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## 54. Contribution to the Knowledge of the Amphipoda. On the Genus *Bogidiella* Hert. (fam. Gammaridae) in Yugoslavia.

### Abstract

The species of the genus *Bogidiella* (Amphipoda, Gammaridae) from Yugoslavia are studied. Six species of that genus are redescribed and figured: *Bogidiella albertimagni* Hertzog 1933, *B. dalmatina* (S. Kar. 1953), *B. glacialis* (S. Kar. 1959), *B. longiflagellum* (S. Kar. 1959), *B. semidenticulata* Meštrov 1961 and *B. skopljensis* (S. Kar. 1933).

The key to the species of the genus *Bogidiella* known from Yugoslavia was composed.

### Introduction

The study of the genus *Bogidiella* in Yugoslavia began in 1933 when S. Karaman has described the first member of that genus, *B. skopljensis* from the subterranean water in Skoplje. Later, S. Karaman described *B. dalmatina* from the brackish subterranean waters at the seaside in Dubrovnik (in 1953), *B. longiflagellum* from Negorci by Gevgelija and *B. glacialis* from the small spring in the mountain Jakupica cca 1900 m high above sea level (in 1959). Later, Meštrov described in 1961 *B. semidenticulata* and *B. denticulata* from several localities in Croatia and Slovenia. As I have not found any difference between *B. albertimagni* and *B. denticulata* (based on the descriptions and figures of both species only), it appears that the later species was synonym of *B. albertimagni*.

Except *B. skopljensis*, all other *Bogidiella* species from Yugoslavia were insufficiently described, and for this reason there were not possible to establish one exact relation between these species.

In this study were used holotypes and paratypes of the most part of *Bogidiella* species, as well as the other specimens collected in other localities. There are presented some new localities of *B. skopljensis* and *B. dalmatina*.

*B. albertimagni* is established now for the first time in Yugoslavia, and the status of several other *Bogidiella* species is changed.

For completion of this work I am obliged for the material assistance to prof. Dr B. Sket from the University of Ljubljana and Dr S. Ruffo from Museo Civ. Storia Naturale Verona (Italy).

*Bogidiella albertimagni* Hertzog 1933  
figs. I-III

Syn.: *Bogidiella albertimagni* Hertzog 1933, p. 226, fig. 1; Hertzog 1935, p. 50; Hertzog 1936, p. 356, figs. 1-4; Schellenberg 1942, p. 87, fig. 67; Ruffo 1953, p. 16; Husmann 1956, p. 160; S. Karaman 1959, p. 339; Ruffo 1963, p. 190; Dancau et Serban 1965, p. 339, pl. 71-75; Mateus et Maciel 1967, p. 35.

*Bogidiella denticulata* Meštrov 1961, p. 76, figs. I, 1-2, 4-11; II, 1-12; Ruffo 1963, p. 191.

*Bogidiella* sp. Ruffo 1952, p. 125; Ruffo 1963, p. 191.

Description of the female: Body-length up to 2 mm. Body smooth, urosomites smooth. Lateral cephalic lobes rounded, no eyes (fig. III, 1).

Antenna 1: nearly 50 percent of the body-length, peduncular articles 1 2 3, poorly setose (fig. III, 1). The first peduncular article bears one elliptic setose organ on inner surface (fig. III, 3). Principal flagellum up to 8-articulate, several articles with one aesthetasc each, shorter than the article itself. Accessory flagellum 2-3-articulate, nearly as long as two flagellar articles of principal flagellum together (figs. III, 1, 8).

Antenna 2: peduncular article 5 slightly shorter than article 4. Flagellum up to 5-articulate, antennal gland cone short (fig. III, 1).

Mouthparts basic, labrum trapezoidal, labium with well developed inner lobes (=plates), outer lobes with acute distoinferior corner (fig. III, 4). Maxilla 1: inner lobe broad, with 2 distal setae, outer lobe with 7 distal spines bearing one tooth each; palp biarticulate, with 3-4 distal setae. Maxilla 2: inner lobe with 5-6 distal setae, outer lobe with 6-8 setae.

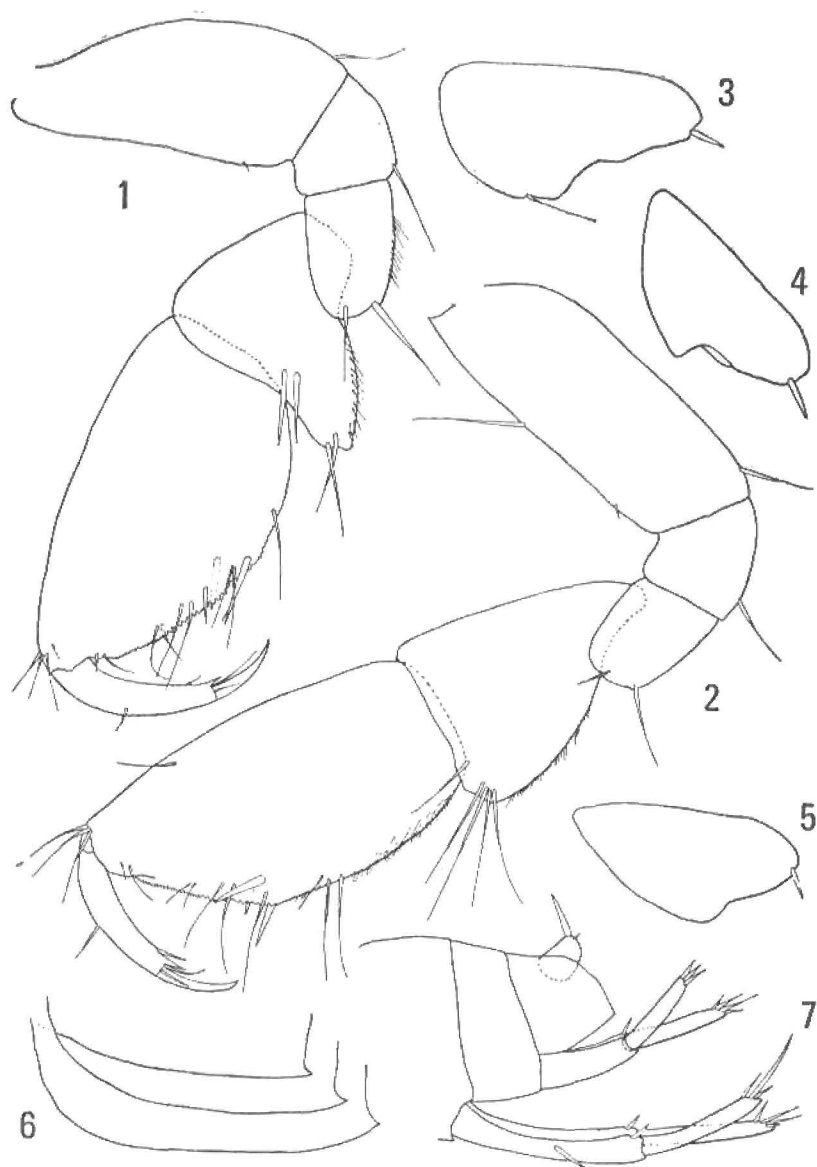


Fig. 1. *Bogidiella albertimagni* Her., Trebaljevo, female 1.9 mm: 1 = gnathopod 1; 2 = gnathopod 2; 3 = coxa 5; 4 = coxa 6; 5 = coxa 7; 6 = epimere; 7 = urosome with uropods.

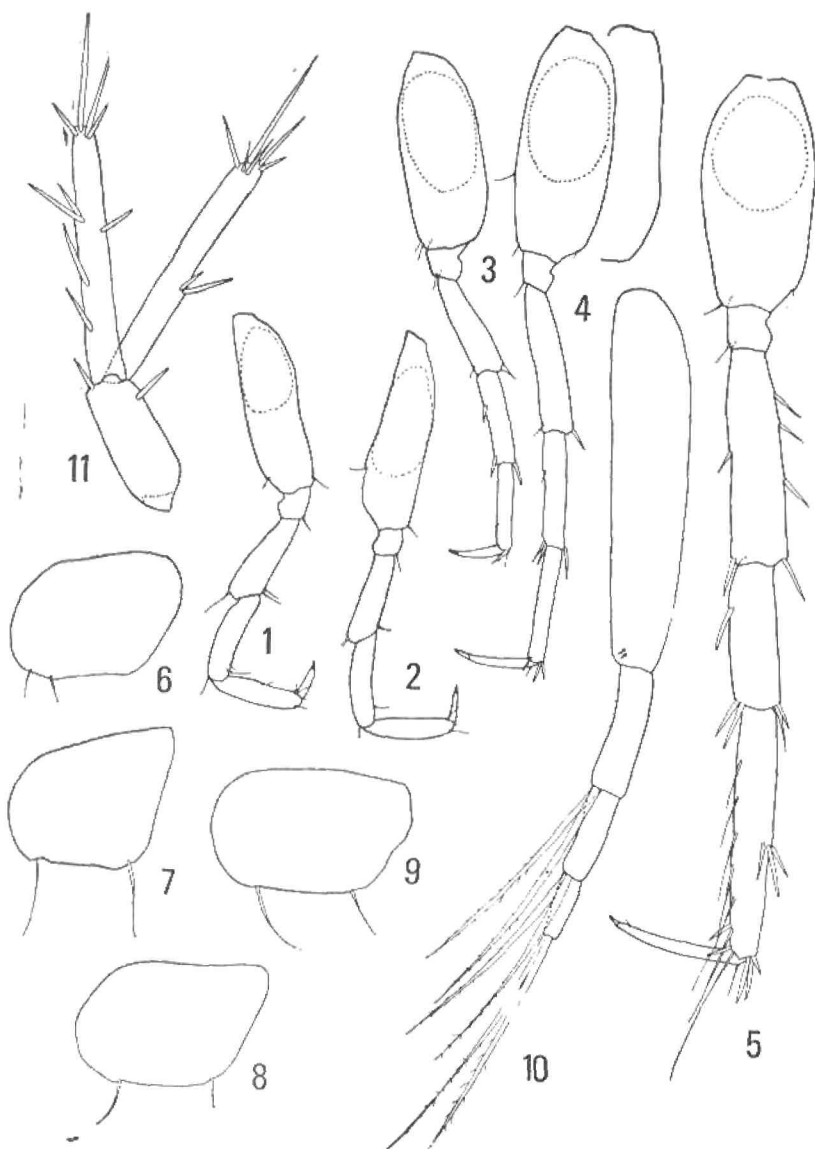


Fig. 11. *Bogidiella albertimagni* Her., Trebaljevo, female 1.9 mm: 1 = pereopod 3; 2 = pereopod 4; 3 = pereopod 5; 4 = pereopod 6; 5 = pereopod 7; 6-9 = coxae 1-4; 10 = pleopod; 11 = uropod 3.

