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The terrestrial isopods (Isopoda: Oniscidea) of Greece. 21st contribution: Genus *Schizidium* (Armadillidiidae)[1]

Helmut Schmalfuss

Abstract

The Greek species of the terrestrial isopod genus *Schizidium* are revised. Descriptions and illustrations of the diagnostic characters are given for the species *S. delmastroi*, *S. hybridum*, *S. oertzenii*, *S. perplexum*, *S. schmalfussi* and *S. tinum*. The species *S. beroni* and *S. paragamiani* are described as new, with figures of the diagnostic characters. The distribution of all species except *S. perplexum* is depicted on maps.
Keywords: Isopoda, Oniscidea, *Schizidium*, Greece, new species, biogeography.

Zusammenfassung

Die griechischen Arten der Landisopoden-Gattung *Schizidium* werden revidiert. Die Arten *S. delmastroi*, *S. hybridum*, *S. oertzenii*, *S. perplexum*, *S. schmalfussi* und *S. tinum* werden beschrieben und deren diagnostische Merkmale werden abgebildet. *S. beroni* and *S. paragamiani* werden als neue Arten beschrieben und illustriert. Die Verbreitung aller Arten mit Ausnahme von *S. perplexum* wird auf Karten dargestellt.

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[1] 20th contribution see Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie) 618 (2000).

1 The genus *Schizidium* Verhoeff, 1901

Type species: *Armadillidium Oertzenii* Budde-Lund, 1896 (designated by SCHMALFUSS 1986).

Inside the family Armadillidiidae a number of nominal genera are characterized by a schisma at the hind corner of the pereion-epimera I. Such a schisma has been developed convergently in many other groups of terrestrial isopods. It is an optimization of the conglobation strategy, to avoid an opening of the rolled-up animal by shearing forces. The genera with schisma inside the Armadillidiidae have been united in the subfamily "Schizidiinae" (ARCANGELI 1948). Considering the likelihood of a convergent development of such structures it is not clear whether these Schizidiinae are a monophyletic unit, because except for the schisma no other synapomorphies have been shown up to now. In addition, none of the diagnoses of these genera contain character formations that could be interpreted as safe autapomorphies of the corresponding genus. So the definitions of these genera continue to be open to discussion.

The following armadillidiid genera possess a schisma:

1. *Eluma* Budde-Lund, 1885;
2. *Schizidium* Verhoeff, 1901 (junior synonyms: *Cretodillium* Vandel, 1957, see SCHMALFUSS 1979; *Pareluma* Omer-Cooper, 1923, see SCHMALFUSS 1986);
3. *Alloschizidium* Verhoeff, 1919 (compare TAITI & FERRARA 1996, who synonymized *Typhloschizidium* Arcangeli, 1933 and *Nesolidium* Verhoeff, 1941 with *Alloschizidium*).

Paraschizidium Verhoeff, 1917 (compare TAITI & FERRARA 1996: 511–512) with the type-species *P. coeculum* does not possess a schisma, but the species described from the Aegean region under this genus have a schisma (SCHMALFUSS 1981; SFENTHOURAKIS 1992, 1995), so their generic ascription must be revised.

If we try to find a definition of *Schizidium* based on all species united in this genus we arrive at the following diagnosis, compared with other genera of the family Armadillidiidae:

1. Cross-section of pereionites semi-circular, indicating complete conglobation abilities.
2. Cleft hind-corners of pereion-epimera I (schisma).
3. Head always with frontal line, with or without lateral parts of interocular line.
4. Frontal line continuous or interrupted in the middle.

This diagnosis comprises, however, all the other genera possessing a schisma. A detailed revision of all taxa of this group is necessary to allow for clear definitions on the generic level that are not restricted to mere quantitative characters.

Those species ascribed to the genus *Schizidium* are distributed in the northeastern Mediterranean region and the Near East, from the southeastern Aegean islands through southern Turkey, Cyprus, Azerbaidjan, northern Iran, Iraq, Syria, Lebanon, Israel, Palestine and Jordan. The 16 species recognized as valid by the year 2000 are listed, with bibliographies and distribution areas for every species, in my world catalog of terrestrial isopods (SCHMALFUSS 2003). In the meantime one more species has been described from Crete (SCHMALFUSS et al. 2004), and two new species from Aegean islands are described in the present paper.

Abbreviation

SMNS Staatliches Museum für Naturkunde Stuttgart

Acknowledgments

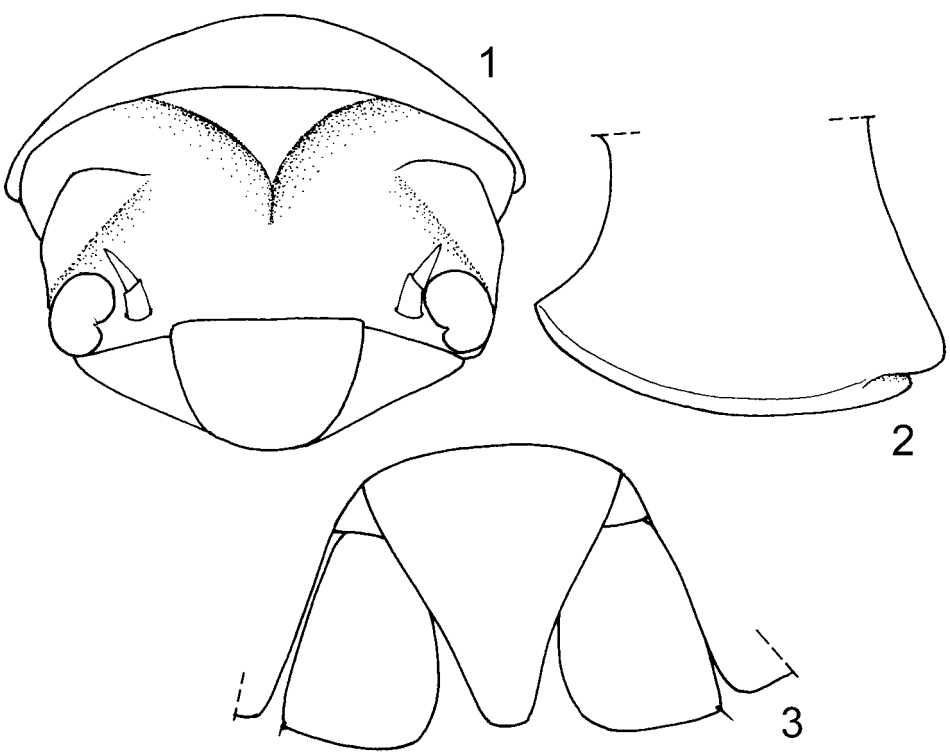
The following persons have donated isopod material for this revision: Dr. S. ANDREEV (Sofia/Bulgaria), Drs. C. and P. DEELEMAN (Ossendrecht/Netherlands), S. FIECHTNER (now LEIDENROTH, SMNS), I. MAURER (Plochingen/Germany), K. PARAGAMIAN (Iraklio/Crete), Dr. H. PIEPER (Kiel/Germany), J. SCHÖNFELD (Westum/Germany), Dr. S. SFENTHOURAKIS (Patras/Greece), Dr. S. TAITI (Florence/Italy); Dr. K. WOLF-SCHWENNINGER (SMNS) operated the scanning electron microscope, and J. REIBNITZ and Dr. H.-P. TSCHORSNIG (both SMNS) edited the SEM-photographs. To all of them I wish to express my sincere thanks.

2 The Greek species of *Schizidium*

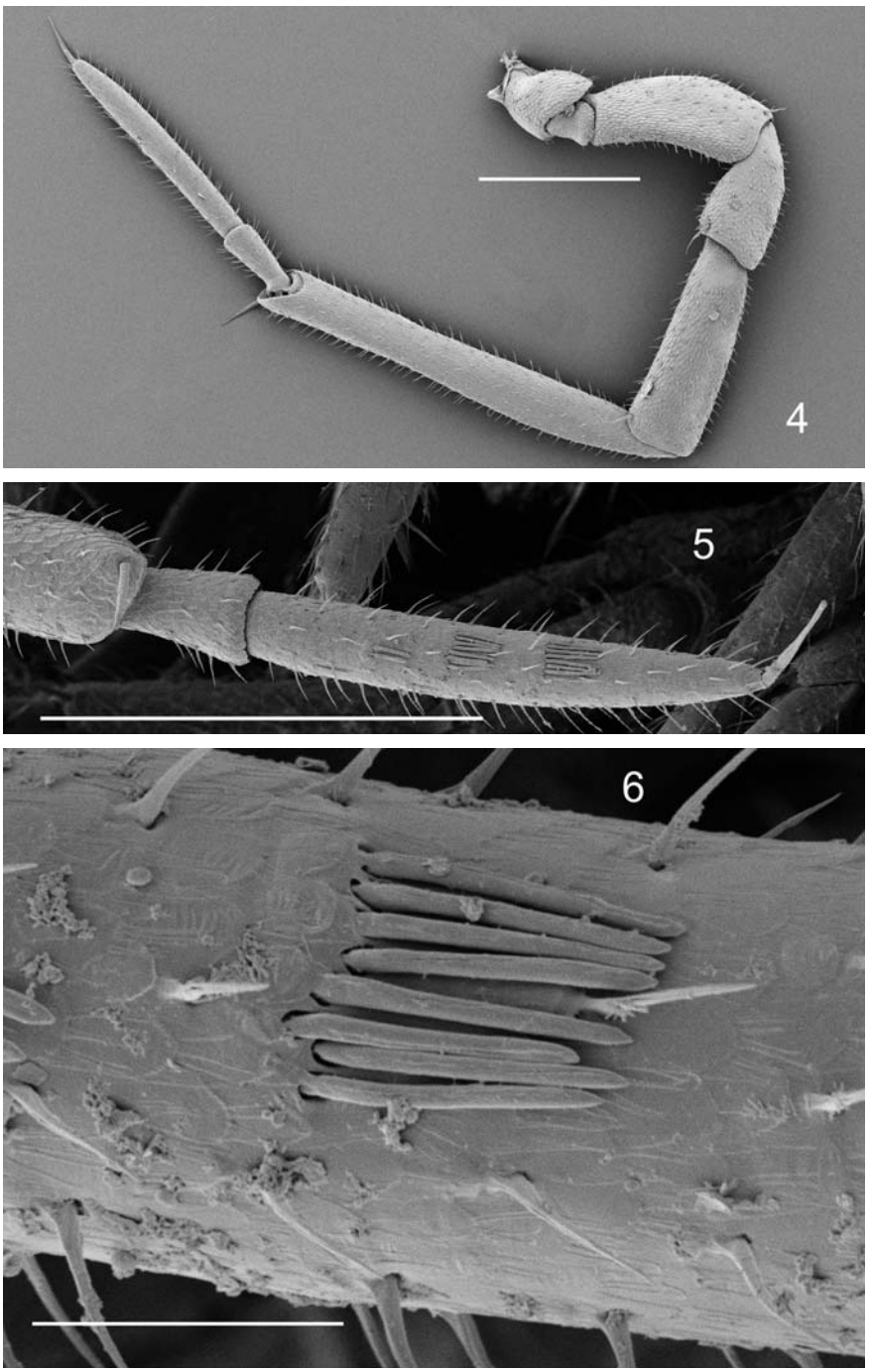
2.1 *Schizidium beroni* **n. sp.**
(Figs. 1–16 and map Fig. 96)

Material examined

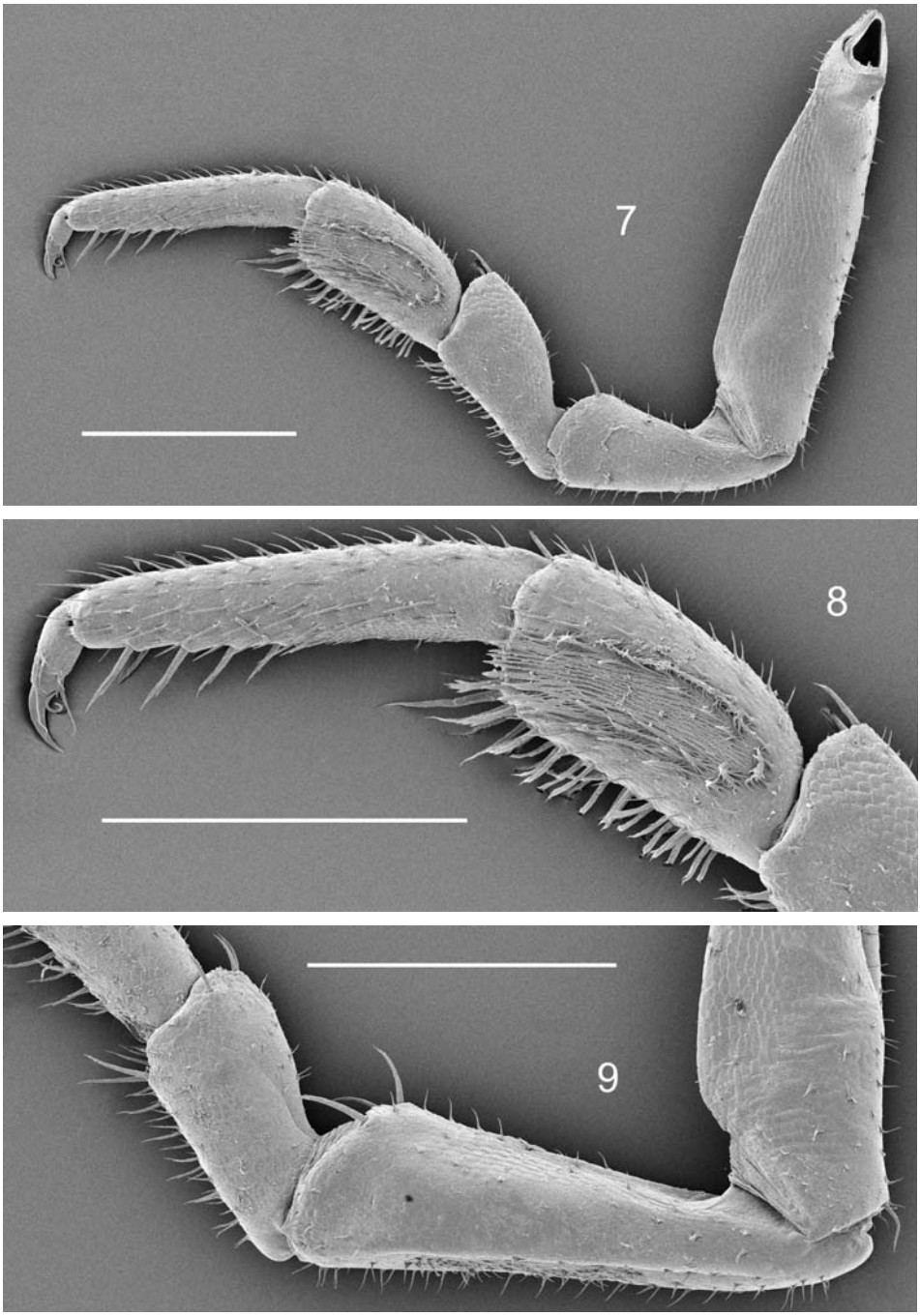
Holotype: ♂, 9.0 × 3.7 mm, Greece, southern Aegean, island Santoríni, cave Zoodókhos above Kamári, limestone, flowstone floor, perennial dripping water, leg. SCHMALFUSS, V.1986 (SMNS T496).



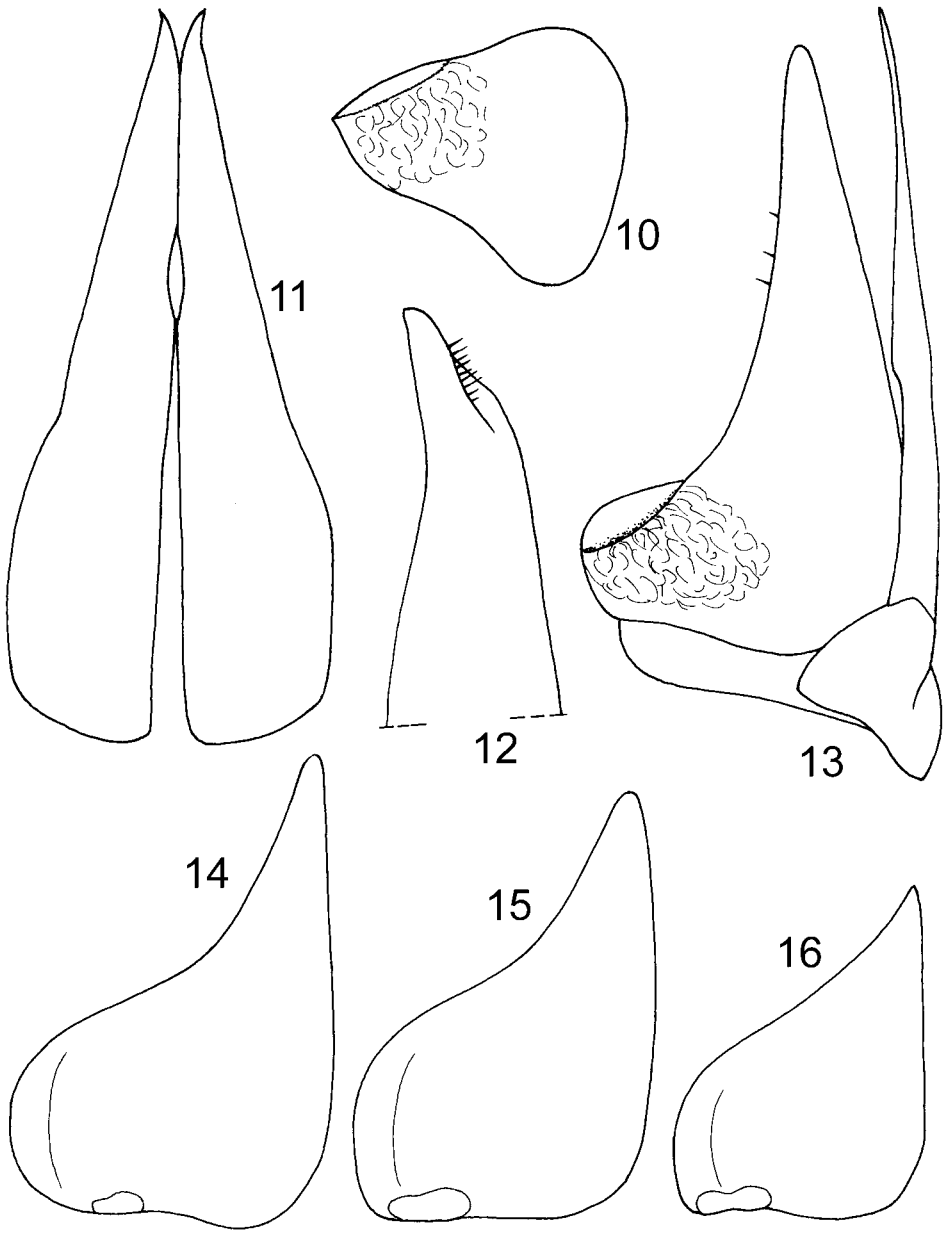
Figs. 1–3. *Schizidium beroni* n. sp., holotype, ♂, 9 mm long (SMNS T496). – **1**. Head in frontal view. **2**. Pereion-epimeron I in lateral view. **3**. Telson and uropods in situ.



