

***Cryptorchestia garbinii* n. sp. (Amphipoda: Talitridae) from Lake Garda (Northern Italy), previously referred to as *Orchestia cavimana* Heller, 1865, and notes on the distribution of the two species**

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(Received 29 October 2013; accepted 25 January 2014; first published online 12 March 2014)

Abstract

A new species of Talitridae, *Cryptorchestia garbinii*, is here described and illustrated. It was collected in Lake Garda in 1895 and initially identified by Adriano Garbini, one of the first Italian hydrobiologists, as *Orchestia littorea*; then as *O. gammarellus* in a second publication, and finally as *O. bottae*. In 1925, Spandl identified the specimens from Lake Garda and other localities in Europe, as *O. cavimana* while noticing some morphological differences with the specimens from Cyprus, the type locality of the species. These differences in taxonomic characters were disregarded or less considered by other authors over the years. Very recently, Lowry and Fanini included *Orchestia cavimana* in the new genus *Cryptorchestia*. In this paper, the populations from Lake Garda, Europe and the Balkan area are identified as a new species, named, in accordance with the new genus created by Lowry and Fanini, *Cryptorchestia garbinii* sp. nov. We ascribe to *C. cavimana* only the population from Cyprus.

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Keywords: *Crustacea, Amphipoda, taxonomy, new species, Northern Italy*

Introduction

Cryptorchestia cavimana (Heller, 1865) was described by C. Heller on specimens found in a spring at Mount Olympus (Troodos Mountains) in Cyprus Island, at 1250 m above sea level (a.s.l.). Thirty years later, Chevreux (1895) identified some specimens as *Orchestia bottae* Milne Edwards, 1840 which were collected on the banks of several lakes in Syria (Lakes Tiberiade, Homsand and others). *Orchestia bottae* was superficially described by Milne Edwards (1840) from the Red Sea where no further specimens of this species were found afterwards. Therefore the identification could possibly be ascribed to another species, such as *Talorchestia martensii* (Weber, 1892) (Schellenberg 1940), which is quite common on the coast of the Red Sea (Ruffo 1969). Since the type material of *O. bottae* was lost (Chevreux 1895), we consider it a dubious species.

In 1895, Garbini collected for the first time in Europe an *Orchestia* in Lake Garda. He first

identified it as *Orchestia littorea* (Montagu, 1808) (Garbini 1895a), later synonymized with *O. gammarellus* (Pallas, 1766) (Stebbing 1906). At a later time he identified it as *O. gammarellus* (Garbini 1895b) and successively as *O. bottae* (Garbini 1904). Finally, Spandl (1924) identified the specimens from Lake Garda as *O. cavimana* Heller (1865), while noticing some morphological differences in the propodus of gnathopod 2 with the specimens from Cyprus.

Comparing the specimens from Lake Garda and Cyprus (specimens studied by Heller and new specimens recently collected), we observed some other small but important differences in morphology. Further molecular analyses, carried out by colleagues at the University of Roma “Sapienza” on several specimens from Cyprus, Lake Garda (Italy) and other European localities, supported our observations highlighting the deep mitochondrial divergence and the allozyme differences between the two species (Ketmaier & De Matthaeis 2010).

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Very recently, Lowry and Fanini (2013) designated and described the new genus *Cryptorchestia* Lowry and Fanini (2013), in which *Orchestia cavimana* was included.

This paper aims to describe the specimens from Lake Garda as a new species widespread in Europe, Great Britain and other localities in the Balkan area, belonging to a different lineage than the former *Orchestia cavimana* from Cyprus. Based on the characters described by Lowry and Fanini (2013), we ascribe the new species to the genus *Cryptorchestia*.

Material and methods

The specimens examined were collected in several localities of the shores of Lake Garda and in different years, and preserved in 70% ethanol. A total of 76 specimens were examined for the description of the new species, being 71 specimens preserved in 70% alcohol, two in Faure's medium mounted on glass slides and three mounted on stubs for scanning electronic microscope (SEM) photography.

All the material is deposited in the collection of the Museo Civico di Storia Naturale of Verona (MSNVRCr).

SEM photographs were obtained with a Zeiss EVO 40 XVP Scanning Electron Microscope at the Museo Tridentino di Scienze Naturali after sputter coating, using a gold-palladium mixture. Other photographs were obtained with stereo microscope Leitz MZ12s with camera Nikon Coolpix 4500.

