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**FIRST DISCOVERY OF FAMILY SALENTINELLIDAE (CRUSTACEA:  
SENTICAUDATA) IN ALBANIA  
(CONTRIBUTION TO THE KNOWLEDGE OF THE AMPHIPODA 332)**

*Abstract*

The subterranean species *Salentinella angelieri* Delamare Deboutteville & Ruffo, 1952 (Crustacea Amphipoda, fam. Salentinellidae) is discovered at the first time in Albania, in the material collected in the frame of APPEAR project VjoSusDev (programme of the Austrian Development Cooperation implemented by the OeAD).

Short redescription and figures of this species is based on specimens from subterranean waters of Shushica River, tributary of Fjosa River in southern Albania. Variability and distribution of this species (southern Europe and NW part of African coast) are discussed. Type-locality (locus typicus) of all *Salentinella* species is mentioned. The list and typus generis of genera of family Salentinellidae is cited.

*Keywords:* Amphipoda, Salentinellidae, *Salentinella angelieri*, Albania, taxonomy, description.

**MATERIAL AND METHODS**

The studied material was collected in Albania over APPEAR project VjoSusDev (programme of the Austrian Development Cooperation implemented by the OeAD) in the years 2021.

The specimens were collected by hand-net and Bou-pump, and preserved in 70-95% ethanol. Specimens were dissected using a WILD M20 microscope and drawn using a camera lucida attachment. Specimens were submersed in a mixture of glycerin and water for study. Later all dissected appendages were transferred to Liquid of Faure on permanent slides. All illustrations were inked manually.

Terms “setae” and “spines” are used based on shape, not origin. Our studies were based on the external morphology, ecology and zoogeography.

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In References we mentioned the presence of figures in various papers, what is very important and helpful in taxonomical determination of this species.

## INTRODUCTION

The subterranean water fauna in Albania was relatively poorly known, including Amphipoda, where only several species of families Gammaridae and Niphargidae have been mentioned by several authors (Sandro Ruffo (1995), Stanko Karaman (1929), Gordan Karaman (2011a; 2011b), Dhimiter Dhora (2010), Filipi Ndoc (1959), K. Lindberg (1955), etc.).

During intensive investigation of the subterranean fauna of Albania, in the frame of the APPEAR project VjoSusDev (programme of the Austrian Development Cooperation implemented by the OeAD), the samples of subterranean Amphipoda from southern part of Albania (Vjosa River region) were collected in May, 2021, and kindly sent me at disposition for study, thanks to Prof. C. Griebler from the University of Wien, Austria. One part of this research is presented in this work, regarding specimens of family Salentinellidae, discovered at the first time in Albania.

The family Salentinellidae is limited to the central and western part of the Mediterranean basin of Europe (including Adriatic and Aegean Sea) as well as north-western part of the Mediterranean basin of north Africa (Algeria, Morocco), settling subterranean fresh and anchialine waters, sometimes mixed with various other subterranean amphipods (*Niphargus*, *Hadzia*, *Rhipidogammarus*, etc.). The species of this family have been considered as members of the family Gammaridae till 1977, when Bousfield (1977) erected new family Salentinellidae with 2 genera: *Salentinella* Ruffo, 1947 and *Parasalentinella* Bou, 1971. It is interesting that family Salentinellidae is unknown in the eastern part of the Mediterranean Sea basin, what can be explained by different zoogeographical events or weaker investigations in this region.

Ruffo (1947) described a new genus and species *Salentinella gracillima* from Italy, and later nearly 15 taxa of this genus were described by various authors. Bou, C. (1971) described a monotypic second genus *Parasalentinella*, with new species *P. rouchi* from the subterranean waters of Pyrenees Francoise. Messouli et al. (2018) in their revision of family Salentinellidae, established two new genera: *Coxosalentinella* and *Aposalentinella* from Spain and France.

## TAXONOMICAL PART

### Order Amphipoda Latreille, 1816

#### Suborder Senticaudata Lowry & Myers, 2013

#### Infraorder Bogidiellida Hertzog, 1936 (Lowry & Myers, 2013)

#### Parvorder Bogidiellidira Hertzog, 1936 (Lowry & Myers, 2013)

#### Superfamily Bogidielloidea Hertzog, 1936 (Bousfield, 1977)

### FAMILY SALENTINELLIDAE Bousfield, 1977

Typus familiae: *Salentinella* Ruffo, 1947

The family Salentinellidae is composed of 4 genera:

### GENUS APOSALENTINELLA Messouli, Coineau & Boutin, 2018

[Typus generis: *Aposalentinella latus*, Messouli, Coineau, & Boutin, 2018].

Taxa: *Aposalentinella latus*, Messouli, Coineau & Boutin, 2018 [loc. typ.: Carcagente, Campo de Cogulada, Valencia, Spain].

## GENUS *COXOSALENTINELLA* Messouli, Coineau & Boutin, 2018

[Typus generis: *Salentinella gineti* Balazuc, 1957]

Taxa: *Coxosalentinella gineti* (Balazuc, 1957) [loc. typ.: Caujolle Cave waters near Saint-Girons, Ariège, southern France].

Platvoet (1984) removed *Salentinella lescherae* Coineau, 1968 [loc. typ.: Les Tavernes, Gard, Gardon d'Ales, France] to *Salentinella major* Barbe, 1965 as synonym.

Ruffo (1986) removed *Salentinella major* Barbé, 1965 [loc. typ.: Valence d'Agen (Tarn et Garonne), France] to *Salentinella gineti* as synonym, and *Salentinella prognatha* Barbe, 1963 [loc. typ.: Cave Caujolle, Pyrenees, France] to *Salentinella lescherae* as synonym.

## Genus *PARASALENTINELLA* Bou, 1971

[Typus generis: *Parasalentinella rouchi*, Bou, 1971].

Taxa: *Parasalentinella rouchi* Bou, 1971 [loc. typ.: Haute Garonne, Ariège dept., France].

## GENUS *SALENTINELLA* Ruffo, 1947

[Typus generis: *Salentinella angelieri* Delamare-Deboutteville & Ruffo, 1952].

Taxa: *Salentinella anae* Messouli, Coineau & Boutin, 2002 [loc. typ.: groundwater of a tributary of the Rio Tajo, Puerto -Peralveche, Guadalajara Prov., Spain];

*Salentinella angelieri* Delamare-Deboutteville & Ruffo, 1952 [loc. typ.: subterranean waters of torrent Casaluna, Corsica island, France]. G. Karaman (1979) removed *S. gracillima balcanica* S. Karaman, 1953, *S. angelieri pisana* Ruffo, 1953, *S. franciscoloi* Ruffo, 1953, and *Salentinella* sp. Dancau, 1973 as synonyms of *S. angelieri*.

Platvoet (1984) removed *S. juberthiae* Coineau, 1968 to *S. angelieri* as synonym, and Pretus (1991) removed *S. formenterae* Platvoet, 1984 to *S. angelieri* as synonym. Jaume & Vonk (2021) confirm this synonymy, although in World Amphipoda Database (2023, last changes in 2016) *S. formenterae* is cited as a distinct species.

*Salentinella carracensis* Platvoet, 1987 [loc. typ.: Tajo, Rio, Valtablado del Rio, Guadalajara, Spain];

*Salentinella casteresi* Jaume & Vonk, 2021 [loc. typ.: Raja Santa Cave, Sierra Elvira, Granada, Spain];

*Salentinella cazemierae* Platvoet, 1987 [loc. typ.: Villobas, Huesca, Spain];

*Salentinella delamarei delamarei* Coineau, 1962 [loc. typ.: Tech River groundwater, France];

*Salentinella delamarei macrocheles* Coineau, 1968 [loc. typ.: Saint-Alban-sous Sampson, Ardeche, France];

*Salentinella gracillima* Ruffo, 1947 [loc. typ.: L'Abisso, Casto Marina, Lecce, Italia];

*Salentinella longicaudata* Platvoet, 1987 [loc. typ.: Villamarchante, Valencia, Spain];

*Salentinella longispina* Platvoet, 1987 [loc. typ.: Corbera de Alcira, San Bernardo, Valencia, Spain] (was described as *S. angelieri* var. *longispina*). Messouli et al. (2018) considered it as valid species, as sister species of *S. meijersae*. Jaume & Vonk (2021) cited it as one variety of *S. angelieri*;

*Salentinella meijersae* Platvoet, 1987 [loc. typ.: Merindad de Montija, Burgos, Spain];

*Salentinella messanai* Messouli, Coineau & Boutin, 2018 [loc. typ.: Terternia, well, Sardinia island, Italy];

*Salentinella petiti* Coineau, 1963 [loc. typ.: Savignac-les-Eglises, Dordogne, France]. Messouli et al. (2002) synonymized *Salentinella prognatha* Barbe, 1963 with *Salentinella petiti*.

