

Five new bogidiellid Amphipoda from Spain – the first freshwater records in the Iberian Peninsula*

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Abstract

Five new species of the amphipod genus *Bogidiella* are described from fresh groundwaters in Spain. No freshwater Bogidiellidae were known previously from the Iberian peninsula.

Introduction

During a year's sampling program in Spain, in 1984, 490 subterranean stations were sampled (Notenboom & Meijers, 1985). Additional samples were taken during Notenboom & Meijers' 1985 program (40 stations sampled). In 13 stations, bogidiellid Amphipoda were found, belonging to 4 different species.

Furthermore a number of hyporheic samples collected by Mrs. Anna I. Camacho and her colleagues of the Museo Nacional de Ciencias Naturales, Madrid, were examined. These samples contained another bogidiellid, bringing the total recorded in this paper to five species, described below.

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Descriptive part

Bogidiella (Bogidiella) hispanica n. sp.

Material. 1 ♀ (holotype), 1 ♂ (allotype), 2 ♀ (paratypes). Stn. 84-4/44. Hyporheal of Río Escabas, 9 km upstream of Priego, prov. Cuenca, UTM coordinates WK 6377, altitude 900 m, chlorinity 6 mg/l, 29 Apr. 1984 (ZMA Amph. 107.959).

1 ♂, 2 ♀. Stn. 84-5/45. Hyporheal of Río de Arcos, near confluence with Río Turia, Las Rinconadas, Santa Cruz de Moya, prov. Cuenca, coord. XK 526241, alt. 640 m, chl. 186 mg/l, 11 May 1984 (ZMA Amph. 107.960).

1 ♀. Stn. 84-7/37. Well of cortijo (=farm) El Moral, N of Río Guadalmedina, 2 km E of Casarbermeja, prov. Málaga, coord. UF 7484, alt. 700 m, chl. 226 mg/l, 30 July 1984 (ZMA Amph. 107.961).

Description. Length of the female with setose oostegites 1.56 mm; females with non-setose costegites 1.50 and 1.58 mm; male 1.39 mm (all from the type-locality).

Antenna 1 (Fig. 1a): First peduncle segment with distoventral spine. Flagellum 8-segmented, long aesthetes on segments 5 to 8. Accessory flagellum 3-segmented (♀, Fig. 1c), or 2-segmented (♂, Fig. 1b).

* Groundwater crustaceans of Spain, 3.

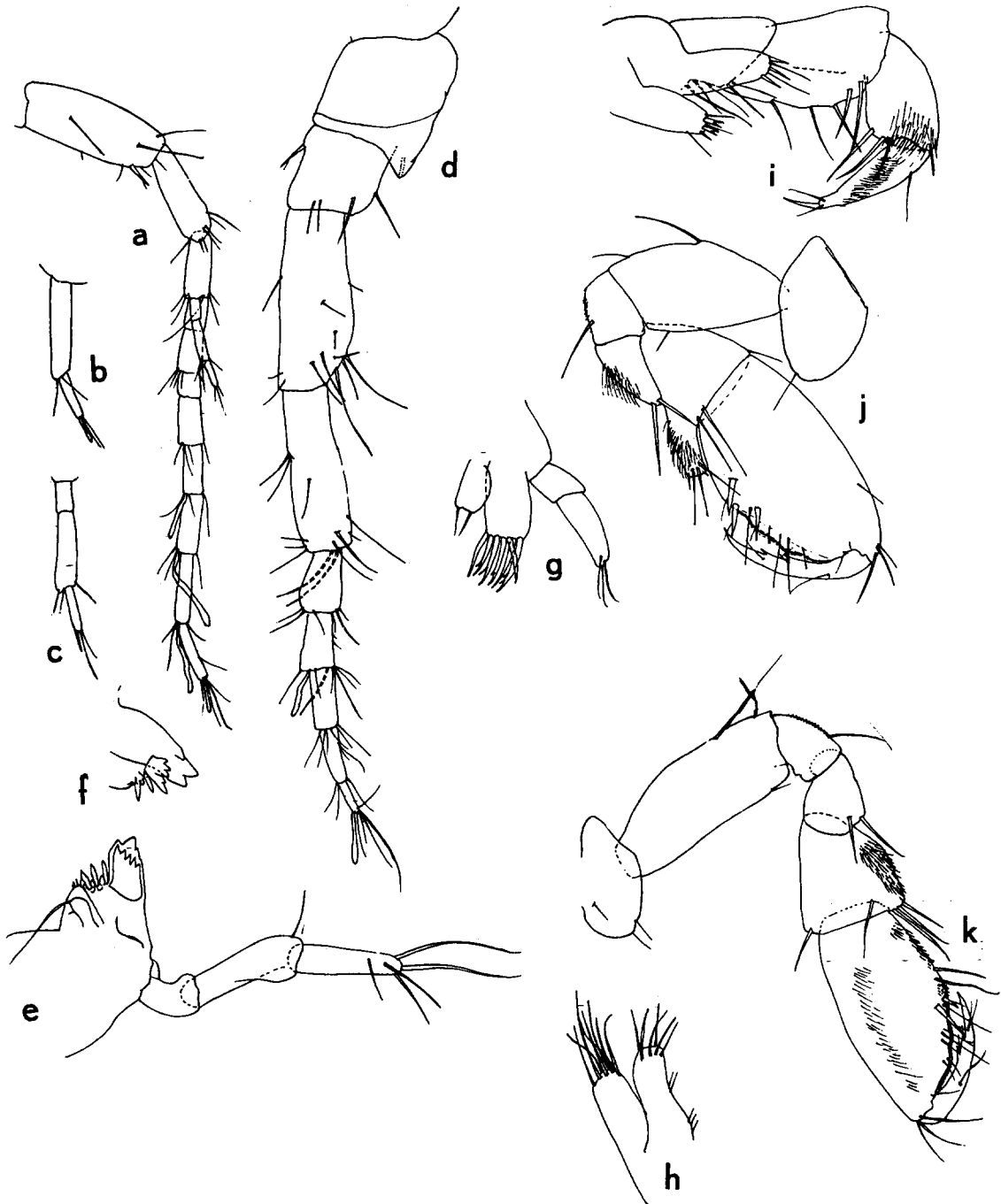


Fig. 1. *Bogidiella (B.) hispanica* n. sp. (Stn. 84-4/44). a, first antenna, ♀ (scale AD); b, accessory flagellum of first antenna, ♂ (AE); c, same of ♀ (AE); d, second antenna, ♀ (AE); e, left mandible, ♀ (AF); f, pars incisiva of right mandible, ♀ (AF); g, first maxilla, ♂ (AF); h, second maxilla, ♀ (AF); i, maxilliped, ♂ (AF); j, first gnathopod, ♀ (AE); k, second gnathopod, ♀ (AE). Scales on Fig. 6.

Antenna 2 (Fig. 1d): With short gland cone. Flagellum 5-segmented; aesthetes on segments 2 and 5.

Left and right mandibles (Figs. 1e, f) with molar seta, implanted on a palp-like prominence. Right side with 2, left side with 3 flat spines between molar and incisor. Left lacinia mobilis with 5 coarse teeth. Right lacinia bicuspidate, cusps with 3 and 2 fine teeth, respectively. Palp segment 1 unarmed; segment 2 with 1 distal seta; segment 3 with 2 subterminal and 3 terminal setae.

Maxilla 1 (Fig. 1g) with 3 setae on 2nd palp segment. Outer lobe with 7 spines; inner margin of spines with 0, 1 or 2 medial denticles. Inner lobe elliptical, with 2 distal setae.

The lobes of maxilla 2 with 8 and 6 distal setae, respectively (Fig. 1h).

Maxilliped (Fig. 1i) with 2 bifid spines on inner lobe; outer lobe with 3 simple spines. Palp as illustrated.

Gnathopod 1 (Fig. 1j) with 1 mid-posterior seta and 1 disto-posterior seta on basis. Posterior propodal margin without setae. Three palmar angle spines; palmar margin somewhat sinuous, with 2, almost setiform, bifid spines and 2 setae. Palmar index 0.52. Claw with 2 inner teeth.

Basis of gnathopod 2 (Fig. 1k) without mid-posterior seta. Posterior propodal margin with 2 setae. Two palmar angle spines; palmar margin with 3 seta-like, bifid spines and 2 setae. Palmar index 0.45.

Pereiopods 3 and 4 (Fig. 2a): Basis with only 1 anterodistal setule.

Coxal gills large, pedunculate, elongate-ovoid, on P4 through P6. Oostegites elongate, narrow, on P2 through P5.

Pereiopod 5 (Fig. 2b) very slender, shorter than P6; basis unarmed, except for 2 distal setules. Pereiopod 6 (Fig. 2c) very slender; basis as in P5. Pereiopod 7 (Fig. 2d) as long as P6; basis as in P6; propodus with a limited number of setae. Lenticular organs absent on P3 through P7 in both sexes.

Epimeral plates (Fig. 2e) with subrectangular posterior corner.

Pleopods (Fig. 2f) not sexually dimorphous. Peduncle with 2 retinacula, each with 2 inner teeth. All exopodites 3-segmented, each segment with 2 plumose setae. Distal exopodite segment long and

slender. No endopodites.

Uropod 1 (Fig. 3a): Peduncle without proximoventral spine; distal spines of rami long.

Uropod 2 (Fig. 3b) with very long spines on rami. Uropods 1 and 2 without sexual dimorphism.

Uropod 3 (Fig. 3c) with very long spines on lateral margin of exopodite, medial margin of endopodite, and distal margin of both rami.

Telson (Fig. 2g) wider than long; distal concavity wide, shallow; distal armature I+I. No sexual dimorphism.

Etymology. The specific name, *hispanica* (Latin) refers to the fact that the taxa described in this paper are the first freshwater bogidiellids recorded from Spain.

Remarks. Within the subgenus *Bogidiella* s. str. (and taking into account certain species of dubious subgeneric status, attributed provisionally to related subgenera), only four taxa share the combination of a I+I telson armature and absence of lenticular organs with the new species. These taxa are *B. italica* G. Karaman, 1979, *B. helenae* Mateus & Maciel, 1967, *B. skopljensis* (S. Karaman, 1933), and *B. longiflagellum* S. Karaman, 1959. All of these, except for *helenae*, possess setiferous pleopodal endopodites; in *helenae*, these endopodites are described as vestigial and devoid of setal armature, in the new species they are absent.