Taxonomic accounts

Order Amphipoda Latreille, 1816

Suborder Gammaridea Latreille, 1802

Family Talitridae Rafinesque, 1815

Genus *Cryptorchestia* Lowry & Fanini, 2013

***Cryptorchestia garbinii* n. sp.**

(Figures 1–3)

Orchestia littorea; Garbini (1895a): 16

Orchestia gammarellus; Della Valle (1893): 499, pl. 2, fig. 11, Garbini (1895b), Lorenzi (1900): 3.

Orchestia Bottae; Chevreux and Fage (1925): 276, fig. 286; Ruffo (1937): 35.

Orchestia bottae; Garbini (1904), Cecchini (1928): 7, pl. 2, fig. 4; Stammer (1932): 593.

Orchestia cavimana; Nebeski (1880): 32 (142), pl. 2, figs 10–12, 16–17; pl. 3, figs 21–25, 29, 32, pl. 4, figs 33–38; Spandl (1924): 462, figs 7, 8; Ruffo (1946), Giordani Soika (1950), Ruffo (1951), Den Hartog (1963), Curry et al. (1972), Bellan-Santini (1993): 742, fig. 508; Karaman (1993): 303, figs 149, 150; Karaman (2011): 186.

Cryptorchestia cavimana; Lowry and Fanini (2013): 204–205.

Type locality

Italy, Lake Garda.

Material examined

Cryptorchestia garbinii n. sp.: Several localities in Europe (see the list of material and the list in the distribution paragraph).

Additional material: *Cryptorchestia cavimana* (Heller 1865): Cyprus, Mount Olympus, 1200 m a.s.l., 1865; Cyprus, Troodos Mountains, Kaledonia falls, 1250 m a.s.l., 9-VI-2000 M. Tarocco leg.; Cyprus, Troodos Mountains, between Prodomos and Troditissa, 1300 m a.s.l., 10-VI-2000 M. Tarocco leg.

Type specimens

Holotype male (18.7 mm), Italy, Lombardy, Brescia province, Lake Garda, between Desenzano and Padenghe, 45°29'N–10°30'E, V-1895, A. Garbini leg. (Coll. Museo di Storia Naturale of Verona – MSNVRCr 509).

Paratypes (in Coll. Museo di Storia Naturale of Verona – MSNVRCr 510–585): nine males and 10 females, Veneto, Verona province, Lake Garda, between Desenzano and Padenghe, V-1895, A. Garbini leg.; five males and five females, Veneto, Verona province, Lake Garda, between Assenza and Navene 23-IV-1936, S. Ruffo leg.; four males, Veneto, Verona province, Lake Garda, Punta S. Vigilio, 45°34'44"N–10°40'22"E, 8-II-2003, M. Tarocco leg.; five males and five females, Veneto, Verona province, Lake Garda, Punta S. Vigilio, 45°34'44"N–10°40'22"E, 7-X-2002, M. Tarocco leg.; 23 males and nine females, Veneto, Verona province, Lake Garda, Peschiera, 45°26'51"N–10°41'39"E, 18-IV-2010 L. Latella, V. Lencioni leg.

Description

Male, based on holotype and paratypes with an average length of 17.18 mm (Table I). *Head*. Eyes large, subcircular, black. Antenna 1 short, 2.16 mm long in average, frequently reaching peduncle article 4 of antenna 2, peduncle segment 2 subequal to segment 3, flagellum with five to six articles. Antenna 2 long 1/2 of body, peduncle not swollen, and with sparse small robust setae, flagellum relatively short with 19–22 articles. Maxilliped palp article 2 with distomedial lobe well developed, article 4 fused with article 3. Mandible left lacinia mobilis 4-dentate.

