whitish or yellow in preserved specimens. The chelicerae of all nymphal stages are deep yellow.

A more or less complete reticulate pattern of the dorsal side is developed in the adult stage, while both deutonymph (Fig. 7A) and tritonymph (Fig. 7B) still have large areas of opisthosoma without these reticulations. The reticulations of the ventral side also show gradual development of the reticulation typical of the adult specimens of this species.

The chaetotaxy of all nymphal stages (Figs. (8A–C & 9A, C & E) as well as of adults of *L. luteum* seems to be diagnostic, at least in comparison to *L. lyra* and *L. cornutum* (cf. Vistorin 1980; Błoszyk 1980).

Similar to the males of bisexually reproducing *L. luteum*, the genital and anal plates of all nymphal stages are distinctly separate. The relative size of the genital plate is increased at all stages and simultaneously the relative distance of these plates is decreased, P: GP < AP, D: GP = AP; T: GP > AP; ♀: GP >> AP (touching throughout). According to Grandjean (1942c) the genital plate is relatively larger in all nymphal stages of *L. cornutum* (P: GP = AP; D: GP > AP; T: GP >> AP). The posterior half of the ventral side is without reticulate pattern in all nymphal stages (Fig. 9B, D & F), while this area including the genital and anal plates is reticulate throughout in adult females (Fig. 8D).

Acknowledgments. We are grateful to Dr. Jouko Pokki, Director of the Tvärminne Zoological Station for arrangement of the field trip to the neighbouring archipelago and to Mr Kalervo Heikka for technical help in the field and in the laboratory. Mr Veikko Rinne, M.Sc. created the mapping programme used in this study and has given much advice in all aspects of the computer work. Dr. Luigi de Anna helped in the interpretation of some Italian texts. The English text has been checked by Mr. Ken Pennington, M.A.

References

Athias-Binche, F. 1980: Contribution a la connaissance des Uropodides libres (Arachnides: Anactinotriches) de quelques ecosystems forestiers europeens. I-II. — Thesis, Université Pierre et Marie Curie, Paris VI, 80 pp.

Atyeo, W. T. & Crossley, D. A. 1961: The Labidostomidae of New Zealand (Acarina). — Rec. Dominion Mus. 4(4):29–48.

Berlese, A. 1883: Escursione in Sicilia. Acarofauna Sicula. Ie Serie. — Boll. Soc. Entomol. Ital. 15:212–220.

— 1887: Acari, Myriapoda et Scorpiones hucusque in Italia reperta. — Padova 36:N:o 7.

Bertrand, M. 1980: Cycle saisonnier et distribution verticale de Labidostomma luteum Kramer 1879, espèce parthénogénétique dans une charmaie à mercuriales (Brunoy, France). — Vie et Milieu 30:81–86.

— 1981: Labidostomma luteum Kramer, 1879 (Acariens, Actinedida, Labidostommidae). — Doc. Atlas Zoogeogr. Languedoc-Roussillon 21:1–4.

— 1982: Contribution à l'étude des appendices des Labidostommidae (Acari: Prostigmata). — Acarologia 23:233–237.

Błoszyk, J. 1980: Badania nadrodzina Nicoletiellidae (Acari, Prostigmata) Polski. — Poznan Przy. Mat. Biol. 54:53–85.

Bregetova, N. G. 1961: The Veigaiaid mites (Gamasoidea, Veigaiaideae) in the USSR. — Parasitol. Sborn. 20:9–107.

Brolemann, H. W. 1930: Élements d'une faune des Myriapodes de France. Chilopodes. — Librairie de la Faculte des Sciences, Paris, 405 pp.

Canestrini, G. 1885: Prospetto dell'acarofauna Italiana, Parte I. Oribatini e Gamasini. — Atti Ist. Ven. Sci. Let. Art. (Ser. 6) 2:1397–1443.

Castagnoli, M. & Pegazzano, F. 1985: Catalogue of the Berlese Acaroteca. — Istituto Sperimentale per la Zoologia Agraria, Firenze. 489 pp.

Coineau, Y. 1964: Un nouveau Labidostoma à pustules multiples: Labidostoma jacquemarti n. sp. (Labidostomidae. Acar. Prostigmata). — Rev. Ecol. Biol. Sol. 3:543–552.

Ebermann, E. 1982: Fortpflanzungsbiologische Studien an Scutacariden (Acari, Trombidiformes). — Zool. Jahrb., Abt. Syst. Ökol. Geogr. Tiere 109:98–116.