From *B. (B.) helenae* (from the mouth of river Douro, Portugal, in interstia of sand) the new species differs in following characters: (1) mandible with molar seta (absent in *helenae*); (2) left lacinia mobilis with 5 teeth (6 in *helenae*); (3) inner lobe of maxilliped with bifid spines (simple spines in *helenae*); (4) merus, carpus and propodus of P3–P7 more slender than in *helenae*; (5) anterior and posterior margins of basis of P3–P7 naked (setiferous in *helenae*); (6) terminal segment of exopodite of pleopods 1–3 elongate (very short in *helenae*); (7) terminal spines of both rami of uropods 1 and 2 long (short in *helenae*); (8) marginal spines of both rami of uropod 3 long (short in *helenae*); (9) posterior margin of basis of P1 with 2 setae (3 setae in *helenae*); (10) posterior margin of propodus of P1 without setae (1 seta in *helenae*); (11) posterior margin of basis of P2

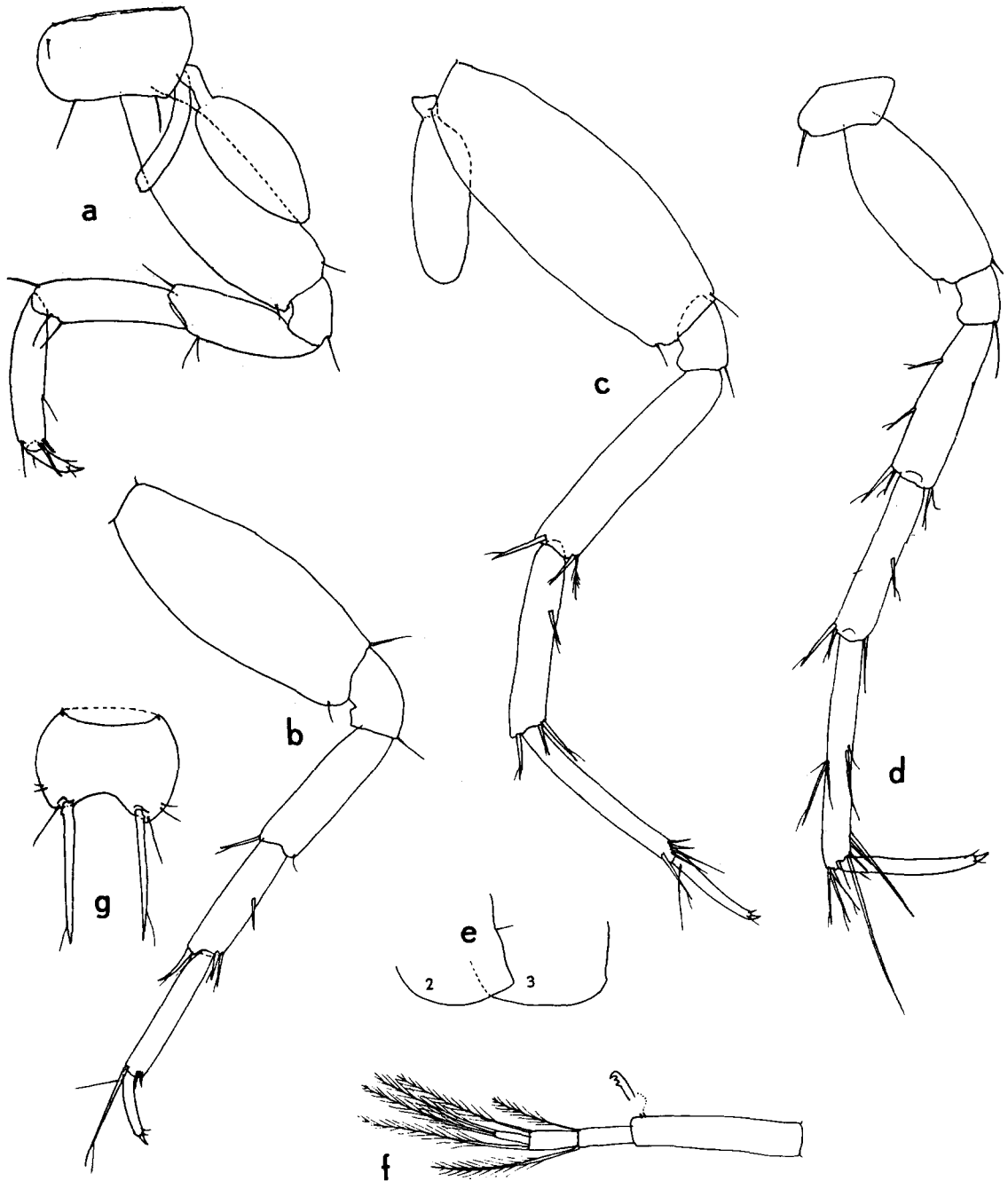


Fig. 2. *Bogidiella (B.) hispanica* n. sp. (Stn. 84-4/44). a, fourth pereopod, ♀ (scale AE); b, fifth pereopod, ♀ (AE); c, sixth pereopod, ♀ (AE); d, seventh pereopod, ♂ (AD); e, epimeral plates 2 and 3, ♂ (AD); f, second pleopod, ♀ (AD); g, telson, ♀ (AF). Scales on Fig. 6.



Fig. 3. *Bogidiella (B.) hispanica* n. sp. (Stn. 84-4/45). a, first uropod, ♀ (scale AE); b, second uropod, ♀ (AE); c, third uropod, ♀ (AE). (i = inner ramus). Scales on Fig. 6.

with 1 seta (2 setae in *helenae*); (12) accessory flagellum of female first antenna 3-segmented (2-segmented in *helenae*).

The last character needs some comment: the number of segments in the accessory flagellum of A1 is 2 in the two available males, and 3 in the females. A comparable situation is recorded for *Bogidiella (Medigidiella) vandeli* by Coineau, 1968, be it that in that case the male accessory flagellum counts one segment more than that of the female. However, it must be remarked that G. Karaman (1979: 27; 1982: 34) considers the number of segments in the accessory flagellum subject to variation and of no great taxonomic importance.

Although each of the differences 1 to 12, enumerated above, is slight, the total sum of the differences leaves little or no doubt that this freshwater form from higher altitudes (640–900 m) in Spain is different from the estuarine, low altitude taxon, *helenae*, with which it is no doubt closely related.

B. hispanica has been found in a large area in S and SE Spain, in waters draining into the river Tajo (the type-locality), as well as in waters draining into the Mediterranean (the two other stations).

Bogidiella (Bogidiella) glabra n. sp.

Material. 1 ♂ (holotype) and 5 damaged specimens

(paratypes). Stn. 84-5/45. Hyporheal of Río de Arcos, near confluence with Río Turia, Las Rinconadas, Santa Cruz de Moya, prov. Cuenca, UTM coordinates XK 526241, altitude 640 m, chlorinity 186 mg/l, 11 May 1984 (ZMA Amph. 107.953).

1 ♂ (paratype). Stn. 84-8/2. Hyporheal of Manatial (= spring) de Deifontes, Deifontes, prov. Granada, coord. VG 4732, alt. 580 m, chl. 16 mg/l, 1 Aug. 1984 (ZMA Amph. 107.954).

1 small specimen, probably this species. Stn. 85-7/11. Well at El Badil, Cantoria, prov. Almería, coord. WG 755341, alt. 440 m, chl. >200 mg/l, 19 July 1985 (ZMA Amph. 107.955).

Description. Body length of two intact males 1.33 and 1.66 mm.

Male: Antenna 1 (Fig. 4a) with distal spine on peduncle segment 1; peduncle segment 3 short. Accessory flagellum 2-segmented, short. Flagellum 7-segmented; long aesthetes on segments 5 to 7.

Antenna 2 (Fig. 4b) without peculiarities. Flagellum 5-segmented; aesthetes on segments 3 and 5.

Mandible with molar seta, implanted on palp-like basis. Two flat spines between molar and incisor. Right lacinia mobilis with 1 strong and 6 fine teeth; left lacinia with 5 coarser teeth (Figs. 4c, d). Palp segment 1 unarmed; segment 2 with 1 distal seta; segment 3 with 2 distal and 2 subdistal setae.

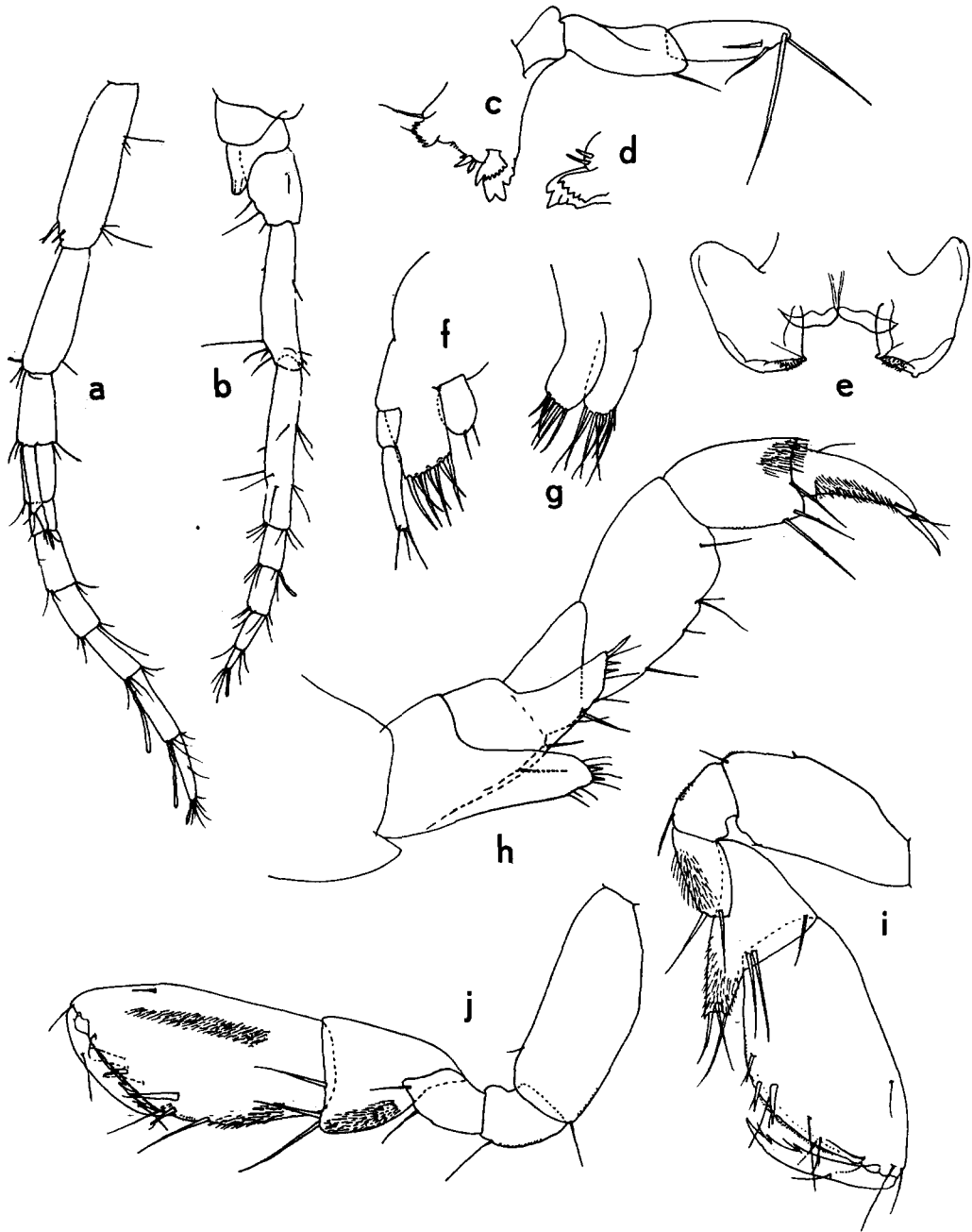


Fig. 4. *Bogidiella (B.) glabra* n. sp. (♀, Stn. 84-5/45). a, first antenna (scale AD); b, second antenna (AD); c, right mandible (AF); d, pars incisiva of left mandible (AF); e, lower lip (AF); f, first maxilla (AF); g, second maxilla (AF); h, maxilliped (AF); i, first gnathopod (AE); j, second gnathopod (AE). Scales on Fig. 6.

