PORCELLIO OBSOLETUS BUDDE-LUND, 1885, AN EASTERN MEDITERRANEAN TERRESTRIAL ISOPOD IN THE IBERIAN PENINSULA (CRUSTACEA, ONISCIDEA, PORCELLIONIDAE) [1]

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ABSTRACT: *Porcellio obsoletus* Budde-Lund, 1885 is reported for the first time from the Iberian Peninsula, including both mainland Portugal and Spain. Previously, the species was known mostly from the eastern Mediterranean. To aid in its identification, a new description is provided, expanding on those published by other authors for this species and taxa currently considered as its synonyms. The results of this study also suggest that *P. obsoletus libanicus* Vandel (1955) is likely a distinct species, whereas *P. obsoletus mavromoustakisi* Strouhal (1968) does not exhibit significant differences from the species originally described by Budde-Lund in 1885. The fragmented distribution of *P. obsoletus* may be a consequence of the Messinian salinity crisis, which could have fragmented its original range throughout the Mediterranean region, or of human-mediated introduction.

KEY WORDS**:** Distribution, Portugal, Spain, woodlice.

INTRODUCTION

Porcellio obsoletus Budde-Lund, 1885 was originally described by the Danish author based on specimens from Cyprus, Turkey, and Ukraine (Budde-Lund 1885). As was typical of the time, the description was relatively general, making it difficult to distinguish from closely related species. Consequently, several taxa were subsequently described and are now considered synonyms. Nevertheless, discrepancies among these descriptions continue to complicate the recognition of this species within the genus *Porcellio* Latreille, 1804. Several authors have contributed to a better understanding of *P. obsoletus* by examining a range of morphological characters (Vandel 1955; Strouhal 1968; Schmalfuss 1992). Others have provided additional, generally brief, descriptions of taxa that are currently considered synonyms of this species (e.g., Dollfus 1892; Verhoeff 1907). Taken together, these descriptions reveal both points of agreement and notable discrepancies, which may reflect intraspecific variability or the possibility that some descriptions correspond to closely related species. This issue could be clarified through a detailed examination of the type specimens of all taxa currently regarded as synonyms or subspecies of *Porcellio obsoletus*, an analysis that lies beyond the scope of the present study.

Ongoing surveys of terrestrial isopods in the Ibero-Balearic region (e.g., Cifuentes and Da Silva 2023, 2024; Cifuentes et al. 2025) have yielded several specimens of *P. obsoletus*. We aim to contribute to a clearer understanding of this species by providing a new, detailed description accompanied by corresponding figures. This updated description allows comparison of the morphological characters of Iberian Peninsula

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specimens with those reported by previous authors for the subspecies and species currently regarded as synonymous with *P. obsoletus*.

MATERIALS AND METHODS

The specimens examined in this study were hand-collected by the authors from various localities in Portugal and Spain (Figure 1) in suitable microhabitats, such as beneath rocks, trunks, and tree bark, and preserved in tubes containing 70% or 96% ethanol (Cifuentes and Da Silva 2023).

Figure 1. Map of the Iberian Peninsula showing the distribution of *Porcellio obsoletus* (black dots). Thick black lines indicate national borders, while thin lines delineate Portuguese districts and Spanish provinces.

Morphological characters were used to identify the specimens following the terminology proposed by Vandel (1960). Figures were obtained using a microscope and a Gundlach stereomicroscope equipped with a 12 MP digital camera (C2CMOS), then digitized using the free graphic editor Inkscape (https://inkscape.org/). To determine the coordinates of the *noduli laterales* used in this study, we followed the procedure described by Cifuentes and Da Silva (2024), and ratios a/c, b/c, and d/c followed Vandel (1953b, 1960), where a = distance from the middle of the glandular field to the posterior edge, b = distance from the *nodulus lateralis* to the posterior edge, c = pereonite length, and d = distance from the *nodulus lateralis* to the lateral edge. The list of species currently regarded as synonyms follows Schmalfuss (2003) and Boyko et al. (2025).

The specimens used in this study are deposited in the collection of the InBio Barcoding Initiative at the Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO-InBIO/BIOPOLIS), Vairão, University of Porto, Portugal (LPS), and in the collection of Julio Cifuentes, Madrid, Spain (JC).