*Salentinella ruffoi* Messouli, Coineau & Boutin, 2018 [loc. typ.: hyporheic water from the Comelade River, Millas (hydrographic system of the Têt River, France)];

*Salentinella seviliensis* Platvoet, 1987 [loc. typ.: well S of Alcolea del Rio, Seville, Spain].

**SALENTINELLA ANGELIERI Delamare Deboutteville & Ruffo, 1952**

Figures 1-5

*Salentinella angelieri* Delamare-Deboutteville & Ruffo, in: Ruffo & Delamare-Deboutteville, 1952: 1, figs. 5-9; Ruffo 1953b: 27, pl. 10; Delamare Deboutteville & Ruffo, 1954: 139, figs. 1-2; Balazuc, 1954: 183; G. Karaman, 1974: 29; Pesce et al., 1979: 111; G. Karaman, 1979: 30, figs. I-VII; Pesce, 1980: 573, fig. 4; G. Karaman & Pesce, 1980: 201; Barnard, J.L. & Barnard, C.M., 1983: 701; Pesce & Maggi, 1983: 58, fig. 6 (map); Pesce, 1985a: 142; Ruffo, 1986: 566; Platvoet, 1987: 218, fig. 11; Notenboom, 1990: 169, fig. 3; G. Karaman, 1993: 297, figs. 146, 147; Rossi & Inguscio, 2003: 223; Ferreira et al., 2007: 589; Gottstein & Jalžić, 2009: 27, fig. 8. G. Karaman, 2011a: 183; G. Karaman, 2012: 54; Navarro-Barranco et al., 2023: 13;

*Salentinella cf. angelieri* Belaidi et al., 2011: 30 [Tafna wadi, Algeria];

*Salentinella gracillima balcanica* S. Karaman, 1953: 140 [loc. typ.: Lapad [Dubrovnik, Croatia, orig. design.] [G. Karaman (1974) misquotes loc. typ.: Šipun cave near Cavtat]; S. Karaman, 1955: 223, 240;

*Salentinella angelieri balcanica* G. Karaman, 1967: 2, figs. 1-15; Sket, 1969: 148; G. Karaman, 1974: 29; Sket & G. Karaman, 1990: 169; Sket, 1994: 69;

*Salentinella angelieri pisana* Ruffo, 1953a: 60, fig. V, 5, 6 [loc. typ.: Toscana Cava della Croce di Agnano, Italia];

*Salentinella denticulata* Baschieri, 1952: 4, figs. 1-10 [loc. typ.: Grotta di Punta degli Stretti, Monte Argentario, Toscana Italia];

*Salentinella franciscoi* Ruffo, 1953a: 62, figs. IV, 3, 4; V, 3, 6, 8 [loc. typ.: Grotta dell'Orso o del Poggio, Ponte di Nava, Cuneo, Italia]; Ruffo, 1953b: 27, pl. 10;

*Salentinella juberthiae* Coineau, 1968: 186, figs. 20, 21 [loc. typ.: St. Alban, Ardeche, France]. Platvoet (1984) and Pretus (1991) moved it to *S. angelieri* as synonym, as well as World database [2023], but Messouli et al. (2018) consider it as distinct species.

*Salentinella formenterae* Platvoet, 1984: 178, figs. 1-2 [loc. typ.: Coves de la Pedrera Cave, Formentera Island, Balears, Spain], removed later to *S. angelieri* as synonym by Pretus (1991) and Jaume & Vonk (2021).

*Salentinella sp.* Dancau, 1973: 225, figs. 1-4 [Mallorca island, Balears], mentioned by G. Karaman (1979) as probably synonym of *S. angelieri*.

**LOC. TYP.:** Subterranean waters of torrent Casaluna, Corsica Island, France.

**MATERIAL EXAMINED: ALBANIA:**

AL 1 (VJO 002 = Shus 15): Right bank of the Shushica river 300 m upstream of the new bridge of Gjorm (Ura e Gjormit), 2.5 km north of the city of Gjorm, 31.3.2021, several exp. mixed with *Niphargus* sp. (leg. C. Karwautz, G. Rasch & C. Griebler);

AL 7 (VJO 020 = Shus 19): Right bank of the Shushica river at Himare, 3 km southeast of the village Kallarat. Latitude 40.19856075724803, Longitude 19.773140649349333, 2021, 2 exp. (leg. C. Karwautz, G. Rasch & C. Griebler);

AL 8 (VJO 017 = Shus 7): Shushica, 2.8 km downstream of Kallarat right bank. Inbetween the two tributaries at the left bank of the Shushica, 9 exp. mixed with *Niphargus* sp., 2021, (leg. C. Karwautz, G. Rasch & C. Griebler);

AL 10 (VJO 018 = Shus 05): Tributary of the Shushica right bank, 1.8 km east of Kallarat, 1 exp. mixed with *Niphargus* sp., 2021 (leg. C. Karwautz, G. Rasch & C. Griebler);

- AL 12 (VJO 04 = Shus 18): Shushica about 1 km upstream of Drashovice, right bank of the river at an pedestrian bridge (Ura e Pallambillos), 5 exp. mixed with *Niphargus* sp., 2021 (leg. C. Karwautz, G. Rasch & C. Griebler);
- AL 13 (VJO 021 = Shus 20): Shushica, 1.5km before it merges with the Vjosa. 2.9 km small road from the village Mesarak to the west, 5 exp., 2021 (leg. C. Karwautz, G. Rasch & C. Griebler).

**SHORT TAXONOMICAL DATA OF *SALENTINELLA ANGELIERI* FROM ALBANIA:**

**FEMALE 1.9 mm [Shus 20]:** Body stout, urosomal segments 1 and 2 on each dorsolateral side with one very small seta, urosomal segment 3 with small spine-like seta on each dorsolateral side (fig. 3E). Urosomal segment 1 on each ventroposterior margin with one distinct spine near basis of uropod 1-peduncle (fig. 3E). Epimeral plate 1 distinctly angular to poorly pointed, epimeral plates 2-3 more or less pointed, with posterior margin smooth or irregularly emarginated (fig. 3A), epimeral plates 1-3 without subventral spines.

Head with short rostrum, subtriangular lateral cephalic lobes and ventroanterior excavation, eyes absent (fig. 1A).

Mouthparts like these of type-species. Labrum rather broader than long, convex distally (fig. 4A). Labium rather broader than long, inner lobes absent, outer lobes subrounded distally (fig. 4B).

Mandibles with triturative molar and symmetric palpus. Left mandible: incisor with 5 distinct teeth, lacinia mobilis with 4 distinct teeth accompanied by 4 rakers (fig. 1C). Right mandible: molar with long lateral seta, incisor with 4 distinct and one indistinct tooth (?), lacinia mobilis serrate, accompanied by 4 rakers (fig. 1B). Palpus 3-articulated; first article short, naked; second article long, at distoventral margin with 6 strong plumose setae; article 3 short, with 5 unequal strong plumose setae at ventral margin and with 2 short facial setae (fig. 1D).

Maxilla 1: inner and outer plate identic in left and right maxilla 1; inner plate short, with 2 distal rather plumose setae; outer plate with nearly 9 spines bearing 3-4 lateral teeth each. Palpus 2-articulated, exceeding tip of outer plate-spines. Left palpus narrower, with 5 distal weak teeth (fig. 1E); right palpus stronger, with 4 distal strong teeth (fig. 1F).