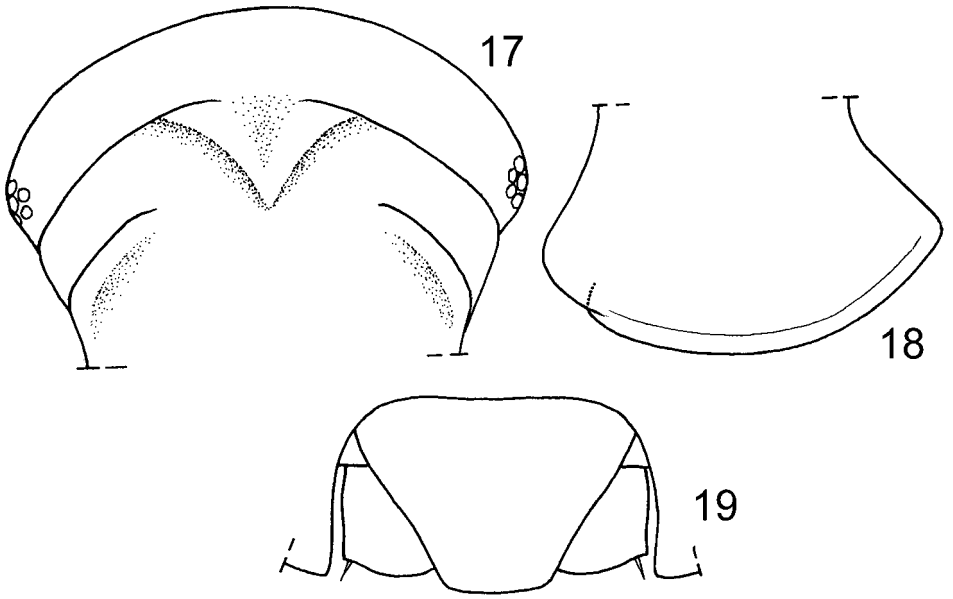
Figs. 4–6. *Schizidium beroni* n. sp. – **4**. Paratype, ♂, 8 mm long (SMNS T500), antenna. **5**. Paratype, ♀, 6.7 mm long (SMNS T497), antennal flagellum. **6**. As before, detail with aesthetascs. – Scales: 0.5 mm (4, 5), 0.05 mm (6).



Figs. 7–9. *Schizidium beroni* n. sp., paratype, ♂, 8 mm long (SMNS T500). – **7**. Pereiopod I, frontal view. **8**. Carpus I and propodus I, frontal view. **9**. Ischium VII, caudal view. – Scales: 0.5 mm.



Figs. 10–16. *Schizidium beroni* n. sp., paratype, ♂, 8 mm long (SMNS T500), pleopods in dorsal (= caudal) views. – **10**. Exopodite I. **11**. Endopodites I. **12**. Apex of endopodite I. **13**. Exo- and endopodite II. **14**. Exopodite III. **15**. Exopodite IV. **16**. Exopodite V.



Figs. 17–19. *Schizidium delmastroi*, holotype, ♂, 4 mm long, from SCHMALFUSS et al. (2004). – **17**. Head in frontal view. **18**. Pereion-epimeron I in lateral view. **19**. Telson and uropods in situ.

Paratypes: 2 ♂♂, 1 ♀ without marsupium, same data as holotype (SMNS T497). – 5 ♂♂, 2 ♀♀ without marsupium, same locality as holotype, leg. SCHMALFUSS, 21.IV.1985 (SMNS T498). – 1 ♂, 1 ♀ without marsupium, same locality as holotype, leg. SCHMALFUSS, 17.I.1992 (SMNS T499). – 1 ♂, 1 ♀ with empty marsupium, same locality as holotype, leg. BERON & BESHKOV, 25.IX.1983 (SMNS T500).

Diagnostic characters

Maximum dimensions: ♂♂ 9.0 × 3.5 mm, ♀♀ 9.5 × 4.0 mm.

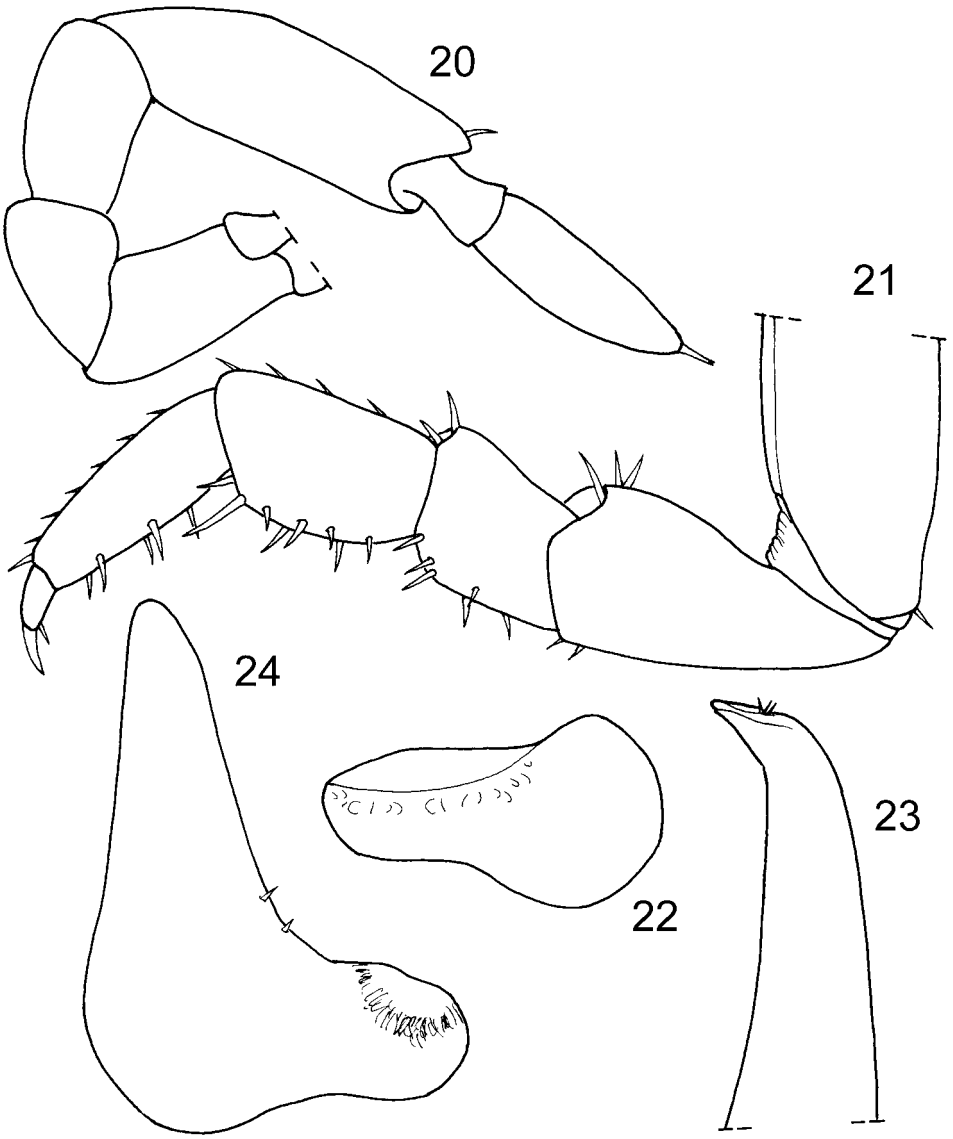
Coloration: Without pigmentation, only rudimentary eyes with dark pigment.

Cuticular structures: Tergites totally smooth.

Head with continuous frontal ridge, posteriorly no second ridges present as in *S. perplexum*, rudimentary eyes recognizable by dark pigmentation (Fig. 1). Schisma on epimeron I with inner lobe considerably shorter than outer one, lateral ledge see Fig. 2. Telson with straight sides and narrowly truncated apex (Fig. 3). Antenna see Fig. 4, flagellum with distal segment about five times as long as proximal one (Fig. 5) and with numerous aesthetascs (Fig. 6). Pereiopod I with usual grooming structures on frontal side (Figs. 7–8), male ischium VII ventrally straight (Fig. 9). Male pleopod I see Figs. 10–12, pleopod II see Fig. 13, pleopod-exopodites III–V see Figs. 14–16.

Remarks

S. beroni differs from the other unpigmented species of *Schizidium* by the continuous frontal ridge (contrary to *S. perplexum* and *S. delmastroi*) and by the telson being longer than wide and having a narrowly rounded apex (contrary to *S. paragamiani* and *S. tinum*).



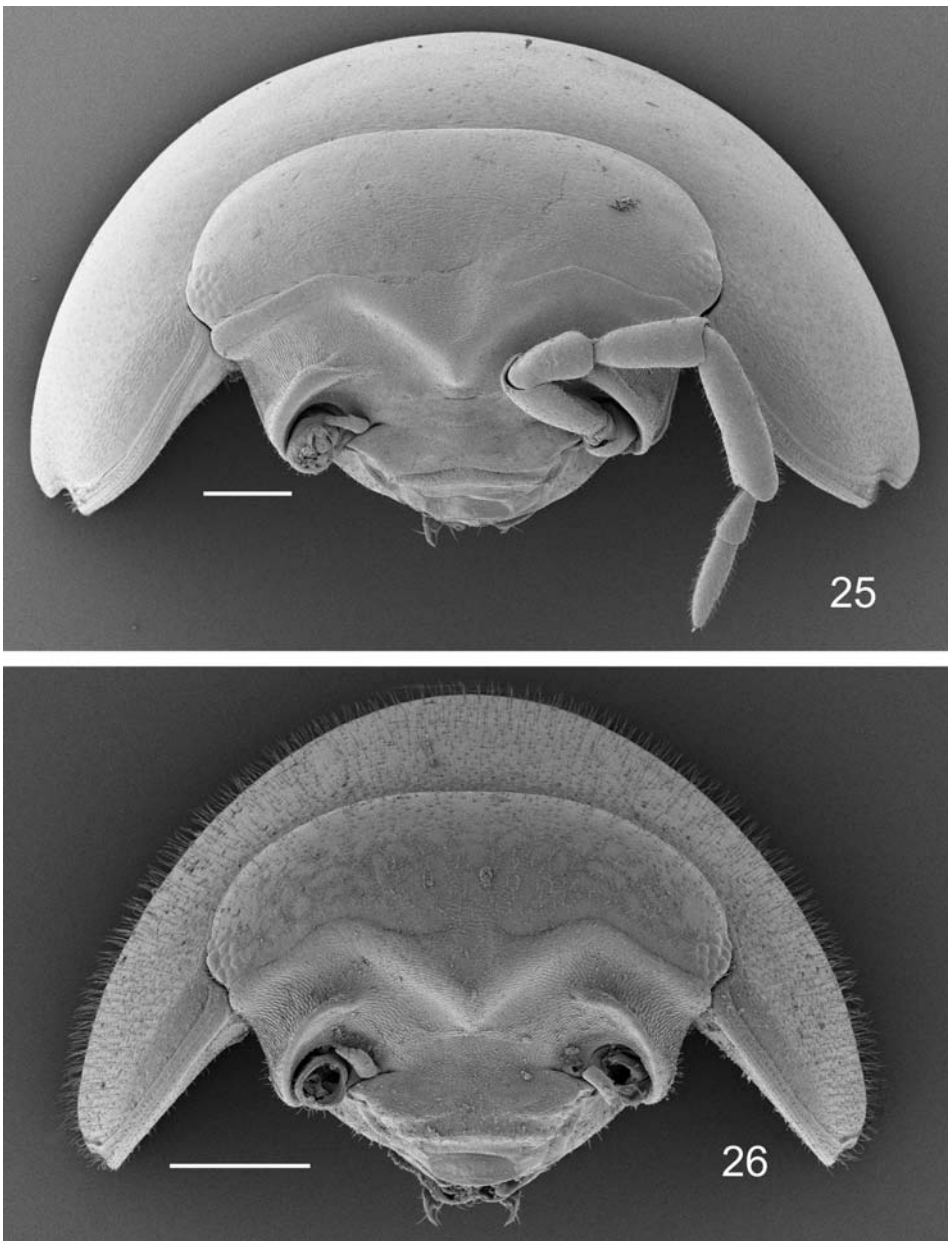
Figs. 20–24. *Schizidium delmastroi*, holotype, ♂, 4 mm long, from SCHMALFUSS et al. (2004). – **20**. Antenna. **21**. Pereiopod VII, caudal view. **22**. Pleopod-exopodite I. **23**. Apex of pleopod-endopodite I. **24**. Pleopod-exopodite II.

2.2 *Schizidium delmastroi* Schmalfuss, Paragamian & Sfenthourakis, 2004 (Figs. 17–24 and map Fig. 96)

Schizidium delmastroi: SCHMALFUSS et al. 2004: 56, figs. 101–110.

Diagnostic characters

Maximum dimensions: The only known specimen is 3.9 mm long.



Figs. 25–26. *Schizidium hybridum*. – **25**. ♂, 11 mm long (island Tílos, SMNS 2636), head and pereion-tergite I in frontal view. **26**. ♀, 8 mm long (island Kárpathos, SMNS 1450), head and pereion-tergite I in frontal view (note the upright setae). – Scales: 0.5 mm.

Coloration: White, without pigmentation.

Cuticular structures: Tergites smooth.

Head with frontal ridge interrupted in the middle, no interocular ridge visible (Fig. 17). Rudimentary eyes present, but without pigmentation. Pereion-epimeron I with schisma, inner lobe much shorter than outer one (Fig. 18), margin with pronounced exterior ledge. Telson trapezoidal, wider than long (Fig. 19). Antenna stout and thickset, antennal flagellum with basal joint about one fourth of distal joint (Fig. 20). Male pereiopod VII (Fig. 21) without conspicuous modifications. Male pleopod-exopodite I with rounded inner lobe, hind-lobe missing (Fig. 22), endopodite I see Fig. 23, exopodite II see Fig. 24.

Recorded distribution

Greece, western Crete (map Fig. 96).

2.3 *Schizidium hybridum* (Budde-Lund, 1896) (Figs. 25–40 and map Fig. 97)

Armadillidium hybridum: BUDDE-LUND 1896: 40, 44 (Aegean island Sími).

