BULLETIN
ZOOLOGISCH MUSEUM

UNIVERSITEIT VAN AMSTERDAM

Vol. 1 No. 14 10 - VI - 1970

WESTERN EUROPEAN SPECIES OF THE PRESUMED BAIKAL-GENUS EULIMNOGAMMARUS (CRUSTACEA-AMPHIPODA), WITH DESCRIPTION OF A NEW SPECIES FROM SPAIN

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RESUME

Plus de 150 échantillons de Gammaridae ont été collectionnés dans la région septentrionale de l'Espagne pendant l'été de 1969. Des représentants du genre Eulimnogammarus furent trouvés dans cinq localités. Ces stations ainsi que les deux nommées dans la littérature, se trouvent assez éloignées l'une de l'autre. Cependant, ce qu'elles ont en commun, ce sont leurs taux en ions beaucoup plus élevés que ceux d'une eau douce "normale", surtout quant au Ca, qui surpasse toujours 70 mg/l.

Dans cette note une description est donnée d'une nouvelle espèce, E. toletanus n.sp., avec une clef de détermination pour les 4 représentants du genre Eulimnogammarus connus d'Europe. En outre il y a question de la variabilité dans ce genre. Celle-ci diffère de la variabilité qu'on a constatée chez d'autres groupes de Gammaridae, comme p.e. chez ceux de Gammarus locusta et d'Echinogammarus pungens, par l'instabilité de la longueur de l'endopodite des troisièmes uropodes.

INTRODUCTION

During the last 15 years, 6 new species of gammarids were discovered in waters of the Iberian peninsula and adjacent parts of France, but nevertheless our knowledge of the amphipod fauna of this part of Europe is still very poor and incomplete. Therefore it seemed worth-while to us to fill up this gap by systematic sampling of the different drainage-systems in Spain. This was undertaken in 1969, when more than 300 localities in northern Spain were visited, in more than 150 of which gammarids were found. Water samples were taken in order to get some information about the environmental conditions under which the animals are living. The greater part of the samples contained members of the Echinogammarus berilloni - group, but also members of the Gammarus pulex - group, the Echinogammarus lusitanus - group and of the genus Eulimnogammarus were found.

In the map (fig.1) the localities in which the members of the different groups have been found, are plotted. From this map it becomes clear that the E. berilloni - group is the most common group of amphipods in northern Spain and that representatives of this group occur in almost any

river system, not only in those draining into the Atlantic, but also in those draining into the Mediterranean.

Echinogammarus lusitanus was found in a very restricted area around La Coruña. It also occurs in the adjacent northern part of Portugal, the type specimens coming from this region. The waters in which this species was found, always had a very low ion-content, both of Cl and of Ca ions (Cl always less than 25 mg/l; Ca always less than 10 mg/l).

Representatives of the Gammarus pulex - group were found in the province of Cuenca and in the surroundings of Burgos only, always in very hard waters (in all cases more than 70 mg Ca per 1).

In five localities members of the genus Eulimnogammarus were found. Those localities along with the two Iberian localities for this genus known from literature seem to be more or less isolated, and it is clear that representatives of the genus Eulimnogammarus certainly are rare in Spanish waters. They were always found in waters with raised contents of Ca-ions (70 - 540 mg/l).

In one of the localities a new species of this genus, Eulimnogammarus toletanus, was found.

This paper gives a comparative description of the new species, and the other three known European representatives of the genus Eulimnogammarus, in the sense proposed by Stock, 1969.

ACKNOWLEDGMENTS

The authors are indebted to Dr. J. Forest of the Muséum National d'Histoire Naturelle, Paris, for the loan of the type material of E. anisocheirus (Ruffo, 1959). Furthermore grants of the Netherlands' Organization for the Advancement of Pure Research (Z.W.O.) to the junior author and of the University of Amsterdam to the senior author are gratefully acknowledged. Thanks are also due to the Embassy of Spain in the Netherlands for their kind introduction to Spanish authorities.

KEY TO THE FOUR SPECIES OF THE GENUS EULIMNOGAMMARUS FROM WESTERN EUROPE

1 a) Eyes elongate reniform, more than twice as long as wide. First segment of mandible palp with 2 or 3 setae. Coxal plates 3 and 4 rounded. Intertidal along European coasts, in places with brackish influences. ..... E. obtusatus (Dahl, 1938)

b) Eyes rounded, less than twice as long as wide. First segment of mandible palp unarmed. Coxal plates of P3 and P4 subquadrate. In fresh waters 2

2 a) A2 of male with straight setae. Third segment of mandible palp with more than 6 terminal setae. ..... E. anisocheirus (Ruffo, 1959)

b) A2 of male with many groups of densely implanted, (long) curled setae. Third segment of mandible palp with less than 6 terminal setae 3

3 a) Hand of gnathopod 1 of male without a medial palmar spine. Basis of P7 with a backward projecting ventro-posterior corner ..... E. macrocarpus Stock, 1969

b) Hand of gnathopod 1 of male with a strong medial palmar spine. Basis of P7 with rounded, non-projecting, ventro-posterior corner ..... E. toletanus n.sp.