Maxilla 2 longer than broad, outer plate with row of stronger distal setae; inner plate slightly smaller than outer, bearing several distal and distolateral setae (fig. 1G).

Maxilliped: inner plate short, with 2 distal spines and single setae; outer plate reaching nearly half of palpus article 2, with row of distomesial strong spines (fig. 1H); palpus 4-articulated, article 2 with 3 mesial setae; article 3 with distoexternal and distomesial setae; palpus article 4 with one median external marginal seta and 1-2 mesial setae near basis of the long nail (fig. 1H).

Coxae 1-7 of different length and size. Coxa 1 short, subbroad, with obtuse ventroanterior corner (fig. 2A); coxa 2 almost as long as coxa 1, subangular (fig. 2C); coxa 3 distinctly smaller than coxa 2, nearly as long as broad (fig. 3B). Coxa 4 elongated, subrounded and tapering distally (fig. 3D). Coxa 5 slightly shorter but broader than coxa 4, with shallow anterior lobe and subrounded posterior lobe (fig. 4C). Coxa 6 short, nearly quadrate, broader than long, unlobed (fig. 4E). Coxa 7 short, broader than long, unlobed (fig. 4F); all coxae with one short marginal seta.

Gnathopods 1-2 nearly linear, of unequal size and shape. Gnathopod 1 shorter than gnathopod 2, with article 2 slightly inflated in the middle, bearing 3 long median setae at posterior margin and 2 long median setae at anterior margin (fig. 2A). Article 3 short, with one distoposterior short seta; article 4 short, with 3 long posterodistal setae. Article 5 elongated, triangular, nearly twice as long as broad, with 5-6 strong posterior marginal setae and one distoanterior seta (fig. 2B). Propodus slightly egg-shaped, nearly twice as long as broad, tapering distally, palm very inclined, reaching nearly half of posterior margin of propodus, bearing 4 long setae, anterior margin with 1-2 median and 2 distal setae (fig. 2B); dactylus longer than diameter of propodus, exceeding half of propodus-length, with one median seta at outer margin (fig. 2B).

Gnathopod 2: article 2 narrow, along anterior margin with 2 long median and one distal posterior marginal seta; article 3 short, with one posterior short seta; article 4 short, with one distoposterior seta (fig. 2C). Article 5 elongated, rather longer and more narrow than propodus, at posterior margin with 6 setae and one short distoanterior seta (fig. 2D). Propodus elongated egg-shaped, tapering distally, with 5 long posterior marginal setae and one distal distoanterior short seta; palm very inclined, not excavated (fig. 2D); dactylus reaching nearly half of propodus-length, with one median seta at outer margin (fig. 2D).

Pereopods 3-4 linear, nearly of the same length, with rare short single setae along both margins. Pereopod 3: article 2 is the longest one, rather broader than other articles; article 6 is rather longer than articles 4 and 5 (fig. 3B). Dactylus slender, reaching nearly half of article 6, at inner margin with short seta near basis of the nail, nail rather shorter than pedestal (fig. 3C).

Pereopod 4 rather similar to pereopod 3 but poorly shorter (fig. 3D).

Pereopod 5: article 2 dilated, longer than broad, rather tapering distally, anterior margin convex, with 5-6 short setae, not produced distoanteriorly; posterior margin poorly convex, poorly serrate, with 5 marginal short setae, ventroposterior lobe shallow but distinct (fig. 4C); article 3 short, with distoanterior short seta; article 4-5 longer, nearly of the same length; article 6 rather longer than articles 4 and 5, all articles with rare single short marginal setae; 2 very long plumose setae are attached distally of article 6 (fig. 4D). Dactylus slender, rather longer than article 6, with one very short seta at inner margin near basis of the nail, nail rather shorter than pedestal (fig. 4D).

Pereopod 6: article 2 longer than broad, ovoid, not tapering ventrally, along anterior slightly convex margin with several short setae, along posterior convex, poorly serrate margin with 7-8 short setae, ventroposterior lobe shallow but well developed (fig. 4E). Article 3 short, with one short anterodistal seta; articles 4-5 with nearly of equal length, at both margins with 1-2 distal short setae each. Article 6 longer than article 4 and 5, with one median seta at posterior margin and 2-3 short setae at the tip of the article, long distal plumose setae absent. Dactylus slender, rather longer than half of article 6-length, with one very short seta at inner margin near basis of the nail; nail rather shorter than pedestal (fig. 4E).

Pereopod 7 slightly shorter than pereopod 6, article 2 dilated, ovoid, anterior margin slightly convex, with 3-4 short setae, posterior margin remarkably convex, poorly serrate, bearing nearly 11 short setae, ventroposterior lobe very large and deep (fig. 4F). Article 3 short, with distoanterior short seta; article 4 slightly dilated, much longer than article 3, bearing ventroposterior lobe with one lateral and distal short seta, and one distoanterior spine. Article 5 nearly as long as 4 but not dilated, with 2-3 distal short setae and one spine; article 6 longer than article 5, narrow, with one median spine and 2-3 short distal setae. Dactylus rather shorter than half of article 6, slender, with one seta at inner margin near basis of the nail, nail shorter than pedestal (fig. 4F).

Pleopods 1-3 with almost naked peduncle bearing 2 slender retinacula (fig. 4H), inner ramus 3-articulated, outer ramus 4-articulated (fig. 4G).

Uropods 1-3 with pointed rami. Uropods 1-2 relatively short, poorly exceeding basis of uropod 3. Uropod 1: peduncle with distal spines, inner ramus with row of strong lateral spines, outer ramus remarkably shorter than inner one, with subdistal spine and short seta (fig. 3E).

Uropod 2: peduncle with distal spines; inner ramus longer than peduncle, bearing one lateral and subdistal spine, outer ramus remarkably shorter than inner one, with subdistal spine (fig. 3E).

Uropod 3 relatively short; peduncle short, nearly as long as broad; outer ramus 2-articulated, first article along outer ramus with 3 single spines, along mesial margin with 3 single long plumose setae and 1-2 spines; second article shorter than diameter of first article (fig 1 I); inner ramus almost reaching half of first article of outer ramus, with one median and one subdistal seta at outer margin.

Telson longer than broad, incised  $\frac{3}{4}$  of telson-length, each lobe tapering and incised distally, bearing one spine-like seta in the incision. A pair of short plumose setae is attached in upper half of each lobe (fig. 3F).

Coxal gills short, ovoid, occur on mesosomal segments 2-6.  
Oostegites never observed.

**MALES** slightly differing from females by rather stronger and shorter distal articles 5-6 of gnathopods 1-2 (fig. 5A, B) and by flagellum of antenna 1 bearing higher number of aesthetascs. G. Karaman (1979) figured males from Cavtat (Croatia) and Monrovalle (Italy) and Dancau (1973) these for *Salentinella* sp. (= *angelieri*) from Mallorca).

But many *Salentinella* species are described based on females only, what open the question on possible different unknown taxonomical differences between various species. The similar problem is with coxal gills, neither described not figured in many *Salentinella* species.

**VARIABILITY:** There are rather variability in the length of uropod 3 inner ramus and number of lateral plumose setae at mesial margin of outer ramus of first article (fig. 1 I, K), more or less pointed or angular epimeral plates (fig. 3A, G), shape of pereopod 7. Variability of morphological character in *S. angelieri* is well visible observing descriptions of various *Salentinella* species moved later to *S. angelieri* as synonyms.

Belaidi et al. (2011) cited *Salentinella* cf. *angelieri* from wells in NW Algeria without any morphological data and it needs further confirmation.

#### **ECOLOGY**

*S. angelieri* has very wide distribution, settling fresh and brackish subterranean waters, marine and freshwater caves, usually not far from the sea, but sometimes rather far from the sea coast [Ponte di Nava in Cuneo, over 50 km far from the sea (Ruffo, 1953a), present work, etc.]. So extremely wide distribution of this species open the possibility that *S. angelieri* can be not one, but complex of morphologically similar species, but with molecular genetic differences among them.