Maxilliped: inner lobe short, not reaches to the tip of the first palpar article; outer lobe short, reaches to the tip of the first palpar article, palp 4-articulate.

Mandible: molar and pars incisiva well developed, palp 3-articulate, second palpar article bears one seta, third article bears 3-4 setae (fig. III, 2).

Coxae 1-7 are broader than long (only posterior portion of coxa 2 as long as broad), coxae 1-4 with 1-2 long setae at distal margin (figs. II, 6-9), coxae 5-7 with one posterior spine (figs. I, 3-5), coxae 5-7 progressively shorter towards coxa 7.

Gnathopod 1: article 2 slightly dilated distally, with very weakly crenellated posterior margin bearing one short seta. Articles 3-4 short; article 5 triangular, with produced distoposterior portion. Article 6 ovoid, longer than broad, palm oblique and strong crenellated (the crenellation is progressively more fine towards the basis of dactyl). Palm bears 2-3 corner spines (1-2 spines on outer, and one spine on inner surface). Dactyl with very fine crenellated inferior margin (as well as posterior margin of article 6), bearing 2 teeth at inferior margin; superior margin of dactyl bears one median seta (fig. I, 1).

Gnathopod 2: article 2 not dilated distally, with weakly crenellated posterior margin bearing one short seta only. Articles 3-4 short, article 5 nearly triangular, with many very fine setulae at posterior margin (fig. I, 2). Article 6 as long as that of gnathopod 1 but more slender, with parallel lateral margin. Palm less inclined than that of gnathopod 1, fine crenellated, provided with 2-3 corner-spines (1-2 on outer and one on inner surface), dactyl with 3-4 marginal tooth-like setae at inferior margin, as well as with one median seta at superior margin. The median part of outer surface of article 6 on gnathopod 2 provided with very fine setules.

Pereopods 3-4 like to each other, with slender and poorly setose articles. Their article 2 slightly dilated. Dactyl nearly 50 percent as long as article 6, nail short (figs. II, 1, 2).

Pereopods 5-7 progressively longer towards pereopod 7.

Pereopod 5: article 2 slightly dilated, with convex posterior margin. Articles 4-6 lacking median spines at posterior margin. Dactyl longer than 50 percent of the article 6 length (fig. II, 3).

Pereopod 6: article 2 is 2-3 times as long as broad, with convex or concave posterior margin. Articles 4-6 lacking median spines at posterior margin, dactyl much longer than the half of article 6 (fig. II, 4).

Pereopod 7: much longer than pereopod 6. Article 2 usually with convex, occasionally concave posterior margin. Article 4 with

3 median spines at posterior margin. Article 6 with one spine-group at posterior margin. Anterior margin of article 6 bears one row of 6-8 long setae, (article 6 is not wider than article 5). Dactyl slender and longer than the half of the article 6 length (fig. II, 5). All articles of pereopod 7 are much broader than those of pereopods 5-6.

Hertzog's organ appears on article 6 (fig. III, 10). Pleopods 1-3 with peduncle bearing 2 coupling hooks (fig. II, 1-5). Pleopod 1 of medial size, longer than half of the article 6 length (figs. II, 1-5).

Pleopods 1-3 with peduncle bearing 2 coupling hooks (retinaculate outer ramus bearing 2 plumose setae; inner ramus absent (only by one aberrant specimen, very short, unisegmented, with

apex pointed distoposteriorly, lacking spine) (fig. I, 6).

Pleopod 2: peduncle longer than rami, provided with one median spine; inner ramus nearly subequal in length, provided with one median spine (fig. I, 7).

Pleopod 3: peduncle nearly as long as rami, lacking median spine; inner ramus longer than outer one, both provided

with one median spine, nearly 60 percent of the rami length. Rami of pleopod 3: inner ramus longer than outer; outer ramus provided with one median spine and several apical spines; inner ramus bears several lateral spines or spine-groups at inner margin (fig. II, 11).

Telson broader than long, with distal margin more or less concave (incised), bearing 2 apical spines and several pairs of short plumose setae appearing in upper portion of telson-lobes.

Gills on segments 4-6, ovoid, simple (fig. III, 7). Gills on posterior corner of epimere 1-3 appear as small, simple, bilobed. The distal margin of telson appears

as a shallow notch. Gills on segments 4-6 appear biarticulate (accessory gill) and 4 distal setae on palp of mandible.

Material examined: River Tara near Trebaljevo (Crna Gora), (pump), 11 July, 1972, many specimens; river Piva near Pluzine, pump, 18 July, 1972, several specimens; river Piva near Komarnica, 18 July, 1972, several specimens.

Valley of Rhein near Strasbourg

Pleopod 1 of medial size, longer than half of the article 6 length (figs. II, 1-5).

Pleopods 1-3 with peduncle each, and with 3-articulate setae each (fig. II, 10). Inner specimens inner ramus was present, long apical plumose seta.

Epimere 1-3 more or less provided with one or two spines or setae at distal margin.

Uropod 1: peduncle long, bearing one median and 2 apical spines. Ramus provided with only apical spines (fig. I, 7).

Uropod 2: peduncle nearly as long as rami, bearing one median spine; inner ramus slightly longer than outer, both provided with apical spines (fig. I, 7).

Uropod 3: peduncle nearly as long as rami, bearing one median spine; inner ramus nearly as long as outer, both provided with one median spine and several apical spines.

Telson broader than long, with distal margin more or less concave (incised), bearing 2 apical spines and several pairs of short plumose setae appearing in upper portion of telson-lobes.

Gills appear on thoracic segments 4-6, ovoid, simple (fig. III, 7).

Variability. Distal margin of telson more or less acute, subacute or angular on anterior margin, more or less concave.

The specimens from Piva River appear biarticulate (accessory gill) and 4 distal setae on palp of mandible.

Material examined: River Tara near Trebaljevo (Crna Gora), subterranean water, (pump), 11 July, 1972, many specimens; river Piva near Pluzine, pump, 18 July, 1972, several specimens; river Piva at the mouth of its affluents, 18 July, 1972, several specimens.

Localities cited: Valley of Rhein near Strasbourg (Hertzog 1933) subterranean water.

smann 1956); valley of Cernisoara and of Cerna (Cerna-sat, Rumania) (Dancau et Serban 1965); wells in S. Martino B. A. near Verona, Italy (Ruffo 1963); Borovnica, Dovjež, Bled, Levec pri Celju, Podsredo, Murska Sobota, Lendava, Varaždin, Zagreb (Meštrov 1961).

**Distribution:** Central Europe up to Rumania, Yugoslavia. That species has penetrated in Yugoslav continental waters during the Ice Age, because that species was not found in Yugoslav regions lacking glaciers during the Ice Age.

**Loc. typ.:** Valley of Rhein by Strasbourg.

**Ecology:** living in subterranean fresh waters, sometimes accompanied by *Niphargus* sp., Asellids etc.

**Remarks.** The Hertzog's original description and figures of *B. albertimaghi* are not detailed. Later Dancau and Serban gave very good description of that species based on the specimens from Rumania.

The our specimens of Crna Gora (rivers Tara and Piva, Montenegro) are identic with description and figures of Dancau and Serban 1965 (the difference is only in slightly more slender and longer peduncle of antennae 1-2 by our specimens).

Meštrov described in 1961 *B. denticulata* from Croatia and Slovenia. I have not found any difference between his description of *B. denticulata* and that one of *B. albertimaghi* (including also our specimens of Crna Gora), and I removed *B. denticulata* to *B. albertimaghi* as synonym.

S. Karaman mentioned in 1953 *B. skopljensis* as one subspecies of *B. albertimaghi*, but numerous differences between these two species (uniramous pleopods by *B. albertimaghi*, biramous pleopods by *B. skopljensis*, etc.) doubtlessly to point out, *B. skopljensis* and *B. albertimaghi* are distinct species (as already mentioned also Dancau et Serban).

*Bogidiella dalmatina* (S. Kar. 1953)  
figs. III-V

**Syn.:** *Bogidiella albertimaghi dalmatina* S. Karaman 1953, p. 141, figs. 1-2; S. Karaman 1959, p. 346.

*Bogidiella chappuisi dalmatina* Meštrov 1961, p. 79.

*Bogidiella chappuisi* (part.) Ruffo 1963, p. 190; Mateus et Maciel 1967, p. 37.

**Description of the female:** Body-length up to 2 mm. Body smooth, lateral cephalic lobes rounded (fig. III, 9).

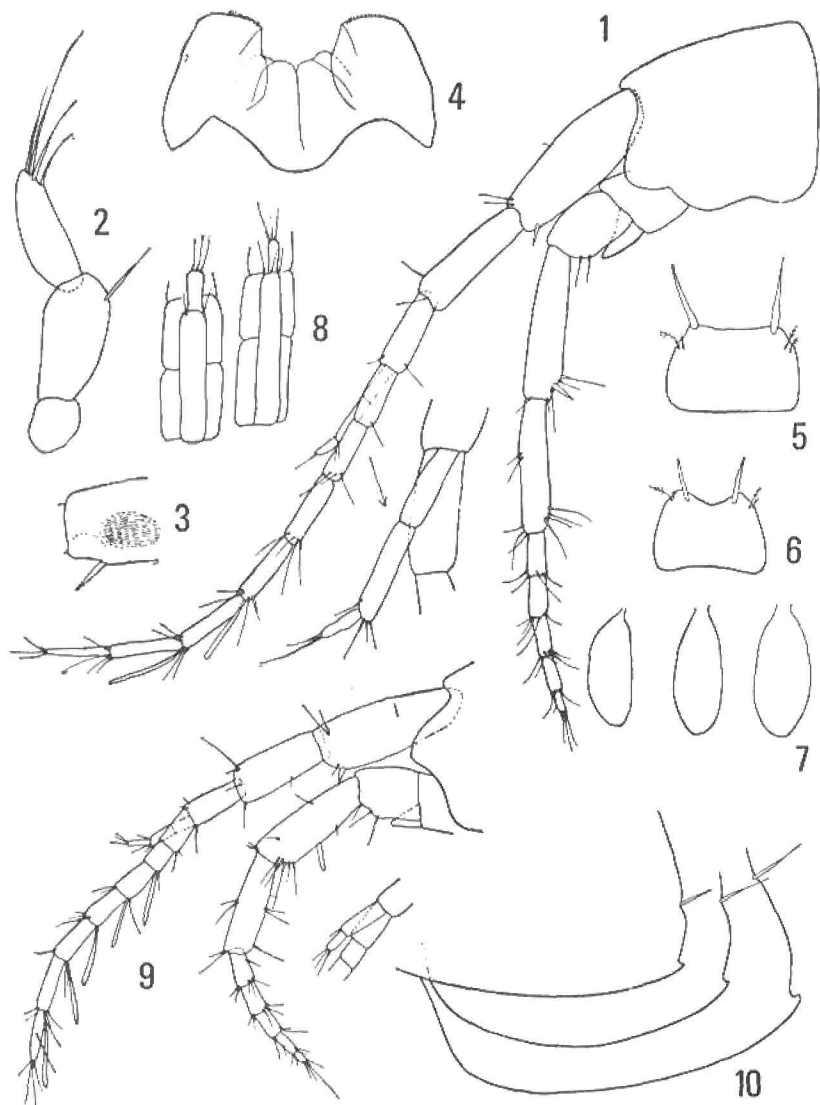


Fig. III. *Bogidiella albertimagni* Her., Trebaljevo, female 1.9 mm: 1 = head with antennae; 2 = palpus mandibularis; 3 = distal organ on first peduncular article of antenna 1; 4 = labium; 5-6 = telson; 7 = gills 1-3; 8 = accessory flagellum of specimens from river Piva.