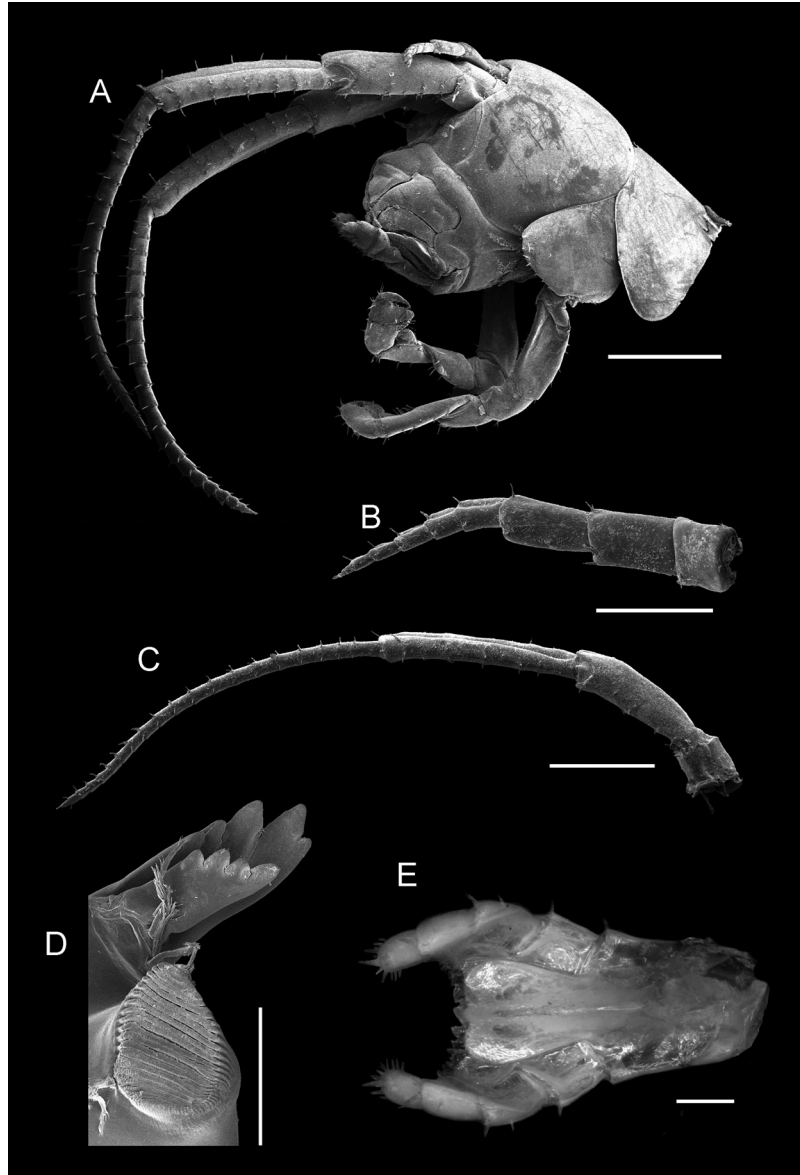


Figure 1. *Cryptorchestia garbinii* n. sp., males (paratypes MSNVRCr 550–551; Lake Garda, Garda, Punta S. Vigilio). **A**, head; **B**, first antenna; **C**, second antenna; **D**, left mandibula; **E**, maxillipeds. Scale bars: A, 1 mm. B–C, 0.5 mm. D–E, 0.2 mm.

Coxae. Coxal plate 1 with some short robust setae only on distal rounded margin. Coxal plates 2–3 wider than deep.

Pereion. Gnathopod 1 rectipalmate, posterior margin of merus, carpus and propodus with lobe covered in palmate setae; propodus sub-triangular; palm excavated; dactylus shorter than palm. Gnathopod 2 subchelate, propodus oviform, stout with a rounded protuberance near dactylus insertion, palmar margin with large sinus in the anterodistal part, dactylus somewhat longer than palm.

Pereopods 3–7 cuspidactylate. Pereopods 3–4 similar, without special feature; merus of pereopod 3 longer than that of pereopod 4. Pereopod 5 basis elongate, posterodistal lobe not very wide; propodus with five groups of robust setae on anterior margin. Pereopod 6 shorter than pereopod 7; basis elongate, posterior margin convex; propodus as long as carpus, anterior margin with five groups of long robust setae and one to two couples of smaller robust setae. Pereopod 7 basis wide with distinct, rounded posterodistal lobe; merus and carpus not enlarged; propodus longer than carpus.