Schizidium hybridum: VERHOEFF 1901: 36; VERHOEFF 1923: 226; STROUHAL 1929a: 112 (Crete); STROUHAL 1929b: 39, 77 (Crete); STROUHAL 1937b: 247 (island Sámos); ARCANGELI 1936: 7, 8; ARCANGELI 1937: 77, figs. I–III (island Kárpathos); VANDEL 1958: 82 (Crete); SCHMALFUSS 1972a: 51 (Crete); SCHMALFUSS 1972b: 599 (island Kárpathos); SCHMALFUSS 1975: 57 (islands Kos, Nísiros, Kárpathos, Astipálea, Sírna, Crete, Gávdos); SCHMALFUSS 1979: 29 (islands Kos, Sími, Ródos); SCHMALFUSS 1988: 5, figs. 14–19 and map fig. 20 (islands Crete, Kásos, Kárpathos, Saría, Nísiros, Tílos, Khálki, Sími, Nímos, Ródos,

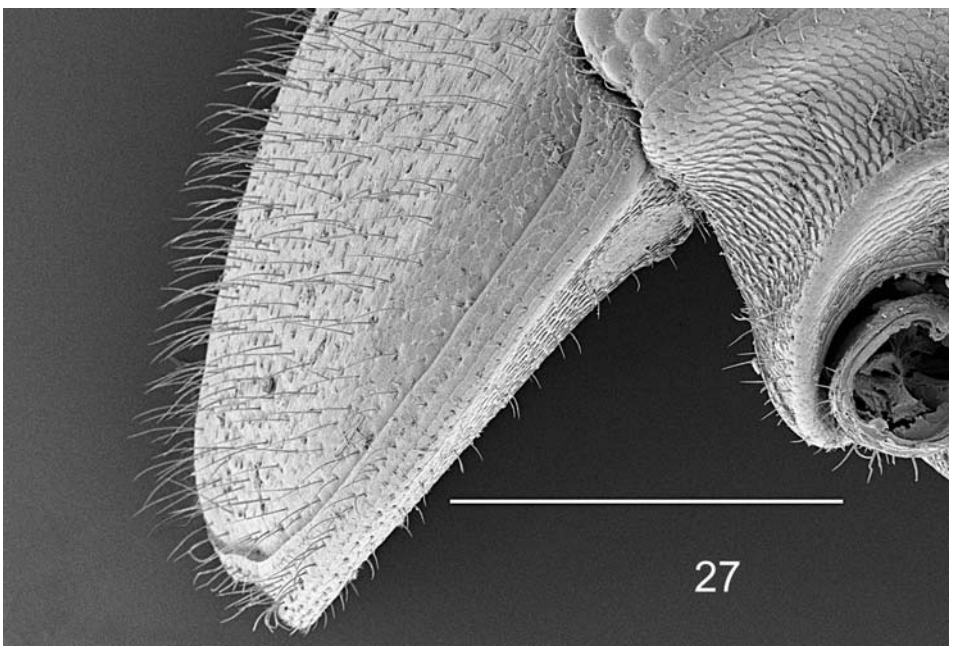
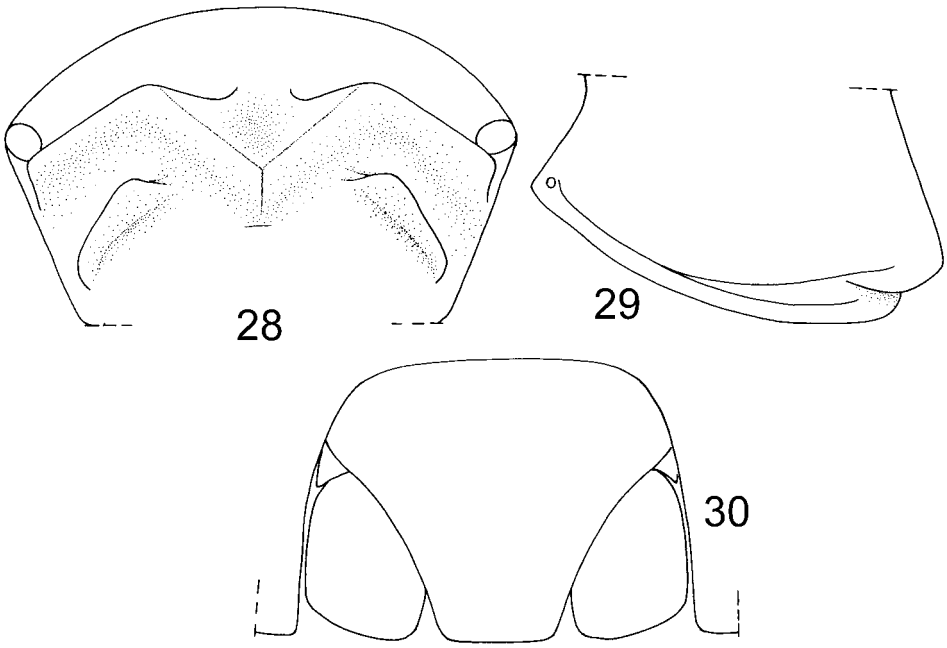


Fig. 27. *Schizidium hybridum*, ♀, 8 mm long (island Kárpathos, SMNS 1450), pereion-tergite I in frontal view (note the upright setae). – Scale: 0.5 mm.



Figs. 28–30. *Schizidium hybridum*, ♂, 10 mm long (island Sími), from SCHMALFUSS (1988). – **28**. Head in frontal view. **29**. Pereion-epimeron I in lateral view. **30**. Telson and uropods in situ.

Kastelórizo; SW-Turkey: district Antalya; NW-Turkey: district Eskişehir); SCHMALFUSS 1999: 5, 6; SCHMALFUSS & SCHAWALLER 1984: 13 (island Santoríni); SFENTHOURAKIS 1996: 698 (islands Sámos, Kos, Kálimnos, Léros, Nísiros, Pátmos, Gialí, Astipálea, Anáfi, Lévitha, Kínaros, Pergúsa); SCHMALFUSS et al. 2004: 58 (islands Crete, Ágria Gramvúsa, Gávdos).

Schizidium oertzeni non Budde-Lund: STROUHAL 1937a: 9, fig. 5 (see SCHMALFUSS 1988) (Aegean islands Tría Nisiá S Sírna).

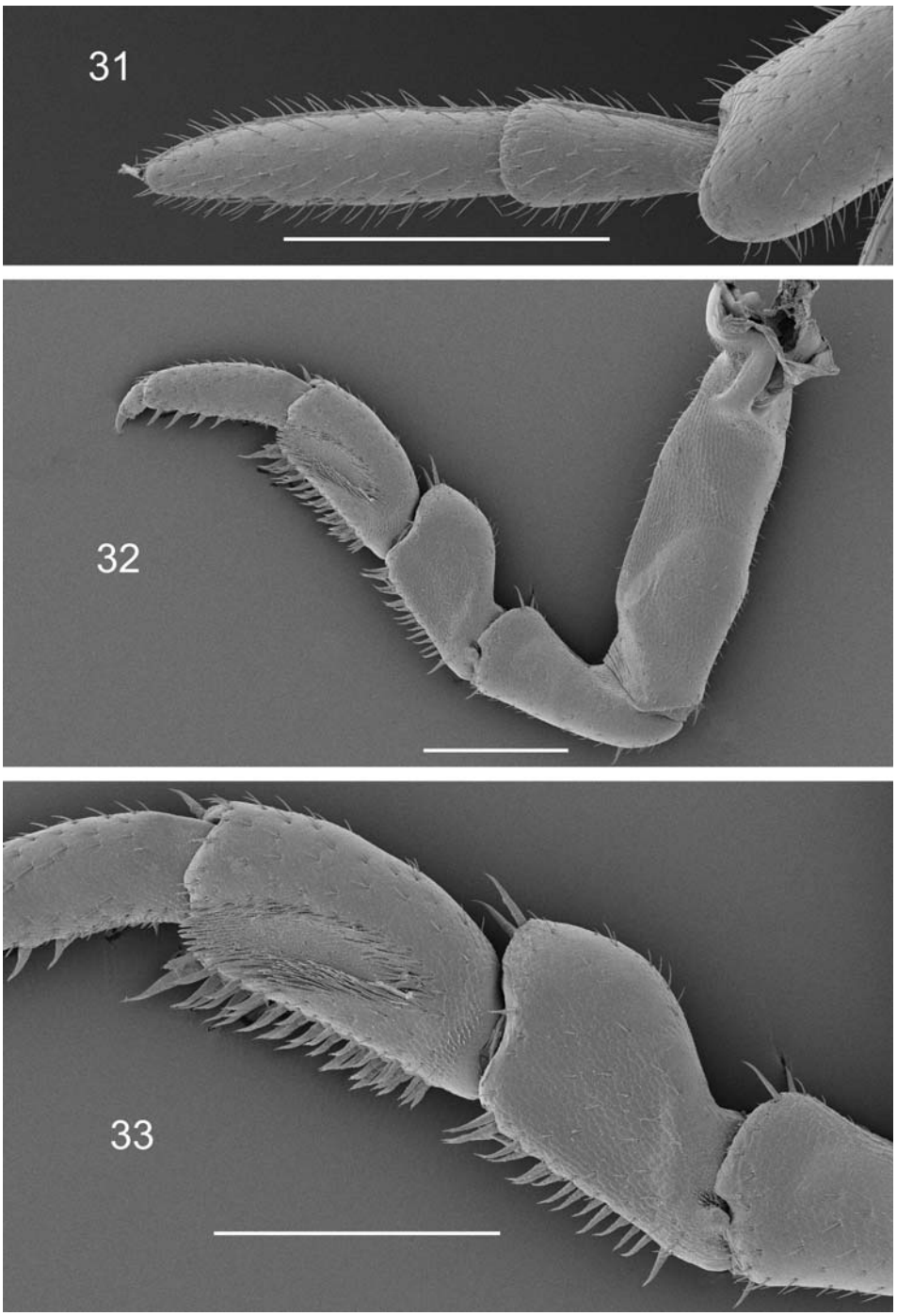
Material examined

Greece: 4 ex., Crete, Lasíthi Plain, leg. FIECHTNER, 29.IX.1988 (SMNS 2188). – 6 ex., Crete, Óros Díkti, 8 km W Kritsá, 1200 m, leg. PIEPER, 11.IV.1987 (SMNS 2230). – 2 ex., Crete, Elúnda N Ágios Nikólaos, leg. TAITI, 19.VII.1989 (SMNS 2250). – 1 albinotic ex., Crete, Arméni S Réthimno, leg. DEELEMAN, 3.V.1986 (SMNS 2251). – 5 ex., southeastern Aegean, island Kárpathos, leg. PIEPER, IV.1982 (SMNS 1450, published in SCHMALFUSS 1988). – 7 ex., southeastern Aegean, island Nísiros, SE Mandráki, leg. MAURER, 3.V.1990 (SMNS 2298). – 32 ex., southeastern Aegean, island Tílos, leg. SCHMALFUSS, 25.–26.IV.1998 (SMNS 2636, 2637). – 9 ex., island Ródos, southeastern coast, Lárdos and Gennádi, leg. SCHMALFUSS, 24.–25.IV.1992 (SMNS 2323, 2325). – 1 ex., island Ródos, Monólithos, leg. SCHMALFUSS, 28.IV.1998 (SMNS 2638). – 4 ex., island Ródos, Mount Atáviros, eastern side, 800 m, leg. SCHMALFUSS, 28.IV.1998 (SMNS 2639). – 6 ex., island Kastelórizo 130 km E Ródos, leg. SCHMALFUSS, 29.IV.–2.V.1992 (SMNS 2319).

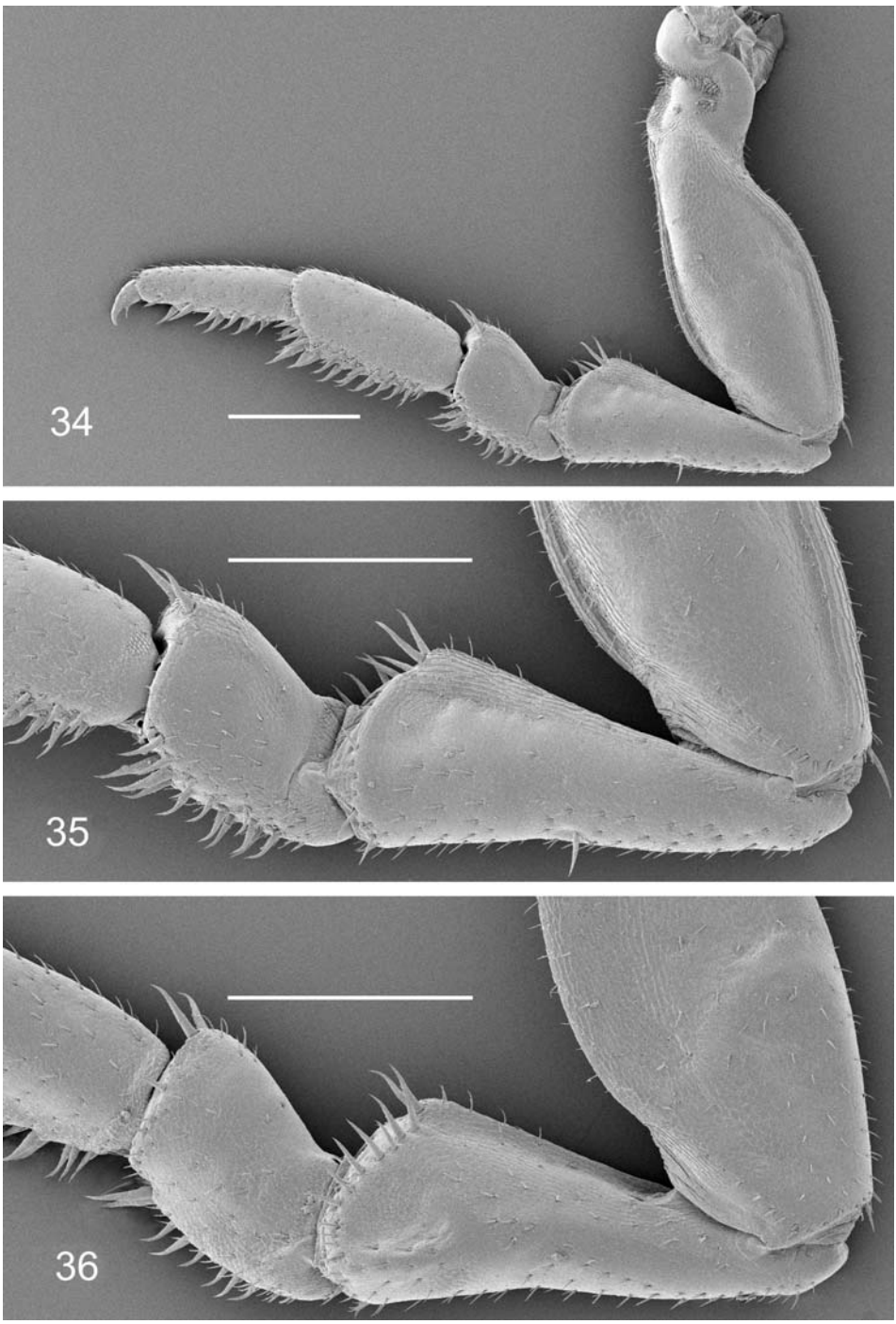
SW-Turkey: 25 ex., S of Marmaris, Çiflik, leg. SCHÖNFELD, X.2002 (SMNS 11544).

Diagnostic characters

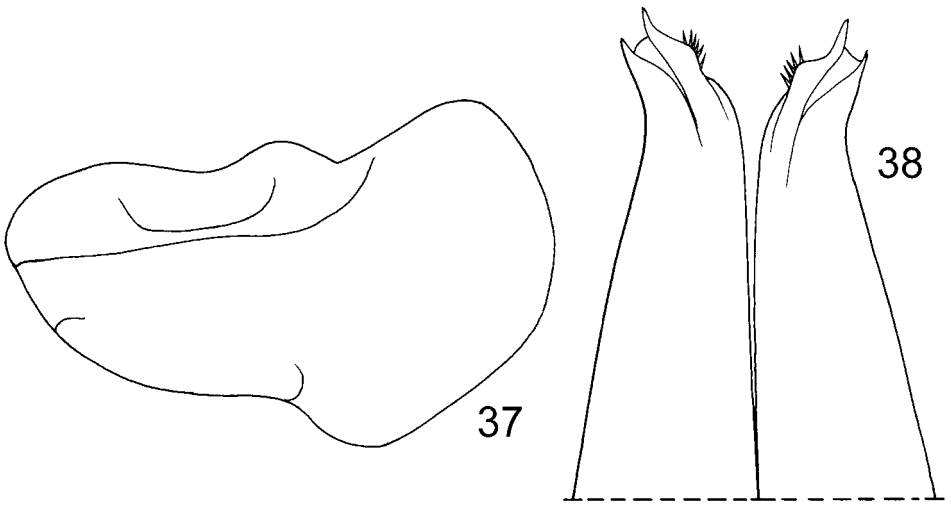
Maximum dimensions: 13.0 × 5.5 mm (♀ from Khálki island, SCHMALFUSS 1988).
Coloration: Bluish grey as in *S. oertzenii*, sometimes more violet brownish.



Figs. 31–33. *Schizidium hybridum*, ♂, 11 mm long (island Tílos, SMNS 2636). – **31**. Antennal flagellum. **32**. Pereiopod I, frontal view. **33**. Merus I and carpus I, frontal view. – Scales: 0.5 mm.



Figs. 34–36. *Schizidium hybridum*, ♂, 11 mm long (island Tílos, SMNS 2636). – **34**. Pereiopod VII, frontal view. **35**. Ischium VII and merus VII, frontal view. **36**. Ischium VII and merus VII, caudal view. – Scales: 0.5 mm.



Figs. 37–38. *Schizidium hybridum*, ♂, 10 mm long (island Sími), from SCHMALFUSS (1988). – **37**. Pleopod-exopodite I. **38**. Apices of pleopod-endopodites I.

Cuticular structures: Tergites smooth (Fig. 25); in the majority of the specimens from Kárpathos the tergal parts are covered with conspicuous upright setae (Figs. 26, 27).

Head with interrupted frontal ridge (Fig. 28); the number of ommatidia is not a diagnostic character, since it is related to the size of the animal; the present species can have up to 17 ommatidia. Caudal schisma in pereion-epimeron I with inner lobe considerably shorter than outer lobe (Fig. 29), in the hind part of the epimeron with a secondary ridge above base of outer lobe. Telson as in *S. oertzenii*, with slightly concave sides and broadly truncated apex (Fig. 30). Antennal flagellum with distal segment less than twice as long as proximal one (Fig. 31). Male pereiopod I see Figs. 32–33, pereipod VII see Figs. 34–36. Male pleopod-exopodite I with rounded inner lobe (Fig. 37), tips of male pleopod-endopodites I see Fig. 38; pleopod-exopodite III (Fig. 39) with comb-like microstructures on lateral ledge (Fig. 40) which probably are part of the water-conducting system.