*Bogidiella dalmatina* (S. Kar.), Verige, female 2 mm: 9 = head with antennae; 10 = epimere.



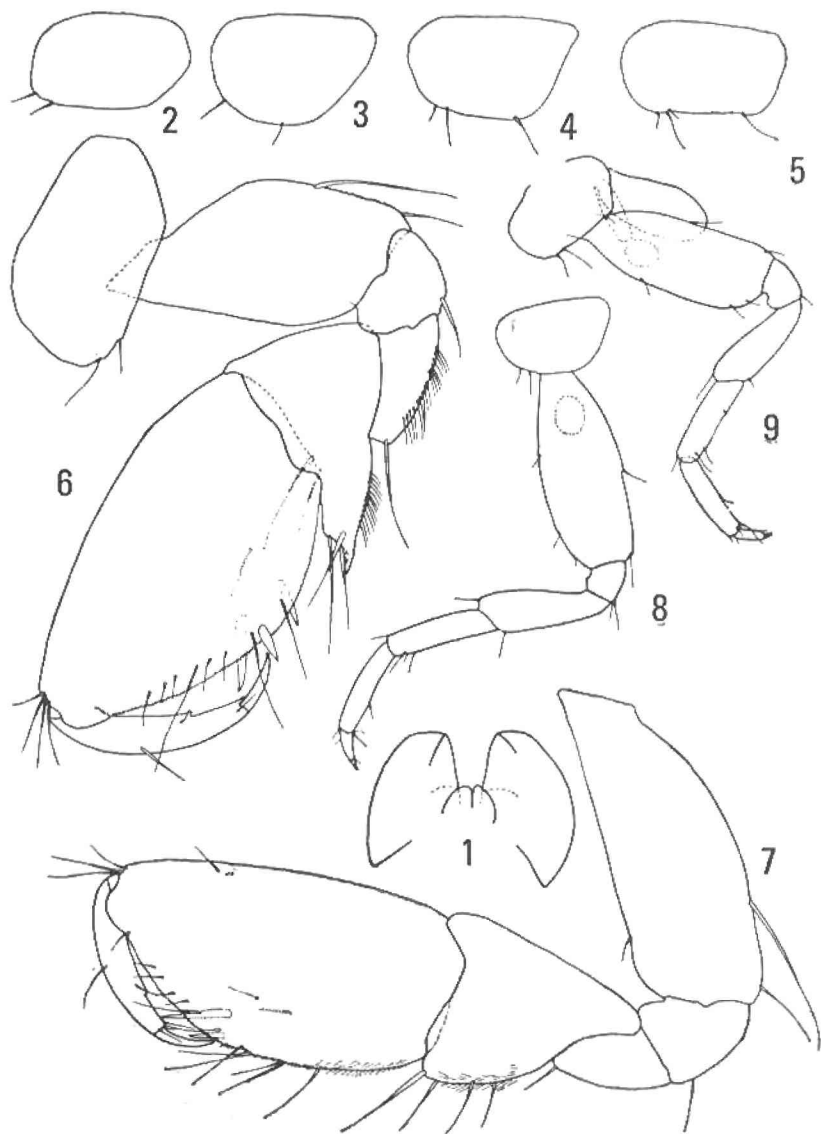


Fig. IV. *Bogidiella dalmatina* (S. Kar.), Verige, female 2 mm: 1 = labium; 2-5 = coxae 1-4; 6 = gnathopod 1; 7 = gnathopod 2; 8 = pereopod 3; 9 = pereopod 4.

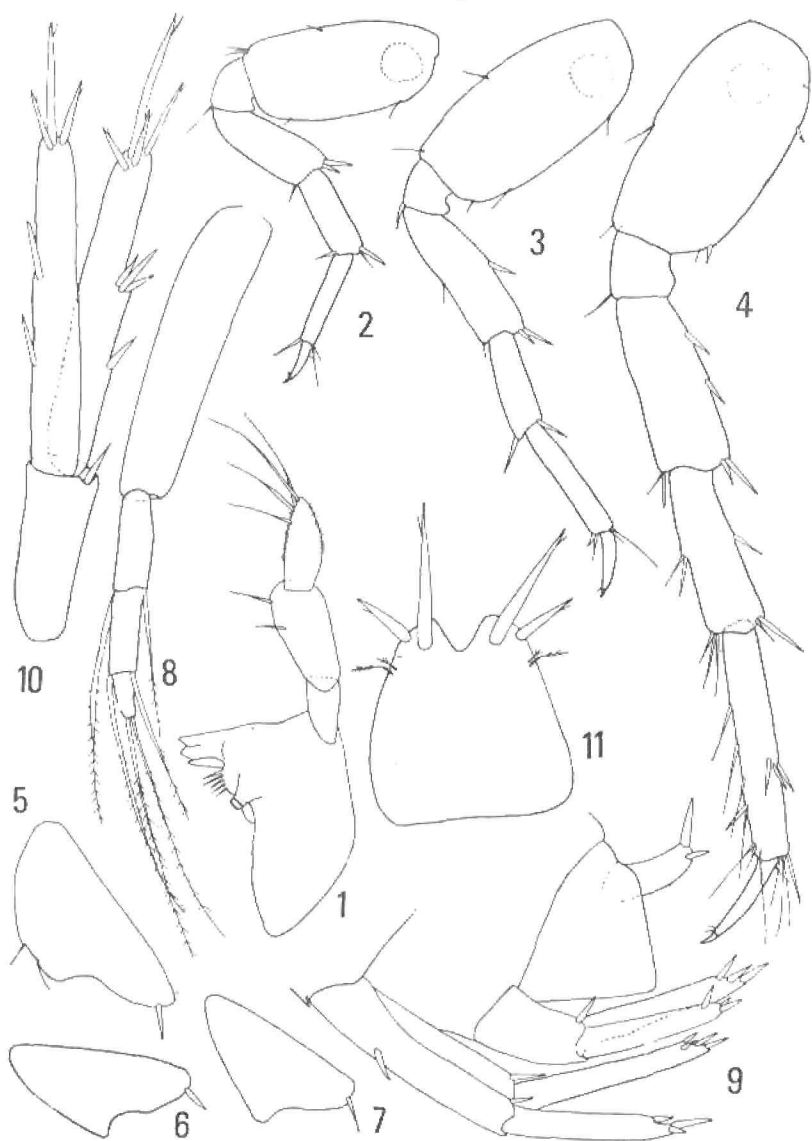


Fig. V. *Bogidiella dalmatina* (S. Kar.), Verige, female 2 mm: 1 = mandible; 2 = pereopod 5; 3 = pereopod 6; 4 = pereopod 7; 5-7 = coxae 5-7; 8 = pleopod; 9 = uropods 1-2; 10 = uropod 3; 11 = telson.

Antenna 1: peduncular articles 1 2 3, principal flagellum up to 7-articulate, articles bear one long aesthetasc each. Accessory flagellum relatively short, 2-3 articulate (fig. III, 9).

Antenna 2: peduncular article 5 shorter than article 4, flagellum up to 5-articulate, articles short (fig. III, 9).

Mouthparts basic. Labium with distoinferior corner, inner plates well developed (fig. IV, 1). Maxilla 1: inner lobe with 2 setae, outer lobe with 7 distal spines bearing 1-2 lateral teeth each; palp biarticulate, with 3-4 distal setae.

Maxilla 2: inner lobe with 5, outer with 7-8 setae. Maxilliped like that of *B. albertimagni*. Mandible: palp 3-articulate, second article with 2 setae, third article bears at both margins fine setulae and provided with 4 long setae (fig. V, 1).

Coxae 1-7 broader than long, coxae 1-4 with 1-3 distal setae (figs. IV, 2-5), coxae 5-7 with one posterior spine-like seta (figs. V, 5-7).

Gnathopod 1: article 2 broad, with one long and one short seta at posterior margin; articles 3-4 short, article 5 triangular, with produced distoposterior portion. Article 6 ovoid, longer than broad, its palm very oblique, provided with one spine on outer, and 2 spines on inner surface. Lateral portion of palm and posterior margin of article 6 are finely crenellated (fig. IV, 6). Dactyl with 2 teeth at inferior margin and one median seta at superior margin.

Gnathopod 2: article 2 more slender than that of gnathopod 1, with one long and one short seta at posterior margin. Articles 3-4 short, article 5 triangular, but lacking distoposterior protrusion. Article 6 elongated, with nearly parallel lateral margins (fig. IV, 7), its palm oblique nearly 40 percent of the article 6 length, provided with 2 corner spines on inner surface. Lateral portion of palm finely crenellated. Dactyl like that of gnathopod 1.

Posterior margin of articles 2-3 of gnathopods 1-2 is finely crenellated.

Pereopods 3-4 like to each other. Their article 2 dilated in anterior portion (figs. IV, 8, 9); articles 3-6 slender, weakly setose at both margins; dactyl short, shorter than half of the article 6 length.

Pereopod 5: short, with article 2 dilated posterally, ovoid. Articles 4-5 with several distal spines at both margins; article 6 longer than the article 5, article 7 (dactyl) shorter than 50 percent of article 6 (fig. V, 2).

Pereopod 6: like pereopod 5 but longer. Article 4 with one median spine at posterior margin. Dactyl shorter than 50 percent of the article 6 length (fig. V, 3).

Pereopod 7: relatively long, article 2 ovoid, with 2 spines at posterior margin (fig. V, 4). Article 4 with 2-3 median and 1-2 distal spines at posterior margin. Article 5 with median spine also. Article 6 with a row of long setae at anterior margin, as well as with one median group of spines at both margins. Article 6 is not dilated, narrower than article 5. Dactyl slender, shorter than 50 percent of article 6.

Hertzog's organ on article 2 of pereopods 3-7 very small, rounded, smaller than the diameter of article 4 itself (figs. IV, 8, 9; V, 2-4).

Pleopods: peduncle longer than outer ramus, bearing 2 retinacula and one seta. Outer ramus 3-articulate, each article bears 2 plumose setae. Inner ramus absent (fig. V, 8).

Epimere 1-3 with produced and pointed distoposterior corner like those of *Harpinia* species (fig. III, 10). Posterior margin of epimere 1-3 provided with one median longer seta; no distal setae or spines.