RESULTS

Family Porcellionidae Brandt *in* Brandt and Ratzeburg, 1831
Genus ***Porcellio*** Latreille, 1804
Type species ***Porcellio scaber*** Latreille, 1804
Porcellio obsoletus Budde-Lund, 1885

Subspecies:
Porcellio obsoletus obsoletus Budde-Lund, 1885
Porcellio obsoletus libanicus Vandel, 1955
Porcellio obsoletus mavromoustakisi Strouhal, 1968

Synonymized species (11):
Porcellio anatolicus Arcangeli, 1938; ***Porcellio contractus*** Dollfus, 1892;
Porcellio ficorum Verhoeff, 1931; ***Porcellio fissifrons*** Dollfus, 1892;
Porcellio griseus Brandt, 1833; ***Porcellio hatayensis*** Verhoeff, 1949;
Porcellio iskenderunus Verhoeff and Strouhal, 1967;
Porcellio napolitanus Verhoeff, 1930; ***Porcellio parvus*** Budde-Lund, 1885;
Porcellio rodiensis Schmalfuss, 1972; ***Porcellio syriacus*** Brandt, 1833;

Material examined: **Portugal**: Leiria, Óbidos, 39°21'56"N 9°09'29"W, 30 Jun 2025, on the bark of a narrow-leaved ash *Fraxinus angustifolia* Vahl in semi-natural woodland, V.A. Mata leg., 2 ♂♂, LPS1104a; same data as preceding, 1 ♀, LPS1104b; Lisbon, Parque Florestal de Monsanto, 38°43'13"N 9°12'30"W, 19 Nov 2023, under the bark of exotic eucalyptus (species unidentified) in urban park, 1 ♀, L.P. Da Silva leg., LPS805; same data as preceding but, 38°43'37"N 9°12'17"W, 1 ♀, LPS812a; same data as preceding, 1 ♂, L.P. Da Silva leg., LPS812b; same data as preceding, 3 ♀♀, LPS812c; same data as preceding but, 38°43'37"N 9°12'20"W, 2 ♀♀, LPS818; Setubal, Convento de Nossa Senhora da Arrábida, 38°28'31"N 8°59'37"W, 16 May 2024, under stones in semi-natural Mediterranean maquis in convent garden, 2 ♂♂, L.P. Da Silva leg., LPS928a; same data as preceding, 3 ♀♀, LPS928b; same data as preceding but, 38°28'29"N 8°59'37"W, 1 ♀(ovigerous), LPS927; ; same data as preceding but, 38°28'30"N 8°59'38"W, 2 ♂♂, LPS929. **Spain**: Málaga, Benalauría, Siete Pilas, 36°35'53"N 5°18'27"W, 10 Sep 2024, under stones in holm oak *Quercus rotundifolia* Lam. and cork oak *Quercus suber* L. woodland,1 ♂, J.L. Rando leg., JC1164; same data as preceding, 6 ♂♂, JC1165; same data as preceding, 1 ♀, JC1166; same data as preceding, 4 ♀♀, JC1167.

Description:

Measurements: Maximum observed length: female: 21 mm (23 mm including uropods); male 19.3 mm (21.1 mm including uropods).

Coloration: Large specimens dark greyish-brown (Figure 2A-E); muscle insertions barely visible; antennae and uropods dark; ventral side white; pereopods and pleopod exopods weakly pigmented; some individuals slightly lighter, darker cephalon and pleon. Smaller specimens, muscle insertions more marked; pale spots on posterior margin of pereon and pleon; pale mark on anterior corner of pereonite I and narrow white band along epimeron margin; posterior corners of pereonites V-VII epimera and neopleura III-IV sometimes depigmented (Figure 2B).

Integumentary characters: Dorsal surface with large, rounded scales; circular depressions; small, flattened granulations (Figure 3A-B). Granulations on cephalon in numerous irregular rows (Figure 2A-D). Pereon: 6-7 rows on pereonite I, 3 on pereonite II, 2 on remaining pereonites, plus fine row along posterior edge of each pereonite; granulations smaller, denser on epimera (Figure 2A, D). Pleon: 1 row at midline, 1 at posterior edge. Telson: 2 rows; 4 granules at base in first row, 2 in second (Figure 2A, D-E). Glandular fields large (Figure 3A); with few pores (10-12), oval on anterior

pereonites, rounder on posterior ones; on pereonite I, positioned near anteromedial angle; on other pereonites shifted from lateral margin, sometimes hidden by preceding pereonite. Scale-setae triangular, very small, with short basal branches and broad, rounded tips (Figure 3B). *Noduli laterales* small, within tiny white spots in heavily pigmented specimens; ratios a/c, b/c and d/c as in Fig. 3C–D (Portuguese specimen LPS812a) and Figure 3E-F (Spanish specimen JC1166), with d/c particularly high on pereonites I-IV.