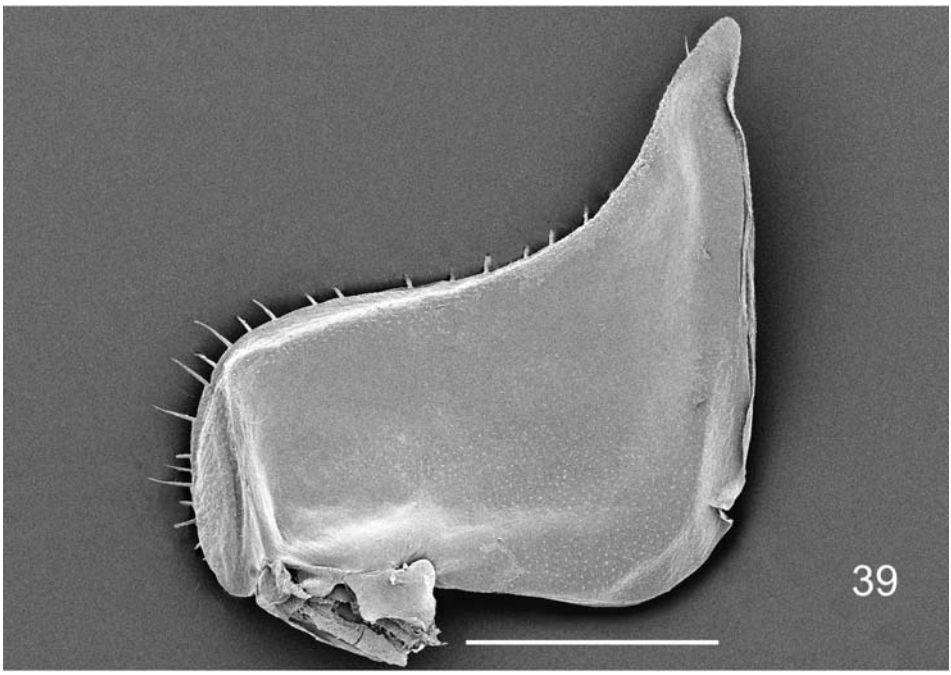
Recorded distribution

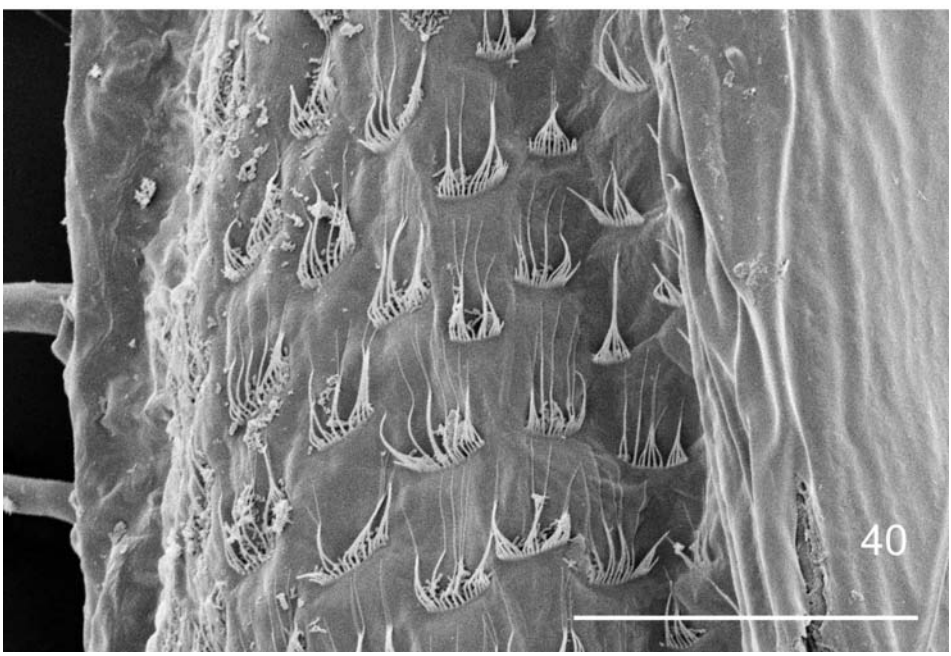
Turkey, Asia Minor; Greek island Kastelórizo 130 km E Ródos and Greek islands of southeastern Aegean including Crete (see map Fig. 97).

Remarks

The species lives in macchia and phrygana biotopes as *S. oertzenii*, but is apparently attracted to wetter micro-habitats. The two species are, however, often found syntopically and even under the same stone. On islands, where both species occur, there is a pronounced size difference, *S. oertzenii* reaching a maximum length of 26 mm, while the biggest specimen of *S. hybridum* attains only 13 mm.

In a former publication (SCHMALFUSS 1972b) I reported a number of 55 eggs in the





Figs. 39–40. *Schizidium hybridum*, ♂, 11 mm long (island Tílos, SMNS 2636). – **39**. Pleopod-exopodite III, ventral (= caudal) view. **40**. Lateral margin of pleopod-exopodite III, detail with comb-like microstructures. – Scales: 0.5 mm (39), 0.05 mm (40).

Fig. 41. *Schizidium oertzenii*, live animals on island Ródos. Note the pleon-epimera and the telson overlapping the frontal part of the head, resulting in a completely and tightly closed ball.

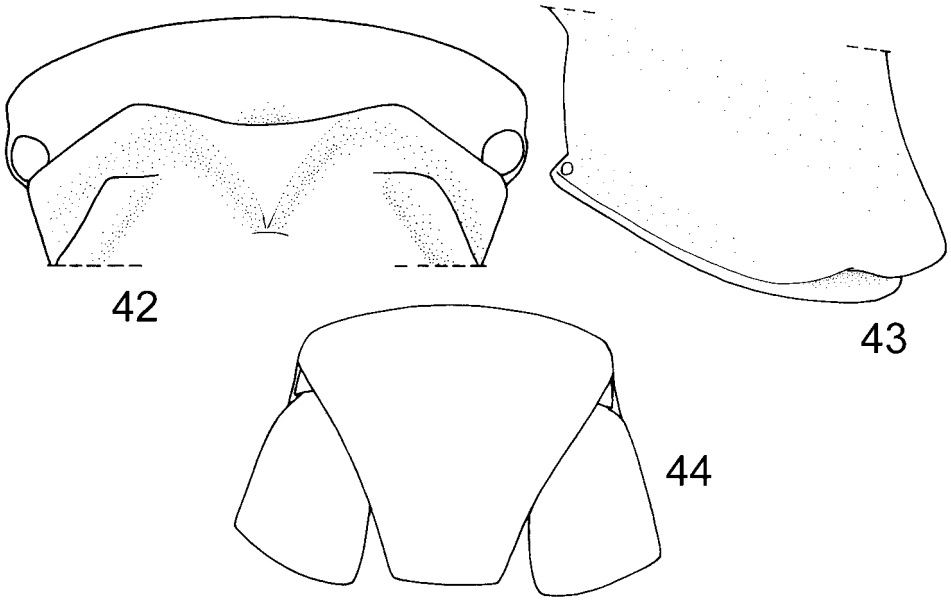
marsupium of a female of 11 mm length. There were, however, the eggs in the ovary counted and not in the marsupium.

2.4 *Schizidium oertzenii* (Budde-Lund, 1896)
(Figs. 41–56 and map Fig. 98)

Armadillidium Oertzenii: Budde-Lund 1896: 40, 43 (Aegean islands Ródos, Kásos, ?Kárpathos; southwestern Asia Minor [= "Karien"]).
Schizidium Oertzeni: Verhoeff 1901: 36.
Armadillidium Oertzeni: Arcangeli 1914: 4, figs. 4–7 (island Ródos).
Schizidium oertzeni: Verhoeff 1923: 226, figs. 7–8; Strouhal 1937b: 246 (island Kéros SE Náxos); non Strouhal 1937a: 9, fig. 5 (= *S. hybridum*, see Schmalfuss 1988); Schmalfuss 1972b: 598 (islands Ródos and Kárpathos); Schmalfuss 1975: 57 (islands Kárpathos and Náxos); Schmalfuss 1979: 29; Schmalfuss 1986: 384; Schmalfuss 1988: 3, figs. 1–12 and map fig. 13 (islands Náxos, Iráklia S Náxos, Káto Kufonísi SE Náxos, Áno Kufonísi SE Náxos, Tílos, Khálki, Ródos, Saría, Kárpathos, Kásos, Armáthia N Kásos); Schmalfuss 1999: 5, 6; Sfenthourakis 1996: 698 (islands Ikaría, Náxos, Páros, Antíparos, Mílos, Sérifos, Ánidros, Amorgós).
Schizidium oertzenii: Strouhal 1929a: 112 (islands Náxos and Ródos); Arcangeli 1948: 19.
Schizidium Oertzenii: Arcangeli 1929: 259, 265 (island Ródos); Arcangeli 1934: 39 (islands Ródos and Kárpathos).

Material examined

Greece: 6 ex., southwestern Aegean, island Mílos, leg. Schmalfuss, 24.IV.1993 (SMNS 2343). – 4 ex., southwestern Aegean, island Sérifos, leg. Schmalfuss, 27.IV.1993 (SMNS 2340). – 12 ex., southeastern Aegean, island Kárpathos, leg. Pieper, IV.1982 (SMNS 1450, published in Schmalfuss 1988). – 22 ex., southeastern Aegean, island Ródos, leg. Schmalfuss, IV.1992 and IV.1998 (SMNS 2322–2327, 2638).



Figs. 42–44. *Schizidium oertzenii*, ♂, 20 mm long (island Kárpathos), from SCHMALFUSS (1988). – **42**. Head in frontal view. **43**. Pereion-epimeron I in lateral view. **44**. Telson and uropods in situ.

Diagnostic characters

Maximum dimensions: 26 mm length for ♀♀ and 20 mm for ♂♂.

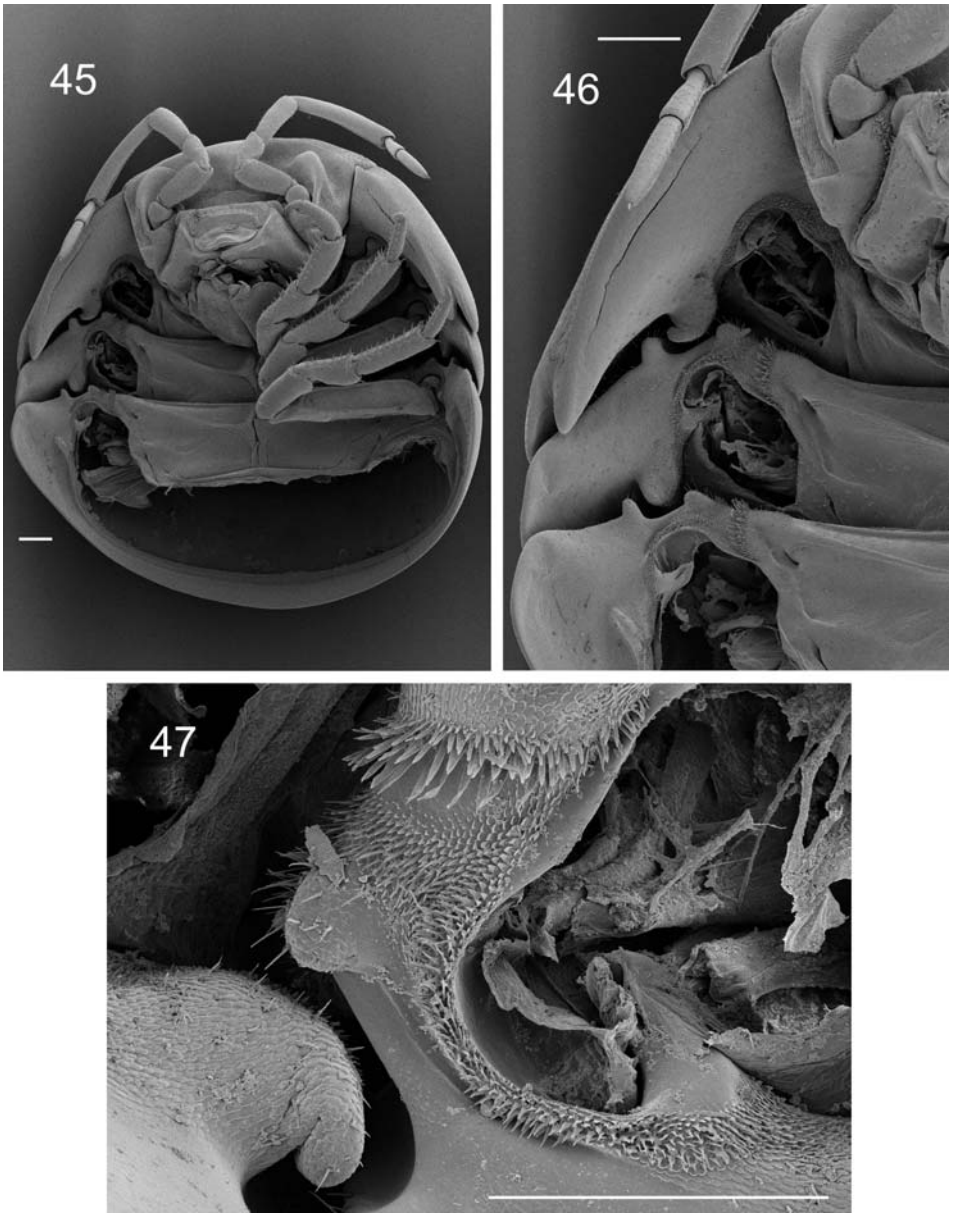
Coloration: Bluish grey, sometimes with a reddish tinge.

Cuticular structures: Tergites smooth.

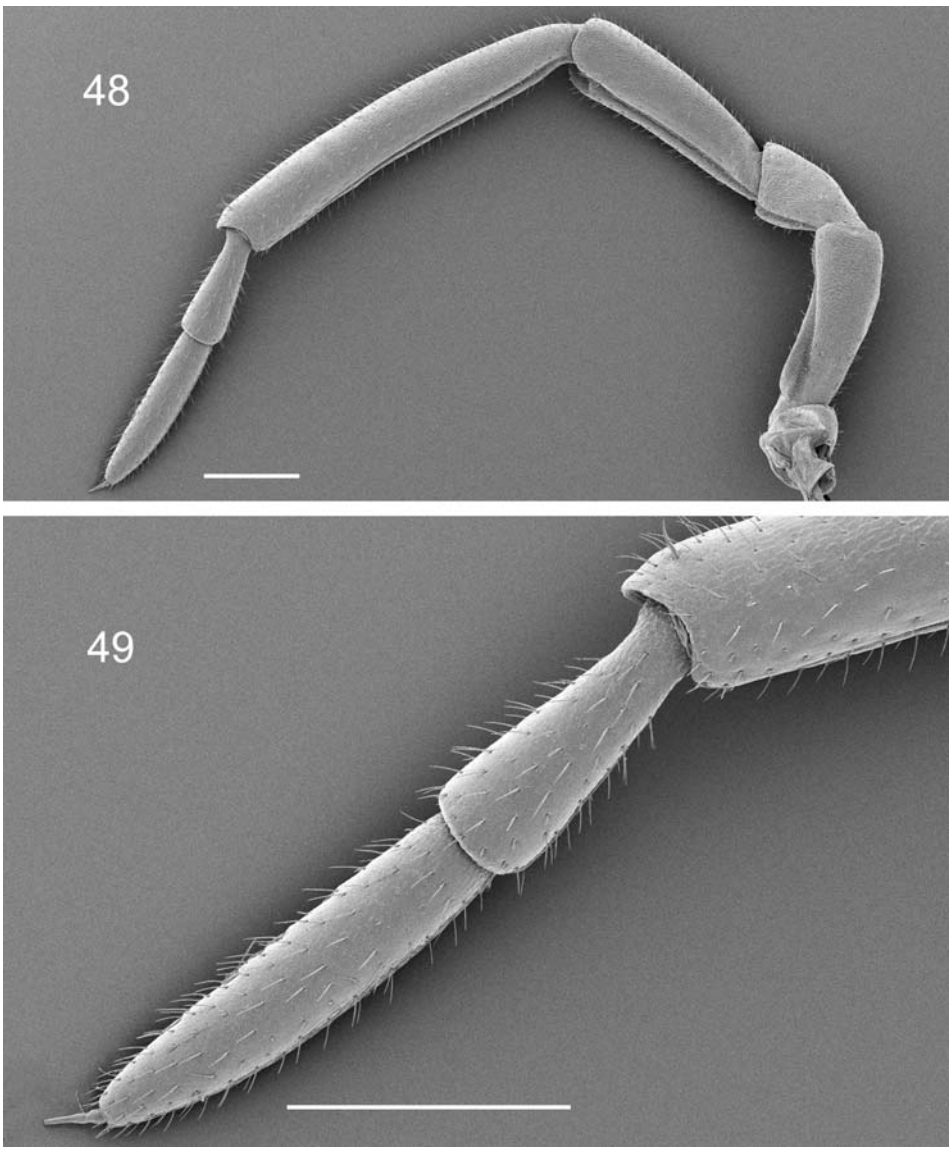
Rolled-up live specimens see Fig. 41. Head with continuous frontal ridge (Fig. 42). Caudal schisma in pereion-epimeron I with inner lobe considerably shorter than outer lobe (Figs. 43, 46); ventral articulation of pereion-segments I–III see Figs. 45–46; scale fields at the leg basis forming part of the water-conducting system, see Fig. 47. Telson with slightly concave sides, apex broadly truncated (Fig. 44). Antenna short and slender, distal article of the flagellum 1.5 times the length of proximal article (Figs. 48–49). Male ischium VII distally with bulbous ridge on frontal side, basipodite VII not laterally enlarged as in the species from the Near East (Figs. 50–52). Male pleopod-exopodite I with pointed hind-lobe, entrance to the respiratory cavities (lungs) closed to a narrow slot (Fig. 53), endopodite I see Figs. 54–55, male pleopod II see Fig. 56; uropod-exopodite trapezoidal (Fig. 44).