Lower lip (Fig. 4e) with wide inner lobes.

Maxilla 1 (Fig. 4f) with slender, 2-segmented palp, distally armed with 3 setae. Outer lobe with 7 smooth spines. Inner lobe rounded, with 2 distal setules.

Lobes of maxilla 2 with 8 and 6 setae, respectively (Fig. 4g).

Maxilliped (Fig. 4h) with 2 simple spines on inner lobe, and 3 simple spines on outer lobe. Palp segments 2 and 3 with low number of short setae.

Gnathopod 1 (Fig. 4i): Anterior margin of basis without long setae, posterior margin with 2 setae. Carpal projection with 3 setae. Propodus ovate; palmar angle with 1+2 spines; palmar margin with 1, bifid, seta-like spine only. Palmar index 0.50. Claw with 2 inner teeth.

Gnathopod 2 (Fig. 4j): Anterior margin of basis without long setae, posterior margin with 1 distal seta only. Propodus subrectangular; palmar margin short, with 1 bifid spine only; 2 palmar angle spines; palmar index 0.45. Claw with 2 inner teeth.

Pereiopods 3 (Fig. 5b) and 4 similar, with lenticular organ. All segments very scantily armed with setules.

Pereiopod 5 shorter than 6. Pereiopod 6 (Fig. 5c) very scantily armed; claw not very slender. Pereiopod 7 (Fig. 5d) longer than 6; spiny armature scarce; propodus with 3 or 4 long setae; dactylus moderately slender. Lenticular organs present on P5 through P7.

Coxal gills (Fig. 5a) on P4 through P6; long, slender, tapering, stalked.

Epimeral plates 1 to 3 (Fig. 5e) with rounded ventroposterior corner.

Pleopods 1 to 3 unmodified, similar to those of *Bogidiella (Medigidiella) uncinata* (vide infra); no endopodites.

Uropod 1 (Fig. 5f) without proximoventral peduncular spine. Exopodite with 1 long and 3 shorter distal spines. Endopodite with 2 longer and 2 shorter distal spines.

Uropod 2 (Fig. 5g) unmodified; armature of rami as in uropod 1.

Uropod 3 (Fig. 5h) with long spines on outer margin of exopodite and inner margin of endopodite. Distal armature of both rami dominated by a very long spine (up to about 70% of the length of the ramus).

Telson (Fig. 5i) longer than wide, with rather deep

and narrow, V-shaped distal emargination. Distal armature I+I.

Remarks. In many respects similar to *B. (B.) helenae* Mateus & Maciel, 1967, but differing in the presence of lenticular organs on P3 through P7; the longer, pointed, coxal gills; the longer spines on uropod 3; and the deeper incision of the telson.

Also similar to *B. (B.) hispanica* (vide supra), but differing in having simple (instead of bifid) spines on the inner lobe of the maxilliped, the presence of lenticular organs, the unadorned spines on the outer lobe of maxilla 1, and the telson which is longer than wide and has a deeper incision.

With *B. (Medigidiella) uncinata* (vide infra), it agrees in the presence of lenticular organs, and the shape of the telson, but it differs in the number of telson spines (I+I, against II+II, rarely I+I, in *uncinata*), the unmodified armature of uropod 2 ♂, the unadorned spines on the outer lobe of maxilla 1, the scanty armature of P5 to P7, the different shape of the coxal gills, the rounded epimeral plates, etc.

The following non-Iberian taxa of the subgenus *Bogidiella* combine a telson armature of I+I with the presence of lenticular organs:

– *B. albertimagni* Hertzog, 1933 (different in a 3-segmented accessory flagellum, a less deeply incised telson, the presence of a proximoventral peduncular spine on uropod 1, and pointed epimera);

– *B. lindbergi* Ruffo, 1958 (different in smaller coxal gills, a convex distal telson margin, and a very small accessory flagellum);

– *B. glacialis* S. Karaman, 1959 (different in the presence of a proximoventral peduncular spine on uropod 1, and in having 3 setae, instead of 2, on the inner lobe of maxilla 1);

– *B. ruffoi* Birstein & Ljovuschkin, 1968 (different in having a very small accessory flagellum, a less deeply incised telson, and the absence of setae on the second mandibular palp segment);

– *B. ichnusae* Ruffo & Vigna, 1975 (different in the presence of a proximoventral peduncular spine on uropod 1, the presence of more palmar margin spines in P1 and P2, and in more spiny P5 to P7);

– *B. ichnusae africana* G. Karaman & Pesce, 1980

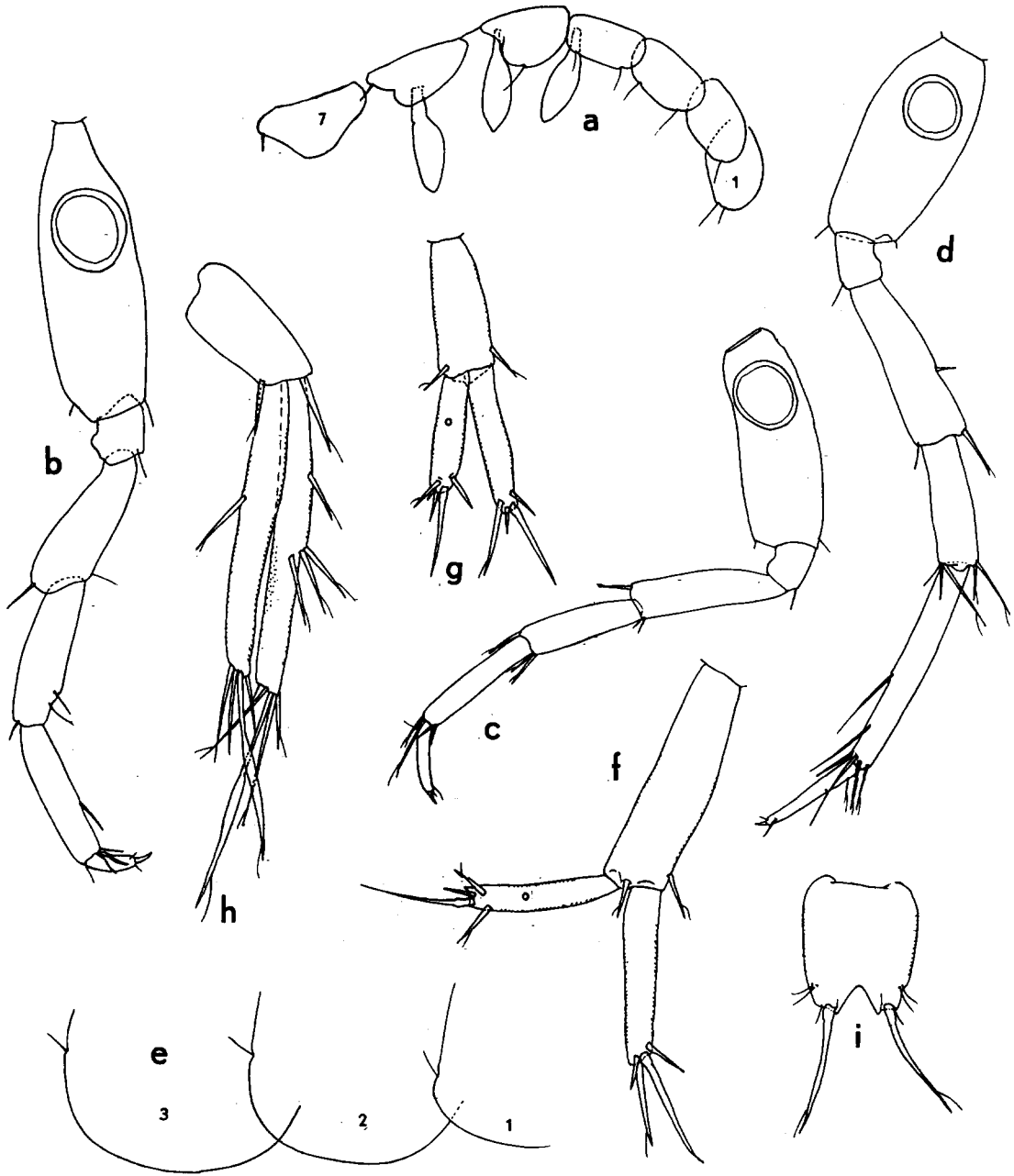


Fig. 5. Bogidiella (B.) glabra n. sp. (h: ♂ from Stn. 84-8/2; a: ♂ from Stn. 84-5/45; remaining figures: ♀ from Stn. 84-5/45). a, coxal plates 1 to 7 (scale AD); b, third pereopod (AE); c, sixth pereopod (AD); d, seventh pereopod (AD); e, epimeral plates 1 to 3 (AE); f, first uropod (AE); g, second uropod (AE); h, third uropod (AE); i, telson (AF). (o = outer ramus). Scales on Fig. 6.

(different in having denticulated spines on outer lobe of maxilla 1, the presence of a peduncular spine on uropod 1, pointed epimeral plates, and shorter spines on uropod 2).

Etymology. The specific name, *glabra* (Latin, smooth) alludes to the scarce spinosity of the legs and the glabrous spines on the outer lobe of maxilla 1.

Bogidiella (Bogidiella) convexa n. sp.

Material. 1 ♂ (holotype), 1 ♀ (allotype), 9 paratypes. Hyporheal of Río Jarama at Torrelaguna (40°50'N 03°33'W), prov. Madrid, 6 Mar. 1984 (holotype and 3 paratypes in Zoölogisch Museum, Amsterdam, ZMA Amph, 107.943 a-b; allotype and remaining paratypes in Museo Nacional de Ciencias Naturales, Madrid, MNCNM).

2 paratypes. Same locality, same date, sample taken at a slightly different place (MNCNM).

2 fragmentary specimens, probably this species. Hyporheal of Río Jarama at Talamanca del Jarama (40°44'N 03°33'W), prov. Madrid, 17 Aug. 1983 (MNCNM).

Description. Body length of ♂ holotype 1.69 mm, of ♀ paratype 1.77 mm.

Antenna 1 similar to that of *B. hispanica*; flagellum 8-segmented, accessory flagellum 3-segmented. Aesthetes on flagellum segments 1(!) to 8, and on accessory flagellum segment 3.

Antenna 2 as in *B. hispanica*, but gland cone slightly less wide. Flagellum 5-segmented, aesthetes on segments 2 and 5.