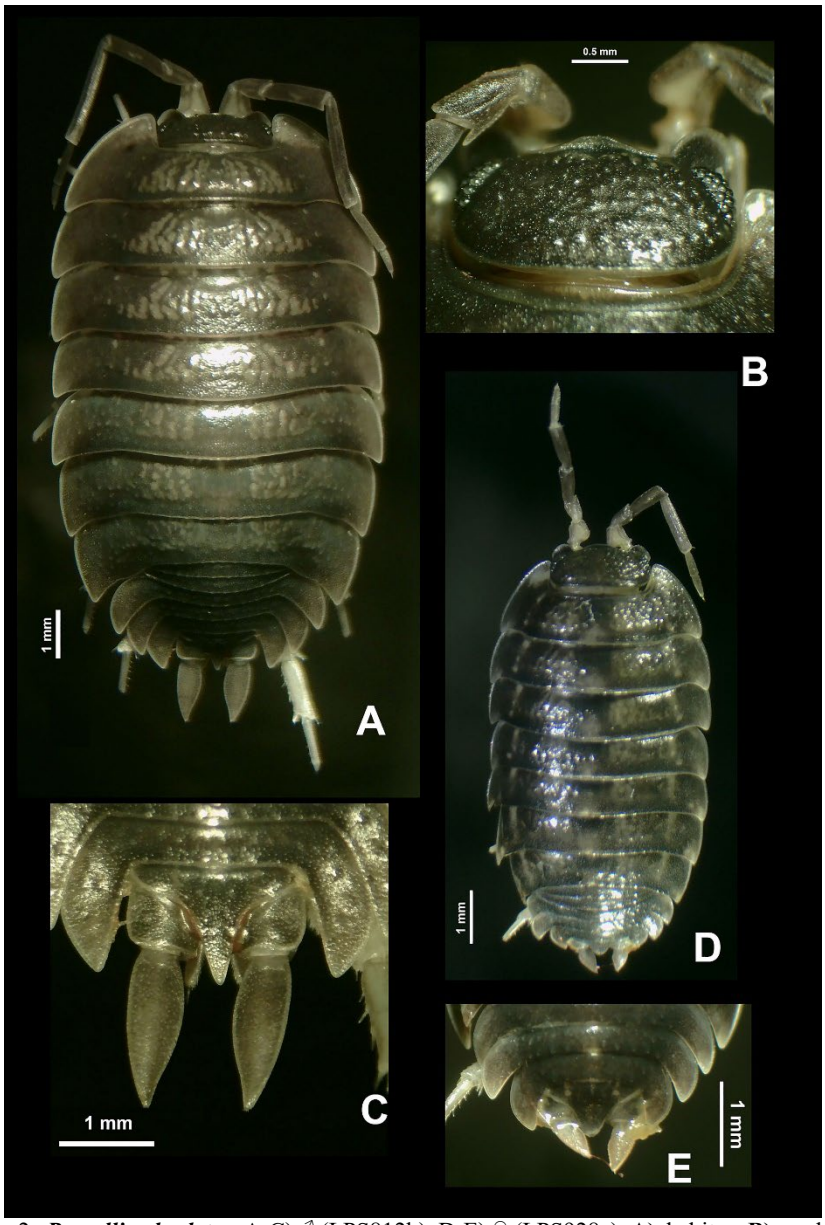

Figure 2. ***Porcellio obsoletus***: A-C) ♂ (LPS812b); D-E) ♀ (LPS928a); **A).** habitus; **B).** cephalon; **C).** pleon, telson and uropods; **D)**. habitus; **E)**. pleon, telson and uropods. Scale bars: A-E = 1 mm.