Uropod 1: peduncle as long as inner ramus, bearing one median and 2 distal spines. Outer ramus shorter than inner one, both rami with distal spines only (fig. V, 9).

Uropod 2: peduncle shorter than rami, inner ramus longer than outer one; both rami with distal spines only (fig. V, 9).

Uropod 3: peduncle nearly 40-50 percent as long as the rami. Rami subequal in length, slender, bearing 1-2 median groups of spines and several distal spines each (fig. V, 10).

Telson nearly as long as broad, shallow incised distally (fig. V, 11). Each lobe with 2 distal unequal spines and one pair of short plumose setae.

Gills appear on thoracal segments 4-6, ovoid, simple. Oostegites short.

**Variability.** The shape of telson (the length of distal incision) and the number of the articles of accessory flagellum are variable (2-3 articles). The median part of the palm of gnathopods 1-2 appears usually non crenellated (only sometimes is crenellated).

**Material examined:** spring at seaside in Verige, Boka Kotorska, 5 Dec., 1971, 4 spec.; seaside in Jaz by Budva, subterranean water, 4 Oyt., 1965, one spec.; Lapad in Dubrovnik (Holotype).

**Localities cited:** peninsula Lapad in Dubrovnik, subterranean water at the seaside; Cavtat, subterr. water at seaside (S. Karaman 1953).

**Distribution:** coast of Adriatic Sea, subterranean water.

**Loc. typ.:** peninsula Lapad in Dubrovnik. Holotype is deposited in my collection in Titograd.

**Ecology:** living in brackish subterranean water near the sea.

**Remarks.** *B. dalmatina* is very closed to *B. chappuisi* Ruffo et Del. Debouteville 1952 described from the Racou (southern France) (shape of pleopods, antennae, coxae, uropods etc.). I confronted the paratypes of *B. chappuisi* Ruffo et Del. Deb. 1952, with the specimens from adriatic coast (*dalmatina*), and I found that *B. dalmatina* differs from *B. chappuisi* by the shape of telson (as long as broad by *dalmatina*, much broader than long by *chappuisi*), by the shape of Hertzog's organ (rounded and shorter than the diameter of article 4 by *dalmatina*, ovoid and longer than the diameter of article 4 by *chappuisi*).

Distal spines on uropod 2 are simple by *dalmatina*, partially crenellated by *chappuisi*(?). Because all differences between *B. dalmatina* and *B. chappuisi* are relatively small, we can not exclude the possibility that *B. dalmatina* is only one variation of *B. chappuisi*, but until the study of the variability of *B. chappuisi* from France is not possible to establish the exact relations between those two species.

*B. dalmatina* differs from *B. semidenticulata* by much shorter Hertzog's organ on pereopods 3-7, by shorter dactyl of pereopods 3-7, by strong pointed epimere etc.

*B. dalmatina* differs from all other Yugoslav *Bogidiella* species (except *B. sedimenticulata*) by the presence of 4 distal spines on telson.

*Bogidiella glacialis* (S. Kar. 1959)  
figs. VI-VIII

Syn.: *Bogidiella albertimagni glacialis* S. Karaman 1959, p. 343, figs. 2, 5-8, 17, 21-22; Ruffo 1963, p. 191.

**Description of the ovig. female:** Length up to 2.5 mm. Body smooth, bearing single fine setulae at dorsoposterior margin of thoracal segments. Lateral cephalic lobes rounded (fig. VIII, 1).

Antenna 1: nearly 40 percent of the body, peduncular articles progressively shorter. First peduncular article with 2-3 spines at ventral margin. Principal flagellum up to 8-articulate, several articles with one long aesthetasc each. Accessory flagellum 2-articulate, second article short (fig. VIII, 1).

Antenna 2: flagellum 5-articulate, antennal gland cone short (fig. VIII, 1).

Mouthparts basic. Labrum trapezoidal, labium like that of *B. dalmatina* (figs. VI, 1; VII, 1). Maxilla 1: inner lobe with 3 setae

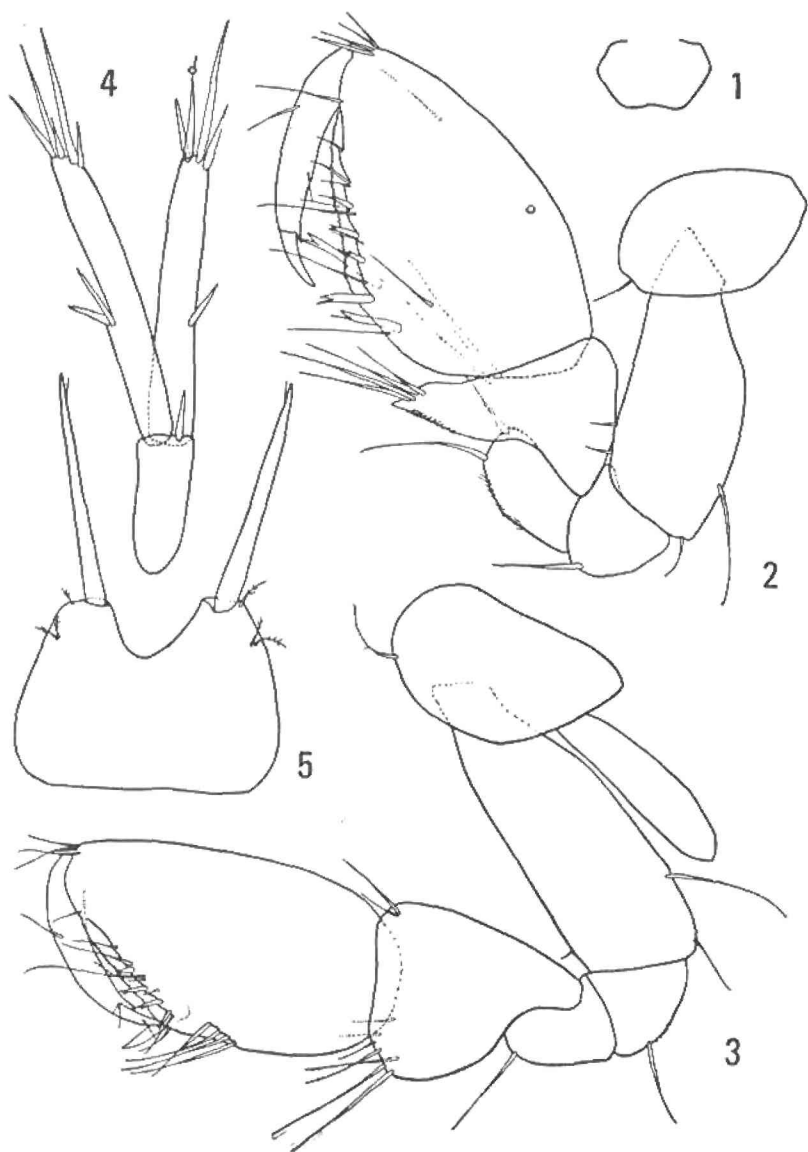


Fig. VI. *Bogidiella glacialis* (S. Kar.), Jakupica, female 2.3 mm: 1 = labrum; 2 = gnathopod 1; 3 = gnathopod 2; 4 = uropod 3; 5 = telson.

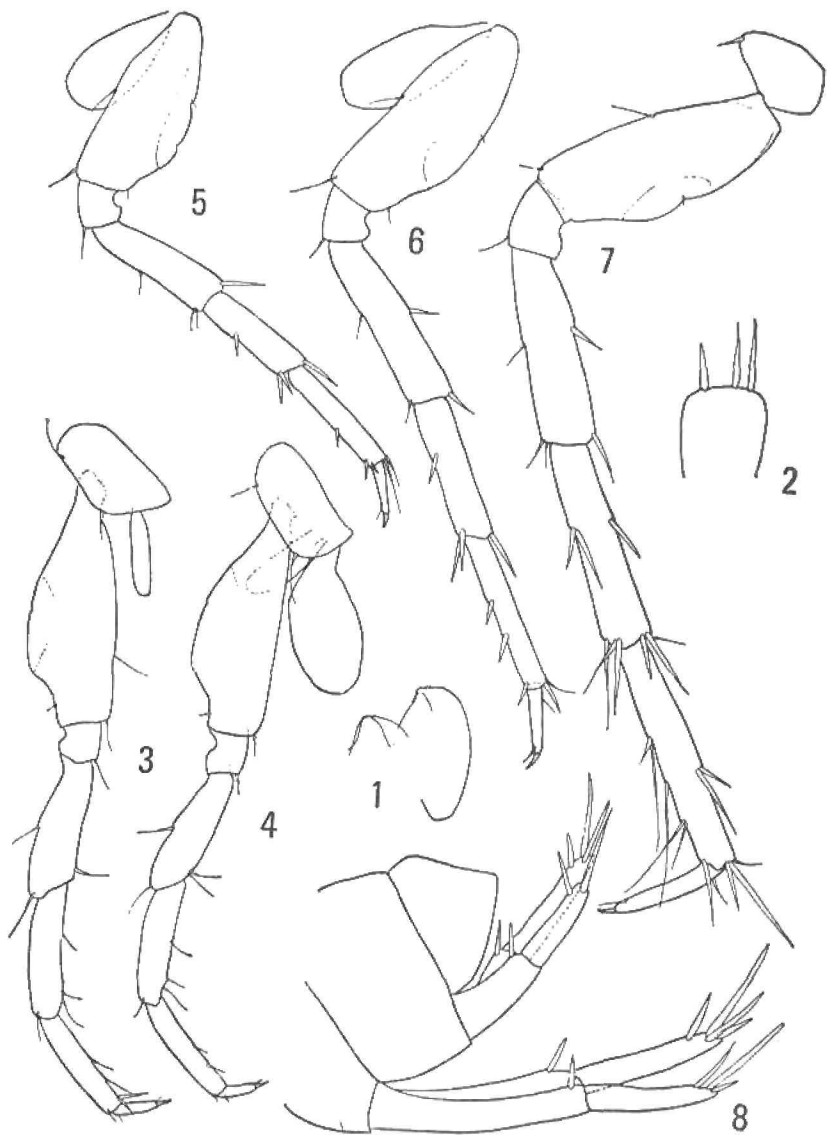


Fig. VII. *Bogidiella glacialis* (S. Kar.), Jakupica, female 2.3 mm: 1 = labium; 2 = inner lobe of maxilla 1; 3 = pereopod 3; 4 = pereopod 4; 5-7 = pereopods 5-7; 8 = urosome with uropods.

(fig. VII, 2), outer lobe with 7 distal spines bearing usually one lateral tooth each; palp 2-articulate, with 2 apical and one subapical seta. Maxilliped: inner lobe with 2 distal spines. Mandible: palp 3-articulate, second article with one seta, third article with 4 setae (fig. VIII, 2).