Recorded distribution

Turkey, southeastern Asia Minor (no records from 20th century) and Greek islands of southeastern Aegean excluding Crete (see map Fig. 98).



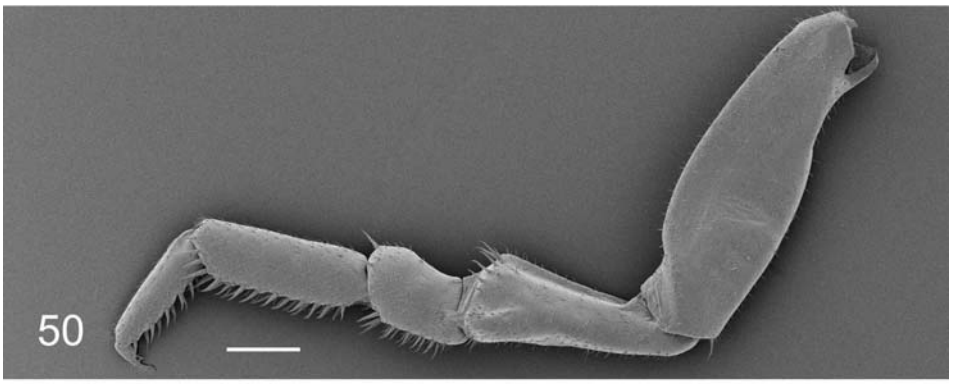
Figs. 45–47. *Schizidium oertzenii*, ♀, 14 mm long (island Kárpathos, SMNS 1450). – **45**. Pereion-segments I–III, ventral view. **46**. Pereion-epimera I–III in ventral view, pereiopods detached. **47**. Scale-fields in front of basis of pereiopod II, forming part of the water-conducting system. – Scales: 0.5 mm.

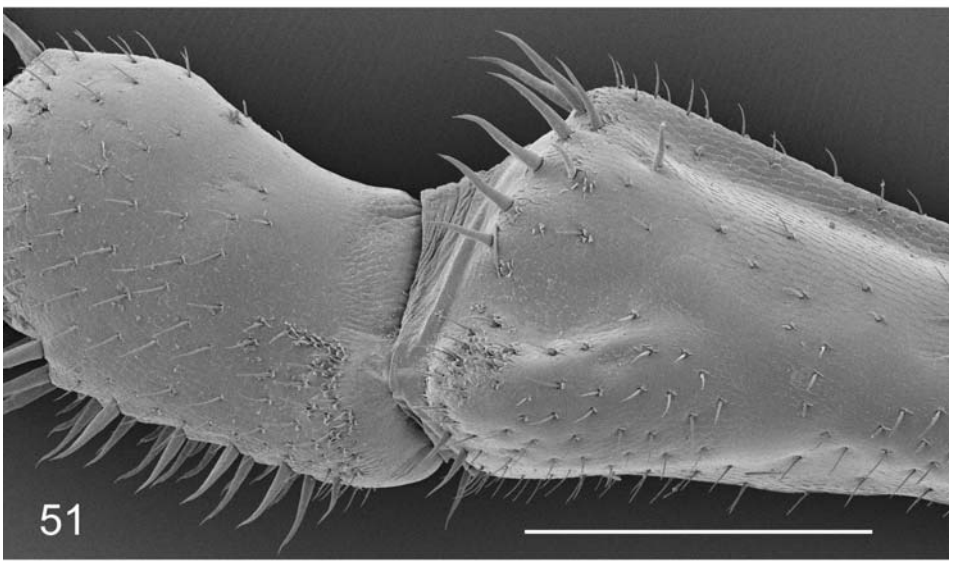


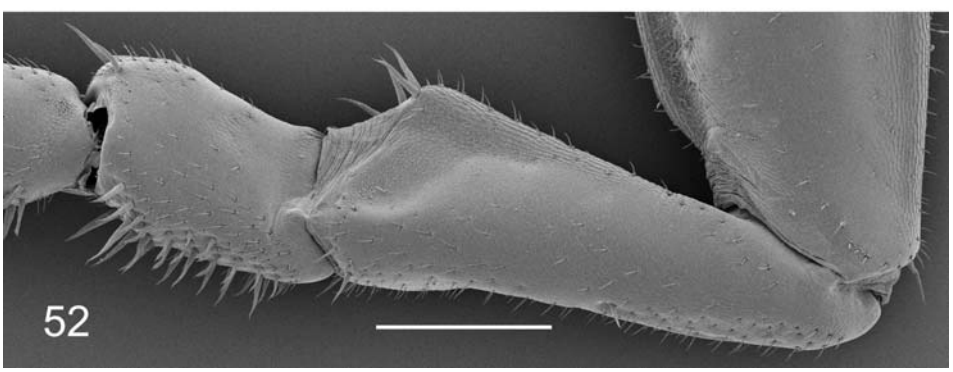
Figs. 48–49. *Schizidium oertzenii*, ♂, 14.5 mm long (island Kárpathos, SMNS 1450). – **48**. Antenna. **49**. Antennal flagellum. – Scales: 0.5 mm.

Remarks

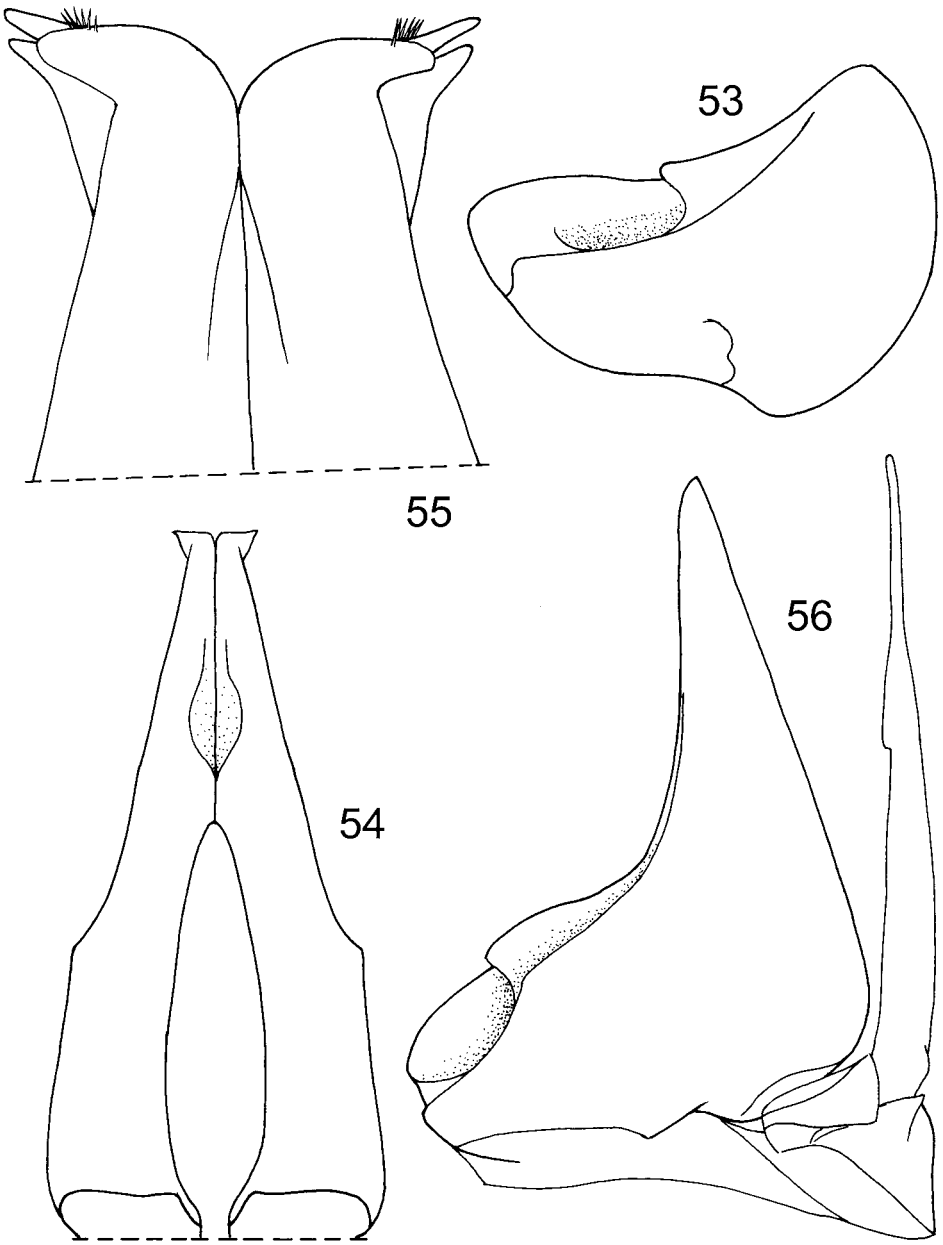
The species lives in macchia and phrygana biotopes as *S. hybridum* (see chapter 2.3). In former publications (e. g. SCHMALFUSS 1988) I have interpreted the lack of *Armadillidium vulgare* on those islands populated by *S. oertzenii* as competitive exclusion of the two species concerned. In the meantime both species have been found on the same islands (e. g. Sérifos, Náxos, Páros, Ikaría, see SFENTHOURAKIS 1996), so



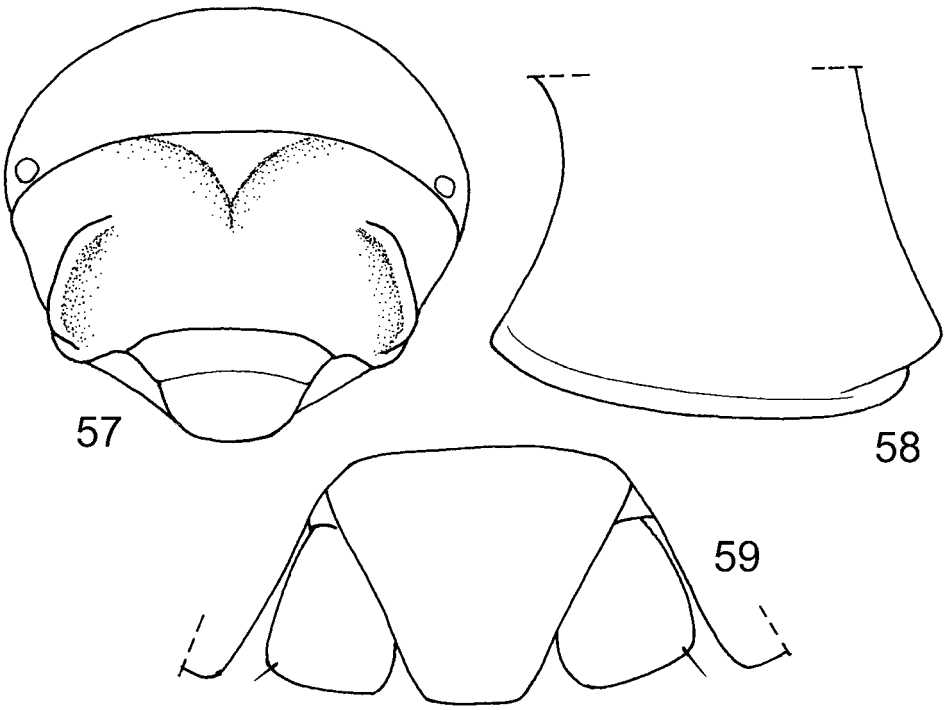




Figs. 50–52. *Schizidium oertzenii*, ♂, 14.5 mm long (island Kárpathos, SMNS 1450). – **50**. Pereiopod VII, caudal view. **51**. Ischium VII and merus VII, caudal view. **52**. Ischium VII and merus VII, frontal view. – Scales: 0.5 mm.



Figs. 53–56. *Schizidium oertzenii*, ♂, 20 mm long (island Kárpathos), from SCHMALFUSS (1988). – **53**. Pleopod-exopodite I. **54**. Pleopod-endopodites I. **55**. Apices of pleopod-endopodites I. **56**. Pleopod II.



Figs. 57–59. *Schizidium paragamiani* n. sp., holotype, ♂, 5.2 mm long (SMNS T571). – **57**. Head in frontal view. **58**. Pereion-epimeron I in lateral view. **59**. Telson and uropods in situ.

it seems that climatic factors are responsible for the distribution boundaries rather than direct competition of the two species.

In April 1966 I found on the island of Kárpathos 6 pellets of the Little Owl (*Athene noctua*; the bird was seen at the place where the pellets were found) which contained skeletal remnants of at least 16 individuals of *S. oertzenii*. The pellets also contained Coleoptera, Dermaptera and scorpions, but no other isopod species.

In an early publication (SCHMALFUSS 1972b) I reported 696 eggs in a female of *S. oertzenii*. The counted eggs were, however, in the ovary and not in invaginations of the marsupium, as supposed in that paper.

2.5 *Schizidium paragamiani* **n. sp.**
(Figs. 57–63 and map Fig. 96)

Material examined

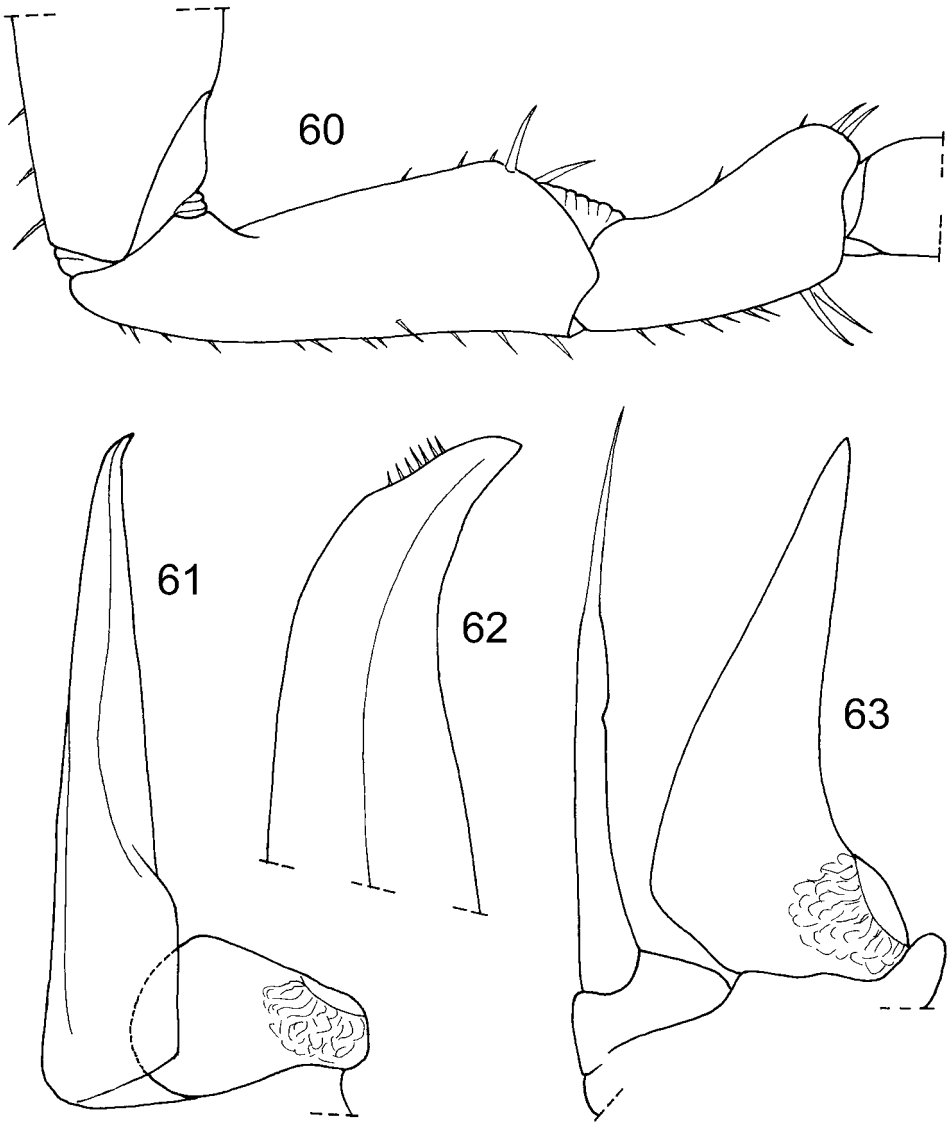
Holotype: ♂, 5.2 × 2.0 mm, Greece, eastern Aegean, island Fúrni, Mount Plagía, pothole Vótsos Agíu Theológu, leg. PARAGAMIAN, 5.VII.1998 (SMNS T571).