Pretus (1987) mentioned that almost all known samples of *Salentinella* are without known ovigerous females or oostegites, suggesting that maybe females of *Salentinella* don't bring the eggs, but deposit eggs on the bottom. G. Karaman (1967) observed and mentioned that the specimens of *S. angelieri* in Šipun Cave in Cavtat are swimming on the back in snatch (the most other amphipods are swimming in lateral position).

#### **DISTRIBUTION**

*Salentinella angelieri* differs from all other species of this genus by its large distribution: western coasts of the Mediterranean Sea, from Greece and its Ionian island Lesbos) and north Aegean islands Zante (=Zakynthos) and Cephalonia, Montenegro, Albania (new), coast of Croatia with some islands [island Gangarol (=Gangaro; 10 km S. of Biograd na Moru)], Italy and its island Sardinia, France with Corsica island, Spain with Balears islands Formentera, Menorca and Mallorca, as well as north-western Mediterranean coast of North Africa [Morocco, Derdara freshwater well (G. Karaman & Pesce, 1980) and Algeria (wells along Tafna wadi alluvial aquifer, up to 45 km from the Mediterranean Sea) (Belaidi et al., 2011). All other known *Salentinella* species have relatively restricted area of distribution. Navarro-Barranco et al. (2023): mentioned 3 regions of the Mediterranean Sea with localities of *S. angelieri*: Algero-Provencal basin, Adriatic Sea, Ionian Sea.

As numerous localities of this species have been published by various authors (Pesce 1985a, b, c, d.; Pretus, 1989; Pesce et al., 2004, etc.), we limited our citations of localities of this species **on eastern Adriatic coast only.**

**CROATIA:** well in Lapad (Dubrovnik) (S. Karaman, 1953; 1955; G. Karaman, 2011a); Gruž (Dubrovnik) (G. Karaman, 1974; 1979; 2011a); Šipun Cave in Cavtat (S. Karaman, 1953; 1955; G. Karaman, 1967; 1974; 1979; 2011a; Bedek et al., 2006); Semi-cave Bikovica near Pirovac; Karin (Sket, 1969; G. Karaman, 1974; 1979; 2011a); anchialine cave in the

island Gangarol (=Gangaro; 10 km S. of Biograd na Moru) (Sket & G. Karaman, 1990; G. Karaman, 2011a);

BOSNIA & HERZEGOVINA: “?Čapljina”: Sket, 1969; G. Karaman, 1979.

MONTENEGRO: Bečići near Budva (G. Karaman, 2012).

## REMARKS AND DISCUSSION

*Salentinella angelieri* (sensu auctorum) based on its large distribution, variability of some morphological characters (length of inner ramus of uropod 3, presence of spine or seta on tip of telson-lobes, length of antenna 1 peduncular articles, number of aesthetascs, variable shape of epimeral plates, etc.), has led many scientists to describe the various populations of this taxon as distinct taxa (species or subspecies). Recently, there are no investigations of breeding possibilities among various *S. angelieri* populations (sensu auct.) to confirm present taxonomical position of its various populations.

Jaume & Vonk (2021) mentioned also the possibility that *S. angelieri* and *S. gracillima* can be the same species, although our observations of both species made this possible fusion questionable.

All these investigations were based on morphological characters; it is necessary to provide detailed molecular/ genetic and other studies to help in recognizing of real status of populations within *Salentinella angelieri* Complex.

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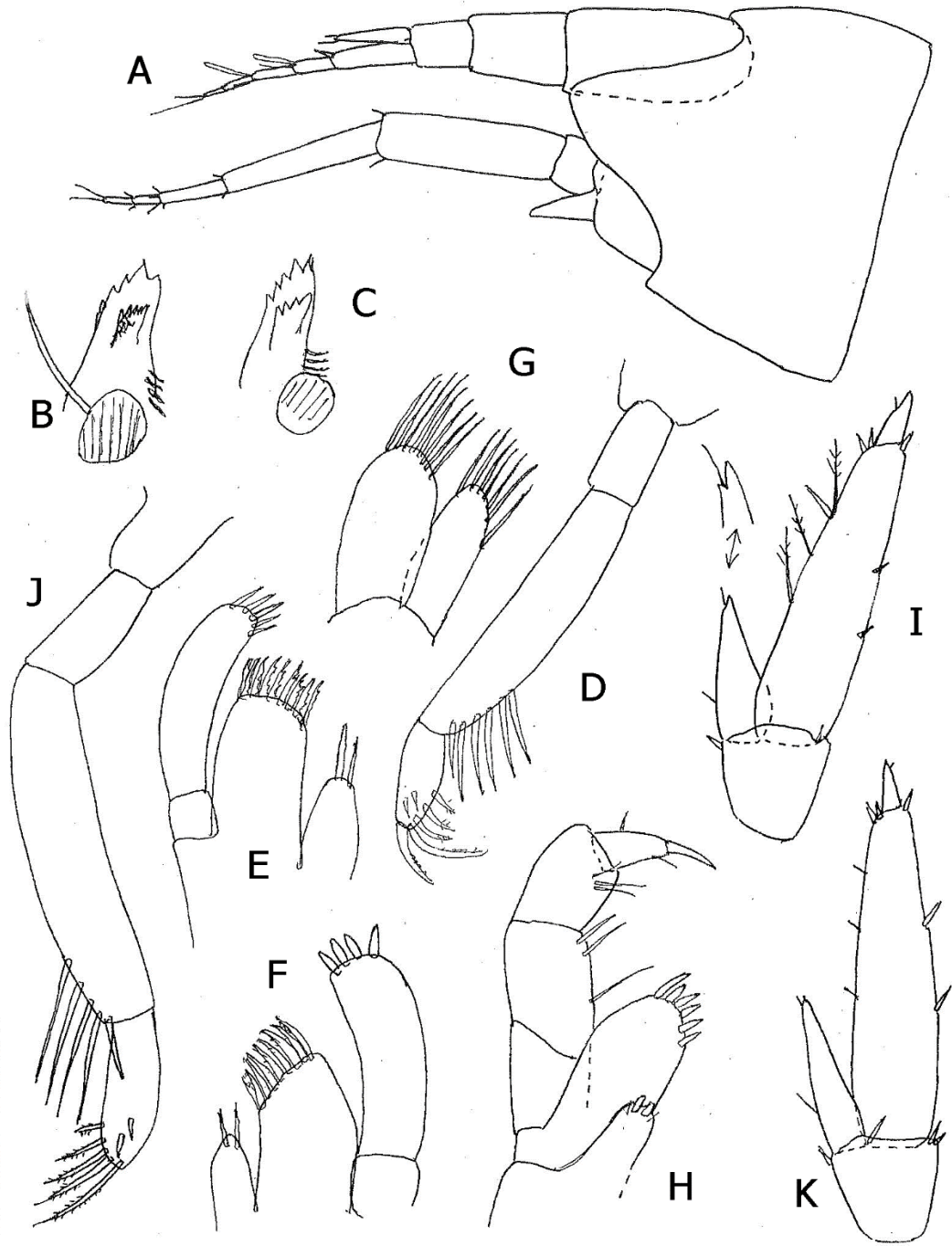


Fig. 1. *Salentinella angelieri* Delamare Deboutteville & Ruffo, 1952, Shus-20, female 1.9 mm: A = head with antennae 1-2; B = right mandible; C = left mandible; D = mandibular palpus; E = left maxilla 1; F = right maxilla 1; G = maxilla 2; H = maxilliped; I = uropod 3; J = mandibular palpus, female 1.88 mm; K = uropod 3, female 1.88 mm.