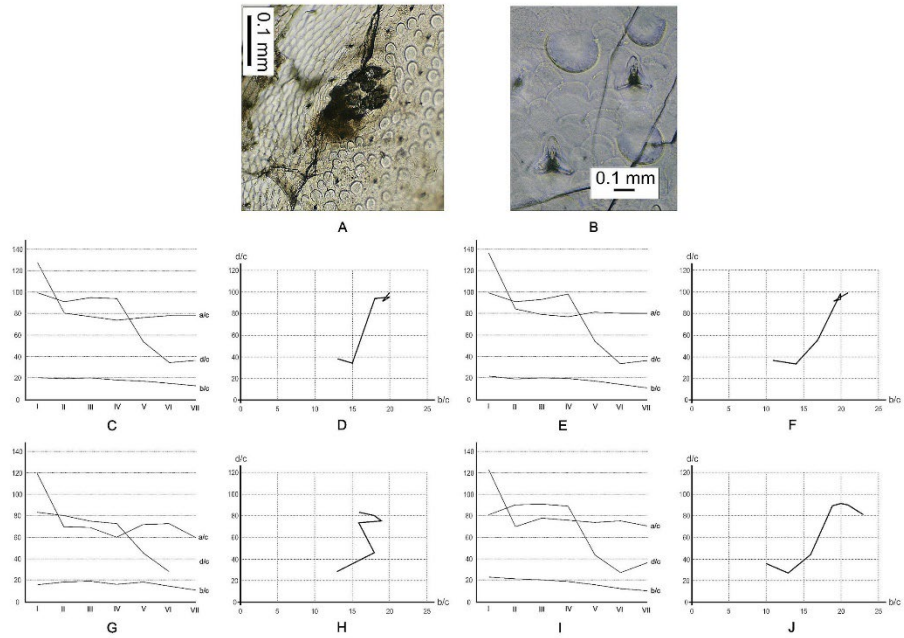

Figure 3. ***Porcellio obsoletus***: A-B) ♀ (LPS812a). **A).** glandular field; **B).** scale-setae; **C).**, **E).**, **G).**, **I).** *noduli lateralis,* ratios a/c, b/c, and d/c following Vandel (1953b, 1960) by pereonite; **D).**, **F).**, **H).**, **J).** coordinates d/c (y-axis) and b/c (x-axis) following Cifuentes and Da Silva (2024). C-D = ♀(LPS812a); E-F = ♀ (JC1166); G-H = Vandel (1955); I-J = Strouhal (1968). Scale bars: A = 0.1 mm; B = 0.01 mm.

Somatic characters: Body very broad (Figure 2A). Ocular apparatus with 24 ommatidia in 4 rows (Figure 2B). Cephalon: frontal line distinct; median lobe small, triangular, tip rounded or truncate, curved upwards; lateral lobes large, rectangular, divergent, clearly exceeding median lobe; frontal tubercle small, variably developed (Figure 2B); supra-antennal line absent. Pereon: posterior margin of pereonites I-III deeply sinuous, with pronounced, rounded lateral corner; lateral processes large and acute; epimera broad, slightly descending ventrally (Figure 2A, D). Pleon: continuous with pereon; neopleura broad, falciform (Figure 2C, E). Telson: dorsally depressed; base very short (1/3 total length), separated from tip by marked angles; tip triangular, narrow and ogival (Figure 2C). In small specimens, tip may be broad, triangular and rounded (Figure 2E).

Appendages: Antennula: with group of very small aesthetascs at tip of third segment (Fig. 4A). Antennae: reach posterior edge of pereonite III (Figure 2A, D); antennal teeth on second and third segments well developed (Figure 4B); tooth on fourth segment indicated only by pointed corner; segments two to five keeled; fifth segment longer than antennal flagellum; flagellum composed of two segments, first almost twice the length of second (Figuer 4B). Uropods: posterior margin of protopod transverse (Figure 2C, E); endopods laterally flattened, almost reaching telson tip (Figure 2C); exopods small, lanceolate (Figure 2C, E) and similar in both sexes.

Sexual characters: Male: pereopods (Figure 4C) I to III with brush of setae on carpus; pereopod VII ischium with concave ventral margin and piliferous pit on rostral surface, carpus with slightly arched tergal margin without ridge (Figure 4D); pleopod I

endopod straight, tip trilobed, one lobe with strong teeth on inner margin, and long setae (Figures 4E, 5A); pleopod I exopod with long, rounded triangular posterior lobe; respiratory field oblique, not indented (Figures 4F, 5B); pleopod II endopod very long, ending in thin tip (Figure 5C); exopod triangular with very long posterior lobe (Figure 5H). Female: pereopod VII as in Figure 4E; pleopod I exopod much wider than long, with small but distinct posterior lobe (Figure 5H); pleopod II exopod very wide and short, with triangular posterior lobe (Figure 5I). Pleopods III-V of male as in Figure 5E-G and female as in Figure 5 J-L.