Upper lip as illustrated (Fig. 6a). Mandible palp (Fig. 6d) with 4 setae on segment 3. Right lacinia mobilis (Fig. 4b) bifid, proximal cusp with 4 fine teeth, distal cusp with 4 coarser teeth. Left lacinia simple, with 6 teeth (Fig. 6c). Molar very reduced, with 3 teeth only; molar seta present on both sides, long, implanted on palp-like process.

Lower lip (Fig. 6e) with narrow, pointed outer lobes.

Maxilla 1 (Fig. 6f) and maxilla 2 similar to those of *hispanica*; the latter appendage with 8 setae on inner lobe and 9 setae on outer lobe. Maxilliped as in *hispanica*.

First gnathopod (Fig. 7a): Coxal plate wider than in *hispanica*. Basis more slender than in *hispanica*; setae slightly longer. Palma more oblique than in *hispanica*; palmar margin somewhat sinuous and armed with setae only, as in *hispanica*. Palmar index 0.50.

Second gnathopod (Fig. 7b) similar to that of *hispanica*; palmar margin with 2 bifid spines only. Palmar index 0.48.

Pereiopods 3 and 4 (Fig. 7c): Basis more slender than in *hispanica*; no lenticular organs (♂, ♀). Oostegites linear (Fig. 7f); setosity concentrated near distal end. Coxal gills as in *hispanica*.

Pereiopod 5 (Fig. 7d) similar to that of *hispanica*; unguis extremely small. No lenticular organ. Pereiopod 6 lacking in all specimens examined. Pereiopod 7 (Fig. 7e) not unlike that of *hispanica*; unguis very small. No lenticular organ.

Epimeral plates (Fig. 6g) with rectangular posteroventral angle, ending in a minute tooth.

Pleopods 1 to 3 as in *hispanica*, without sexual dimorphism.

Uropod 1 (Fig. 6h) with strong proximoventral peduncular spine. Uropod 2 (Fig. 6i) without sexual dimorphism, rami short. Uropod 3 with long spines (Fig. 6j).

Telson (Fig. 6k) wider than long; distal margin straight to slightly convex; distal armature I+I.

Remarks. This species is in many respects very similar to *B. (B.) hispanica* but differs in the presence of a proximoventral peduncular spine on uropod 1, the absence of a distal incision of the telson, a more slender basis of pereiopods 3 and 4, and in the minute unguis of pereiopods 5 through 7.

This is the only species of the subgenus *Bogidiella* in the Iberian peninsula with a proximoventral peduncular spine in uropod 1; all other species showing this character belong to the subgenus *Medigidrella*. It is also the only Iberian species with a non-emarginate telson.

B. convexa has been found on the central Spanish plateau, in river interstia of the Río Jarama, north of Madrid, in altitudes between 600 and 800 m. This river is part of the drainage system of the river Tajo, discharging into the Atlantic Ocean.

Etymology. The specific name, *convexa* (Latin), al-

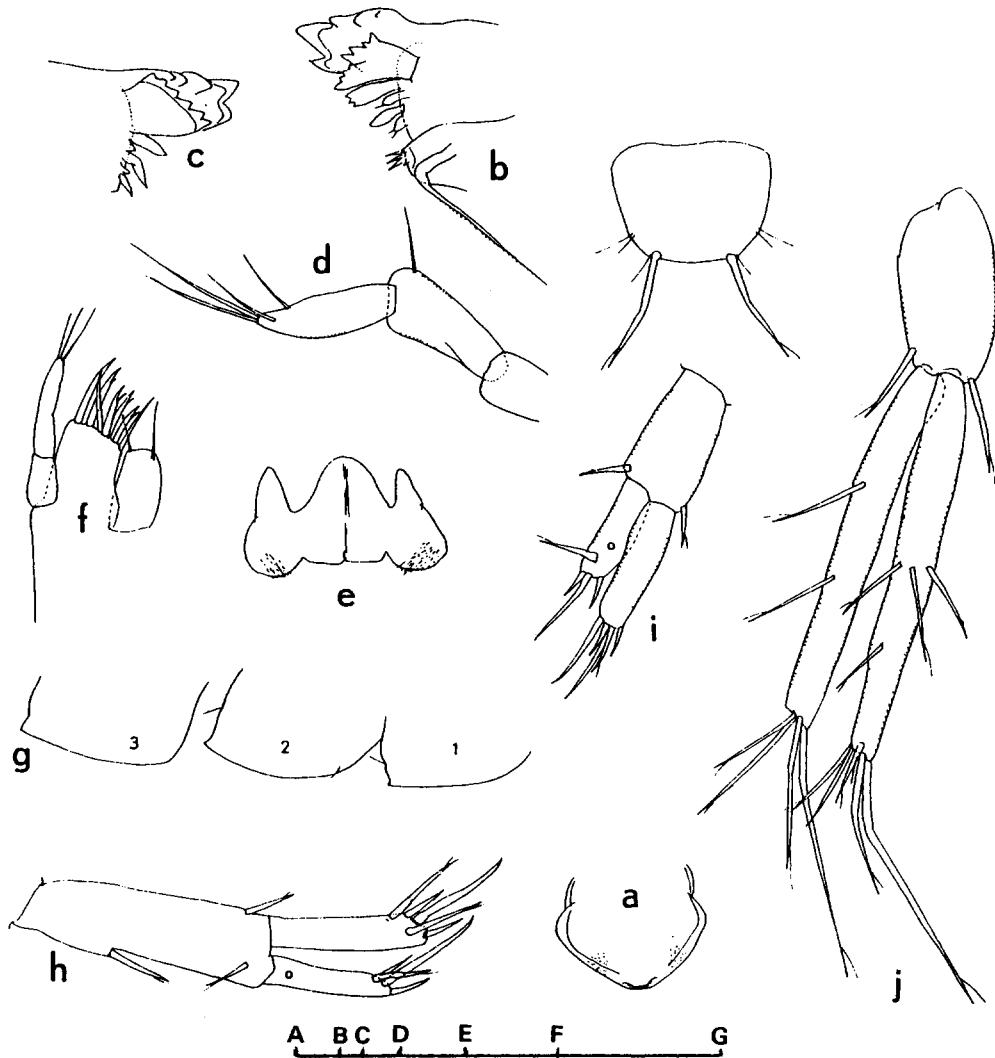


Fig. 6. *Bogidiella (B.) convexa* n. sp. (from type-locality; a–j, ♂; k, ♀). a, upper lip (scale AE); b, right mandible (AG); c, pars incisiva of left mandible (AG); d, mandible palp (AF); e, lower lip (AE); f, first maxilla (AF); g, epimeral plates 1–3 (AD); h, first uropod (AE); i, second uropod (AE); j, third uropod (AE); k, telson (AF). (o = outer ramus). Each scale unit (AB, AC...AG) represents 100 μ m.

ludes to the non-emerginate distal margin of the telson.

Bogidiella (Medigidiella) uncinata n. sp.

Material. 1 ♀ (holotype), 1 ♂ (allotype), 5 ♀ and 1 ♂ (paratypes). Stn. 84-5/71. Hyporheal of Río Cabriel, Baños de Fuente Podrida, Requena, prov. Valencia, UTM coordinates XJ 430559, altitude 400 m, chlorinity 102 mg/l, 17 May 1984 (ZMA Amph. 107.957).

4 ♀ (plus 1 ♀ doubtfully belonging to this spe-

cies). Stn. 84-1/8. Hyporheal of Río Guadalimar, Cotillas, prov. Albacete, coord. WH 4155, alt. 900 m, chl. 28 mg/l, 25 Jan. 1984 (ZMA Amph. 107.963).

2 ♀. Stn. 84-1/28. Hyporheal of Río de Aguas, Los Molinos del Río Aguas, Sorbas, prov. Almería, coord. WG 8205, alt. 350 m, chl. 250 mg/l, 30 Jan. 1984 (ZMA Amph. 107.958).

6 ♀. Stn. 84-5/36. Hyporheal of Río Pequeña, bridge at Onda, Espadilla, prov. Castellón, coord. YK 259349, alt. 260 m, chl. 16 mg/l, 9 May 1984 (ZMA Amph. 107.968).

1 ♂ (plus 1 ♂ doubtfully belonging to this spe-

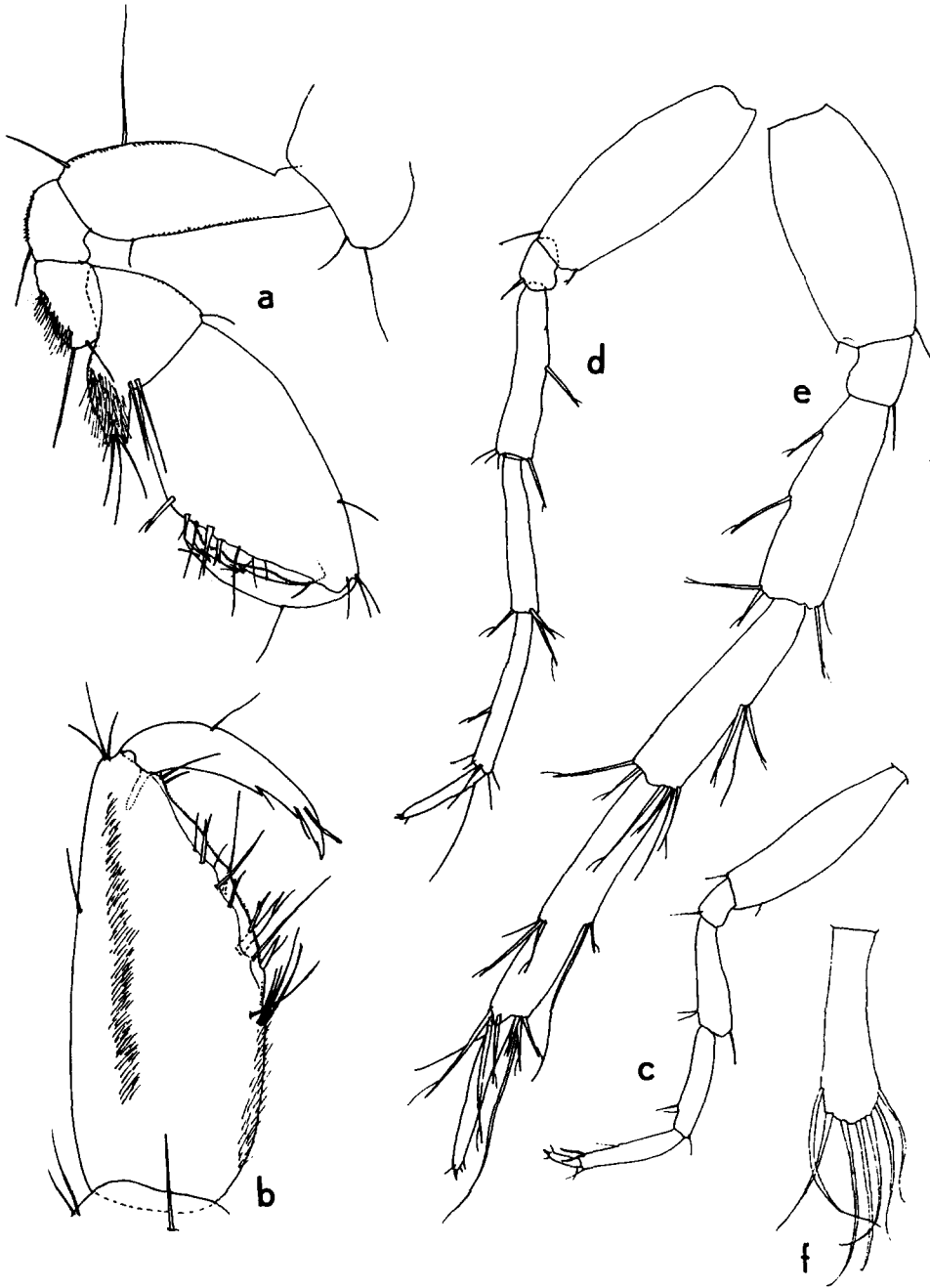


Fig. 7. *Bogidiella (B.) convexa* n. sp. (from type-locality; a–e, ♂; f, ♀). a, first gnathopod (scale AE); b, propodus of second gnathopod (AF); c, fourth pereopod (AD); d, fifth pereopod (AD); e, seventh pereopod (AD); f, oostegite (AE). Scales on Fig. 6.

cies). Stn. 84-5/45. Hyporheal of Río de Arcos, near Río Turia, Las Rinconadas, Santa Cruz de Moya, prov. Cuenca, coord. XK 526241, alt. 640 m, chl. 186 mg/l, 11 May 1984 (ZMA Amph. 107.964).