Coxae 1-4 broader than long, with slightly narrowed anterior portion; distal rounded portion of coxae 1-4 bears 1-2 setae (figs. VI, 2, 3; VII, 3, 4), coxae 5-7 progressively shorter.

Gnathopod 1: article 2 slightly broader, with 2 setae at posterior margin. Articles 3-4 short, article 5 triangular, with produced disto-posterior portion (fig. VI, 1). Article 6 ovoid, palm very oblique, uneven and fine crenellated, bearing on outer surface a row of submarginal short spines (3-4 spines + one corner spine). Inner surface bears one long corner spine and one subcorner spine also. Posterior margin of article 6 undistinctly crenellated on distal portion, smooth in proximal portion. Dactyl with 2 teeth at inferior margin and one median seta at superior margin.

Gnathopod 2: article 2 longer than that of gnathopod 1, with 2 setae at posterior margin. Articles 3-4 short, article 5 triangular lacking distoposterior protrusion. Article 6 elongated, with parallel lateral margins. Palm oblique, uneven and fine crenellated, bearing a row of 4 subdistal spines at outer surface, and one corner spine on inner surface. Dactyl like that of gnathopod 1 (fig. VI, 2).

Pereopods 3-4 like to each in the shape but pereopod 3 is slightly longer (figs. VII, 3, 4). Their article 2 dilated in anterior portion. Articles 3-6 slender, sparsely setose. Article 7 (dactyl) short, 50 percent of the article 6 length.

Pereopod 5 relatively short, its article 2 slightly dilated in posterior portion, with convex posterior margin (fig. VII, 5). Articles 3-6 slender, bearing several spines or setae. Dactyl slender, nearly 50 percent of the article 6 length.

Pereopod 6 longer than pereopod 5, but in the shape of all articles very like to pereopod 5 (fig. VII, 6).

Pereopod 7 much longer and stronger than pereopods 5-6 (fig. VII, 7). Article 2 slightly dilated, with convex posterior margin. Articles 4-6 strong, with several spines at both margins. Article 6 is not wider than articles 4-5. Dactyl slender, 50-60 percent as long as article 6.

The Hertzog's organ is unclear, it appears that the elevation at anterior margin of article 2 of pereopods 3-4 and the elevation at posterior margin of article 2 of pereopods 5-7 are caused because of the presence of Hertzog's organ on these places (figs. VII, 3-7).

Epimere 1-3 with subrounded distoposterior corner, bearing one long simple seta at distoposterior margin (fig. VIII, 4).



Pleopods: peduncle with 2 retinacula each; inner ramus absent; outer ramus 3-articulate, each article bears 2 plumose setae (fig. VIII, 5).

Uropod 1: peduncle longer than rami and provided with distal spines only. Inner ramus slightly longer than outer one, both rami bear distal spines only (fig. VII, 8).

Uropod 2: peduncle as long as outer ramus. Inner ramus longer than outer one, both rami and peduncle with distal spines only (fig. VII, 8).

Uropod 3: peduncle nearly 50 percent as long as rami; rami subequal in length, provided with one median and one distal group of spines (fig. VI, 4).

Telson broader than long, shallow incised distally, bearing two distal long spines (fig. VI, 5). One short distal plumose seta and one pair of short subdistal plumose setae appear on each telson-lobe.

Gills appear on thoracal segments 4-6, ovoid (figs. VII, 4-6).

Oostegytes smaller than gills, slender (fig. VII, 4).

Variability. The shape of article 2 of pereopods 3-7 and the shape of telson and palm of article 6 of gnathopods 1-2 are constant.

The shape of distoposterior corner of epimere 1-3 appears more or less subrounded, but never angular. Hertzog's organ of all specimens was undistinct.

Material examined: Jakupica mountain, small spring on 1900 m high above the sea level (Macedonia), 1955 (holotype and paratypes).

Localities cited: known only from Jakupica.

Distribution: Macedonia.

Loc. typ.: Jakupica mountain, 1900 m. Holotype and paratypes are deposited in my collection in Titograd.

Ecology: living in springs in the mountains.

Remarks. *B. glacialis* differs from all other yugoslav species of genus *Bogidiella* by the shape of article 2 of pereopods 3-7, and it is no closed to any other yugoslav *Bogidiella* species.

*Bogidiella longiflagellum* S. Karaman 1959  
figs. VIII, IX

Syn.: *Bogidiella longiflagellum* S. Karaman 1959, p. 339, figs. 1, 4, 9-15, 20; Ruffo 1963, p. 190; Dancau et Serban 1965, p. 341; Mateus et Maciel 1967, p. 38.

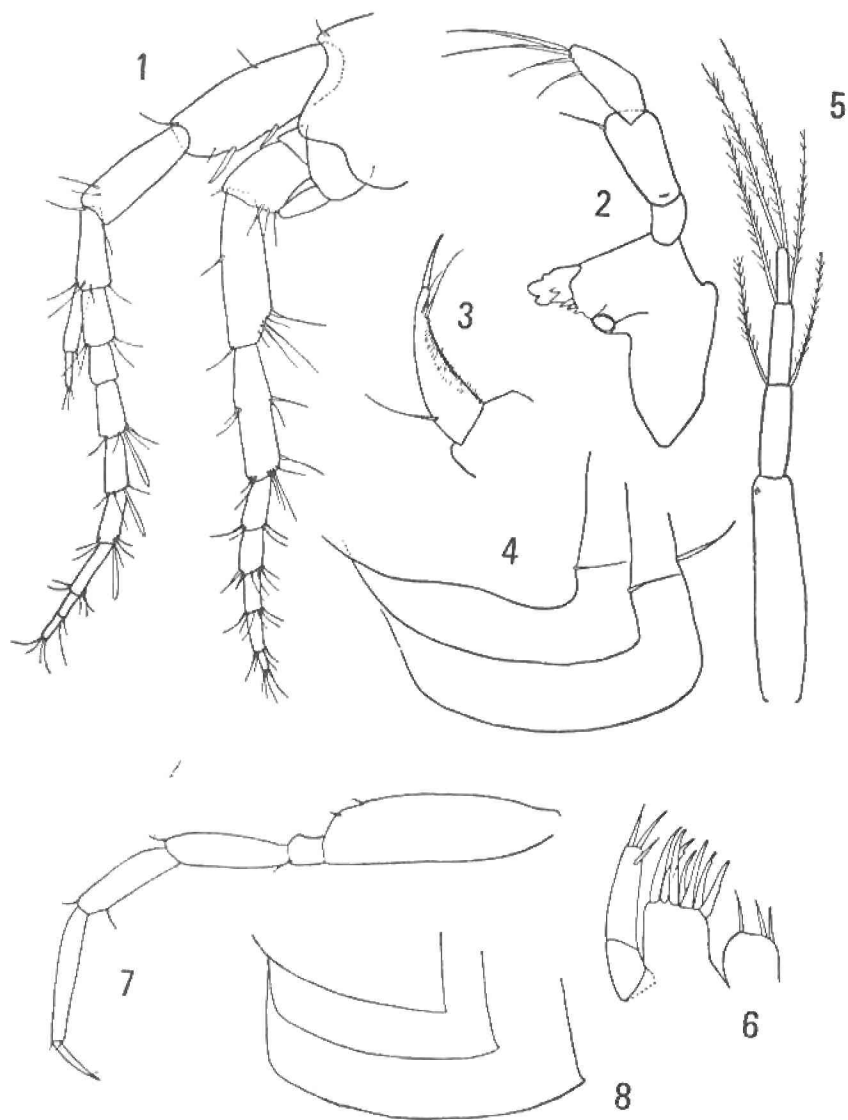


Fig. VIII. *Bogidiella glacialis* (S. Kar.), Jakupica, female 2.3 mm: 1 = head with antennae; 2 = mandible; 3 = palp of maxilliped, distal article; 4 = epimere; 5 = pleopod.

*Bogidiella longiflagellum* S. Kar., Negorci, female 2.6 mm: 6 = maxilla I; 7 = pereopod 3; 8 = epimere.

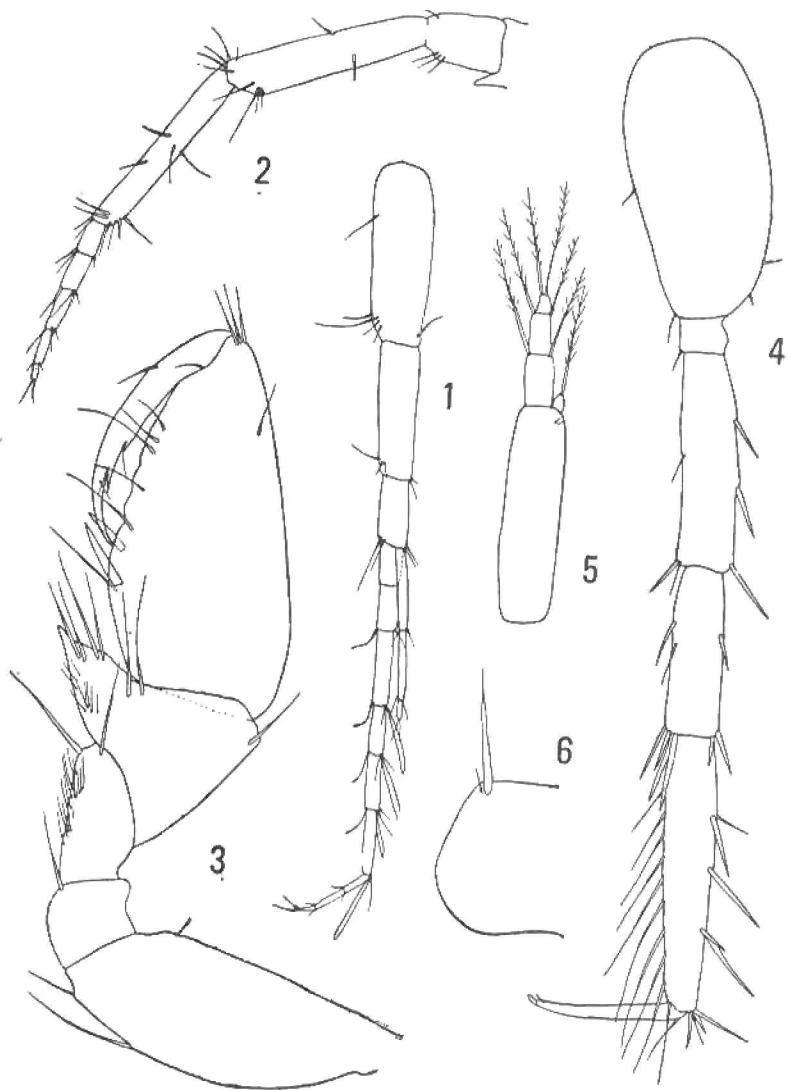


Fig. IX. *Bogidiella longiflagellum* S. Kar., Negorci, female 2.6 mm: 1 = antenna 1; 2 = antenna 2; 3 = gnathopod 1; 4 = pereopod 7; 5 = pleopod; 6 = telson.