Diagnostic characters

Maximum dimensions: The only ♂ specimen measures 5.2 × 2.0 mm.

Coloration: Without pigmentation, rudimentary eyes with three ommatidia black.

Cuticular structures: Tergites smooth, covered with very short scale-spines obliquely pointing backwards.



Figs. 60–63. *Schizidium paragamiani* n. sp., holotype, ♂, 5.2 mm long (SMNS T571). – **60**. Ischium VII and merus VII, caudal view. **61**. Pleopod I. **62**. Apex of pleopod-endopodite I. **63**. Pleopod II.

Head with continuous frontal ridge, posteriorly no second ridges present as in *S. perplexum*, rudimentary eyes recognizable by dark pigmentation (Fig. 57). Schisma on epimeron I with inner lobe considerably shorter than outer one (Fig. 58). Telson wider than long, with straight sides and broadly truncated apex (Fig. 59). Antennae missing in the single specimen. Male ischium VII ventrally straight (Fig. 60). Male pleopod I see Figs. 61–62, pleopod II see Fig. 63.

Remarks

S. paragamiani differs from the other unpigmented species of *Schizidium* by the continuous frontal ridge (contrary to *S. perplexum* and *S. delmastroi*), by the telson being wider than long (contrary to *S. beroni*) and by the lack of conspicuous upright scale-spines on tergal parts (contrary to *S. tinum*).

2.6 *Schizidium perplexum* (Vandel, 1958)
(Figs. 64–80)

Cretodillidium perplexum: VANDEL 1958: 96, figs. 9A–C, 10A–B (3 caves in eastern Crete); SCHMALFUSS 1972a: 50; SCHMALFUSS 1975: 56 (2 caves in eastern Crete).
Schizidium perplexum: SCHMALFUSS 1979: 29 (4 caves in eastern Crete); ANDREEV 1986: 162 (1 cave in eastern Crete); PARAGAMIAN et al. 1987: 165. fig. 2 (2 caves in eastern Crete); SCHMALFUSS et al. 2004: 58 (numerous caves in eastern Crete).

Material examined

Greece: 10 ex., eastern Crete, cave Trápeza near Tzermiádo, leg. PIEPER, 24.IV.1991 (SMNS 2306, published in SCHMALFUSS et al. 2004). – 4 ex., eastern Crete, Mílatos, Mílatos Cave, leg. PIEPER, 18.–22.IX.1973 (SMNS 1281, published in SCHMALFUSS 1975). – 8 ex., eastern Crete, Skotinó, Cave Agía Paraskeví, leg. PIEPER, 24.IX.1973 (SMNS 1284, published in SCHMALFUSS 1975).

Diagnostic characters

Maximum dimensions: 14.5 × 6.5 mm (♀ from Mílatos Cave).

Coloration: Whitish, completely without pigmentation.

Cuticular structures: Tergites smooth with small scales and tiny scale-spines (Fig. 69).

Head with interrupted frontal ridge, rudimentary eyes with up to 5 pigmentless ommatidia (Fig. 64). Caudal schisma in pereion-epimeron I with inner lobe considerably shorter than outer lobe (Figs. 65–67). Telson slightly shorter than wide, with slightly concave sides and truncated apex (Fig. 68). Antennula with 3 segments and more than 15 aesthetascs on terminal segment (Fig. 70); antennal flagellum with distal segment about twice as long as proximal one (Figs. 71–72), aesthetascs on distal segment see Fig. 73. Male carpus I see Fig. 74; male ischium VII without clear differences between frontal and caudal face (Figs. 75–76). Male pleopod I see Fig. 77, exopodite I with rounded inner lobe (Fig. 78), apex of endopodite I see Fig. 79; male pleopod II see Fig. 80.

Recorded distribution

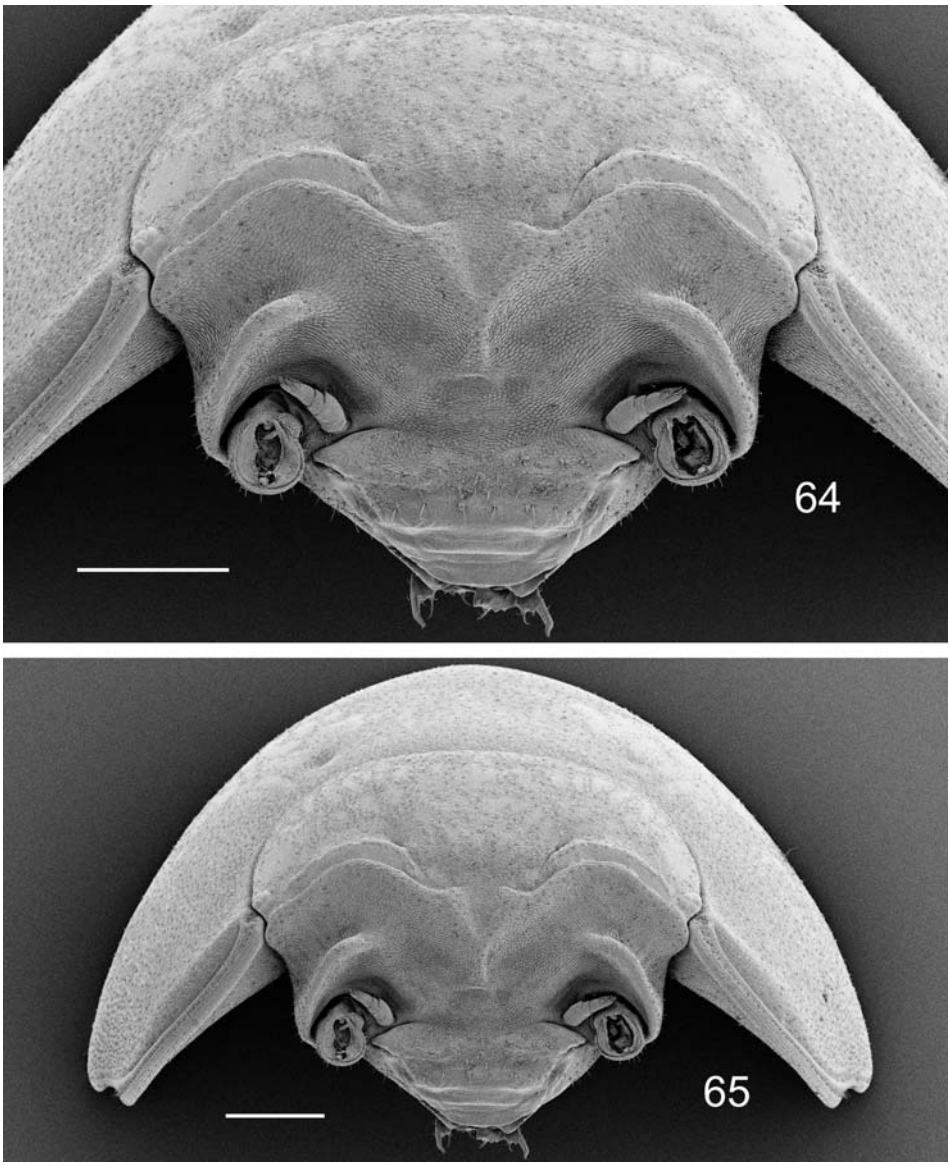
Caves in eastern Crete (see map in SCHMALFUSS et al. 2004: 58, fig. 110).

2.7 *Schizidium schmalfussi* Sfenthourakis, 1992
(Figs. 81–89 and map Fig. 96)

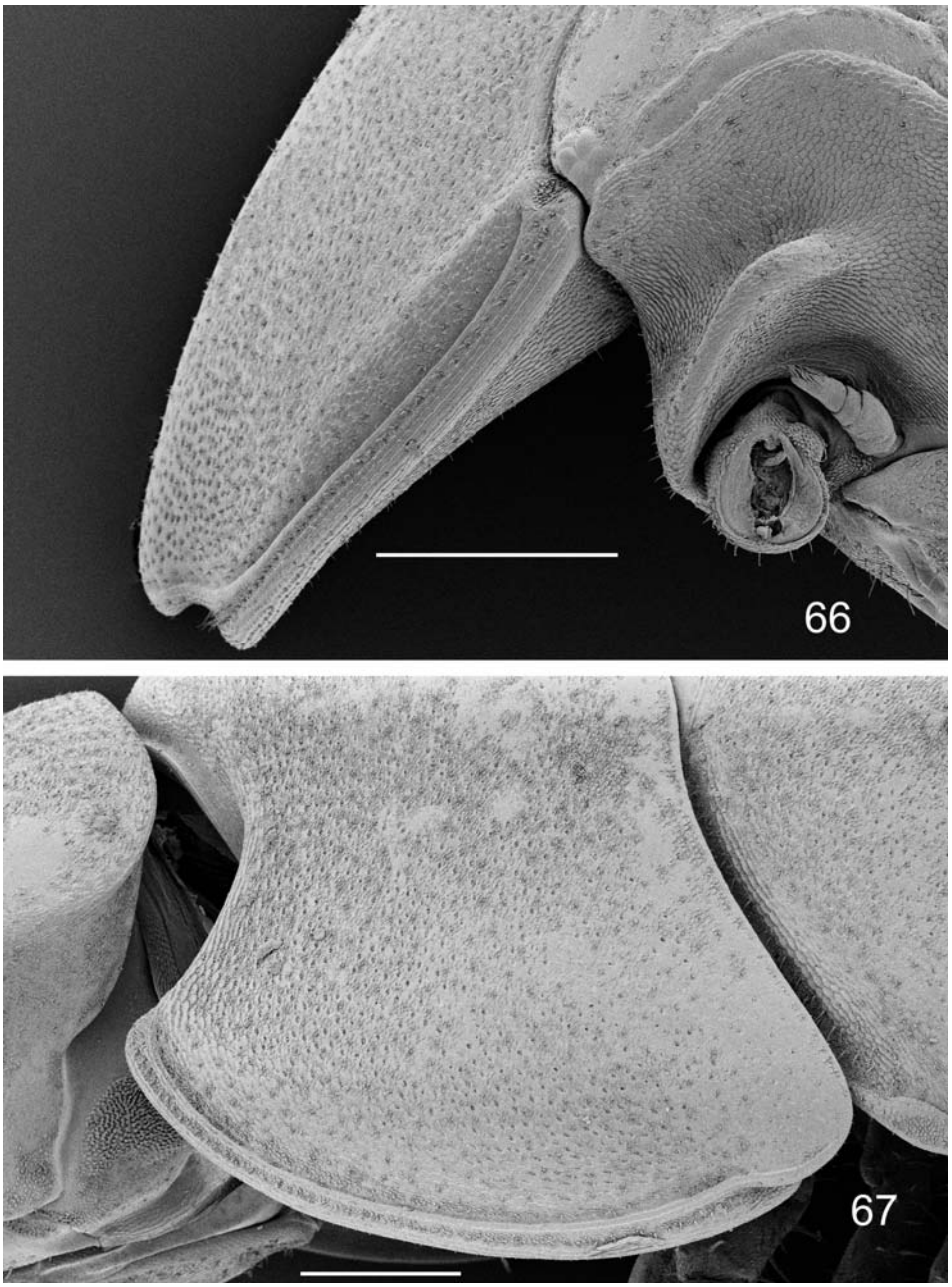
Schizidium schmalfussi: SFENTHOURAKIS 1992: 206, figs. 21–27; SCHMALFUSS et al. 2004: 59.

Material examined

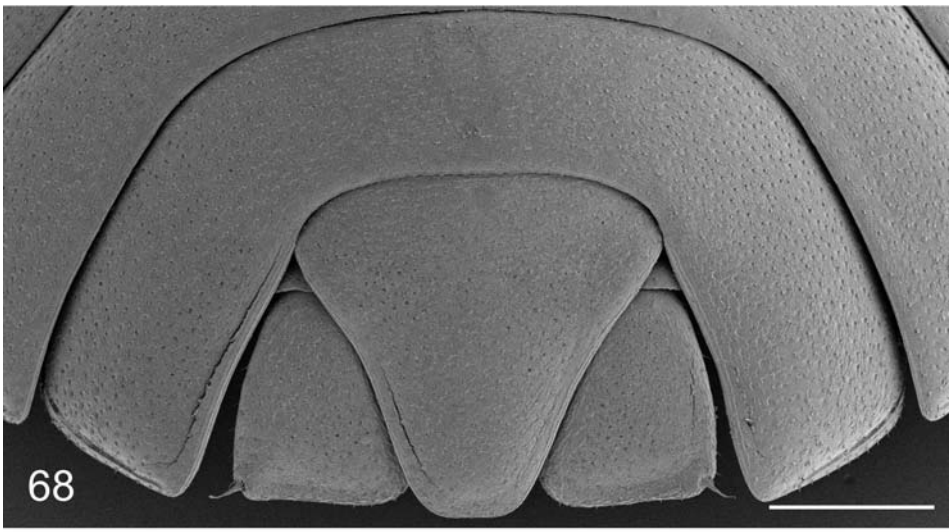
Greece: 2 ♀♀, paratypes, island Día 20 km NE of the town Iráklio on the northern coast of Crete, leg. SFENTHOURAKIS, 3.XI.1989 (SMNS T267).

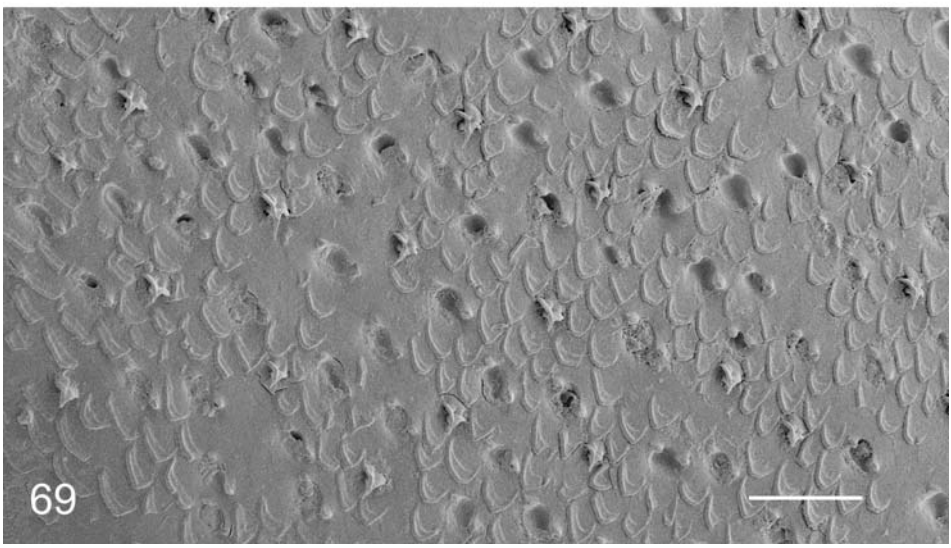


Figs. 64–65. *Schizidium perplexum*, ♂, 9 mm long (cave of Skotinó, SMNS 1284). – **64**. Head in frontal view. **65**. Head and pereion-tergite I in frontal view. – Scales: 0.5 mm.

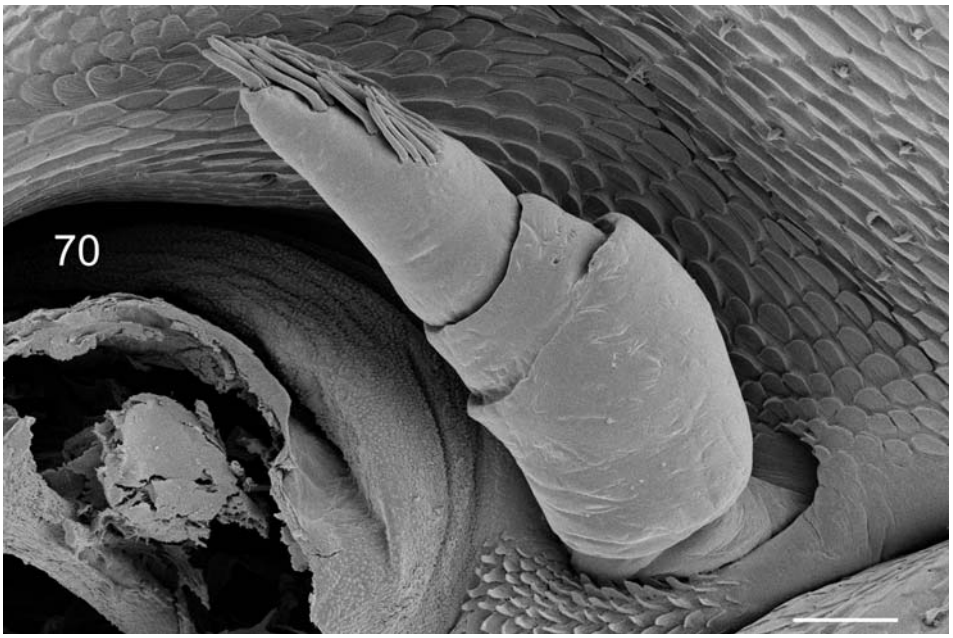


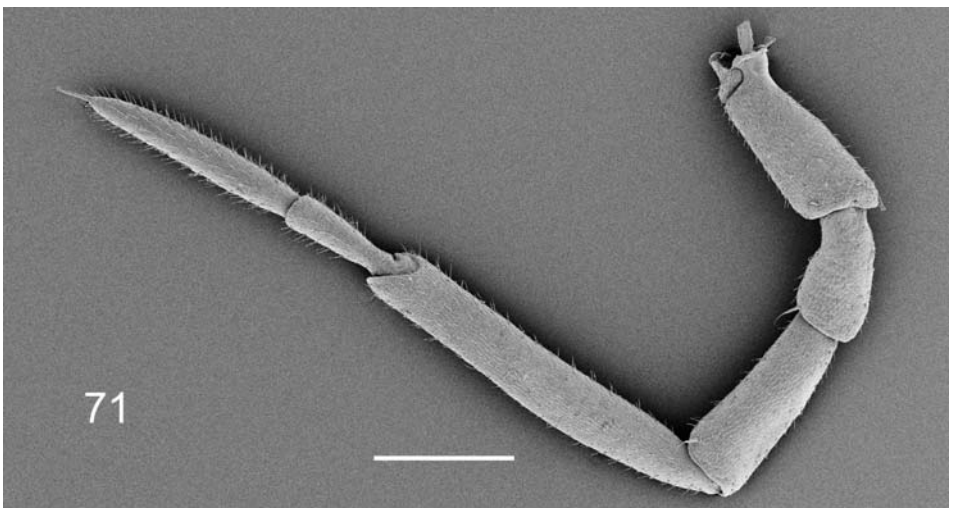
Figs. 66–67. *Schizidium perplexum*. – **66**. ♂, 9 mm long (cave of Skotinó, SMNS 1284), pereion-epimeron I, frontal view. **67**. ♂, 8 mm long (cave Trápeza, SMNS 2306), pereion-epimeron I, lateral view. – Scales: 0.5 mm.