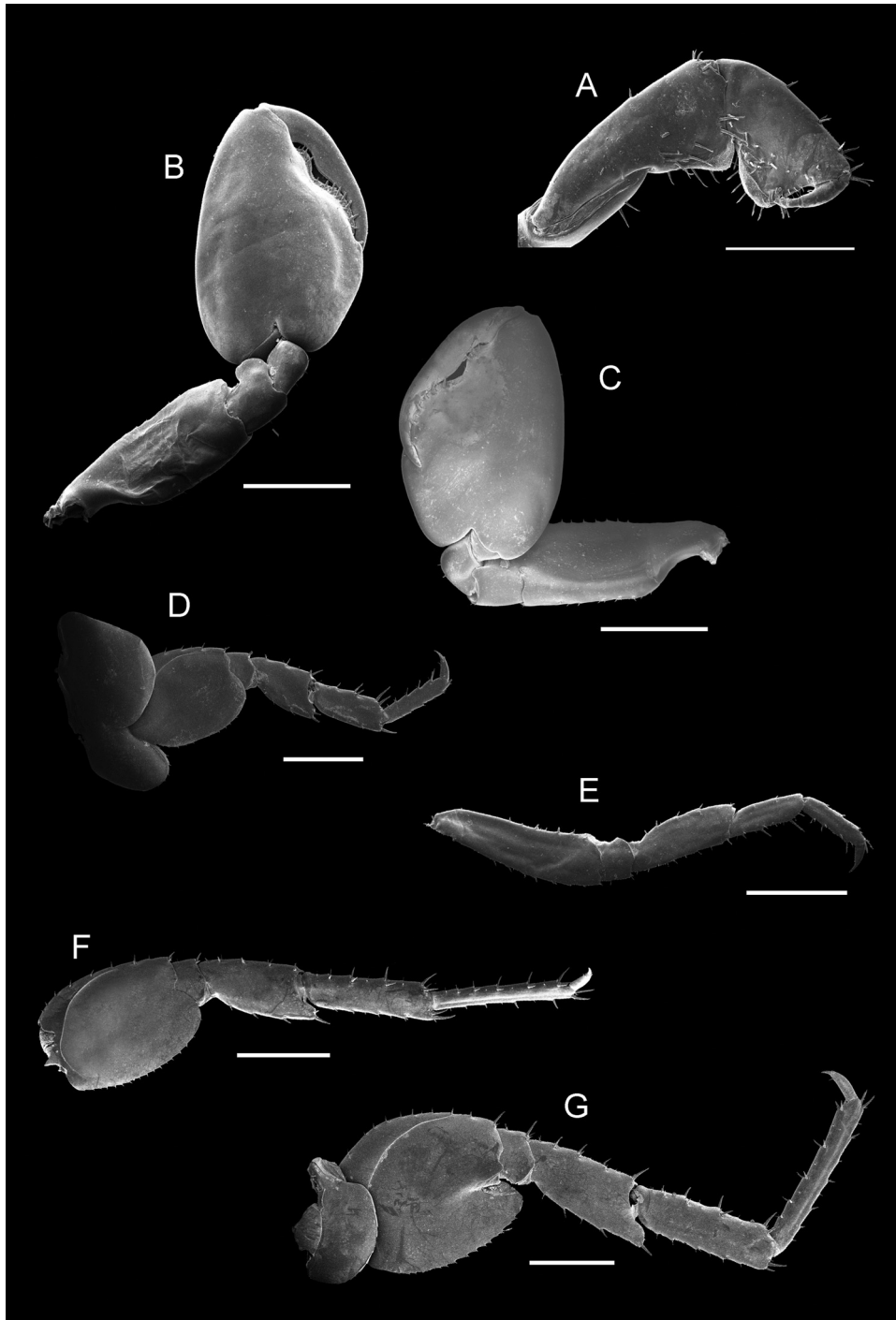


Figure 2. *Cryptorchestia garbinii* n. sp., male (Paratype MSNVRCr 551; Lake Garda, Garda, Punta S. Vigilio). **A**, gnathopod 1; **B**, right gnathopod 2 in external view; **C**, left gnathopod 2 in internal view; **D**, pereopod 4; **E**, pereopod 5; **F**, pereopod 6; **G**, pereopod 7. Scale bars: A, 0.5 mm. B–G, 1 mm.

Pleon. Epimeral plates 2–3 with a small posteroventral tooth and crenulate posterior margin.

Pleopods 1–3 well developed, biramous, peduncle without marginal setae, slightly longer than ramus; rami with slender setae; inner ramus slightly longer than outer.

Uropods 1–2 with peduncle and both rami spinose, distal robust setae longer than the others; uropods 1, rami shorter than peduncle; uropods 2, rami as long as peduncle. Uropods 3, peduncle with three robust setae; ramus shorter than peduncle, with three distal robust setae.