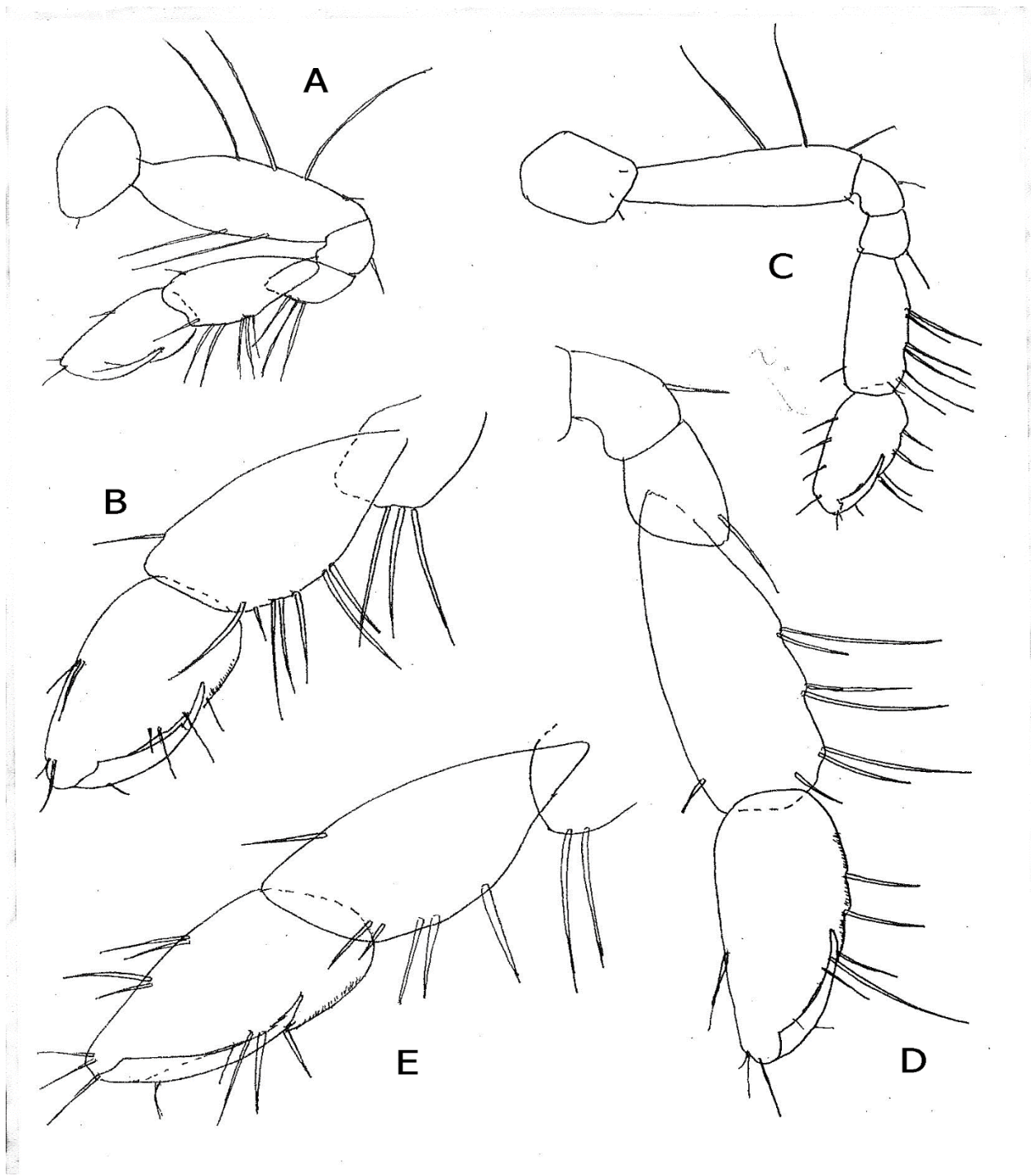


Fig. 2. *Salentinella angelieri* Delamare Deboutteville & Ruffo, 1952, Shus-20, female 1.9 mm: A-B = gnathopod 1; C-D = gnathopod 2. E = gnathopod 1, female 1.88 mm.

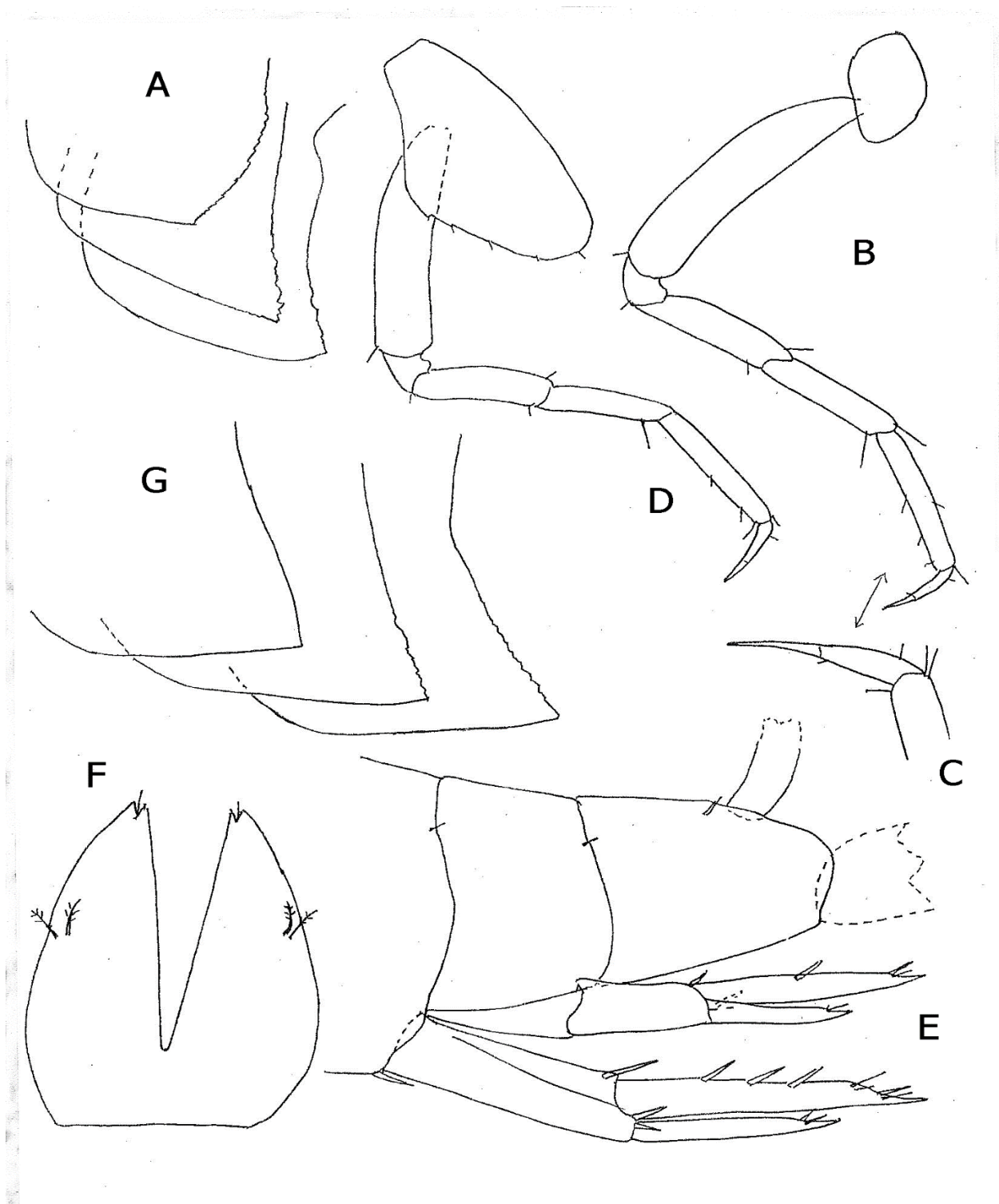


Fig. 3. *Salentinella angelieri* Delamare Deboutteville & Ruffo, 1952, Shus-20, female 1.9 mm.: A = epimeral plates 1-3; B-C= pereopod 3; D = pereopod 4; E = urosome with uropods 1-2; F = telson; G = epimeral plates 1-3, female 1.88 mm.