1 specimen, doubtfully belonging to this species.

Stn. 84-3/23. Hyporheal of Río Turia, bridge at Liria, Villamarchante, prov. Valencia, coord. YJ 045840, alt. 95 m, chl. 142 mg/l, 6 Mar. 1984 (ZMA Amph. 107.965).

22 specimens (♀ ♀ and juveniles). Stn. 84-7/40.

Hyporheal of Río Vélez, 2 km downstream of Viñuela, prov. Málaga, coord. UF 9979, alt. 110 m, chl. 22 mg/l, 30 July 1984 (ZMA Amph. 107.966).

3 ♀. Stn. 84-8/1. Hyporheal of Manantial (=spring) de Alomartes, Alomartes, Illora, prov. Granada, coord. VG 1925, alt. 600 m, chl. 14 mg/l, 1 Aug. 1984 (ZMA Amph. 107.969).

2 ♀. Stn. 84-8/2. Hyporheal of Manantial (=spring) de Deifontes, Deifontes, prov. Granada, coord. VG 4732, alt. 580 m, chl. 16 mg/l, 1 Aug. 1984 (ZMA Amph. 107.970).

1 ♀. 85-7/11. Well at El Badil, Cantoria, prov. Almería coord. WG 755341, alt. 440 m, chl. >200 mg/l, 19 July 1985 (ZMA Amph. 107.967).

Description. Body length ranging from 1.8 mm (smallest males) to 2.7 mm (largest females).

Antenna 1 (Fig. 8a) with 2 spines on ventral margin of peduncle segment 1. Accessory flagellum (Fig. 8) 3- (rarely 2-) segmented. Flagellum 8-segmented, long aesthetes on segments 3 to 8.

Antenna 2 (Fig. 8c) with narrow gland cone. Flagellum 4- to 5-segmented; aesthetes on the 2nd and distal segments.

Upper lip (Fig. 8d) not very wide.

Mandible with molar seta on both sides; this seta implanted on a curved, finger-shaped projection (Fig. 8e). Three flat spines and 3 ciliated buds between molar and incisor. Left lacinia mobilis (Fig. 8e) with 5 coarse teeth, right lacinia (Fig. 8f) bifid, one cusp with 7 larger teeth, the other finely toothed. Palp segment 1 unarmed, segment 2 with 2 ventral setae, segment 3 with 3 distal and 1 subdistal setae.

Lower lip (Fig. 8g) with wide inner lobes.

Maxilla 1 (Fig. 8h) of usual type. Palp segment 2 with 3 setae. Outer lobe with 7 distal spines, each spine bearing 0, 1, or 2 medial denticles. Inner lobe short and wide, with 2 short distal setae.

Maxilla 2 (Fig. 8i): outer lobe with 6+3 setae, inner lobe with 7 setae.

Maxilliped (Fig. 8j): Inner lobe with 2 distal, bifid spines. Outer lobe with 3 simple distal spines. Palp segment 3 not widened, with row of long medial setae and mediobasal row of fine setules.

Gnathopod 1 (Fig. 9a) with 1 mid-posterior and 1 disto-posterior seta on basis. Projection of carpus bearing 3 setae. Propodus ovate, posterior margin

with 1 seta. Palmar margin long; palmar angle with some 6 bifid spines (Fig. 9b); palmar index 0.50. Inner margin of claw with 2 teeth.

Gnathopod 2 (Fig. 9c): Basis as in P1. Propodus more elongate, posterior margin with 1 group of setae. Palma shorter than in P1, palmar index 0.37; palmar angle with 2 spines; palmar margin with ca. 5 bifid spines (Fig. 9d). Claw with 2 inner teeth.

Pereiopods 3 (Fig. 8k) and 4 similar, with circular lenticular organ in female. In male, this organ is absent or vestigial. Coxal gills ovate, small, pedunculate (Fig. 8m), on P4 through P6. Oostegites linear, with long setae in distal third (Fig. 8l), on P2 through P5.

$P5 < P6 < P7$, with lenticular organs in ♀ (absent or vestigial in ♂). Distal segments of P7 not excessively slender; propodus of P7 with numerous long setae on anterior margin (Figs. 9e, f, g).

Epimeral plates (Fig. 10a) with rectangular posteroventral corner, ending in minute tooth.

Pleopods not sexually dimorphous: pl.1 > pl.2 > pl.3. Exopodite 3-segmented, each segment with 2 plumose setae (Fig. 10b). Retinacula with 2 inner denticles. Endopodites absent.

Uropod 1 (Fig. 10c) not sexually dimorphous; with strong proximoventral peduncular spine. Endopodite stronger than exopodite, former with 5 distal distal spines, latter with 4 distal spines; several of these spines very long.

Uropod 2 (Fig. 10d) sexually dimorphous: longest endopodal spine 'normal' in ♀, distally provided with minute recurved hook in ♂ (Fig. 10e, f).

Uropod 3 (Fig. 10g) armed with long spines on peduncle, on outer margin and tip of exopodite and on inner margin and tip of endopodite.

Telson (Fig. 10h) longer than wide, not sexually dimorphous, with II+II long distal spines; distal margin with narrow, rather deep, emargination.

Variability. One female from Stn. 84-1/8, 1 male from Stn. 84-5/45, and a specimen from Stn. 84-3/23 have a telson armature of I+I, but seem otherwise undistinguishable from *B. (M.) uncinata*. In the light of similar variations in the telson armature of *B. (M.) antennata* (vide infra), we do not feel justified to attribute a special taxonomic status to these specimens.

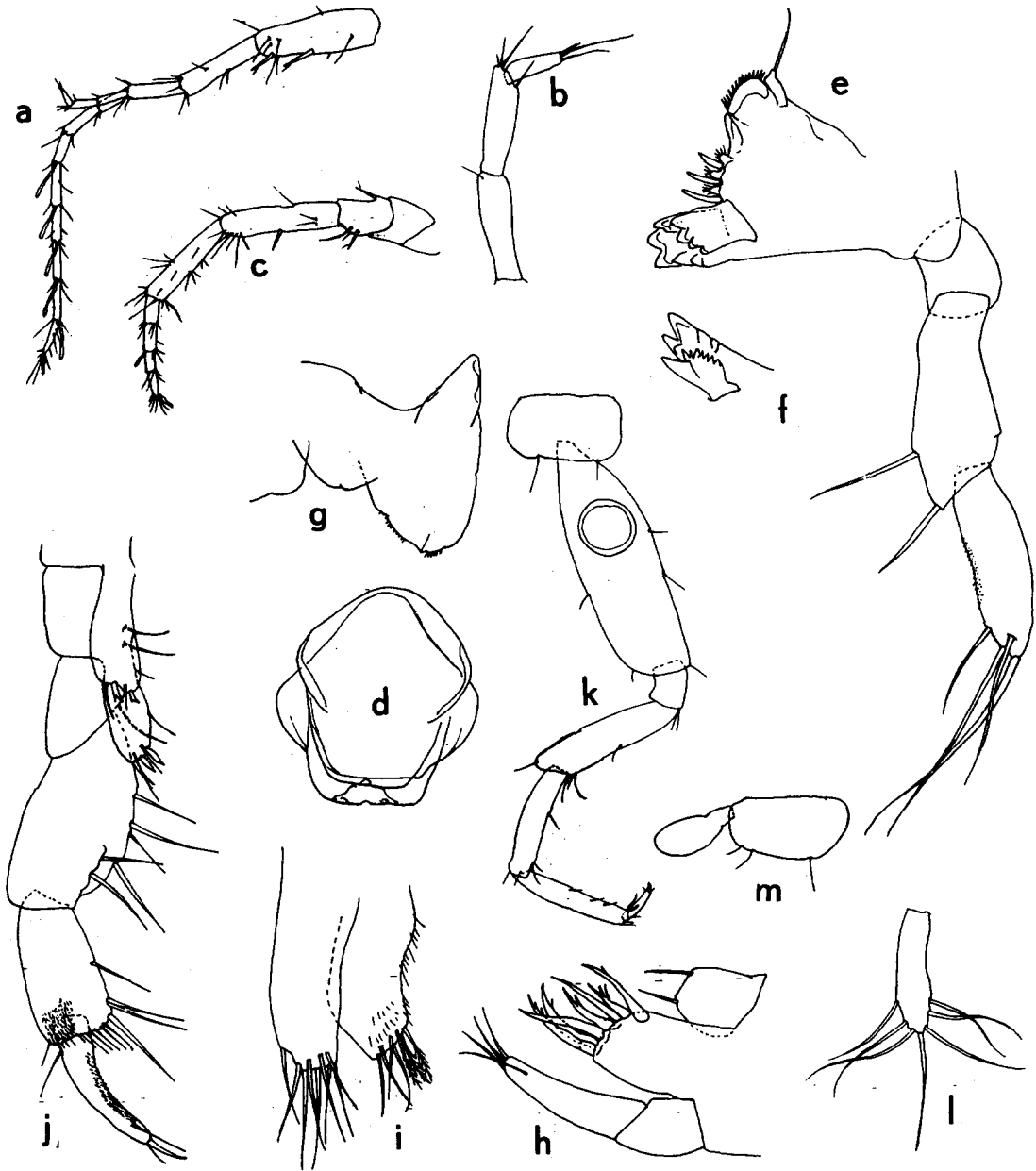


Fig. 8. *Bogidiella (Medigidiella) uncinata* n. sp. (♀, from Stn. 84-5/71). a, first antenna (scale AB); b, accessory flagellum (AE); c, second antenna (AB); d, upper lip (AE); e, left mandible (AF); f, pars incisiva of right mandible (AF); g, lower lip (AF); h, first maxilla (AF); i, second maxilla (AF); j, maxilliped (AE); k, third pereiopod (AC); l, oostegite of third pereiopod (AC); m, coxal plate and gill of fourth pereiopod (AC). Scales on Fig. 6.