Enghoff, H. 1976: Morphological comparison of bisexual and parthenogenetic Polyxenus lagurus (Linné, 1758) in Denmark and Southern Sweden, with notes on taxonomy, distribution and ecology. — Entomol. Medd. 44:161–182.

— 1978: Parthenogenesis and bisexuality in the millipede Nemasoma varicorne C. L. Koch, 1847. II. Distribution, substrate and abundance of the bisexual and thelytokous form in some Danish forests. — Entomol. Medd. 46:73–79.

Feider, Z. & Vasiliu, N. 1969: Révision critique de la famille Nicoletiellidae. — Proc. 2nd Int. Congr. Acarol., Sutton-Bonnington 1967, pp. 201–207.

Feiertag-Koppen, C. C. M. 1976: Cytological studies of the two-spotted spider mite Tetranychus urticae Koch (Tetranychidae, Trombidiformes). I. Meiosis of eggs.

— Genetica 46:445–456.

George, C. F. 1883: Labidostomma luteum. — J. Post. Micr. Soc. 2:245, pl. 42.

Glesener, R. & Tilman, D. 1978: Sexuality and the components of environmental uncertainty: clues from geographic parthenogenesis in terrestrial animals. — Amer. Nat. 112(986):659–673.

Grandjean, F. 1941: Observations sur les Acariens (6. sér.). — Bull. Mus. Nat. Hist. Nat. Paris (2)12:532–539.

— 1942a: Observations sur les Labidostommidae. (2. sér.). — Bull. Mus. Nat. Hist. Nat. Paris (2)14:185–192.

— 1942b: Observations sur les Labidostommidae (3. sér.). — Bull. Mus. Nat. Hist. Nat. Paris (2)14:319–326.

— 1942c: Observations sur les Labidostommidae (4. sér.). — Bull. Mus. Nat. Hist. Nat. Paris (2)14:414–418.

Halbert, J. N. 1915: Clare Island Survey, part 39 ii. Arachnida: ii – Terrestrial and marine Acarina. — Proc. R. Irish Ac. 31:45–136, pls. 4–8.

Hurlbutt, H. W. 1979: Distribution of unisexual and bisexual forms in mesostigmatid mites. — Recent Adv. Acarol. 2:455–460.

Koch, C. L. 1838: Deutschlands Crustaceen, Myriapoden und Arachniden. — Regensburg. Heft 20:1–24, 24 pls.

— 1842: Übersicht des Arachnidensystems. — Nürnberg. Drittes Heft. Erste Abteilung. 131 pp., 13 pls.

Kramer, P. 1879: Neue Acariden. — Arch. Naturg. 45:13–16.

Kühnelt, W. 1953: Beiträge zur Kenntnis der Bodentierwelt Kärntens und seiner Nachbargebiete. — Carinthia II, Mitt. Naturwiss. Ver. Kärnten 63:42–74.

Luxton, M. 1966: Laboratory studies on the feeding habits of saltmarsh Acarina, with notes on their behaviour. — Acarologia 8:163–175.

— 1981: Studies on the prostigmatid mites of a Danish beech wood soil. — Pedobiol. 22:277–303.

Mehl, R. 1979: Checklist of Norwegian ticks and mites (Acari). — Fauna Norv. (B) 26:31–45.

Michael, A. D. 1880: On two species of Acarina believed not to have been recorded as British. — J. Queckett Micr. Club 6:107–113, pl. 6.

— 1888: British Oribatida. — Ray Society, London. 2:337–656, pls. 25–54.

Nordberg, S. 1936: Biologisch-ökologische Untersuchungen über die Vogelnidicolen. — Acta Zool. Fenn. 21:1--168.

Oliver, J. H. Jr. 1971: Parthenogenesis in mites and ticks (Arachnida, Acari). — Am. Zool. 11:283–299.

Oudemans, A. C. 1904: Notes on Acari. Eleventh Series. — Tijdschr. Entomol. 46:111–134.

— 1906: Das Tracheensystem der Labidostomidae und eine neue Klassifikation der Acari. — Zool. Anz. 29:633–637.

Palmén, E. 1946: Die Landisopoden Finnlands. — Ann. Zool. Soc. Vanamo 11(6):1–36.

— 1949a: The Chilopoda of Eastern Fennoscandia. — Ann. Zool. Soc. Vanamo 13(4):1–45.

— 1949b: The Diplopoda of Eastern Fennoscandia. — Ann. Zool. Soc. Vanamo 13(6):1–53.