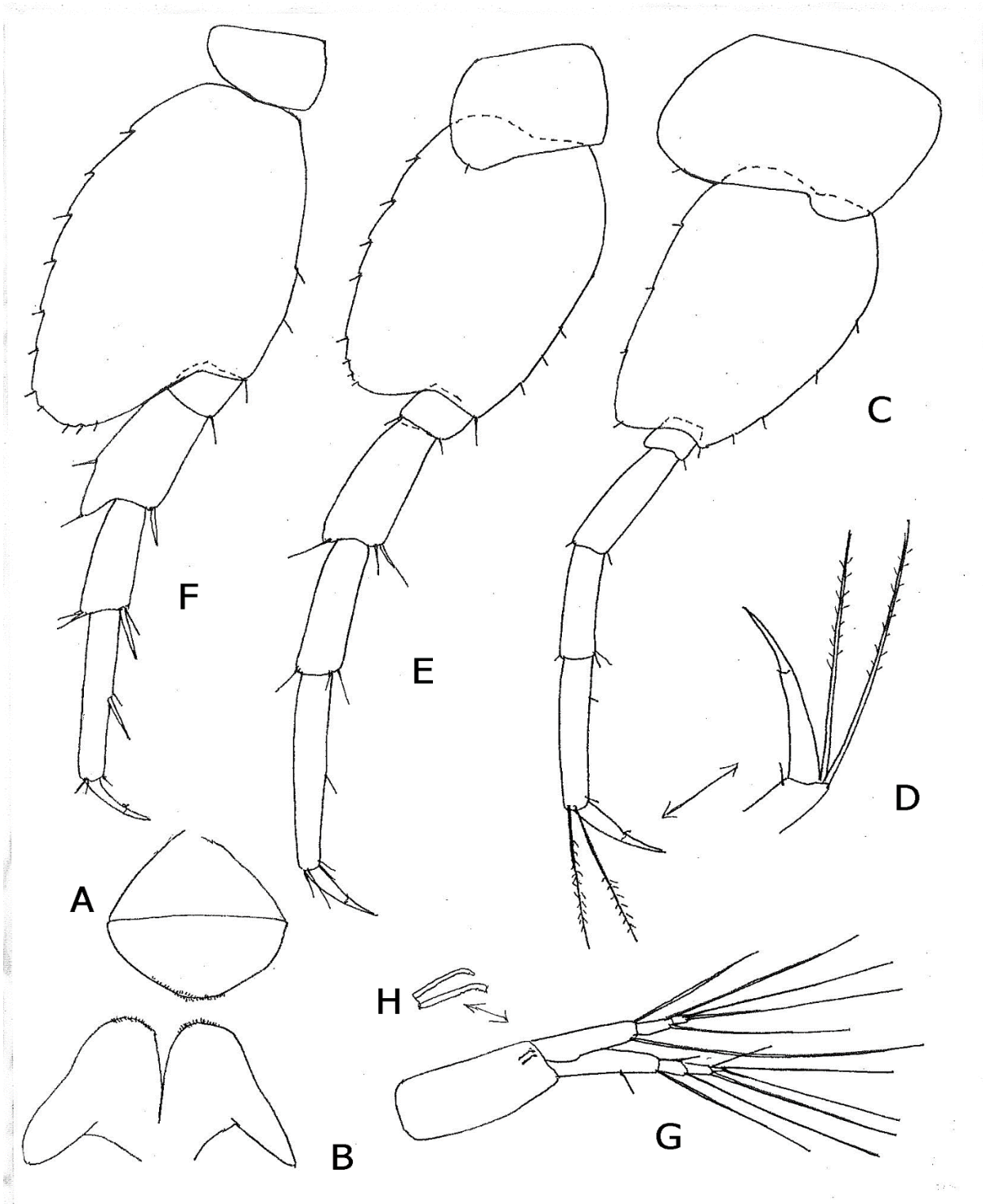


Fig. 4. *Salentinella angelieri* Delamare Deboutteville & Ruffo, 1952, Shus-20, female 1.9 mm.: A = labrum; B = labium; C-D = pereopod 5; E = pereopod 6; F = pereopod 7; G = pleopod; H = retinaculæ.

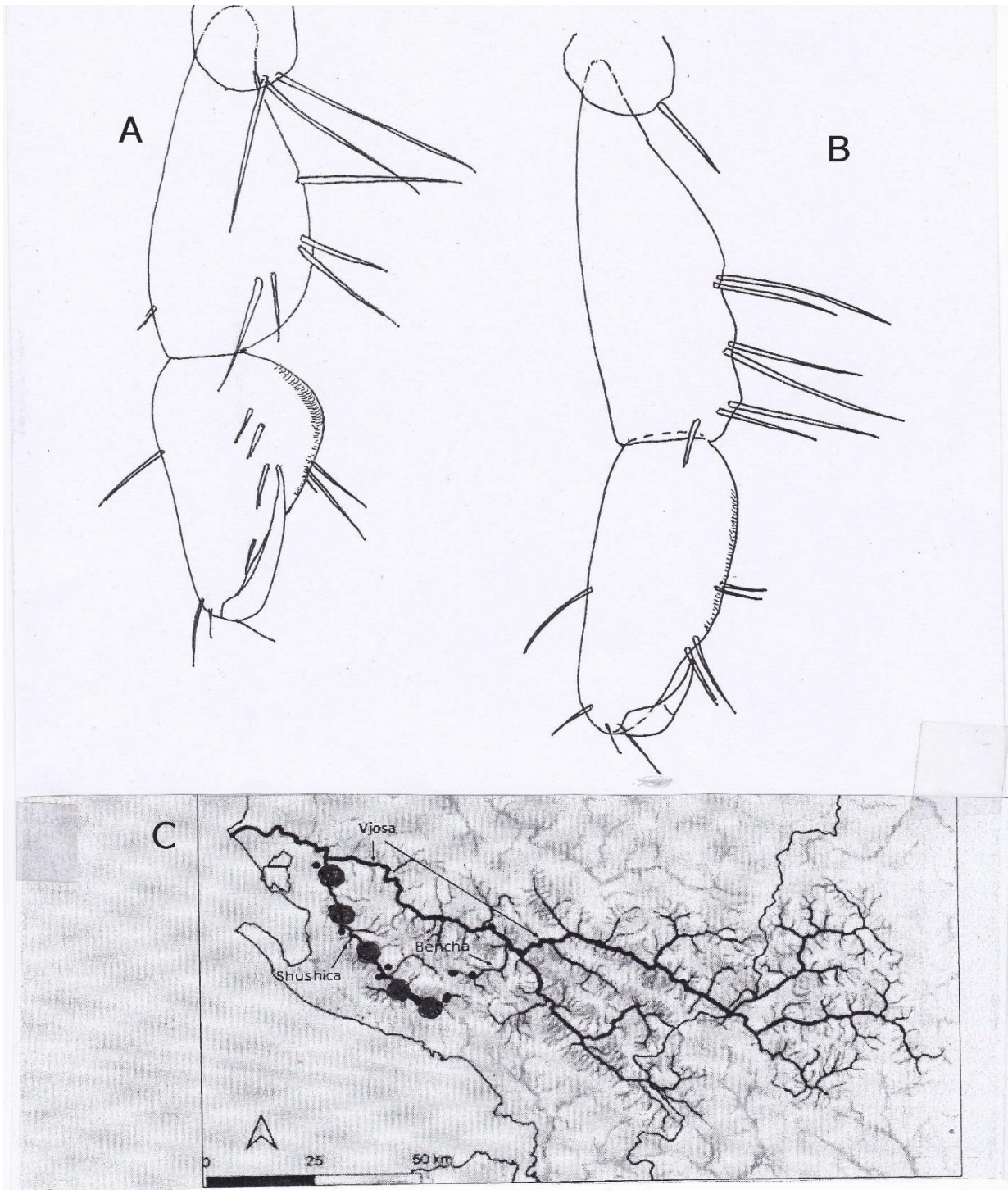


Fig. 5. *Salentinella angelieri* Delamare Deboutteville & Ruffo, 1952, Shus-20, **male** 1.92 mm: A = gnathopod 1; B = gnathopod 2; C = Map of localities of *Salentinella angelieri*. Delamare Deboutteville & Ruffo, 1952 in Shushica River, Albania (black dots).