Description of the female: Body-length up to 2.6 mm. Body smooth, lateral cephalic lobes rounded.

Antenna 1: peduncular articles progressively shorter, slender. Principal flagellum up to 9-articulate, flagellar articles bear one long aesthetasc each. Accessory flagellum very long, almost half of the principal flagellum length, 3-articulate (fig. IX, 1). Antenna 1 slightly shorter than the half of the body.

Antenna 2: peduncular articles slender, flagellum 5-articulate (fig. IX, 2). Antennal gland cone short.

Mouthparts like those of *B. glacialis*. Maxilla 1: inner lobe with 3 distal setae, outer lobe with 7 distal spines bearing 0-1 lateral tooth each. Palp 2-articulate, with 3 distal setae (fig. VIII, 6).

Coxae 1-7 like those of *B. glacialis*.

Gnathopod 1: article 2 elongated, with 2 setae at posterior margin. Articles 3-4 short, article 5 with strong posterodistal protrusion. Article 6 pyriform, palm inclined 2/3 of the article 6 length, uneven and weakly crenellated, provided with 2 corner spines. Dactyl long, with 2 teeth at inferior margin and one median seta at superior margin, nail slender and long (fig. IX, 3).

Gnathopod 2 unknown (»like that of *B. skopljensis*«).

Pereopods 3-4 like to each other, with somewhat dilated anterior portion of article 2. Articles 4-6 slender, with 1-2 setae each. Dactyl short, shorter than half of the article 6 (fig. VIII, 7).

Pereopod 7: Article 2 ovoid, with convex posterior margin; articles 4-6 of subequal width, provided with several spines at posterior margin. Anterior margin of articles 4-5 bear several setae; article 6 bears 10 setae at anterior margin, setae are longer than the diameter of the article 6 itself. Dactyl slender and long, scarcely longer than half of the article 6, nail short (fig. IX, 4).

Hertzog's organ on article 2 of pereopods 3-7 undistinct.

Pleopods 1-3 composed by longer ramus bearing 2 retinacula each and 2 rami: inner ramus short, unisegmented, provided with one long distal seta; outer ramus 3-articulate, each article bears 2 plumose setae (fig. IX, 5).

Epimere 1-3 with weakly pointed distoposterior corner (fig. VIII, 8).

Uropods 1-2 normal. Uropod 3 unknown.

Telson broader than long, with entire (?) distal margin bearing 2 long distal spines (fig. IX, 6).

Material examined: one well near Negorci (reg. Gevgelija, Macedonia), June, 1956 (holotype and paratypes).

Localities cited: Negorci, one well; Demir Kapija, subterranean water at the riverbank of Vardar (S. Karaman 1959).

Distribution: Macedonia.

Loc. typ.: Negorci. Holotype and 2 paratypes are deposited in my collection in Titograd.

Ecology: living in subterranean fresh water.

Remarks. As I had only holotype and two very damaged paratypes at disposition, there was not possible to establish the variability of *B. longiflagellum* and many other very fine differences between that species and other *Bogidiella* species.

*B. longiflagellum* is closed to *B. skopljensis* by biramous pleopods, but differs from later by the presence of 3 setae on inner lobe of maxilla 1 (by *skopljensis* 2 setae), by absence of Hertzog's organ on article 2 of pereopods 3-7, by much longer accessory flagellum of antenna 1, by entire telson (?).

*B. longiflagellum* differs from other *Bogidiella* species from Yugoslavia (*albertimagni*, *dalmatina*, *glacialis*, *semidenticulata*) by biramous pleopods.

*Bogidiella semidenticulata* Meštrov 1961  
figs. X, XI

Syn.: *Bogidiella semidenticulata* Meštrov 1961, p. 74, figs. I, 3, 12; II, 13-17; Ruffo 1963, p. 191; Dancau et Serban 1965, p. 341; Mateus et Maciel 1967, p. 39.

Description of the females: Body-length up to 2,4 mm. Body smooth, lateral cephalic lobes rounded (fig. XI, 1).

Antenna 1 nearly half of the body-length, peduncular articles weakly setose. Principal flagellum up to 8-articulate, major number of articles bear one aesthetasc longer than the article itself. Accessory flagellum 2-3 articulate, relatively short (fig. X, 14).

Antenna 2: it was missing in all our specimens, but after Meštrov »flagellum 5-articulate«.

Mouthparts like those of *B. dalmatina*. Maxilla 1: inner lobe with 2 distal setae, outer lobe with 7 distal spines bearing one lateral tooth each, palp with 3 distal setae (fig. XI, 2). Palpus mandibulae: first article smooth, second article with one seta, third article with 4 longer setae (fig. X, 1).

Coxae 1-4 broader than long, bearing 1-4 long distal setae each (figs. X, 2-5). Coxa 5 broader than coxae 6-7, all nearly triangular (figs. X, 6-8).

Gnathopod 1: article 2 relatively slender, provided with 2 setae at posterior margin. Articles 3-4 short, article 5 triangular, with

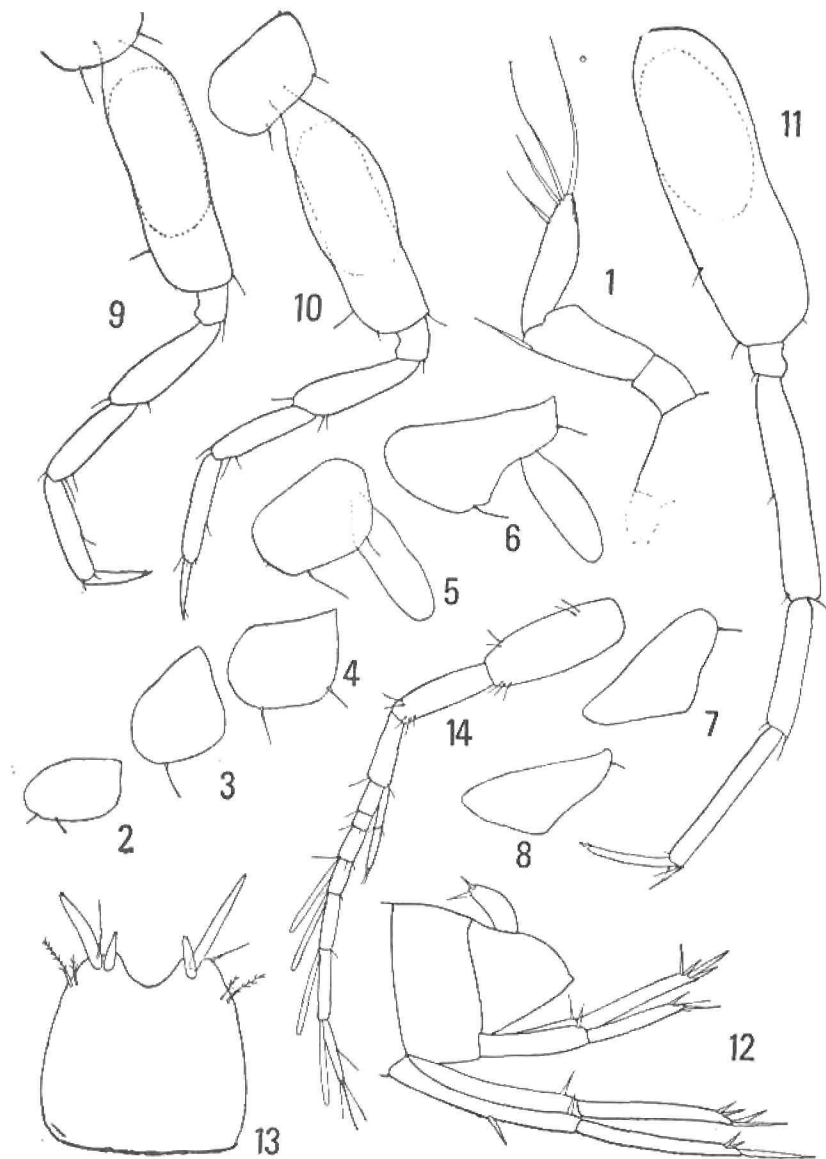


Fig. X. *Bogidiella semidenticulata* Meštrov, Dovjež, female 2 mm: 1 = palpus mandibulae; 2-8 = coxae 1-7; 9 = pereopod 3; 10 = pereopod 4; 11 = pereopod 6; 12 = urosome with uropods; 13 = telson.



Fig. XI. *Bogidiella semidenticulata* Meštrov, Dovjež, female 2 mm; 1 = lateral cephalic lobe; 2 = maxilla 1; 3 = gnathopod 1; 4 = gnathopod 2; 5 = epimere; 6 = pleopod.

distoposterior protrusion. Article 6 ovoid, longer than broad (fig. XI, 3). Palm inclined, practically non crenellated and provided with one corner spine. Posterior margin of articles 2-6 finely crenellated. Dactyl long, with 2 teeth at inferior margin and one median seta at superior margin.

Gnathopod 2: articles 2-4 more or less like to these of gnathopod 1. Article 5 triangular, lacking posterodistal protrusion (fig. XI, 4). Article 6 ovoid, longer than broad. Palm practically non crenellated, provided with one corner spine. Dactyl like to that of gnathopod 1. Posterior margin of articles 2-6 finely crenellated.

Pereopods 3-4 like to each other in the shape and pilosity (figs. X, 9-10). Article 2 bears Hertzog's organ wider than the diameter of the article 2 itself. Articles 3-6 slender. Articles 4-5 of the same length, article 7 (dactyl) nearly half of the article 6 length.

Pereopods 5 and 7 were missing. Pereopod 6: relatively long, its article 2 elongated, slightly narrowed in the middle. Article 3 short, articles 4-6 slender, article 5 shorter than article 6. Article 7 (dactyl) slender, nearly 60 percent as long as article 6 (fig. X, 11).

Pleopods with 3-articulate outer ramus, each article with 2 plumose setae. Inner ramus absent. Peduncle with 2 retinacula (fig. XI, 6).

Hertzog's organ ovoid and long, up to  $2/3$  of the article 2 of pereopods 3-6 (figs. XI, 9-11).

Epimere 1-3 smooth, with obtuse distoposterior corner (fig. XI, 5).

Uropod 1: peduncle and rami slender. Peduncle bears one median and 2 distal spines. Rami subequal in length, only with several distal spines (fig. X, 12).

Uropod 2: peduncle with 2 distal spines, inner ramus longer than outer one, both provided with distal spines only (fig. X, 12).

Uropod 3: was missing by our specimens. After Meštrov, peduncle shorter than the half of the rami-length, rami unequal to each other.

Telson nearly as long as broad, shallow cleft, each lobe bears 2 distal unequal spines and one seta. A pair of short plumose setae appears in the upper part of the lobes (fig. X, 13).

Gills appear on thoracal segments 4-6, ovoid and simple (figs. X, 5, 6).