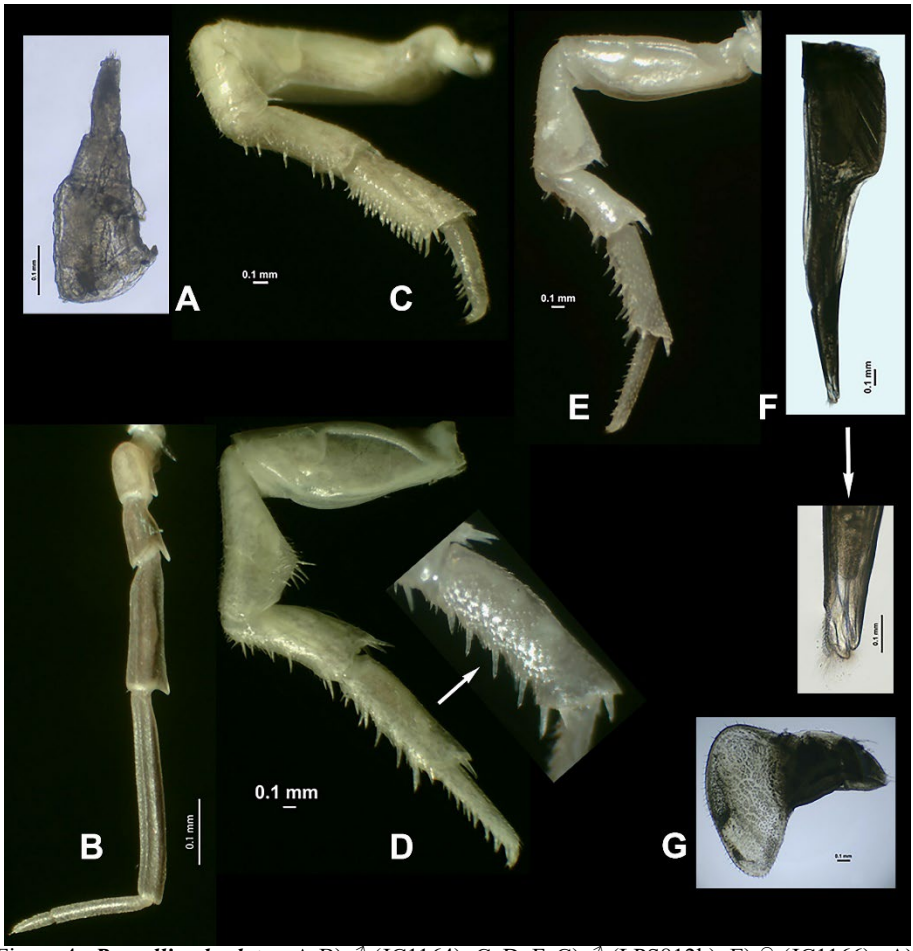

Figure 4. ***Porcellio obsoletus***: A-B) ♂ (JC1164); C, D, F, G) ♂ (LPS812b); E) ♀ (JC1166). **A).** antennula; **B).** antenna; **C).** pereopod I; **D).** pereopod VII; **E).** pereopod VII; **F).** endopod I; **G).** exopod I. Scale bars: A-G = 0.1 mm.

DISCUSSION

Budde-Lund (1885) described *Porcellio obsoletus* based on specimens from Cyprus, Turkey, and Ukraine. As was common at the time, the description provided by the Danish author was rather general, making it difficult to distinguish this species from other closely related taxa. Consequently, several authors later described 11 additional species that are now considered synonyms of *P. obsoletus*. According to Schmalfuss (2003) and Boyko et al. (2025), these include *Porcellio anatolicus* Arcangeli, 1938;

Porcellio contractus Dollfus, 1892; *Porcellio ficorum* Verhoeff, 1931; *Porcellio fissifrons* Dollfus, 1892; *Porcellio griseus* Brandt, 1833; *Porcellio hatayensis* Verhoeff, 1949; *Porcellio iskenderunus* Verhoeff and Strouhal, 1967; *Porcellio napolitanus* Verhoeff, 1930; *Porcellio parvus* Budde-Lund, 1885; *Porcellio rodiensis* Schmalfuss, 1972; and *Porcellio syriacus* Brandt, 1833. When these descriptions are considered collectively, both similarities and differences become apparent, although it is important to remember that the original description was by Budde-Lund (1885).