## REFERENCES

- Balazuc, J. (1954). Les amphipodes troglobies et phreatobies de la faune Gallo-Rhénane, *Archives de Zoologie Expérimentale et Générale*, 91 (1): 153–193, 7 figs.
- Balazuc, J. (1957). Notes sur les amphipodes souterrains, I. Un nouveau Gammaride troglobie de l'Ariège, *Salentinella gineti* n. sp. *Notes Biospéologiques*, 12: 67–74, 2 pls.
- Barbé, L. (1963). Une seconde espèce du genre *Salentinella* (Crustacé Amphipode) trouvée dans les Pyrénées, *Annales de Spéléologie*, 18: 333–342, fig.
- Barbé, L. (1965). Une nouvelle espèce de Gammaride du genre *Salentinella* Ruffo en Aquitaine, *Annales de Spéléologie*, 20: 81–93, fig.
- Barnard, J., L. & Barnard, C. M. (1983). *Freshwater amphipods of the World. I. Evolutionary patterns, II. Handbook and bibliography*. Hayfield Associates: Mt. Vernon, Virginia, 1983, pp. XIX + 849 pages, 50 figs., 7 graphs, 98 maps, 12 tables.
- Baschieri, S., F. (1952). *Salentinella denticulata* n. sp., Amphipoda gammaride di acque cavernicole del Monte Argentario, *Bollettino di Zoologia*, pubblicato dall'Unione Zoologica Italiana, 19: 3–7, fig.
- Bedek, J., Gottstein-Matočec, S., Jalžić, B., Ozimec, R. & Štamolj, V. (2006). Catalogue of cave type localities of Croatian fauna, *Natura Croatica*, 15, Supplement 1, Zagreb, 15: 1–154, 9 figs.
- Belaidi, N., Taleb, A., Mahi, A. & Messana, G. (2011). Composition and distribution of stygobionts in the Tafna alluvial aquifer (north-western Algeria), *Subterranean Biology*, 8: 21–32 (2010).
- Bou, C. (1971). Recherches. 16. *Parasalentinella rouchi* n. g., n. sp., des eaux souterraines des Pyrénées Françaises (Amphipoda, Gammaridea), *Annales de Spéologie*, 26 (2): 481–494, pls. 1–3.
- Bousfield, E., L. (1977). A new look at the systematics of Gammaroidea amphipods of the World, *Crustaceana Suppl.* 4: 282–316.
- Coineau, N. (1962). *Salentinella delamarei*, nouvel amphipode Gammaridae des eaux phreatiques du Tech (Pyrénées orientales), *Vie et Milieu*, 13 (3): 507–520, 8 figs.
- Coineau, N. (1963). Etude sur les Amphipodes II. *Salentinella petiti* n. sp. *Vie et Milieu*, 14 (1): 107–122, 6 figs.
- Coineau, C. (1968). Contribution à l'étude de la faune interstitielle isopodes et amphipodes. *Mémoires du Muséum National d'Histoire Naturelle, Paris, nouvelle série, série A: zoologie*, 55 (3): 147–216, 30 figs.
- Dancau, D. (1973). Observations sur les amphipodes souterrains de l'île de Majorque. Genre *Salentinella* Ruffo. Livre du cinquantenaire de l'Institut de Spéologie „Emile Racovitza”, Academia de la R.S.R., Bucarest, Romania: 225–232, 4 figs.
- Delamare-Deboutteville, C. & Ruffo, S. (1954). Une nouvelle *Salentinella* Ruffo (Amphipode Gammaride) des eaux phreatiques de Corse, in: Chappuis (P.A.) et Delamare-Deboutteville (C.): *Recherches sur les Crustacés souterrains (Biospéologica, LXXIV)*, *Archives de Zoologie Expérimentale et Générale*, No.1, Mem. VIII, 91: 139–143, 2 figs.
- Dhora, D. (2010). Register of Species of the Fauna of Albania 2010. Shkodër: Camaj-Pipa: 208, ISBN: 978-99956-02-70-3.
- Ferreira, D., Malard, F., Dole-Olivier, M., J. & Gibert, J. (2007). Obligate groundwater fauna of France: diversity patterns and conservation implications, *Biodiversity and Conservation*, 16: 567–596. DOI 10.1007/s10531-005-0305-7.
- Gottstein, S. & Jalžić, B. (2007). Biospéological explorations of fauna in anchialine caves and pits in the national park Kornati. *Biospéologija (Subterranea Croatica)*, 9: 20–32, 8 figs. UDK 550.8:591.9(26):551.44:502.4
- Jaume, D. & Vonk, R. (2021). A new species of *Salentinella* Ruffo, 1947 from a thermomineral cave in southern Spain, with comments on the systematic position of the family Salentinellidae (Amphipoda). *Journal of Crustacean Biology*, 41 (3): 1–11, figs. 1–5.

- Karaman, G. (1967). Über die Gattung *Salentinella* Ruffo (Amphipoda, Gammaridae) in Jugoslawien [O rodu *Salentinella* (Amphipoda, Gammaridae) u Jugoslaviji], Poljoprivreda i šumarstvo, 13 (39), Titograd: 1–16, 15 figs.
- Karaman, G. (1974). Catalogus Faunae Jugoslaviae, Crustacea Amphipoda (Contribution to the Knowledge of the Amphipoda 60), Consilium Academicarum Scientiarum Rei Publicae Socialisticae Foederativae Jugoslaviae, Academia Scientiarum et Artium Slovenica, 3 (3), Ljubljana: 1–44.
- Karaman, G. (1979). The problem of *Salentinella angelieri* Del.-Deb. and Ruffo 1952 and its Subspecies (Contribution to the Knowledge of the Amphipoda 109), Poljoprivreda i šumarstvo, 25 (4), Titograd: 25–44, figs. I–VII.
- Karaman, G. & Pesce, L. (1980). Researches in Africa by the zoological institute of L'Aquila, Italy. V. On three subterranean amphipods from North Africa (Amphipoda: Gammaridea), Bulletin Zoologisch Museum, 7 (20), Universiteit van Amsterdam: 197–207, figs. I–V.
- Karaman, G. (1993). Crustacea Amphipoda di acqua dolce, Fauna d'Italia, vol. XXXI, Edizione Calderini Bologna, Italia: 1–337, 154 figs.
- Karaman, G. (2011a). Catalogue: Fauna of Gammaridean Amphipoda (Crustacea, Malacostraca) of the Adriatic Sea (Contribution to the Knowledge of the Amphipoda 252), The Montenegrin Academy of Sciences and Arts, Catalogue 2, The Section of Natural Sciences, Podgorica, 1: 1–288.
- Karaman, G. 2011b. One new subterranean species of the genus *Niphargus* Schiödte, 1849 (Crustacea, Amphipoda, Niphargidae) from Albania, *N. tomori*, sp. n. (Contribution to the Knowledge of the Amphipoda 254), Glasnik Republičkog zavoda za zaštitu prirode, (31/32), Podgorica: 101–114, 5 figs.
- Karaman, G. (2012). The anchialine Amphipoda (Crustacea) in the subterranean waters of Crna Gora (Montenegro) (Contribution to the Knowledge of the Amphipoda 261), *Natura Croatica*, 21(suppl. 1), Zagreb: 53–55.
- Karaman, S. (1929). Beiträge zur Kenntnis der Amphipoden Jugoslawiens, *Zoologischer Anzeiger*, 85 (9/10), Leipzig: 218–225, figs. 1–4.
- Karaman, S. (1953). Über subterrane Amphipoden und Isopoden des Karstes von Dubrovnik und seines Hinterlandes, *Acta, Musei Macedonici Scientiarum Naturalium*, 1 (7), Skopje: 137–167, 47 figs.
- Karaman, S. (1955). Über einige Amphipoden des Grundwasser der jugoslawischen Meeresküste, *Acta, Musei Macedonici Scientiarum Naturalium*, 2 (11), Skopje: 223–242, figs. 1–51.
- Lowry, J., K. & Myers, A., A. (2013). A Phylogeny and Classification of the Amphipoda with the establishment of the new order Ingolfiellida (Crustacea: Peracarida), *Zootaxa* 4265 (1): 001–089.
- Messouli, M., Coineau, N. & Boutin, C. (2002). Revision, phylogeny and biogeography of the groundwater amphipods Salentinellidae. I. Description of *Salentinella anae* nov. sp. from Spain with remarks on the genera *Salentinella* and *Parasalentinella*, *Zoological Science*, 19, Tokyo: 1147–1154, 5 figs.
- Messouli, M., Coineau, N. & Boutin, C. (2018). Revision, phylogeny and biogeography of the subterranean Amphipod Salentinellidae (Crustacea), with description of two genera and two species, *Bulletin de la Société d'Histoire naturelle de Toulouse*, 154: 71–103, 11 figs.
- Navarro-Barranco, C., Martínez, A., Sempere-Valverde, J., Chebaane, S., Digenis, M., Plaitis, W., Voultziadou, E. & Gerovasileiou, V. (2023). Amphipods in Mediterranean Marine and Anchialine Caves: New Data and Overview of Existing Knowledge, *Diversity* 15, 1180: 1–23, 4 figs. <https://doi.org/10.3390/d15121180>
- Ndoc, Filipi (1959). L'ichtyofaune du lac de Podgradecet de ses effluents. *Bull. de la Stat. de Precherches scientifiques de l'economie de peche*, vol. 1, Tirana: 140–173.
- Notenboom, J. (1990). Introduction to Iberian groundwater amphipods. *Limnetica*, 6: 165–176, 8 figs.
- Pesce, G., L., Maggi, D., Ciocca, A. & Argano, R. (1979). Biological research on the subterranean phreatic waters of northern Greece. *Premier Symposium Intern. Zoogeographie. et ecologie Greece et regions avoisinantes*, Athenes, Avril 1978. *Biologia Gallo-Hellenica*, 8: 109–126 (1978).