Etymology. The specific name, *uncinata* (from *uncinus*, Latin) means 'provided with a hook' and alludes to the transformed spine on the male second uropod.

Remarks. By the presence of a modified element on the endopodite of uropod 2 of the male, and by the absence of sexual dimorphism in the pleosomal appendages, *B. uncinata* classifies with the subgenus *Medigidiella*.

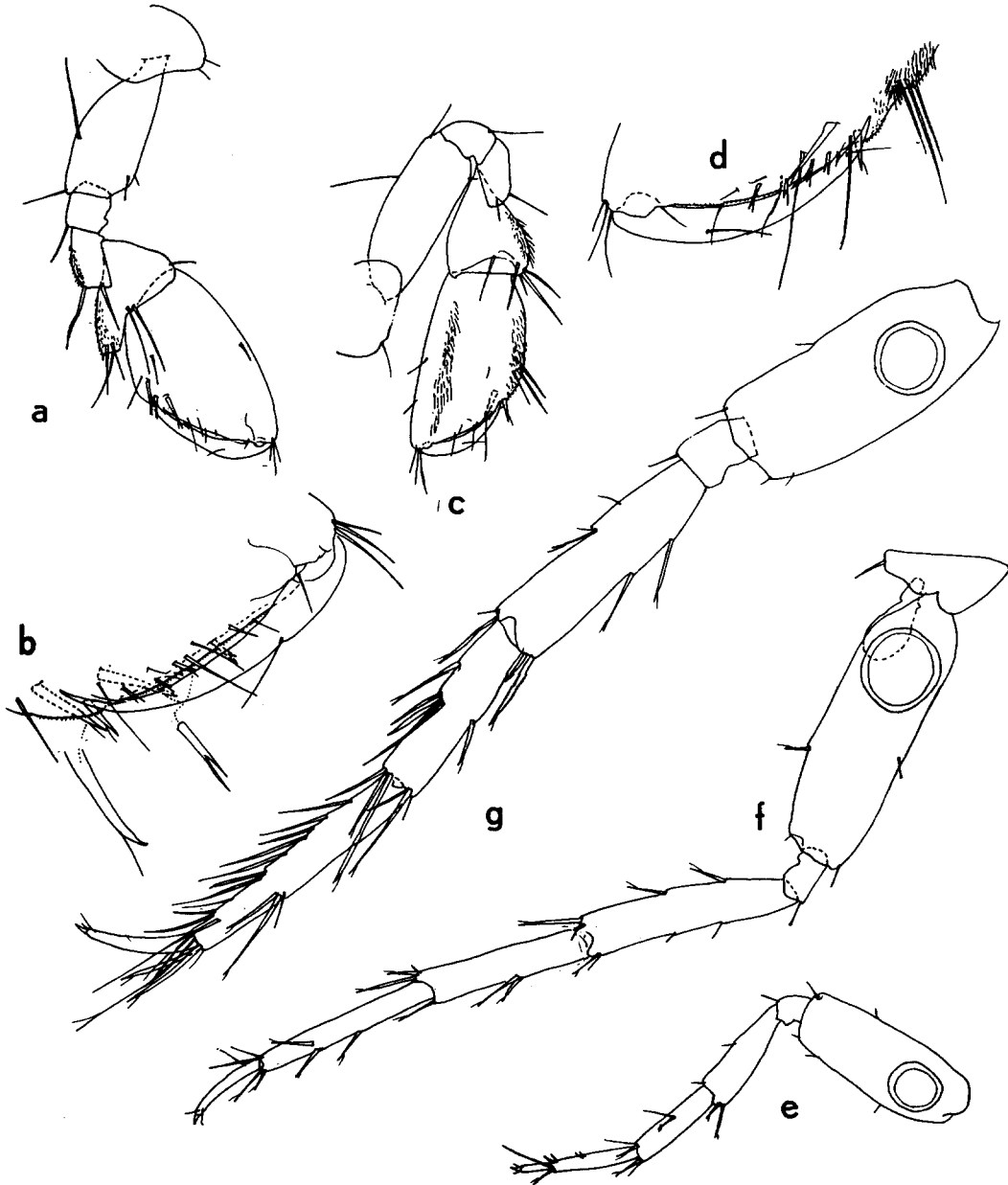


Fig. 9. *Bogidiella (Medigidiella) uncinata* n. sp. (♀, Stn. 84-5/71). a, first gnathopod (scale AC); b, palma of first gnathopod (AE); c, second gnathopod (AC); d, palma of second gnathopod (AE); e, fifth pereiopod (AC); f, sixth pereiopod (AC); g, seventh pereiopod (AC). Scales on Fig. 6.

The following species differ from *uncinata* by the presence of a setiferous endopodite in the pleopods: *sarawacensis* Stock, 1983, *silverii* Pesce, 1981, *hebraea* Ruffo, 1963, *vandeli* Coineau, 1968 (♂ only), *italica* G. Karaman, 1979.

Of the remaining species of *Medigidiella*, two (*arganoi* Ruffo & Vigna, 1973 and *parichnusae* G. Karaman, 1979) lack lenticular organs on the basis of the female pereiopods.

The only species which combines the presence of

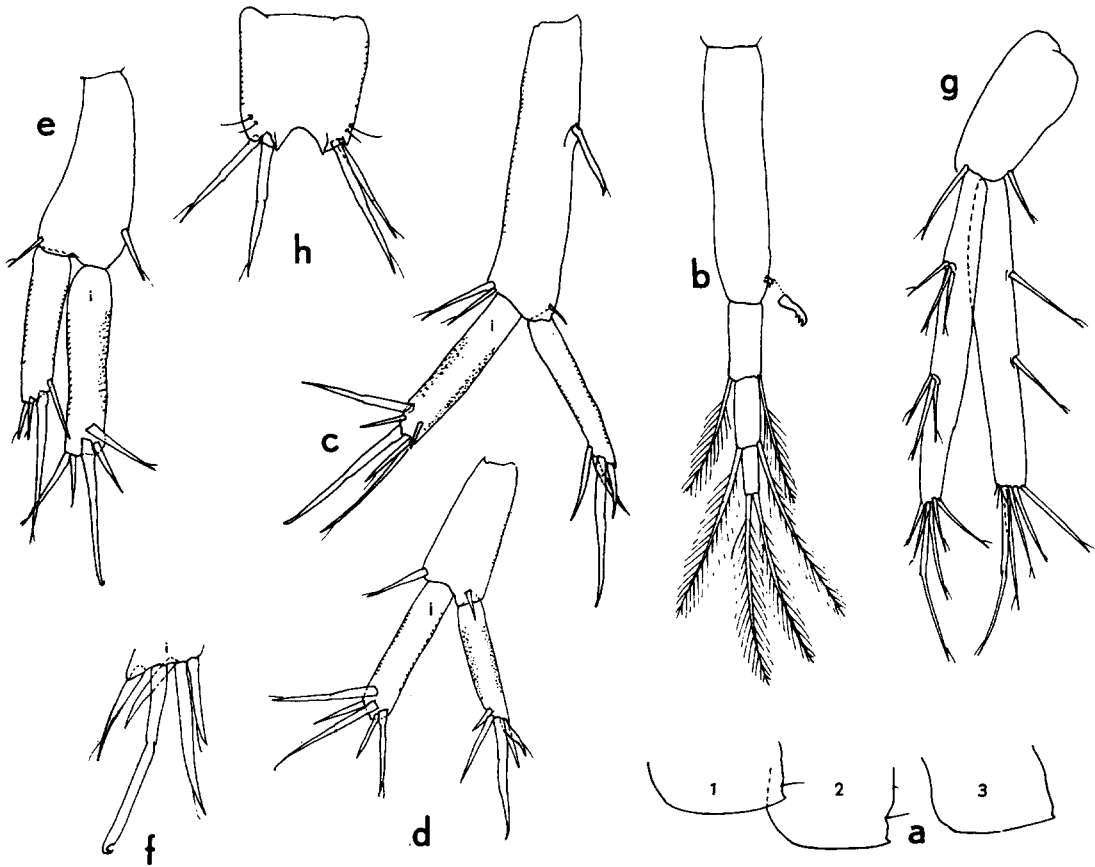


Fig. 10. *Bogidiella (Medigidiella) uncinata* n. sp. (Stn. 84-5/71). a, epimeral plates 1-3, ♂ (scale AC); b, second pleopod, ♂ (AD); c, first uropod, ♀ (AD); d, second uropod, ♀ (AD); e, second uropod, ♂ (AE); f, tip of endopodite of second uropod, ♂, in lateral view (AF); g, third uropod, ♀ (AD); h, telson, ♀ (AE). Scales on Fig. 6.

lenticular organs with the absence of pleopodal endopodites is *B. (M.) chappuisi* Ruffo, 1952. This species, as redescribed by G. Karaman, 1979, differs clearly from *B. uncinata* in the second male uropod (with long spines, one of which distally hooked, in *uncinata*, with short spines, one or two of which denticulated, in *chappuisi*), in uropods 1 and 3 of both sexes (longer spines in *uncinata*), and in the lower lip of both sexes (larger inner lobes in *uncinata*).

The new species differs also in its habitat from *B. (M.) chappuisi*, which is a brackish to marine, coastal interstitial species, whereas *B. (M.) uncinata* occurs in fresh to oligohaline inland interstitial waters.

Bogidiella (Medigidiella) antennata n. sp.

Material. 1 ♀ (holotype), 1 ♂ (allotype), 1 ♀ (para-

type). Stn. 84-5/65. Well, 1.6 km NNE of Vallada, 200 m NW of Rio Cañoles, prov. Valencia, UTM coordinates YJ 014095, altitude 240 m, chlorinity 100 mg/l, 16 May 1984 (ZMA Amph. 107.962).

Description. Length holotype (non-setose oostegites) 1.56 mm, length allotype 1.66 mm, length paratype (non-setose oostegites) 1.71 mm.

Antenna 1 (Fig. 11a) very elongate. Peduncle segments 2 and 3 slender and narrow. Accessory flagellum 3-segmented, very slender, overreaching flagellum segment 3. Flagellum 8-segmented, very slender; aesthetes on segments 3 to 8 and on accessory flagellum segment 3.

Antenna 2 (Fig. 11b) 57% of length of first. Peduncle segments 4 and 5 slender. Flagellum 5-segmented; fat aesthetes on segments 2 and 5.