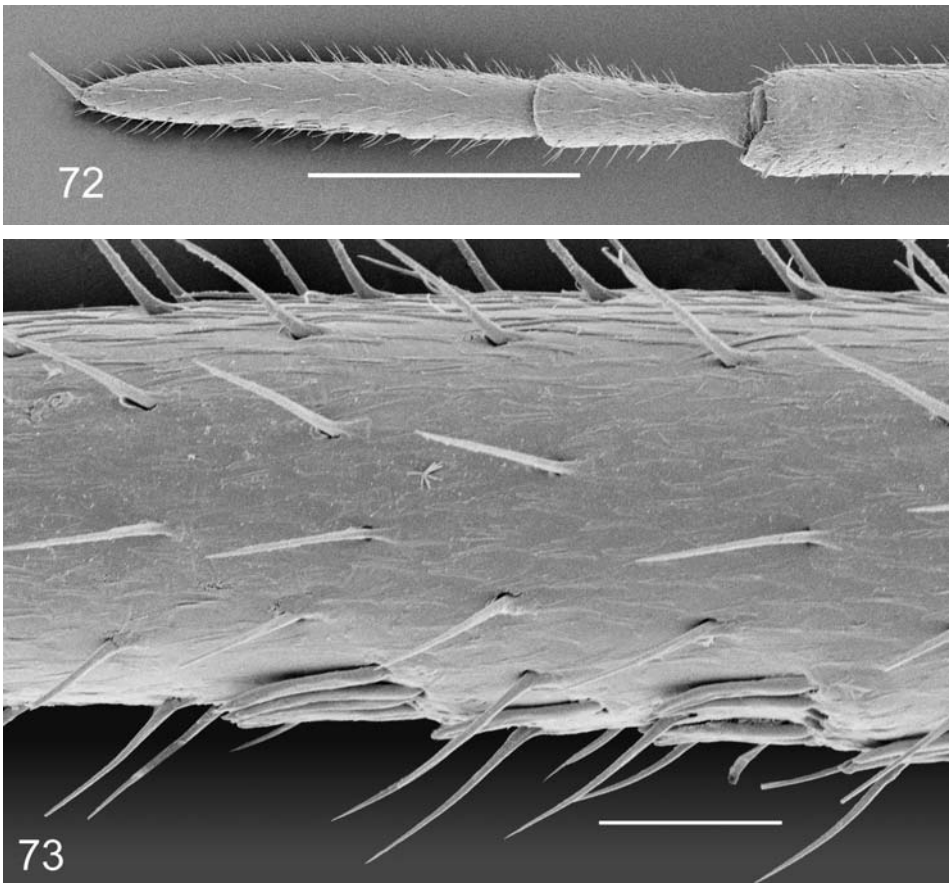


Figs. 68–69. *Schizidium perplexum*, ♂, 11 mm long (cave Trápeza, SMNS 2306). – **68**. Telson and uropods in situ. **69**. Microstructures on pleon-tergite V. – Scales: 0.5 mm (68), 0.05 mm (69).

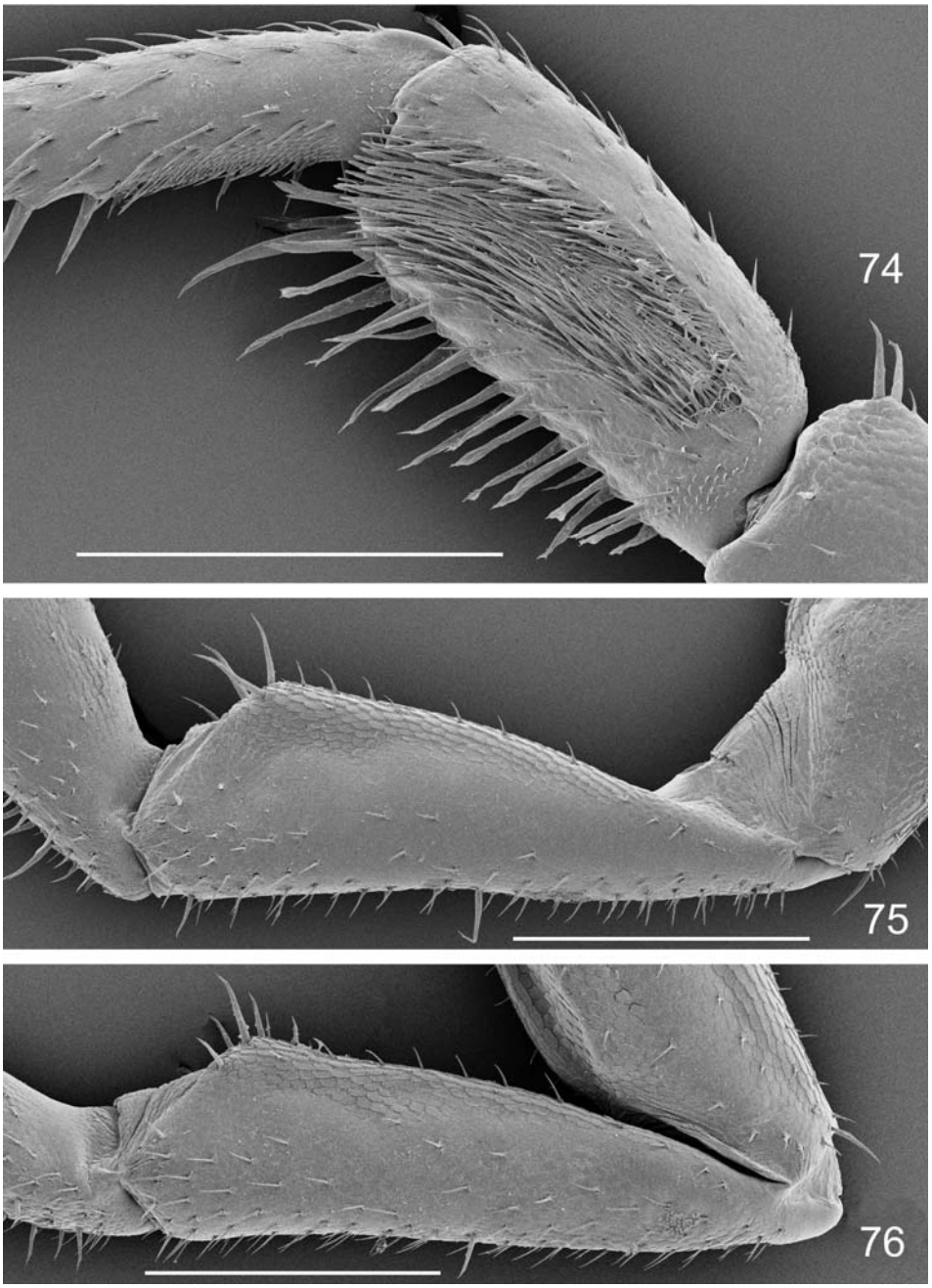




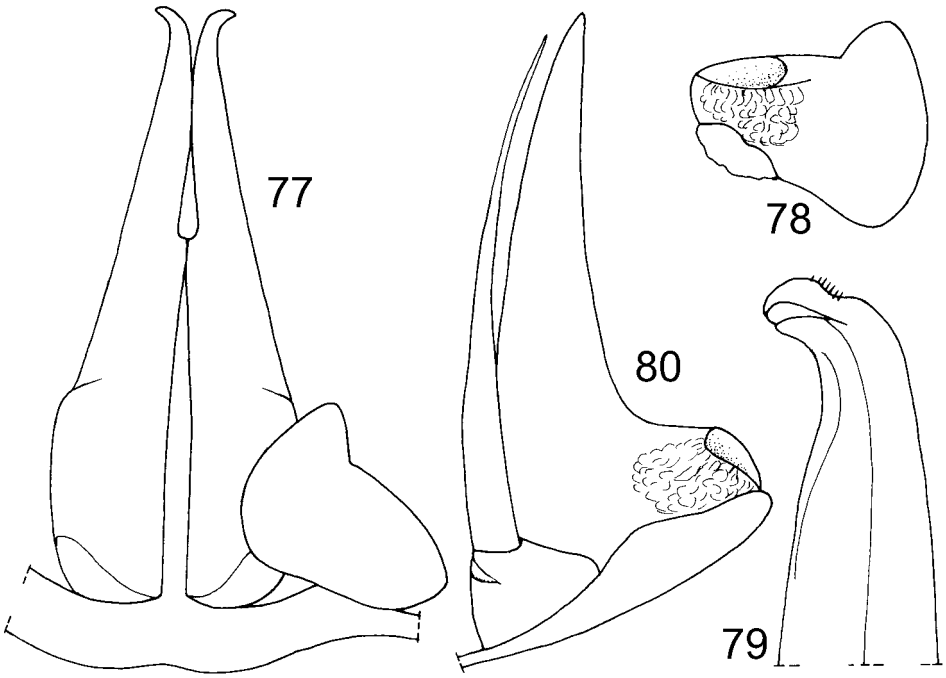
Figs. 70–71. *Schizidium perplexum*. – **70**. ♂, 11 mm long (cave Trápeza, SMNS 2306), antennula. **71**. ♂, 9 mm long (cave of Skotinó, SMNS 1284), antenna. – Scales: 0.05 mm (70), 0.5 mm (71).



Figs. 72–73. *Schizidium perplexum*, ♂, 9 mm long (cave of Skotinó, SMNS 1284). – **72**. Antennal flagellum. **73**. Aesthetascs on distal segment of antennal flagellum. – Scales: 0.5 mm (72), 0.05 mm (73).



Figs. 74–76. *Schizidium perplexum*. – **74**. ♂, 11 mm long (cave Trápeza, SMNS 2306), carpus I, frontal view. **75**. ♂, 9 mm long (cave of Skotinó, SMNS 1284), ischium VII, caudal view. **76**. As before, ischium VII, frontal view. – Scales: 0.5 mm.



Figs. 77–80. *Schizidium perplexum*, ♂, 11 mm long (cave Trápeza, SMNS 2306). – **77**. Pleopod I. **78**. Pleopod-exopodite I. **79**. Apex of pleopod-endopodite I. **80**. Pleopod II.

Diagnostic characters

Maximum dimensions: 10.8 × 5.2 mm.

Coloration: Dark grey.

Cuticular structures: Tergites smooth.

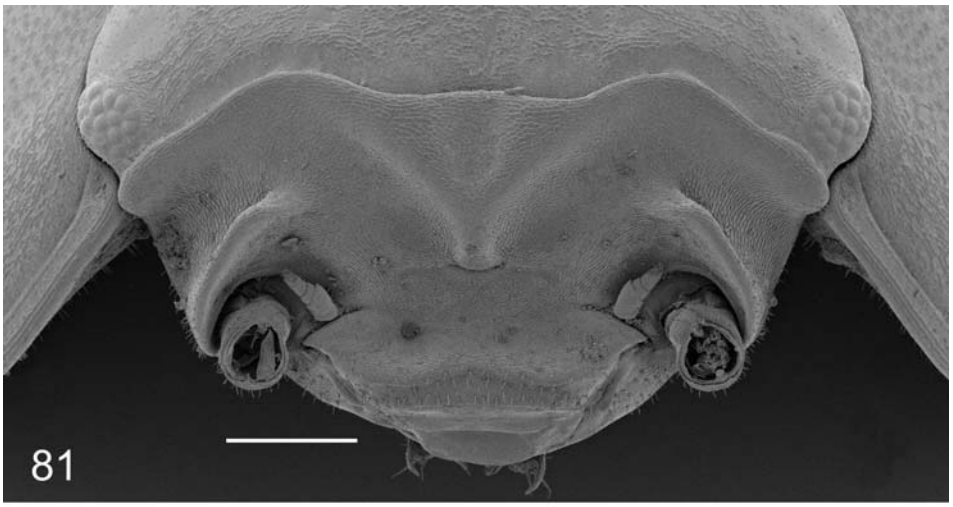
Head with uninterrupted frontal ridge, eyes with up to 11 ommatidia (Fig. 81). Caudal schisma in pereion-epimeron I with inner lobe considerably shorter than outer lobe (Figs. 82–83). Telson slightly shorter than wide, with slightly concave sides and truncated apex (Fig. 84). Antennal flagellum with distal segment about twice as long as proximal one (Fig. 85). Distal part of female pereiopod I see Fig. 86; male ischium VII with ventral side concave (Fig. 87). Male pleopod-exopodite I with evenly rounded inner lobe (Fig. 88), apex of endopodite I see Fig. 89.

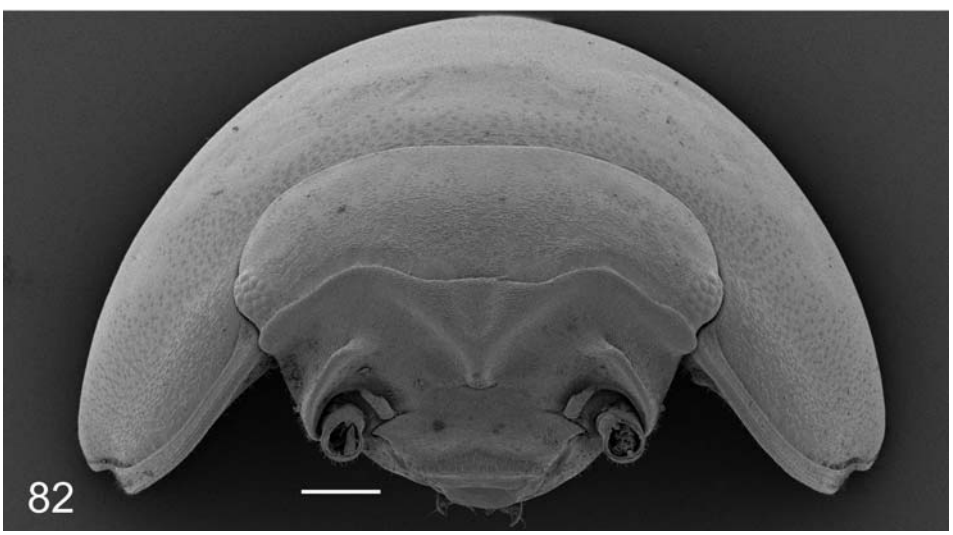
Recorded distribution

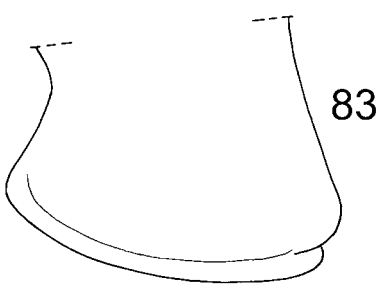
Greece, Island Día 20 km NE of the town Iráklio on the northern coast of Crete (map Fig. 96).

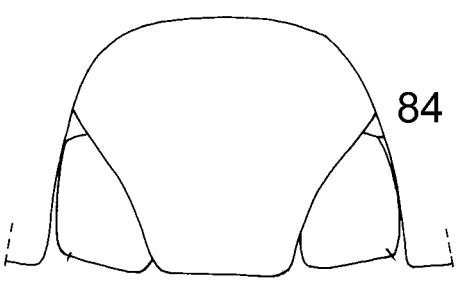
Remarks

S. schmalfussi differs from the other two Greek pigmented species of *Schizidium* by the ventrally concave male ischium VII and by the shape of the male pleopod-exopodite I.