Peitsalmi, M. 1981: Population structure and seasonal changes in activity of Proteroiulus fuscus (Am Stein) (Diplopoda, Blaniulidae). — Acta Zool. Fenn. 161:1–66.

Pijnacker, L. P. Ferwerda, M. A. & Helle, W. 1981: Cytological investigations on the female and male reproductive system of the parthenogenetic privet mite, Brevipalpus obovatus (Phytopalpidae, Acari). — Acarologia 22:157.

Regev, S. 1974: Cytological and radioassay evidence of haploid parthenogenesis in Cheyletus malaccensis (Acarina: Cheyletidae). — Genetica 45:125–132.

Robaux, P. 1977: Observations sur quelques Actinedida (= Prostigmates) du sol d'Amerique du Nord. VI. Sur deux espèces nouvelles de Labidostommidae (Acari). — Acarologia 18:442–461.

Schweizer, J. & Bader, C. 1963: Die Landmilben der Schweiz (Mittelland, Jura, Alpen). Trombidiformes. — Mem. Soc. Helv. Sci. Nat. 84(2):247–248.

Schubart, O. 1934: Tausendfüssler oder Myriopoda I. Diplopoda. — Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise 28:1–308.

Schuster, R. 1986: Bodenbewohnende Milben (Acari) aus Niedersachsen und anderen Regionen Deutschlands (BRD). — Braunschw. Naturk. Schr. 2:519–525.

Sellnick, M. 1940: Die Milbenfauna Islands. — Göteborgs Kgl. Vet. Vitt. - Samh. Handl. 5 (B) 6:28–129.

Štorkán, J. 1938: Příspěvky ku známostem o čeledi Nicoletiellidae (Beitrage zur Kenntnis der Familie Nicoletiellidae). — Věstn. Čs. Společn. Zool. 6–7:436–453.

Suomalainen, E., Saura, A. & Lokki, J. 1987: Cytology and evolution in parthenogenesis. — CRC Press, Boca Raton, 216 pp.

Thor, S. 1931: Bdellidae, Nicoletiellidae, Cryptognathidae. — Das Tierreich 56:66–77.

Trägårdh, I. 1904: Über die Identifizierung von Raphignathus ruber C. L. Koch und Acarus denticulatus L. — Zool. Anz. 27:565--568.

Uusitalo, M. 1993: The identification of mites (Acari) from birds' nests by Nordberg (1936) – a revaluation. — EURAAC Newsletter 6(1):5–9.

Vandel, A. 1928: La parthénogenése géographique: contribution a l'étude biologique et cytologique de la parthénogenése naturelle. — Bull. Biol. France Belgique 62:164–281.

Vistorin, H. E. 1978a: Verbreitung europäischer Nicoletielliden Arten (Acari-Trombidiformes). — Mitt. Naturwiss. Ver. Steiermark 108:271–280.

— 1978b: Fortpflanzung und Entwicklung der Nicoletiellidae (Labidostomidae); Acari, Trombidiformes. — Zool. Jahrb., Syst. 105:462–473.

— 1980: Morphologische Untersuchungen an europäischen Nicoletielliden (Acari, Trombidiformes). — Acarologia 21:367–383.

Vitzthum, H. G. 1929: Milben, Acari, Trombidiformes. — In Brohmer, P., Ehrmann, P. & Ulmer, G. (eds.): Die Tierwelt Mitteleuropas, Spinnentiere, Arachnida. Quelle

& Mayer, Leipzig. 3:39–71.

— 1943: Acarina. — In Dr. H. G. Bronn's Klassen und Ordnungen des Tierreichs. Becker & Erler, Leipzig. 5. Abt. 4. Buch 5. Lief. 1–7:1–1011.

Willmann, C. 1954: Mährische Acari hauptsächlich aus dem Gebiete des mährischen Karstes. — Česk. Parasitol. 1:213–232.

Womersley, H. 1935: On some cryptognathid and nicoletiellid Acarina from Australia and New Zealand. — Ann. Mag. Nat. Hist. (10)16:151–154.

Woodroffe, G. E. 1953: An ecological study of the insects and mites in the nests of certain birds in Britain. — Bull. Entomol. Res. 44:739–772.

Wrensch, D. L., Kethley, J. B. & Norton, R. A. 1993: Cytogenetics of Holokinetic Chromosomes and Inverted Meiosis: Keys to the Evolutionary Success of Mites, with Generalizations on Eukaryotes. — In Houck M. A. (ed.): Mites. Ecological and Evolutionary Analyses of Life-History Patterns. Chapman & Hall, New York and London. pp. 282–343.

Index to genera and species, Volume 9 (1995)