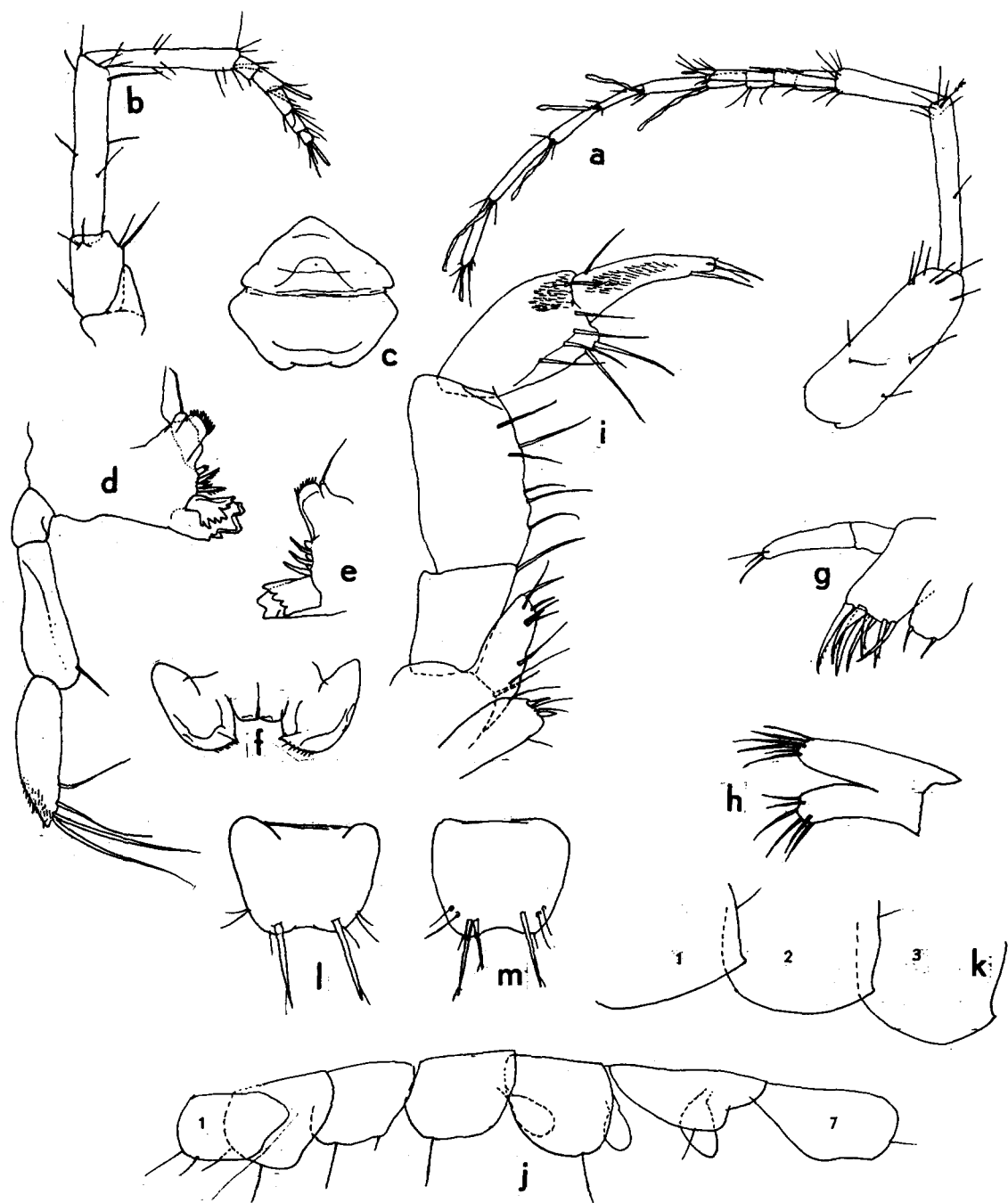


Fig. 11. *Bogidiella (Medigidiella) antennata* n. sp. (m, ♂; all other figures, ♀; all from Stn. 84-5/65). a, first antenna (scale AD); b, second antenna (AD); c, upper lip (AD); d, right mandible (AF); e, left mandible, palp omitted (AF); f, lower lip (AE); g, first maxilla (AF); h, second maxilla (AF); i, maxilliped (AF); j, coxal plates 1-7 and coxal gills (AD); k, epimeral plates 1-3 (AD); l, m, telson (AF). Scales on Fig. 6.

Upper lip (Fig. 11c) of normal type.

Mandibles (Figs. 11d, e) with molar seta on both sides, its basal part palp-like. Between molar and incisor, 2 flat spines and 2 rounded, ciliated buds (right), or 3 spines and 3 buds (left). Right lacinia mobilis bifid, proximal cusp with 3 teeth, distal cusp with 5 teeth; left lacinia entire, with 5 coarser teeth. Palp segment 1 unarmed; segment 2 with 1 distal seta; segment 3 with 2 distal and 2 subdistal setae.

Lower lip (Fig. 11f) with small, wide, truncate inner lobes.

Maxilla 1 (Fig. 11g) with 2-segmented palp, distal segment with 3 setae. Outer lobe with 7 spines, two outmost with 3 or 4 minute medial denticles, two others with 1 strong medial tooth, remaining spines unadorned. Inner lobe broad, with 2 short distal setae.

Maxilla 2 (Fig. 11h) bilobed, distal armature of lobes of 7 and 6 setae, respectively.

Maxilliped (Fig. 11i): Inner lobe with 2 simple distal spines. Outer lobe with 3 slender, almost setiform, distal spines. Palp segment 3 not swollen, distomedially with 2 rows of 4 and 2 setae.

Gnathopod 1 (Fig. 12a): Posterior margin of basis with 1 central seta and 1 distal setule. Ischium and merus small and narrow. Projecting lobe of carpus with 3 setae. Three palmar angle spines; palmar margin with row of about 7 bifid spines. Palmar index 0.51. Claw with 2 inner teeth (Fig. 12b).

Gnathopod 2 (Fig. 12c): Armature of basis and shape and size of ischium and merus as in P1. Carpus without posterior armature; distomedial margin with 4 setae. Posterior margin of propodus with 1 group of setae only. Two palmar angle spines; palmar margin with about 6 bifid spines (Fig. 12d). Palmar index 0.42. Claw with 2 inner teeth.

Pereiopods 3 and 4 (Fig. 12e) similar, slender, with lenticular organs in both sexes.

Pereiopods 5 and 6 lacking in all specimens examined. Coxal gills small, ovate, pedunculate (Fig. 11j). Seventh pereiopod (Fig. 12f) very elongate and slender, especially in the distal segments, lenticular organ present in both sexes.

Epimeral plates (Fig. 11k) ending in a small posteroventral tooth.

Pleopods (σ , φ) with 3-segmented exopodite; endopodite absent (Fig. 12j). All exopodite segments

with 2 plumose setae. Retinacula with 3 teeth.

Uropod 1 (Fig. 12g) with proximoventral peduncular spine. Rami subequal, each ramus with 1 long distal spine and 3 or 4 short spines. No sexual dimorphism.

Uropod 2 (Fig. 12h): Endopodite slightly longer than exopodite, the former with 1 long and 4 short distal spines, the latter with 1 longer and 3 shorter distal spines. The long endopodite spine has a hook-like, modified tip in male, similar to the configuration found in *B. (M.) uncinata* (Fig. 12i).

Telson (Fig. 11l) wider than long, distal margin slightly concave; distal armature of I+I spines. The male allotype has on left telson tip 1 long and 1 short spine, on right tip 1 long spine only (Fig. 11m).

Remarks. The slender first antennal peduncle and the long accessory flagellum of the new species are striking, and are reminiscent of the situation in *B. longiflagellum* S. Karaman, 1959, a species of which only the female sex is known and which, for this very reason, cannot be attributed for sure to any of the subgenera recognized within *Bogidiella*. *B. longiflagellum* is recorded from eastern Yugoslavia and Greece. It differs from *B. antennata* in the shape of the telson (distal margin convex, versus concave in the new species), in the absence of lenticular organs on the pereiopods, and in the presence of pleopodal endopodites.

The presence in *B. antennata* of a transformed element on the endopodite of uropod 2 σ allows classification with the subgenus *Medigidiella* Stock, 1981. The other species belonging to this subgenus differ from *B. antennata* in the following way:

- *B. vandeli* Coineau, 1969: male uropods 1 and 2 with modifications (versus: uropod 2 only); accessory flagellum short; pleopods with endopodite;
- *B. arganoi* Ruffo & Vigna, 1973: Uropod 1 with modified armature, uropod 2 unmodified; telson with lateral spine;
- *B. silverii* Pesce, 1981, *B. hebraea* Ruffo, 1963; *B. italica* G. Karaman, 1979, and *B. sarawacensis* Stock, 1983: one or more pleopods with setiferous endopodite;
- *B. parichnusae* G. Karaman, 1979: lenticular organs absent, peduncle of A1 less slender, distal spine(s) of uropod 2 σ rasp-like (versus: hooked);