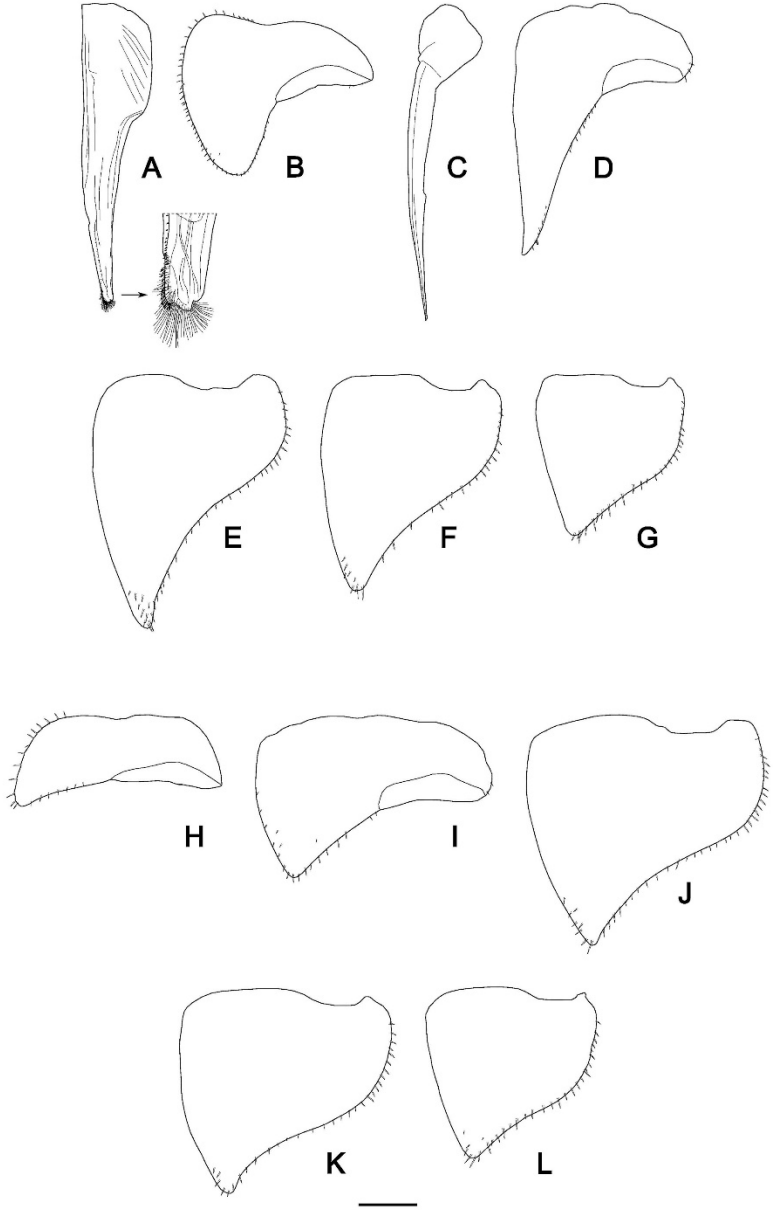

Figure 5. ***Porcellio obsoletus***: A-G) ♂ (LPS812b); H-L) ♀(LPS812a). **A).** endopod I; **B).** exopod I; **C).** endopod II; **D).** exopod II; **E).** exopod III; **F).** exopod IV; **G).** exopod V; **H).** exopod I; **I).** exopod II; **J).** exopod III; **K).** exopod IV; **L).** exopod V. Scale bars: A-L = 0.1 mm.

Table 1. Compilation of character descriptions for the taxa considered synonyms of *P. obsoletus*.

Taxa	*P. obsoletus*	*P. obsoletus*	*P. obsoletus*	*P. obsoletus*	*P. obsoletus*	*P. fissifrons*	*P. griseus*	*P. parvus*	*P. syriacus*	*P. obsoletus libanicus*	*P. obsoletus mavromoustakisi*
Reference	Budde-Lund, 1885	Verhoeff, 1907	Vandel, 1955	Strouhal, 1968	Schmalfuss, 1992	Present work	Dollfus, 1892	Brandt, 1833	Budde-Lund, 1885	Brandt, 1833	Vandel, 1955	Strouhal, 1968
Coloration	uniform dark brown	blackish brown, yellowish-grey markings	-	brown to blackish brown	Blackish; juveniles with whitish spots or lines	dark gray-brown, weakly defined insertions	dark gray, clear muscle insertions, small white spot	blackish grey without markings	grey to black, whitish lateral spots, marked muscle insertions	greenish grey, without markings	uniformly black, pale band around body	light to dark brown, pale spots
Integumentary characters												
Granulations	thin or smooth	two rows on pereonites	-	weak (cephalon, pereon), fading on pleon	weak, strong, or tuberculate	small, flattened	pronounced	marked	-	weak	smooth	thin
Glandular fields	-	near margin, concealed	small, rounded, distant from margin	-	-	big, ovoid, separated along margin	-	-	-	-	Very small, rounded	oval, near lateral margin
Scale-setae	-	-	-	-	-	small, triangular	-	-	-	-	small, triangular	small, triangular
Cephalon												
Median lobe	small	-	small or absent	very small	with or without incision	small, triangular	deeply incised	-	small, rounded	-	small	small
Lateral lobes	medium	-	small or medium	straight outer margin	-	large, rectangular, divergent	broadly rounded on inner margin	small, rounded	small, rounded	-	medium, quadrangular	small
Frontal tubercle	no	-	yes	-	-	yes, small	weakly marked	-	no	-	yes	-
Pereon												
Posterior margin of pereonite I	sinuous	sinuous	sinuous	strongly sinuous	sinuous	sinuous or strongly sinuous	slightly sinuous	-	slightly sinuous	-	strongly sinuous	-
Lateral processes	II-IV acute	-	-	-	-	large, acute	-	-	II-IV small, acute	-	marked	-
Telson tip	acute	-	-	acute	acute	triangular, narrow, ogival	acute	-	acute	-	rounded	acute
Antenna												
Length	reach at least two-thirds of body	-	-	-	-	reach pereonite III	reach half of body	-	reach half of body	-	-	-
2nd-3rd segment	prominent teeth	-	-	with teeth	-	prominent teeth	angular	-	-	-	-	-
4th segment	sharp tooth	pointed corner	-	pointed corner	-	pointed corner	angular	-	-	-	-	-
2nd-4th segment	keeled	keeled	-	keeled	-	keeled	keeled	-	keeled	-	-	-
Flagellum: 1st seg. length vs 2nd	nearly 3	2-2,5	-	2-2,5	2,5	2	1,33	-	subequal or Ist longer	-	-	-
Uropod												
Protopod	shorter than telson	-	-	shorter than telson	-	much shorter than telson	shorter than telson	-	shorter than telson	-	-	-
Exopod	male: long, conical; female: short	-	equal in both sexes	-	short, conical in both sexes	short, lanceolate in both sexes	lanceolate in male	-	short in both sexes	-	equal in both sexes	short, lanceolate in male
Male pereopod												
I carpus	-	-	brush of setae	brush of setae	-	brush of setae	-	-	-	-	brush of setae	brush of setae
I merus	-	-	-	-	-	-	-	-	-	-	-	few, broad setae
II carpus	-	-	-	-	-	brush of setae	-	-	-	-	-	-
III carpus	-	-	-	-	-	brush of setae	-	-	-	-	-	-
VII basipod	-	-	-	-	-	-	-	-	-	-	semicircular lobe	-
VII ischium	-	-	-	curved, with pits	straight	curved, setal pit	-	-	-	-	-	curved
VII carpus	-	-	-	-	without ridge	-	-	-	-	-	-	-
Male pleopod I												
Endopod, tip	-	-	setae	spines and long setae	spines and long setae	teeth and long setae, three lobes	-	-	-	-	long setae	spines and long setae
Exopod, internal tip	-	-	-	large, triangular, broad, slightly rounded	triangular, broad, slightly rounded	triangular, broad, slightly rounded	-	-	-	-	triangular, broad, slightly rounded	triangular, broad, slightly rounded