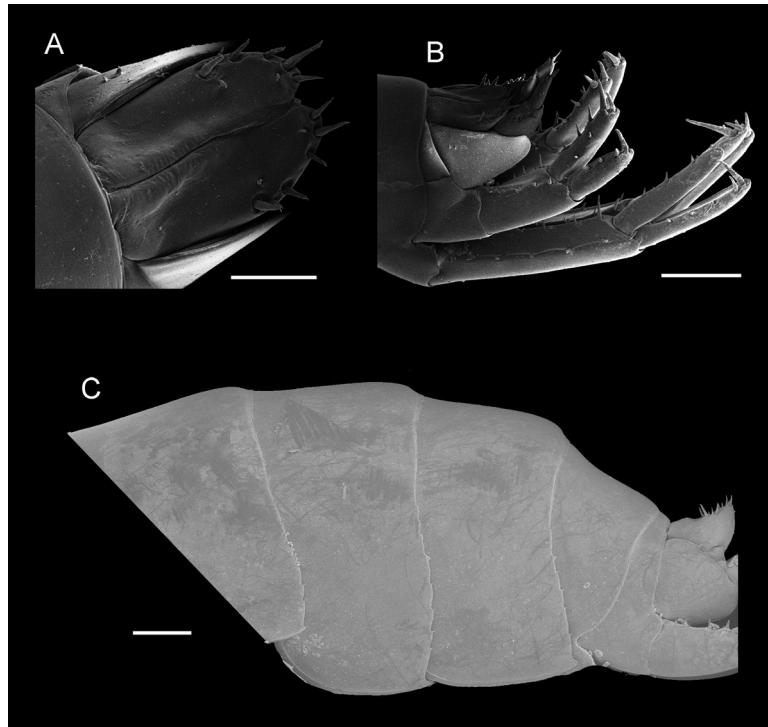


Figure 3. *Cryptorchestia garbinii* n. sp., male (Lake Garda, Garda, Punta S. Vigilio). **A**, telson; **B**, uropods; **C**, epimeral plates 1–3. Scale bars: A, 0.2 mm. B, 0.5 mm. C, 0.2 mm.

Telson longer than broad, dorsal midline entire, eight marginal and distal robust setae per lobe.

Female (sexually dimorphic characters), average 13.89 mm (Table I). Gnathopod 1 subchelate, carpus and propodus without rugose lobe, dactylus longer than palm. Gnathopod 2 dactylus shorter than palm. Oostegites longer than wide; setae with simple straight tips.

Remarks. *Cryptorchestia garbinii* n. sp. is similar to *Cryptorchestia cavimana* (Heller, 1865) in the general habitus, but differing in antennae of male that in *C. cavimana* are shorter (Table II) and with Antenna 1 peduncle segment 2 shorter than segment 3, flagellum with four to five articles, antenna 2 long 1/3 of body, flagellum short with 15–16 articles (Figure 4A–B). *Cryptorchestia garbinii* n. sp. differs also to *Cryptorchestia cavimana* in gnathopod 2 of male, which in the former has the palmar margin less sinuous, dactylus is longer and the process of the dactylus is less developed than in *O. cavimana*. Also in *C. garbinii* n. sp. the palmar sinus is in the anterodistal part of the palmar margin while in *C. cavimana* it is situated in the middle of the palm (Figure 4C–D). P7 basis with posterior lobe smaller in *C. garbinii* than in *C. cavimana*; merus shorter and carpus longer in *C. garbinii* (Figure 4E). No morphological differences were found in the females of the two species.

Cryptorchestia garbinii n. sp. and *Cryptorchestia cavimana* are the only two species belonging to the genus that occur in the continental freshwaters of Mediterranean and European regions. *C. cavimana* was observed in springs and streams on Cyprus, while *C. garbinii* is present mainly in lakes and rivers.

Etymology. The new species is named after Adriano Garbini, one of the first Italian hydrobiologists. During his research on Lake Garda, he collected the new species.

Distribution

On the basis of our actual knowledge, populations of *Cryptorchestia garbinii* are discontinuously distributed in the supralittoral zone of brackish and fresh waters of the Mediterranean basin, central Europe and England.

We identified as *Cryptorchestia garbinii* the specimens collected from the localities listed below and preserved in the Collection of the Verona Museum or reported in Karaman (1993) (for some of the Italian localities). Italy: Lombardy, Como province, Como Lake; Lombardy, Mantova Province, Salionze, Mincio River; Lombardy, Brescia province, Iseo Lake; Lombardy, Venetia and Trentino, Lake Garda, several localities in Verona, Trento and

Table I. *Cryptorchestia garbinii* n. sp. Biometric data related to the specimens examined.