Variability. I have had at disposition cca 20 very damaged specimens as it was not possible to establish the variability of that species.

Material examined: Dovjež, 20 spec. (leg. B. Sket).



Localities cited: Dovjež, Tacen, Zagreb (Meštrov 1961).

Distribution: Slovenia and Croatia, subterranean fresh water.

Loc. typ.: Because loc. typ. was not determined, I propose Dovjež as loc. typ., and I appointed one female of 2 mm as neotype from the same locality. Neotype is deposited in my collection in Titograd.

Ecology: living in subterranean fresh water.

Remarks. *Bogidiella semidenticulata* is closed to *B. dalmatina* by the presence of 4 distal spines on telson, but differs from later by much broader Hertzog's organ on article 2 of pereopods 3-7, by practically non crenellated palm of gnathopods 1-2, by longer dactyls of pereopods 3-7, by less pointed epimere, more slender uropods 1-2 etc.

*Bogidiella skopljensis* (S. Karaman 1933)  
figs. XII-XIV

Syn.: *Jugocrangonyx skopljensis* S. Karaman 1933, p. 45, fig. 2.  
*Bogidiella albertimagni* (part.) Hertzog 1935, p. 50;  
Hertzog 1936, p. 357.

*Bogidiella albertimagni skopljensis* S. Karaman 1953, p. 142; S. Karaman 1959, p. 346, figs. 3, 16, 19.

*Bogidiella skopljensis* S. Karaman 1943, p. 181, figs. 1-19; pl. I; Ruffo 1953, p. 16; Ruffo 1954, p. 671; Carausu, Dobreanu, Manolache 1955, p. 355, figs. 331, 332; Ruffo 1963, p. 190; Dancau et Serban 1965, p. 342; Mateus et Maciel 1967, p. 36.

Description of the female: Body-length up to 2 mm, body smooth, lateral cephalic lobes rounded (fig. XII, 1).

Antenna 1: peduncular articles 1 2 3, peduncular article 1 with 2 spines at distoventral margin. Principal flagellum up to 7-articulate, articles bear one long aesthetasc each. Accessory flagellum 2-articulate, second article short (fig. XII, 1).

Antenna 2: shorter than antenna 1, flagellum 5-articulate. Antennal gland cone short (fig. XII, 1).

Mouthparts basic. Labrum trapezoidal, with concave distal margin. Labium with well developed inner lobes, outer lobes with distoinferior corner (figs. XIII, 1, 2). Maxilla 1: inner lobe with 2 distal setae, outer lobe with 7 distal spines bearing 0-1 lateral tooth each; palp 2-articulate, with 3 distal setae (fig. XIV, 1).

Maxilla 2: inner lobe slightly shorter than outer one, bearing several distal setae each (fig. XIV, 2). Maxilliped: inner lobe with 2

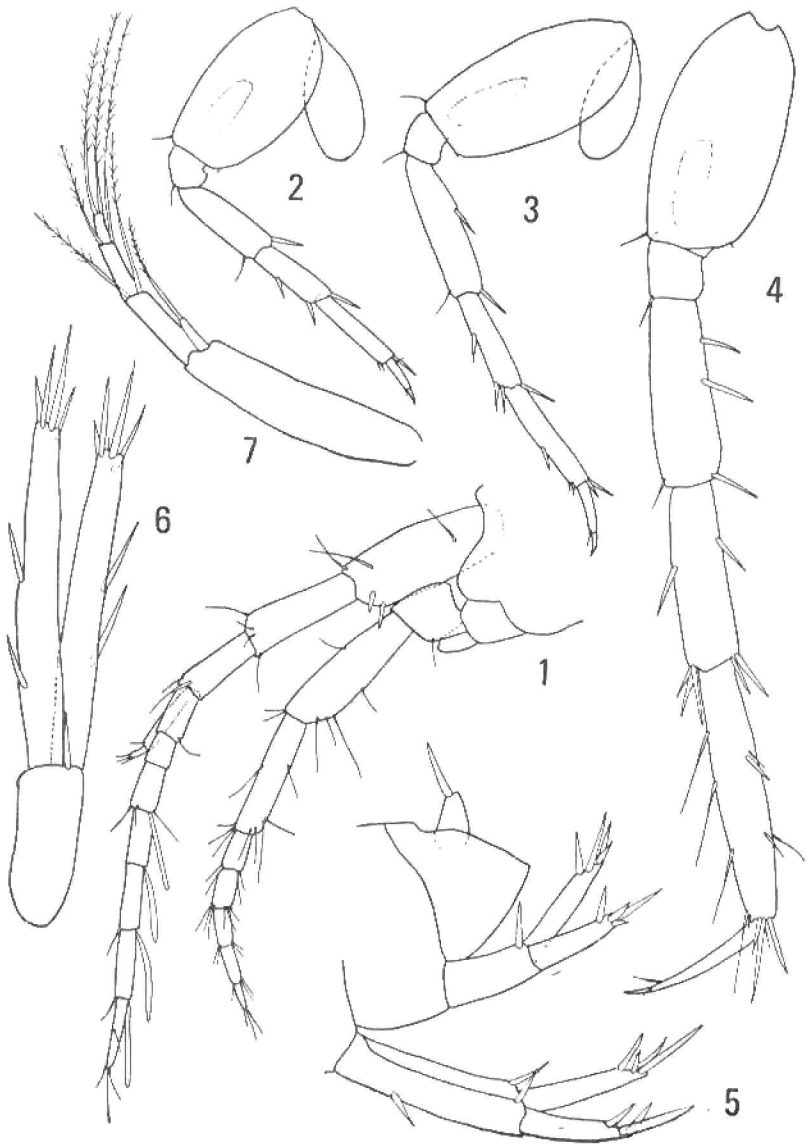


Fig. XII. *Bogidiella skopljensis* (S. Kar.), Raduša, female 1.8 mm: 1 = head with antennae; 2 = pereopod 5; 3 = pereopod 6; 4 = pereopod 7; 5 = uropods 1-2; 6 = uropod 3; 7 = pleopod.

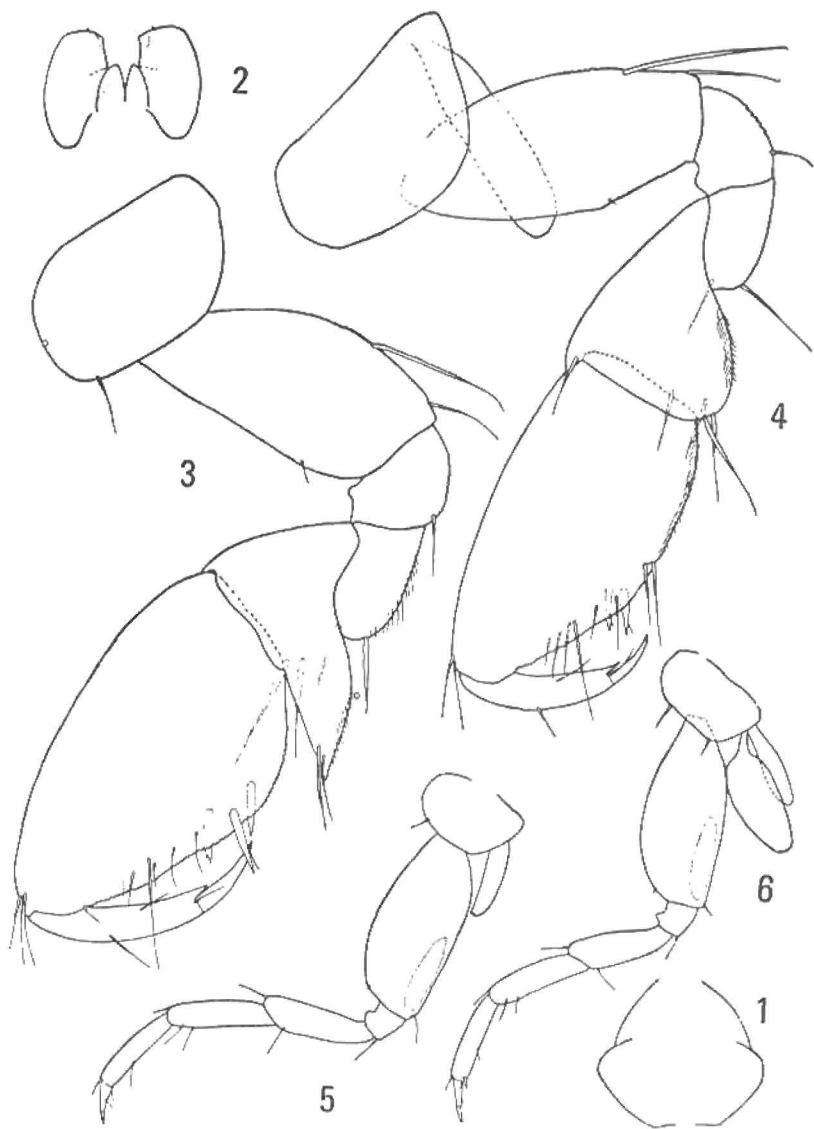


Fig. XIII. *Bogidiella skopljensis* (S. Kar.), Raduša, female 1.8 mm: 1 = labrum; 2 = labium; 3 = gnathopod 1; 4 = gnathopod 2; 5 = pereopod 3; 6 = pereopod 4.

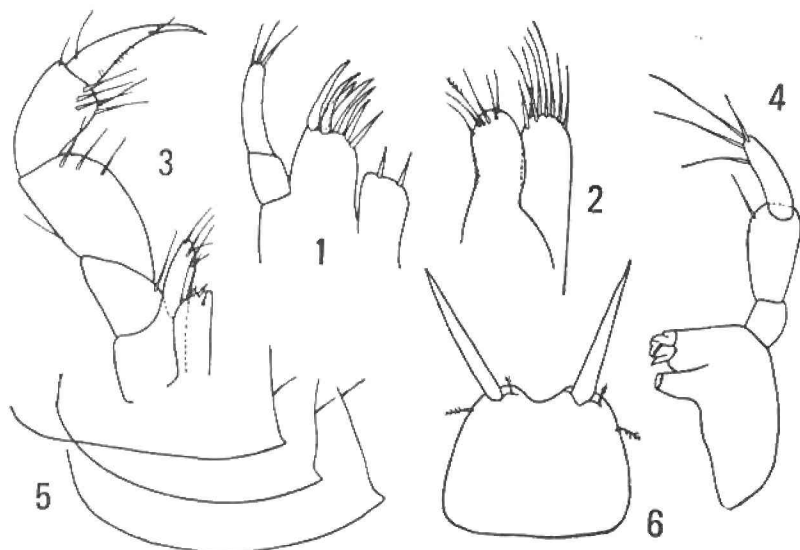


Fig. XIV. *Bogidiella skopljensis* (S. Kar.), Raduša, female 1.8 mm: 1 = maxilla 1; 2 = maxilla 2; 3 = maxilliped; 4 = mandible; 5 = epimere; 6 = telson.

distal spines, palp 4-articulate, article 4 longer than article 3, provided with slender nail (fig. XIV, 3). Mandible: second palpar article with one seta, third palpar article with 4 setae (fig. XIV, 4).