Regarding general morphological characters (Table 1), some, such as the coloration reported by different authors, may vary depending on whether the specimens were fresh or preserved; however, this information is unavailable. Some character descriptions are

also subjective, for example, a median cephalic lobe considered medium by one author may be interpreted differently by another. Taken together, these characters could indicate either a high level of intraspecific variability, as is common in other species of this genus and woodlice in general, or that different authors are referring to closely related species. This uncertainty arises because some of the most important characters for its definition, such as the male pleopods, have been little studied (Table 1). Clarification would require study of the type specimens of all species currently regarded as synonyms of *P. obsoletus* and its subspecies, which is beyond the scope of this work. Vandel (1955), in the description of the subspecies *P. obsoletus libanicus* (Figure 29), illustrates the male pereopod VII basis and the tip of the pleopod I endopod, which differ from those described for *P. obsoletus* by Strouhal (1968) and Schmalfuss (1992), as well as from our observations of Iberian specimens. The positions of the glandular fields and *noduli laterales* on the pereonites, expressed as the ratios a/c, b/c, and d/c, were compared among specimens from Portugal (Figure 3C-D), Spain (Figure 3E-F), the values reported by Vandel (1955) for *P. obsoletus libanicus* (Figure 3G-H), and those provided by Strouhal (1968) for *P. obsoletus mavromoustakisi* (Figure 3I-J). The values for the Iberian specimens in our study were similar to those from Cyprus described by Strouhal (1968) but differed from those of the Lebanese specimens described by Vandel (1955). Based on this evidence, the subspecies *P. obsoletus libanicus* (Vandel 1955) may represent a species distinct from *P. obsoletus*. The description of *P. obsoletus mavromoustakisi* provided by Strouhal (1968), together with the provided figures (p. 359, Figures 66-71) of specimens from Cyprus, closely matches the Iberian specimens examined in this study. This similarity encompasses not only integumentary characters, such as the position of the *noduli laterales*, but also morphological and sexual characteristics, thereby raising doubts on the validity of this subspecies. There is another important discrepancy in the original description of *P. obsoletus*, Budde-Lund (1885) stated that the male uropod exopods are fairly long and conical, whereas those of the females are short. In contrast, subsequent descriptions report them as short and conical or lanceolate (Table 1).

Arcangeli (1934) established the synonymy between *Porcellio sordidus* Budde-Lund, 1885 and *Porcellio obsoletus* by comparing the original descriptions of both species provided by Budde-Lund (1885). For *P. sordidus*, Arcangeli (1934) highlighted: "*lobus medius minimus, vix productus. Epistoma convexiusculum, laeve*," and for *P. obsoletus*: "*lobus medius parvus, late rotundatus, medio subemarginatus. Epistoma medio tuberculo minuto*." He noted that the notch in the median lobe may be absent and that the frontal tubercle is a slight elevation that may be overlooked, whereas in *P. sordidus* it is clearly marked. Currently, *P. sordidus* is considered a subspecies of *Porcellio hoffmannseggii* Budde-Lund, 1885 (Schmalfuss 1992; Boyko et al. 2025), and the absence of a notch in the median lobe, as mentioned by Arcangeli (1934), is more typical of *Porcellio flavocinctus* Budde-Lund, 1885, a species confused with *P. hoffmannseggii*, which does have a notch.