Sex	Total length (mm)	Length of antennae 1	Length of antennae 2
		1	2
Male	18.7	1.87	7
Male	18	1.87	7
Male	18	2	6.5
Male	17.7	2.25	6.62
Male	18.1	2.12	7.87
Male	16.5	1.87	6.87
Male	16.5	1.87	7.25
Male	18.7	2.12	8.37
Male	12.6	2.12	8.75
Male	18.12	1.75	7.5
Male	17.75	2.5	9.62
Male	16.5	2.12	7.62
Male	18.37	2.5	9.25
Male	16.75	2.5	8.75
Male	18.75	2.62	10.25
Male	15.5	2.37	8
Male	16.75	2.12	8
Male	17.5	2.25	7.25
Male	16	1.5	8.12
Male	17	2	7.5
mean	17.18	2.16	8.08
Female	13.6	1.12	4.62
Female	13.4	0.89	4.5
Female	14.12	1.62	5.87
Female	14	1.75	5.62
Female	13.25	1.5	5.25
Female	12.87	1.5	5.25
Female	12.75	1.37	4.62
Female	13.12	1	4.37
Female	15.25	1.62	5.12
Female	14.87	1.37	5.25
Female	14	1.12	5
Female	15	1.62	5.25
Mean	13.89	1.34	5.05

Brescia provinces; Trentino, Trento Provincie, Caldonazzo Lake; Venetia, Verona province, Adige River; Venetia, Verona province, Tartaro River spring; Venetia, Vicenza province, San Germano dei Berici; Venetia, Treviso province, Sile River; Friuli Venetia Giulia, Udine; Friuli Venetia Giulia, Trieste; Friuli Venetia Giulia, Trieste province, Timavo River; Emilia Romagna, Ravenna province; Tuscany, Arezzo province, Arno River; Tuscany, Firenze province, Rosano, Arno River; Lazio, Roma province, Vico Lake, Bracciano Lake, Martignano Lake and Albano Lake.

France: Languedoc-Roussillon, Banyuls-sur-mer.

Germany: Northern Germany, Saale River; Berlin, Tegeler Lake, Schleuse Woltersdorf, Wollin.

Croatia: Rovinj, Porto Vestre.

Holland: Utrecht, Kamerik.

United Kingdom: Great Britain, Gloucestershire, Thames River; Great Britain, Cheshire, Weaver River.

Table II. *Cryptorchestia cavimana*. Biometric data related to the specimens collected in June 2000.

Sex	Total length (mm)	Length of antennae 1	Length of antennae 2
Male	13.8	1.56	6.56
Male	14		
Male	14	1.5	5.37
Male	15	1.37	5.5
Male	13.25	1.37	5
Male	15.87	1.62	6.12
Male	17.12	2	7
Mean	14.72	1.57	5.925
Female	13.37	1.37	4.62
Female	15.75	1.5	4.87
Female	14.37	1.12	4.62
Female	16.5	1.12	5
Female	15	1.25	5
Female	13.87	1.37	4.37
Female	13.75	1.37	4.62
Female	14.37	1.25	4.87
Female	12.5	1	4.75
Female	15	1.75	5.37
Female	14.37	1.5	5.87
Female	15.12	1.75	5.25
Female	13.25	1.37	4.37
Female	14.75	1.25	5
Female	13.37	1.37	4.75
Mean	14.356	1.356	4.889

Cryptorchestia cavimana is present only in the freshwater of Cyprus Island.

We also examined some specimens from Greece (Attica, Central Greece, Thessaloniki and Rhodes), Turkey (Sapanka Lake, Iznik Lake, Kiyikoy) and Israel present in the collection of the Museo di Storia Naturale of Verona, which did not belong to these two species, although clearly belonging to the genus *Cryptorchestia* and with characters similar to *C. garbinii* n. sp. and *C. cavimana*. Those specimens need to be analyzed with more attention and with more abundant material.

Acknowledgements

The late Sandro Ruffo, now posthumous first author of this study, always had a great interest in *Orchestia* (actually *Cryptorchestia*) specimens of Lake Garda and often remarked on their unresolved taxonomic status. He gathered through the years the morphological and referential information presented here. We express our deep gratitude for his tutorship and hope that finalizing this work sees one of his wishes fulfilled. Furthermore, we would like to thank Nicola Angeli (Museo delle Scienze, Trento, Italy) for the SEM photographs, and Daniele Avesani and Roberta Salmaso for the assemblage of the pictures.