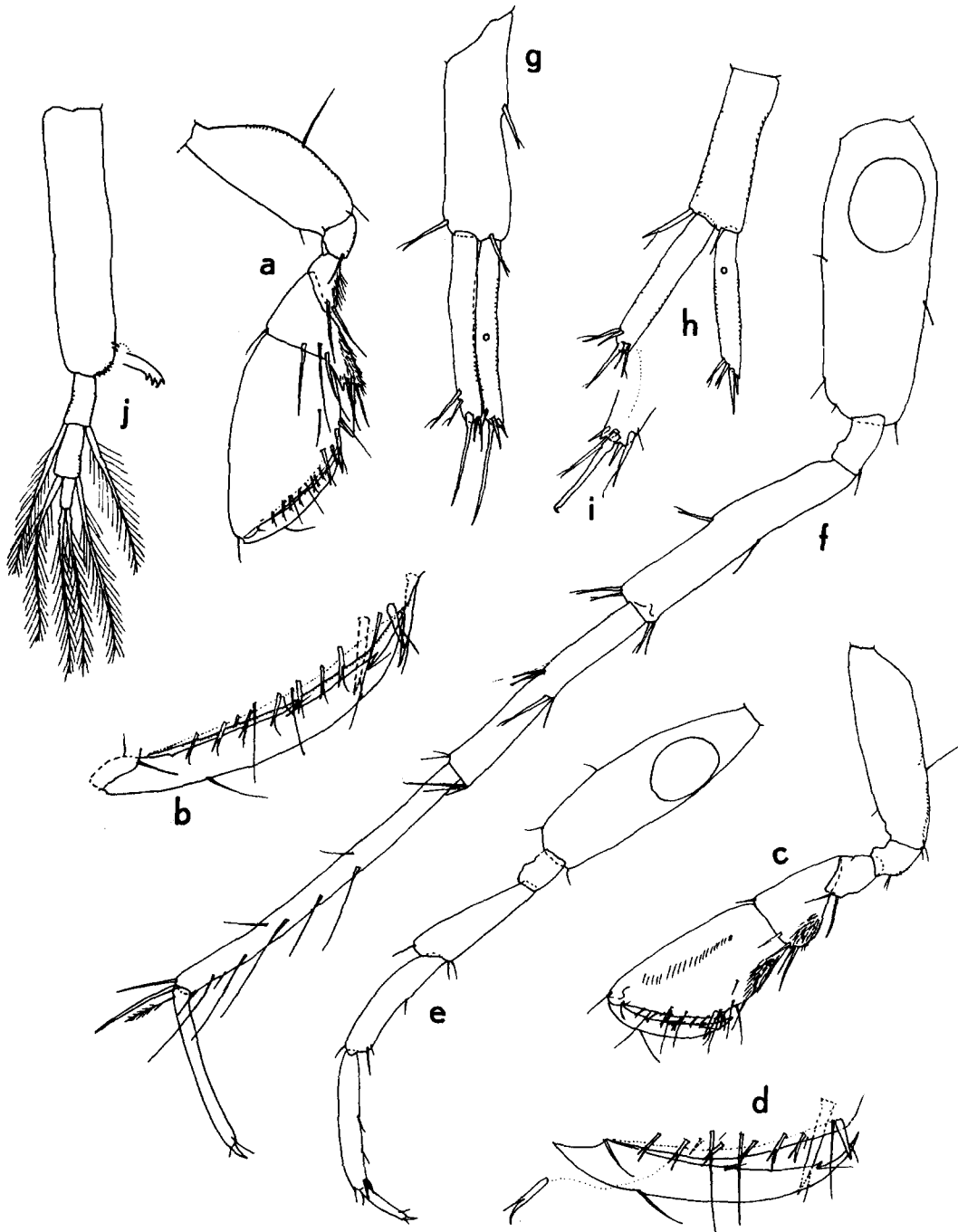


Fig. 12. *Bogidiella (Medigidiella) antennata* n. sp. (i, ♂; all other figures, ♀; all from Stn. 84-5/65). a, first gnathopod (scale AD); b, palma of first gnathopod (AF); c, second gnathopod (AD); d, palma of second gnathopod (AF); e, fourth pereiopod (AD); f, seventh pereiopod (AD); g, first uropod (AE); h, second uropod (AE); i, tip of endopodite of second uropod (AF); j, second pleopod (AD). (o = outer ramus). Scales on Fig. 6.

– *B. chappuisi* Ruffo, 1952: lenticular organs smaller, peduncle of A1 and spines of uropod 2 ♂ as in *B. parichnusae*.

With *B. (M.) uncinata*, described above, the new species agrees in the shape of the transformed distal spine of the endopodite of uropod 2 ♂, but the new species differs from *uncinata* in a longer accessory flagellum of A1, the shape of the telson (distal emargination more shallow), the presence of lenticular organs in both male and female (in *uncinata* in ♀ only), in more slender distal segments of P7, etc. *Etymology*. The proposed specific name, *antennata* (Latin), alludes to the slender peduncle and accessory flagellum of the first antenna.

Bogidiella sp.

In addition to the five species described above, unidentifiable, damaged freshwater bogidiellids have been obtained in the following localities:

- Río Jarama at Talamanca del Jarama (MNCNM)
- Río Jarama at Torrelaguna (MNCNM)
- Río de Arcos near Río Turia, Las Rinconadas, Santa Cruz de Moya (ZMA)
- Río Turia, bridge at Liria, Villamarchante (ZMA)
- Well at El Badil, Cantoria (ZMA)
- Arroyo Valdelagua (Montes de Toledo) (MNCNM).

Key to the Iberian species of the genus Bogidiella s.l.

- 1a) Peduncle of uropod 1 with proximoventral spine (♂, ♀).....2.
- b) Peduncle of uropod 1 without proximoventral spine (♂, ♀).....5.
- 2a) Telson armature usually II+II (♂, ♀). Telson notch deep and narrow (♂, ♀).....3.
- b) Telson armature I+I (♂, ♀). Telson notch wide and shallow, or absent (♂, ♀).....4.
- 3a) Modified spine on endopodite of uropod 2 (♂) hook-like*B. (Medigidiella) uncinata* n. sp.
- b) Modified spine(s) on endopodite of uropod 2 (♂) denticulated.....*B. (M.) chappuisi* Ruffo, 1952.
- 4a) Peduncle segment 2 of antenna 1 slender; accessory flagellum long (♂, ♀). Pereiopod 7

slender (♂, ♀). Telson distally with shallow incision (♂, ♀). One spine on uropod 2 (♂) modified.*B. (M.) antennata* n. sp.

- b) Peduncle segments of antenna 1 not slender; accessory flagellum 'normal' (♂, ♀). Pereiopod 7 not slender (♂, ♀). Telson distally straight or slightly convex (♂, ♀). None of the spines of endopodite of uropod 2 (♂) modified*B. (B.) convexa* n. sp.
- 5a) Telson notch deep and narrow (♂, ♀). Lenticular organs present (♂, ♀). Epimeral plates with rounded posteroventral angle (♂, ♀)*B. (B.) glabra* n. sp.
- b) Telson notch wide and shallow (♂, ♀). Lenticular organs absent (♂, ♀). Epimeral plates (sub)rectangular (♂, ♀)6.
- 6a) Uropods 1 to 3 with short spines (♂, ♀). Merus, carpus and propodus of pereiopods 3 to 7 robust (♂, ♀)*B. (B.) helenae* Mateus & Maciel, 1967.
- b) Uropods 1 to 3 with long spines (♂, ♀). Merus, carpus and propodus of pereiopods 3 to 7 more slender (♂, ♀).....*B. (B.) hispanica* n. sp.

Discussion

Sampling has been performed by Notenboom & Meijers in two major regions of Spain: (1) an Atlantic region (Cantabrian Mountains, western part of the Pyrenees) and (2) a Mediterranean region (including approximatively Levante, Cuenca and Teruel, and – though less intensively sampled – Andalucía). Bogidiellidae have not been found in the Atlantic north-western part of Spain, but four species were encountered in the Mediterranean southern and eastern part (see Notenboom & Meijers, 1985, map 2D), confirming the previous notion that these amphipods are predominant in (though not exclusive to) the peri-Mediterranean belt. In addition, one species is recorded from central Spain.

The bogidiellids described above show close affinities to species of this peri-Mediterranean belt and to the Portuguese mixohaline taxon, *B. (B.) helenae*. In this respect, the present collection yielded no unexpected surprises.

Four of the five bogidiellids founds, show no ge-

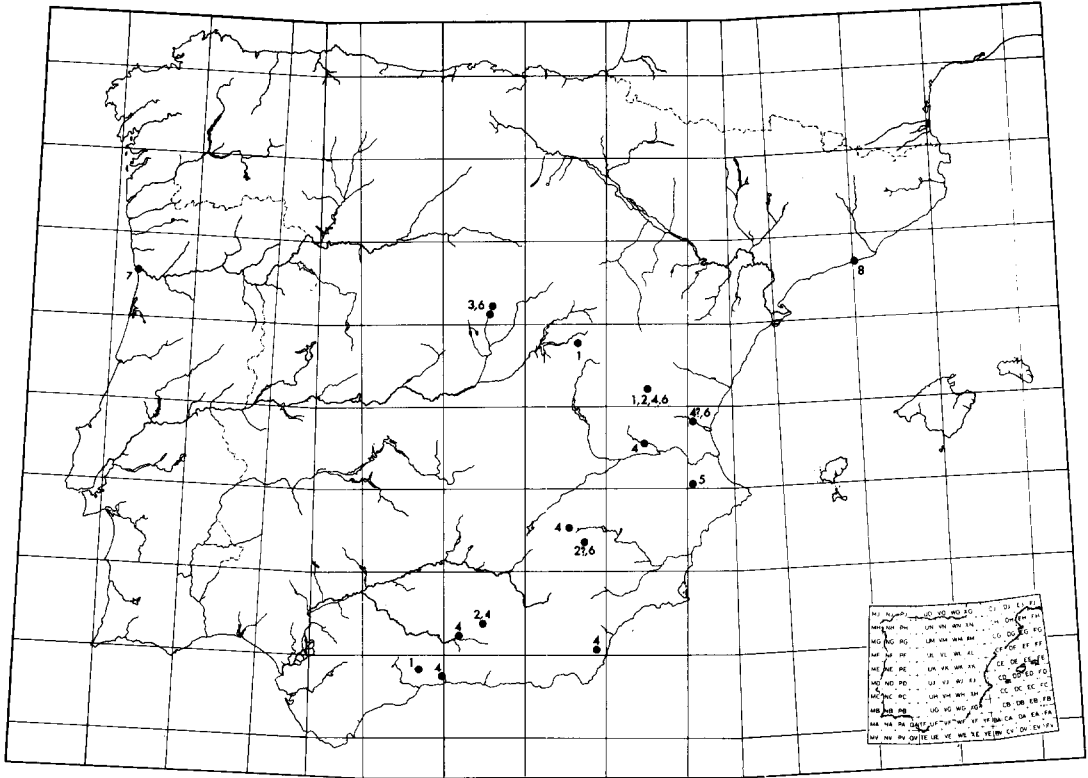


Fig. 13. Distribution of Bogidiellidae in the Iberian peninsula, mostly based on the sampling by Notenboom & Meijers in 1984–85 ($N=530$), supplemented by some samples from the Madrid Museum, and the two older literature records (nos. 7 and 8). 1 = *B. (B.) hispanica* n. sp.; 2 = *B. (B.) glabra* n. sp.; 3 = *B. (B.) convexa* n. sp.; 4 = *B. (M.) uncinata* n. sp.; 5 = *B. (M.) antennata* n. sp.; 6 = *Bogidiella* sp.; 7 = *B. (B.) helenae* Mateus & Maciel, 1967; 8 = *B. (B.)* sp. of Ruffo, 1953 (probably *B. chappuisi*).

ographically isolated ranges. As point of fact, one station (84-5/45) harboured three different species, and other stations (84-8/2 and 85-7/11) two species (see Fig. 13).

Up to now, only two Bogidiellidae were known from the Iberian peninsula, both from mixohaline interstitial waters, viz. *Bogidiella (B.) helenae* Mateus & Maciel, 1967, from the Atlantic coast (mouth of the river Douro, Portugal) and *B. (Medigidiella)* sp. of Ruffo, 1953 (probably *B. chappuisi* Ruffo, 1952) from the Mediterranean coast (Sitges, SW of Barcelona, Spain). The present paper records the first freshwater bodidiellids from the Iberian peninsula. All samples, with two exceptions from wells, originate from hyporheal habitats. Other habitats, such as springs or caves, yielded no bogidiellids.

Summary

Five new species of the amphipod genus *Bogidiella* are described from fresh groundwaters in central, east and south Spain. Three of the species belong to the subgenus *Bodidiella* s. str. two others to the subgenus *Medigidiella*. Previously, only two brackish to marine species of Bogidiellidae were known from the Iberian Peninsula. The present survey yielded no bogidiellids from the Atlantic, northern region of Spain, in spite of intensive sampling.

Resumen

Cinco especies nuevas de anfípodos del género *Bogidiella* son descritas de las aguas subterráneas

dulces en la parte central, este y sur de España. Tres de estas especies pertenecen al subgénero *Bogidiella* s. str., las otras dos al subgénero *Medigidiella*. Anteriormente, solamente dos especies marinas a salobres de Bogidiellidae eran conocidas de la Península Ibérica. El presente reconocimiento no produjo bogidiellidos de la región atlántica del norte de España, a pasar del intensivo muestreo.

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