Coxae 1-4 broader than long, with subrounded distal margin bearing 1-2 setae (figs. XIII, 3-6). Coxae 5-7 subtriangular, with one distoposterior spine each.

Gnathopod 1: article 2 dilated, with 2 unequal setae at posterior margin. Articles 3-4 short, article 5 triangular, with distoposterior protrusion. Article 6 ovoid, with crenellated whole posterior margin and palm. Palm inclined, uneven, with a row of submarginal setae and one corner spine on outer surface, as well as 2 corner spines on inner surface (fig. XIII, 3). Dactyl with 2 teeth at inferior margin and one median seta at superior one.

Gnathopod 2: article 2 twice as long as broad, with 2 setae at posterior margin. Articles 3-4 short; article 5 triangular, lacking distoposterior protrusion (fig. XIII, 4). Article 6 elongated, with parallel lateral margin. Palm inclined and crenellated, provided with 2 corner spines on inner surface. Dactyl like that of gnathopod 1. Article 3 appears slightly crenellated posterior margin.

Pereopods 3-4 like to each other: article 2 dilated, with convex anterior margin lacking median incision. Articles 3-6 slender, weakly

setose at both margins. Dactyl nearly half of the article 6 length (figs. XIII, 5, 6).

Pereopod 5: relatively short; article 2 ovoid, lacking median incision (fig. XII, 2). Articles 4-6 slender, bearing single spines at both margins. Dactyl slightly longer than the half of the article 6 length.

Pereopod 6: like to pereopod 5 but much longer. Article 2 ovoid, articles 4-6 slender, article 7 (dactyl) slightly longer than the half of the article 6 length (fig. XII, 3).

Pereopod 7: very long, with ovoid article 2. Articles 3-6 very strong and relatively broad. Articles 4-5 bear spines at both margins. Article 6 bears 4 setae at anterior margin and 3 spine-groups at posterior margin. Article 6 is not wider than article 5. Dactyl slender, longer than the half of the article 6 length (fig. XII, 4).

Pleopods 1-3: peduncle with 2 retinacula. Inner ramus uniaarticulate, short, with one distal plumose seta. Outer ramus 3-articulate, long; each article with 2 plumose setae (fig. XII, 7).

Epimere 1-3 with pointed distoposterior corner (fig. XIV, 5).

Urosome smooth. Uropod 1: peduncle longer than rami. Inner ramus slightly longer than outer one; both rami with distal spines only (fig. XII, 5).

Uropod 2: Peduncle subequal to the rami; inner ramus slightly longer than outer one, both rami with distal spines only (fig. XII, 5).

Uropod 3: peduncle short, rami slender, with one median spine each. Inner ramus slightly shorter than outer one (fig. XII, 6).

Telson broader than long, incised distally, with 2 long distal spines (fig. XIV, 6).

The gills appear on thoracal segments 4-6, ovoid, simple (figs. XII, 2, 3; XIII, 6).

Hertzog's organ small, partially undistinct. Oostegites slender.

Variability. The number of the setae on inner lobe of maxilla 1 and distal spines on telson are constant.

Material examined: Raduša near Skopje, Mars, 1961, subterranean water in one small brook, several spec.; Skopje, 1932, several spec. (paratypes); Gostivar, riverbank of Vardar, subterranean water, 1953, several spec. (leg. S. Karaman); Mađari near Skopje, Oct., 1972, pump, one spec.

Localities cited: Skopje, Gostivar, Kumanovo (Yugoslavia) (S. Karaman 1933, 1934, 1959); Sighistel (reg. Oradea, Rumania) (Carausu, Dobr., Manolache 1955).

Distribution: southern Yugoslavia and Rumania.

Loc. typ.: Skopje. Holotype and paratypes are deposited in my collection in Titograd.

Ecology: living in subterranean fresh water.

Remarks. *B. skopljensis* is closed to *B. longiflagellum* by biramous pleopods and by partially undistinct Hertzog's organ, but differs from later by presence of 2 setae on inner lobe of maxilla 1 etc. (see sub *E. longiflagellum*).

### Conclusion

The genus *Bogidiella* is presented in Yugoslavia by 6 species: *B. albertimagni*, *B. dalmatina*, *B. glacialis*, *B. longiflagellum*, *B. semidenticulata* and *B. skopljensis*.

For the moment, only two of these species are known out of Yugoslavia (*B. albertimagni* and *B. skopljensis*), and other 4 species are known only from Yugoslavia.

But, we are expecting the finding of these species also in other adjacent countries: the specimens from Macedonia in Grece and Albania, and the species from Croatia and Slovenia in Italy and Hungary.

### Key to the species of *Bogidiella* from Yugoslavia

1. Telson provided with 4 spines . . . . . 2
- Telson provided with 2 spines . . . . . 3
2. Hertzog's organ on article 2 of pereopods 3-7 ovoid, very broad up to 2/3 of article 2 length. Palm of article 6 of gnathopods 1-2 practically non crenellated. Epimere with obtuse distoposterior corner  
*B. semidenticulata* Meštrov 1961
- Hertzog's organ on article 2 of pereopods 3-7 rounded, very small, less than 1/3 of the article 2 length. Palm of article 6 of gnathopods 1-2 distinctly crenellated. Epimere with pointed distoposterior corner  
*B. dalmatina* (S. Karaman 1953)
3. Inner ramus of pleopods 1-3 present . . . . . 4
- Inner ramus of pleopods 1-3 absent . . . . . 5
4. Inner lobe of maxilla 1 bears 3 distal setae. Hertzog's organ on article 2 of pereopods 3-7 completely undistinct. Accessory flagellum of antenna 1 very long, up to half of the principal flagellum length  
*B. longiflagellum* S. Karaman 1959
- Inner lobe of maxilla 1 bears 2 distal setae. Hertzog's organ on article 2 of pereopods 3-7 partially distinct. Accessory flagellum of antenna 1 very short, up to 1/4 of the principal flagellum length  
*B. skopljensis* (S. Karaman 1933)

5. Inner lobe of maxilla 1 bears 3 distal setae. Epimere with obtuse, nearly subrounded distoposterior corner. Article 2 of pereopods 3-7 with very inflated margins bearing 1-2 median incisions  
*B. glacialis* (S. Karaman 1959)
- Inner lobe of maxilla 1 bears 2 distal setae. Epimere with pointed distoposterior corner. Article 2 of pereopods 3-7 slender, lacking marginal median incisions

*B. albertimagni* Hertzog 1933

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## R e z i m e

### 53. PRILOG POZNAVANJU AMPHIPODA. O RODU BOGIDIELLA (FAM. GAMMARIDAE) U JUGOSLAVIJI

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Predstavnici roda *Bogidiella* žive u podzemnim slatkim i bočatnim vodama. Kako su njihovo sakupljanje i obrada skopčani sa znatnim teškoćama, to je otkrivanje vrsta ovog roda na teritoriji Jugoslavije, započelo tek prije četrdeset godina.

Prvu vrstu ovog roda iz Jugoslavije je opisao S. Karaman 1933. iz podzemnih voda Skoplja, *Bogidiella skopljensis*. Isti autor je kasnije (1953) opisao jednu drugu vrstu, *B. dalmatina*, iz podzemnih bočatnih voda kod Dubrovnika i Cavtata, a 1959. još dvije nove vrste, *B. glacialis* iz malog izvora na planini Jakupici u Makedoniji na nadmorskoj visini od 1900. m i *B. longiflagellum* iz podzemnih voda južne Makedonije (Negorci, Demir Kapija).

Meštrov je 1961. opisao dvije vrste roda *Bogidiella* iz Hrvatske i Slovenije, iz podzemnih voda, *B. semidenticulata* i *B. denticulata*. Ova posljednja je sinonim vrste *B. albertimagani* Hertzog.

Istražujući faunu podzemnih voda Crne Gore, otkrili smo u podzemnim vodama rijeke Pive (kod Plužina i uliva rijeke Komarnice u Pivu) i Tare (kod Trebaljeva) vrstu *Bogidiella albertimagani* Hertzog koja je bila poznata jedino iz srednje Evrope i Rumunije. Nalaz ove vrste u sjevernom regionu Crne Gore potvrđuje pretpostavku da je ona vjerovatno prodrla iz srednje Evrope na jug za vrijeme Ledenog doba, jer je ne susrećemo u refugijama stare tercijerne evropske faune na Balkanu.

Ključ za određivanje vrsta roda *Bogidiella* u Jugoslaviji

- |                                 |   |
|---------------------------------|---|
| 1. Telzon nosi 4 trna . . . . . | 2 |
| — Telzon nosi 2 trna . . . . .  | 3 |



2. Hertzogov organ na drugom segmentu 5-7 pereopoda ovalan, dostiže do  $\frac{2}{3}$  dužine samog drugog segmenta. Palma šestog segmenta gnatopoda 1-2 skoro nenazubljena. Epimere sa tupim stražnjim uglom. *B. semidenticulata* Meštrov 1961.
- Hertzogov organ na drugom segmentu 5-7 pereopoda okruglast, vrlo malen, manji od  $\frac{1}{3}$  dužine samog drugog segmenta. Palma šestog segmenta gnatopoda 1-2 jasno nazubljena. Epimere sa šiljastim stražnjim uglom *B. dalmatina* (S. Karaman 1953)
3. Pleopodi 1-3 sa razvijenom unutrašnjom granom . . . . . 4  
 — Pleopodi 1-3 bez unutrašnje grane . . . . . 5
4. Unutrašnji lobus prve maksile nosi 3 dlake. Hertzogov organ na drugom segmentu 3-7 pereopoda sasvim nejasan. Bočni bič prve antene vrlo dug, dostiže do polovine dužine glavnog biča  
*B. longiflagellum* S. Karaman 1959.
- Unutrašnji lobus prve maksile nosi 2 dlake. Hertzogov organ na drugom segmentu 3-7 pereopoda djelimično jasan. Bočni bič prve antene vrlo kratak, dostiže do  $\frac{1}{4}$  dužine glavnog biča.  
*B. skopljensis* (S. Karaman 1933)
5. Unutrašnji lobus prve maksile nosi 3 dlake. Epimere sa tupim, skoro zaobljenim stražnjim uglom. Drugi segment pereopoda 3-7 znatno proširen i nosi 1-2 ureza u sredini.  
*B. glacialis* (S. Karaman 1959)
- Unutrašnji lobus prve maksile nosi 2 dlake. Epimere sa šiljastim stražnjim uglom. Drugi segment pereopoda 3-7 uzak, bez ureza u sredini.  
*B. albertimagni* Hertzog 1933.