- Pesce, G., L. (1980). Ricerche faunistiche in acque freatiche delle Marche e stato attuale delle conoscenze sulla fauna interstiziale italiana (Contributo alla conoscenza della fauna delle acque sotterranee dell'Italia centro-meridionale: XIII). *Rivista di Idrobiologia*, 19 (3), Universita. Perugia: 547–591.
- Pesce, G., L. & Maggi, D. (1983). Ricerche faunistiche in acque sotterranee freatiche della Grecia Meridionale ed insulare e stato attuale delle conoscenze sulla stygofauna di Grecia, *Natura*, 74 (1–2), Milano: 15–73.
- Pesce, G., L. (1985a). The Groundwater fauna of Italy: a synthesis, *Stygologia* 1 (2): 129–159, 8 figs.
- Pesce, G., L. (1985b). Stygobiological researches in subterranean waters of Lesbos (Greece) and description of *Stygonitocrella petkovskii* n. sp. (Crustacea Copepoda: Ameiridae), *Fragmenta Balcanica, Musei Macedonici Sc. Naturale*, 12 (12), Skopje: 125–139, figs. 1–11 (on p. 135 cited *Salentinella angelieri* for Lesbos Island).
- Pesce, G., L. (1985c). New records for *Salentinella* Ruffo (Crustacea Amphipoda) from phreatic waters of Italy and Greece, *International Journal of Speleology*, 14: 19–29.
- Pesce, G., L. (1985d). Some remarks on the stygofauna of Greece. 2e Congres Int. Zoogeogr. Ecol. Greece reg. Avois. Athenes 1981, *Biologia Gallo-Hellenica*, 10: 103–112.
- Pesce, G., L., Ciccacese, N. & Onorato, R. (2004). Ricerche biologiche nell'acquifero del complesso carsico di Badisco (Otranto), *Thalassia Salentina*, 27: 91–97.
- Platvoet, D. (1984). Observations on the genus *Salentinella* (Crustacea, Amphipoda) with description of *Salentinella formenterae* n. sp. *Bijdragen tot de Dierkunde*, 54 (2): 178–184, figs. 1–4.
- Platvoet, D. (1987). The Genus *Salentinella* Ruffo, 1947 (Crustacea, Amphipoda) in Spain, *Stygologia*, 3 (3): 217–240, 11 figs.
- Pretus, J., L. (1989). Noves dades per a la distribucio de l'estigofauna Balear, *Endins*, (14–15): 61–64.
- Pretus, J., L. (1991). Estudio taxonomico, biogeografico y ecologico de los crustaceos epigeos e hipogeos de las Baleares, *Tesis Universitat Barcelona*: 513.
- Rossi E. & S. INGUSCIO, S. (2003). Fauna ipogea pugliese: nuovi dati e osservazioni, *Thalassia Salentina*, 26. supp.: 219–224, 2 figs.
- Ruffo, S. (1947). Studi sui crostacei anfipodi XVI. *Hadzia minuta* n. sp. (Hadziidae) e *Salentinella gracillima* n. gen. n. sp. (Gammaridae), nuovi anfipodi troglobi dell'Italia meridionale, *Bollettino della Societa dei Naturalisti di Napoli*, 56 (4): 1–11, figs. I–IV.
- Ruffo, S. & Delamare-Deboutteville, C. (1952). Deux nouveaux souterrains de France: *Salentinella Angelieri* n. sp. et *Bogidiella Chappuisi* n. sp. *Comptes Rendus des Seances de l'Academie des Sciences*, 234: 1636–1638 (1–3), 9 figs.
- Ruffo, S. (1953<sup>a</sup>). Studi sui crostacei anfipodi XXXV. Nuove osservazioni sul genere *Salentinella* Ruffo (Amphipoda, Gammaridae), *Bollettino della Societa Entomologica Italiana*, 83 (5–6): 56–66, figs. I–VI.
- Ruffo, S. (1953<sup>b</sup>). Lo stato attuale delle conoscenze sulla distribuzione geografica degli Anfipodi delle acque sotterranee europee e dei paesi mediterranei, *Publications de I. Congres International de Speleologie*, 3, Paris, 1953: 13–37, 10 maps.
- Ruffo, S. (1986). Amphipoda: Salentinellidae. In: Botosaneanu, L. (Ed.): *Stygofauna mundi*: 564–566. – E. J. Brill, Leiden.
- Ruffo, S. (1995). Un nuovo Gammaride cavernicolo dell'Albania (*Albanogammarus inguscioi* n. gen. n. sp.) (Studi sui Crostacei Anfipodi CXXIII), *Bollettino del Museo civico di Storia Naturale di Verona*, 19: 443–452 (1992).
- Sket, B. (1969). Über die Verbreitung einiger Malacostraca (*Hadzia*, *Salentinella*, *Neogammarus*, *Jaera*) längs der jugoslawischen Adria-Küste. *Bulletin Scientifique, Conseil des Académies des sciences et des arts de la RSF de Yougoslavie, section A: Sciences naturelles, techniques et médicales*, 14 (5–6): 147–148, 2 figs.
- Sket, B. & Karaman, G. (1990). *Niphargus rejici* (Amphipoda), its relatives in the Adriatic islands, and its possible relations to S.W. Asian taxa. *Stygologia*, The Hague, 5 (3): 153–172, 7 figs.



*Rezime*

**PRVO OTKRIĆE FAMILIJE SALENTINELLIDAE (CRUSTACEA: SENTICAUDATA) U  
ALBANIJI (332. PRILOG POZNAVANJU AMPHIPODA)**

Podzemna vrsta *Salentinella angelieri* Delamare Debouteville & Ruffo, 1952 (Crustacea: Amphipoda, fam. Salentinellidae) otkrivena je po prvi put u Albaniji, u materijalu sakupljenom u okviru APPEAR projekta VjoSusDev. Kratki opisi i slike vrste su bazirani na primjercima iz podzemnih voda rijeke Sušice, pritoke Vjosa, rijeke u južnoj Albaniji. Razmatran je varijabilitet i rasprostranjene ove vrste (južna Evropa i sjeverozapadni dio obala Afrike). Prezentirani su tipični lokaliteti (locus typicus) svih vrsta roda *Salentinella* kao i lista tipičnih vrsta rodova familije Salentinellidae.

*Ključne riječi:* Amphipoda, Salentinellidae, *Salentinella angelieri*, Albanija, taksonomija, opis