According to Vandel (1955), the *obsoletus* group of the eastern Mediterranean includes *Porcellio longicornis* Stein, 1859 from Bosnia-Herzegovina, Croatia, and Montenegro (Stein 1859; Budde-Lund 1885; Strouhal 1939; Schmalfuss 2003), *Porcellio piceus* Dollfus, 1895 and *Porcellio puberulus* Dollfus, 1895, both from Bosnia-Herzegovina (Dollfus 1895), and *P. obsoletus*, whose known distribution encompasses Cyprus, Croatia, Greece, Iran, Italy, Lebanon, Syria, Turkey and Ukraine (Brandt 1833; Budde-Lund 1885; Dollfus 1892; Verhoeff 1907; Arcangeli 1934; Vandel

1955; Strouhal 1936, 1968; Schmalfuss, 2003). This group is considered closely related to the Iberian group described by Vandel (1951, 1958, 1962) from the western Mediterranean. In the *obsoletus* group (Vandel, 1955), the median lobe is very small or absent, the male pereopod I carpus bears a brush of setae, the dorsal edge of the pereopod VII carpus is rounded, and the uropod exopods are short. In contrast, in the Iberian group, the median lobe is moderate, and both carpus and merus of the male pereopod I bear brushes of setae, the dorsal edge of the pereopod VII carpus has a more or less developed crest, and the uropod exopods are longer in the male than in the female. The Iberian *P. obsoletus* specimens we studied show intermediate characters between the groups. The cephalon has a small median lobe with a triangular appearance, the carpus of pereopods I and II bears a brush of setae, the pereopod VII carpus dorsal edge is slightly curved, and the exopods of the uropods are small in both sexes. However, the morphology of the *P. obsoletus* male pleopod I exopod closely resembles several characteristic species of the Iberian group, including *Porcellio duboscqui* Paulian de Félice, 1941; *Porcellio monticola* Lereboullet, 1853; *Porcellio silvestrii* Arcangeli, 1924; *Porcellio spinicornis* Say, 1818; and *Porcellio violaceus* Budde-Lund, 1885 (Vandel 1951, 1962; Cifuentes 2018). This morphological similarity underscores the difficulty of distinguishing *P. obsoletus* from closely related Iberian taxa based solely on male pleopod characters.

Until now, *P. obsoletus* was only known from the eastern Mediterranean, extending westwards to Italy. In this study, we report additional records from Portugal and Spain, resulting in a newly documented fragmented distribution. Several hypotheses can be proposed to explain this pattern. The first hypothesis is that the regions between these populations have not been thoroughly studied and that connecting populations may exist but have not yet been detected. However, the species is relatively large and not particularly difficult to find, which makes this explanation less likely. The second hypothesis suggests that *P. obsoletus* once had a much broader distribution across the Mediterranean, either before or possibly in connection with the Messinian salinity crisis, which occurred around 5.9 million years ago (Soria 2007; Mascle and Mascle 2019). This event led to the near-total dryness of the Mediterranean Sea, allowing land connections between areas that are now separated by water. During the Late Miocene (11.6-5.3 million years ago), the global climate cooled, but this cooling was less severe in what is now the Iberian Peninsula (Blanco et al. 2018). As a result, the region maintained mild temperatures and relatively high humidity (García-Alix et al. 2011), despite a general trend toward increasing aridity. These conditions are similar to those in which *P. obsoletus* populations are currently found in the Iberian Peninsula. The final refilling of the Mediterranean basin, triggered by the opening of the Strait of Gibraltar around 5 million years ago during the Early Pliocene (Soria 2007; Mascle and Mascle 2019), likely fragmented the species' distribution, isolating the Iberian populations from the rest. Although geographic isolation might be expected to lead to morphological divergence, such differentiation has not been observed in the species studied here, or in a few other terrestrial isopods for which data are available (Santamaria 2019; Dimitriou et al. 2022, 2023; Campos-Filho et al. 2023). Finally, a third possibility is human-mediated introduction. All Iberian records of *P. obsoletus* came from humid habitats with abundant precipitation, ecological conditions that differ markedly from those currently found in the eastern Mediterranean, but are associated with human-modified areas, including urban and semi-urban environments. However, only further sampling

in the Iberian Peninsula and other western Mediterranean countries, combined with genetic analyses, will help clarify the distribution of this species.

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