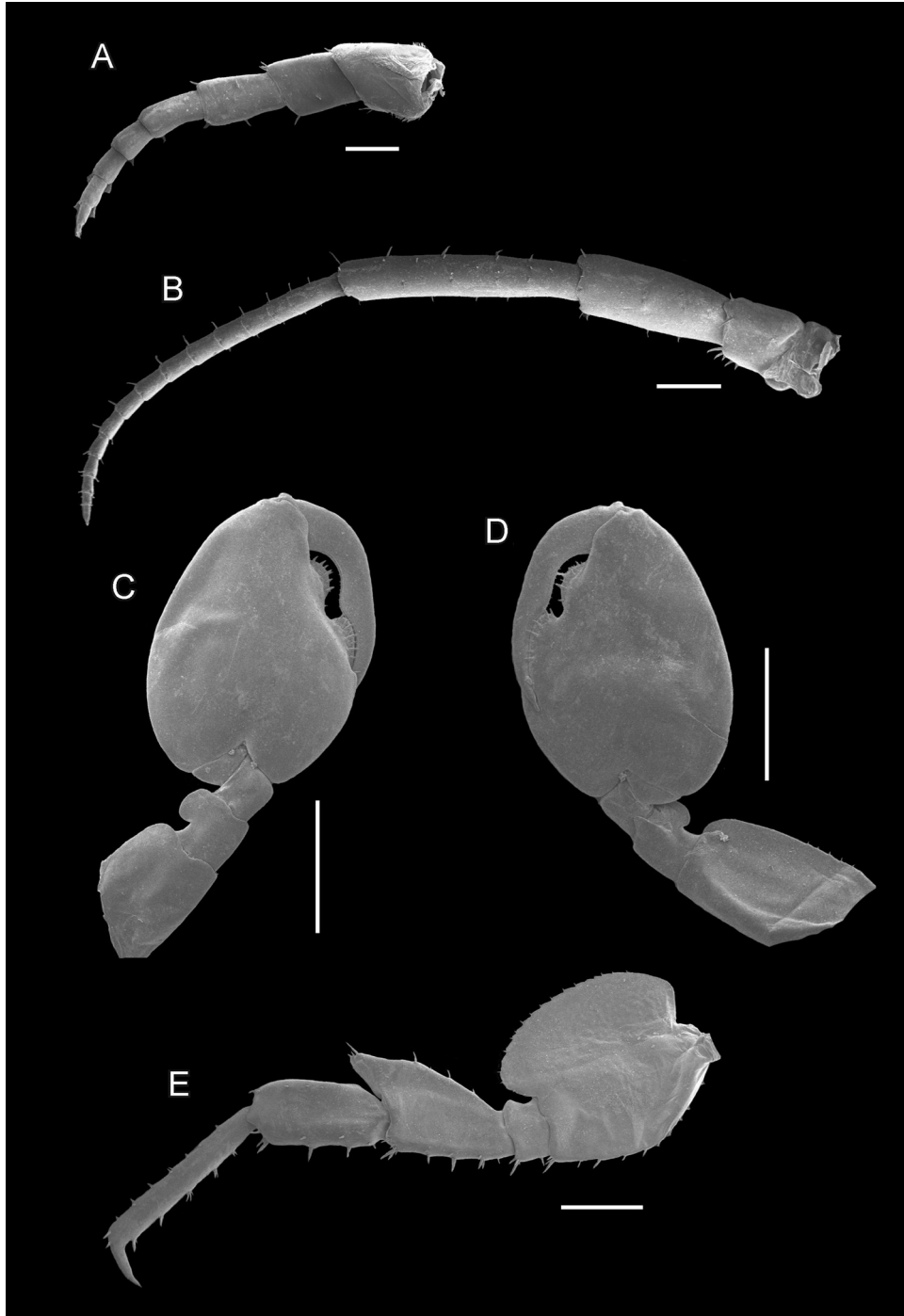


Figure 4. *Cryptorchestia cavimana*, male (Cyprus, Troodos Mountains, Kaledonia falls). **A**, first antenna; **B**, second antenna; **C**, right gnathopod 2 in external view; **D**, left gnathopod 2 in internal view; **E**, pereopod 7. Scale bars: A–B, 0.2 mm. C–E, 1 mm.

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