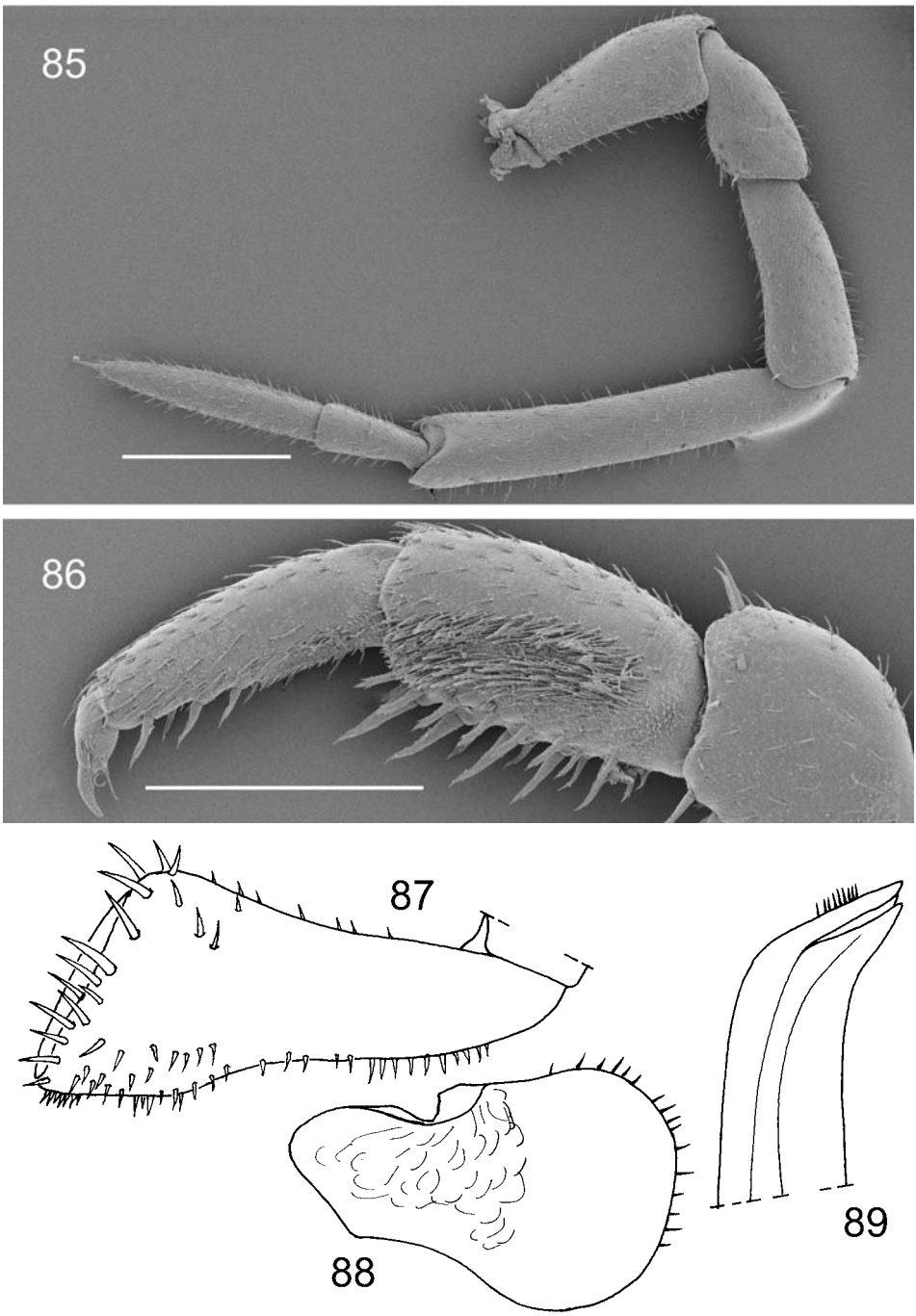




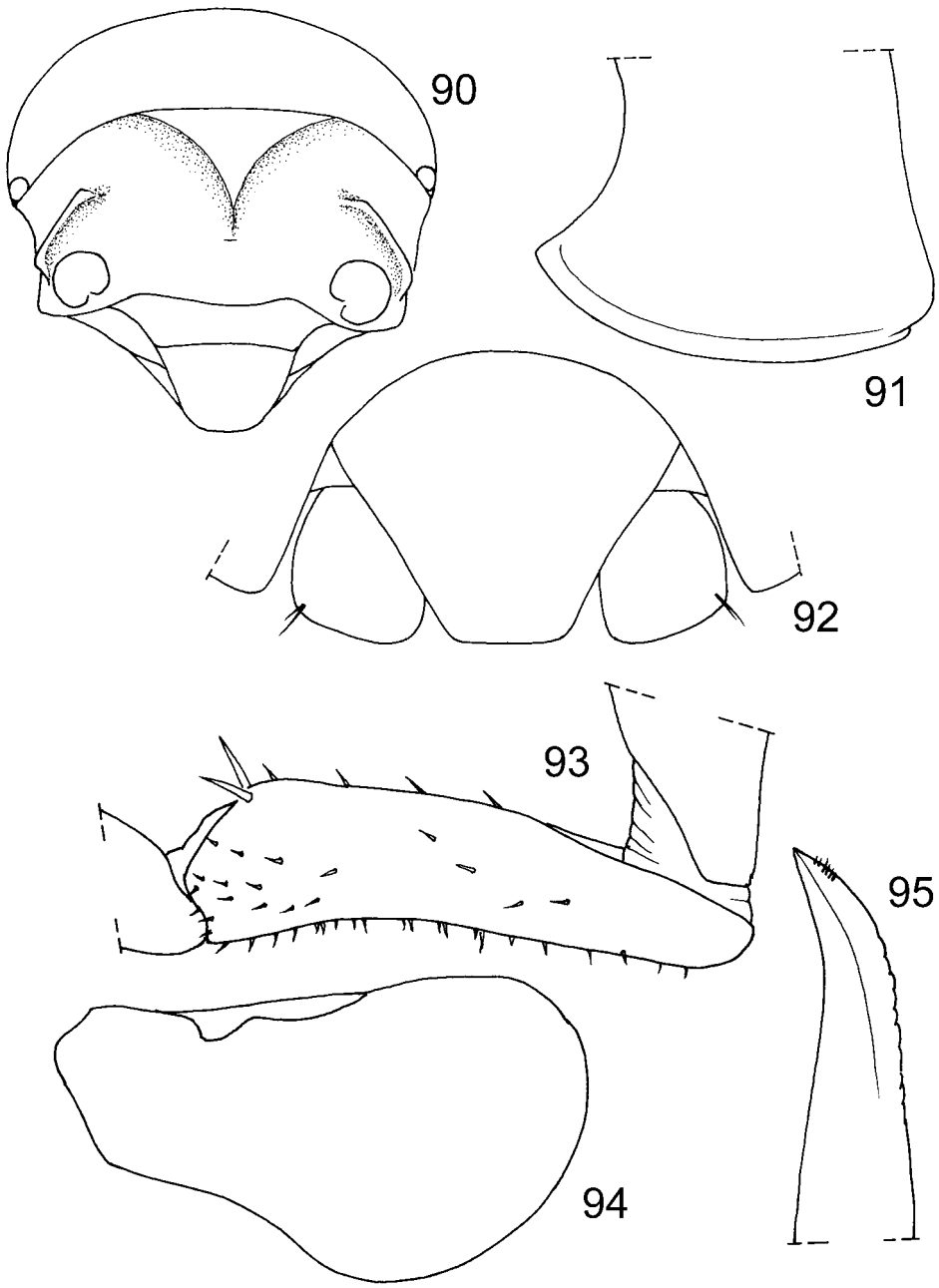




Figs. 81–84. *Schizidium schmalfussi*, paratype, ♀, 11 mm long (SMNS T267). – **81**. Head in frontal view. **82**. Head and pereion-tergite I in frontal view. **83**. Pereion-tergite I in lateral view. **84**. Telson and uropods in situ. – Scales: 0.5 mm.



Figs. 85–89. *Schizidium schmalfussi*, paratype, ♀, 11 mm long (SMNS T267). – **85**. Antenna. **86**. Distal part of pereiopod I in frontal view. **87**. Ischium VII (after SFENTHOURAKIS 1992). **88**. Pleopod-exopodite I (after SFENTHOURAKIS 1992). **89**. Apex of pleopod-endopodite I (after SFENTHOURAKIS 1992). – Scales: 0.5 mm.



Figs. 90–95. *Schizidium tinum*. – **90**. Paratype, ♀, 8 mm long, from SFENTHOURAKIS (1995), head in frontal view. **91**. Paratype, ♀, 5 mm long (SMNS T336), pereion-epimeron I, lateral view. **92**. As before, telson and uropods in situ. **93**. Holotype, ♂, 6.5 mm long, ischium VII (after SFENTHOURAKIS 1995). **94**. As before, pleopod-exopodite I. **95**. As before, apices of pleopod-endopodites I.

2.8 *Schizidium tinum* Sfenthourakis, 1995
(Figs. 90–95 and map Fig. 96)

Schizidium tinum: SFENTHOURAKIS 1995: 9, figs. 28–35 and map fig. 59; SFENTHOURAKIS 1996: 698.

Material examined

Greece: 1 juv. ♂, 1 juv. ♀, paratypes, Aegean island Tínos, Exobúrgo, leg. SFENTHOURAKIS, 18.XI.1991 (SMNS T336).

Diagnostic characters

Maximum dimensions: 8 mm length for ♀♀ and 6.5 mm for ♂♂ (SFENTHOURAKIS 1995).

Coloration: White, without pigmentation.

Cuticular structures: Tergites smooth, but covered with conspicuous upright setae.

Head with continuous frontal ridge (Fig. 90), eyes with 5 black ommatidia. Caudal schisma in pereion-epimeron I with inner lobe shorter than outer lobe (Fig. 91). Telson with straight sides, apex broadly truncated (Fig. 92). Antenna with distal article of the flagellum more than twice the length of proximal article. Male ischium VII with ventral side concave, distal part not widened (Fig. 93). Male pleopod-exopodite I with evenly rounded inner lobe (Fig. 94), apex of endopodite I see Fig. 95.

Recorded distribution

Greece, Aegean island Tínos (see map Fig. 96).

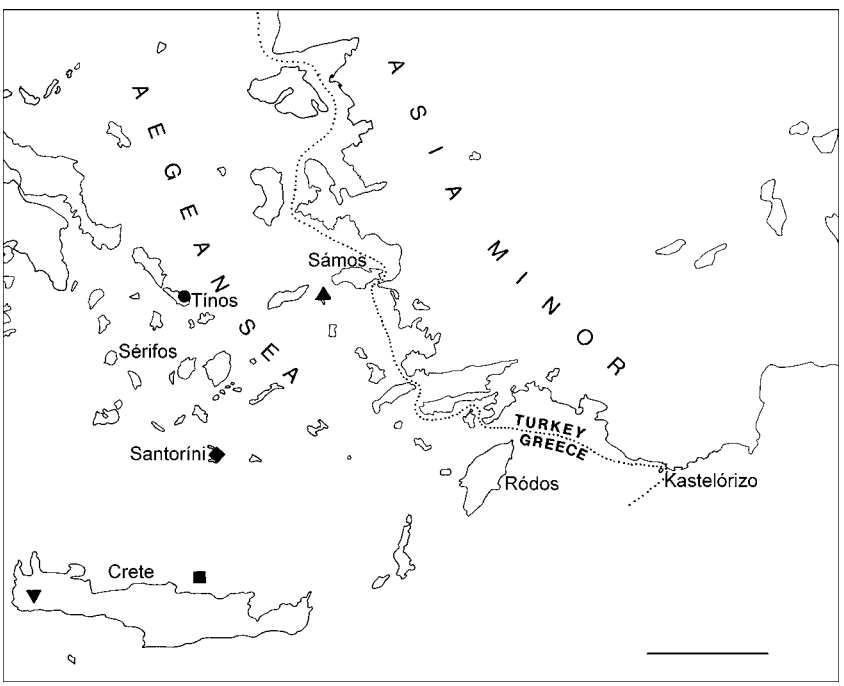


Fig. 96. Records of *Schizidium delmastroi* (▼), *S. schmalfussi* (■), *S. beroni* n. sp. (◆), *S. tinum* (●) and *S. paragamiani* n. sp. (▲). – Scale: 100 km.

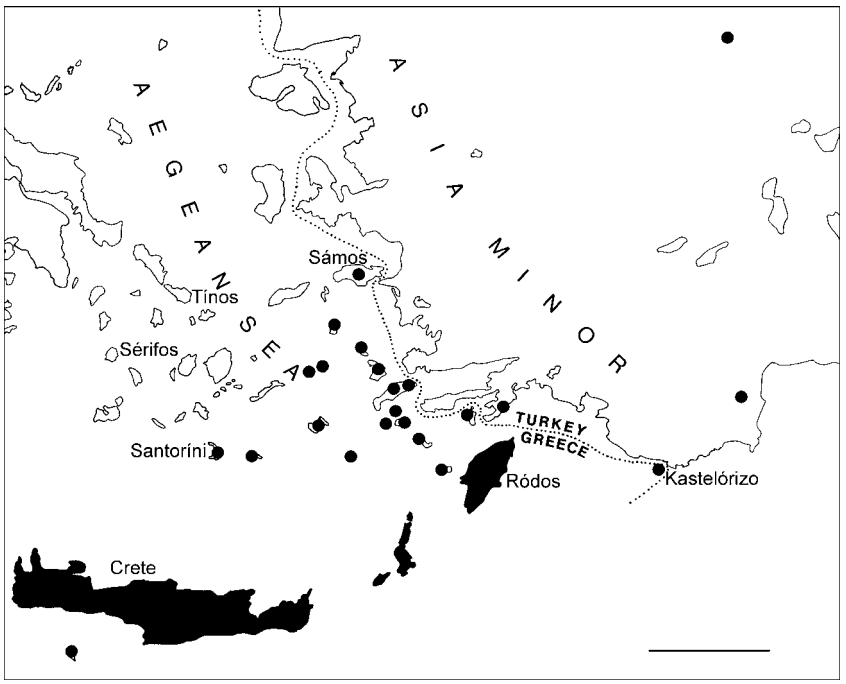


Fig. 97. Records of *Schizidium hybridum* (●); solid black = dense record areas. – Scale: 100 km.

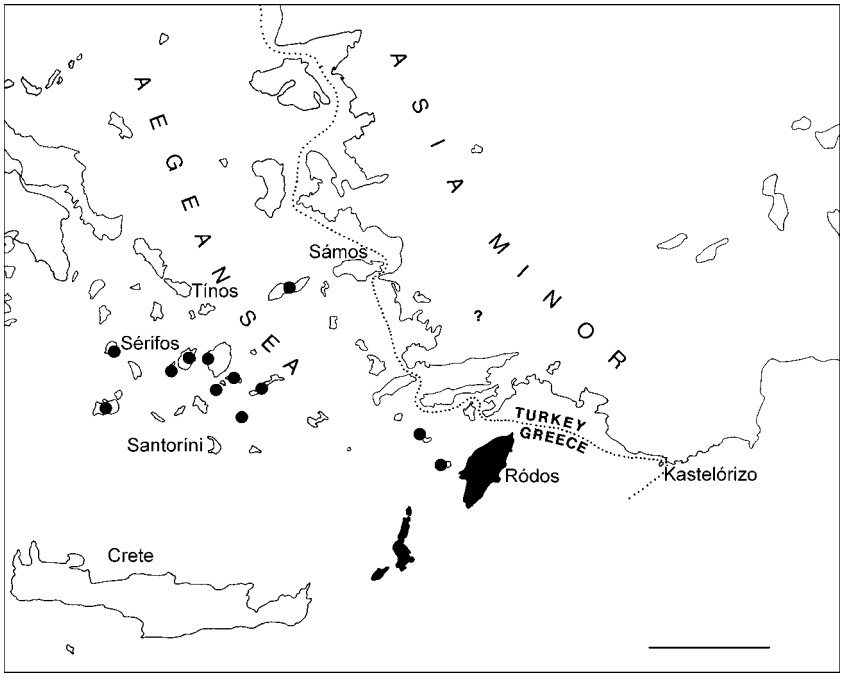


Fig. 98. Records of *Schizidium oertzenii* (●); solid black = dense record areas. – Scale: 100 km.

3 Zoogeography

The genus *Schizidium* as defined today is distributed in western Asia. In Greece it is found only on the islands of the southern Aegean. Conspicuously there are no records from the Greek mainland, including the Peloponnes. On the one hand the restriction to the southern Aegean islands may be due to climatic factors (temperature, precipitation). This would, however, not explain its absence from the Greek mainland. This absence could be a consequence of a predator-pressure different from that on the islands, or to competitive exclusion by some other taxa. Probably a combination of all these factors is responsible for the observed situation. As competitors the species of the closely related genus *Armadillidium* can be suspected. The genus is extremely species-rich on the Greek mainland, the Peloponnese and the Ionian islands (around 50 species are known by now, compare SCHMALFUSS 2003), while only 6 species are reported from all the Aegean islands (SFENTHOURAKIS 1996). The following evolutionary scenario is conceivable: In the Miocene, with a climate considerably warmer than today, there was a coherent land mass connecting Asia Minor with today's Greek mainland and this region was populated by *Schizidium* (compare SFENTHOURAKIS et al. 1999, fig. 2A). In Pliocene times the tectonic events resulted in a separation of the Greek mainland from the Aegean archipelagos and Asia Minor. During the Pleistocene, with wetter and colder climates, a number of *Armadillidium* taxa invaded the Greek mainland from the north, which lead, in connection with the changing climate, to the extinction of *Schizidium* on the mainland. The present distribution of *Schizidium* in Greece would thus have to be considered a relict distribution restricted to the Aegean islands.

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