CONSTANCY AND VARIABILITY OF THE CHARACTERS IN THE GENUS EULIMNOGAMMARUS

The variability pattern in the genus Eulimnogammarus is somewhat different from that found in other groups of gammarids, such as the Gammarus locusta-group and the Echinogammarus pungens-group. Of course, several characters are stable while others are ex-

tremely variable. Stable characters are the structure of the mandible palp, the shape of the eye (in adult specimens), the structure of the propodus of the first and second gnathopods, and the morphology of the legs (although the length/width ratio of the basal segments increases with age, the characteristic features are constant in adult males). However, the shape and relative length of the inner ramus of the third uropod, which is constant in most other groups of gammarids (Stock, 1967, 1968; Pinkster, 1969) is largely variable within this genus. In three of the four species described in this paper, the inner ramus of the third uropod varies from 1/6 to nearly 1/2 of the exopodal length. All intermediates can be found within one sample from one locality. Moreover, some specimens bear feathered setae on the inner and outer margin of the exopod, while others do not.
Other variable characters are:

1) the number of segments in the flagellum of first and second antennae;
2) the degree of hairiness in the second antenna;
3) the setation of the anterior margins of the propodus and carpus of the second gnathopod;
4) the setation of the telson (although the shape of the telson lobes is rather constant);
5) the number of elements participating in the dorsal armature and ornamentation of the metasome and urosome and those on the legs;
6) the degree to which the epimeral plates are produced into a point.

Eulimnogammarus obtusatus (Dahl, 1938). Fig. 2 a-g.

Principal references.-

Gammarus obtusatus Dahl, 1938: 125 - 128, figs. 11 - 21.
Marinogammarus obtusatus; Sexton & Spooner, 1940: 650 - 656, fig. 5.

Material examined.-

Eire : Stony beach at Rinvyle near Tully, Co. Galway, 12 July 1968, many specimens.

France: Cap Blanc Nez, dépt. Pas-de-Calais, 13 August 1968, many specimens.
Cap Gris Nez, dépt. Pas-de-Calais, 13 July 1951, 1 specimen.
" " " " " " " 8 July 1968, many specimens.
Between Ambleteuse and Audresselles, dépt. Pas-de-Calais, 5 July 1951, 1 specimen.
Audresselles, dépt. Pas-de-Calais, under stones in Fucus vesiculosus-zone, 3 August 1966, many specimens.
Ambleteuse, dépt. Pas-de-Calais, 18 - 23 Apr. 1965, many specimens.
Langue de Chien, near Ambleteuse, dépt. Pas-de-Calais, 6 July 1951, 5 specimens.
Pointe aux Oies, near Wimereux, dépt. Pas-de-Calais, 8 July 1951, under muddy stones, many specimens.
Pointe d'Alprech, le Portel, dépt. Pas-de-Calais, 15 July 1951, 10 specimens.
Chenal de l'Ile Verte, near Roscoff, dépt. Finistère-Nord, 10 Sept. 1969, in gravel in Fucus serratus-zone, many specimens.
Roscoff, dépt. Finistère-Nord, near Pointe Ste. Barbe, 26 Sept. 1966, 5 specimens.
Iles des Glénans, St. Nicolas, South of Concarneau, dépt. Finistère-Sud, 17 May 1924, many specimens.

The Netherlands:

Kattendijke, prov. Zeeland, end of the pier, 30 August 1951, 5 specimens.
Den Helder, prov. Noord-Holland, dike near swimming pool, 13 May 1954, 3 specimens.
Isle of Texel, 't Horntje, 11 May 1953, under muddy stones, 9 specimens.

Morphology.-

A very clear description of the species was given by Sexton & Spooner, 1940. The reader is referred to that description and their figure 5. In the present paper figures are given of characters in which the species differs from the other western European species in the genus, but which are not illustrated in the publication cited above.

The lateral lobes of the head are rounded, the sinus is very shallow. The eye is elongate, somewhat constricted in the middle (fig. 2a).

The mandible palp (fig. 2 b) is different from that of the other 3 species, dealt with in this paper, in bearing some setae on its first segment. The 3rd segment has some groups of lateral setae and a terminal group of 5 setae. Moreover, there are some characteristic setae, implanted somewhat dorsally of the comblike row of graduate spines along the ventral margin.

The coxal plates of the first and fourth leg have rounded ventral corners (figs. 2 c and 2 d). The first uropod, which extends just behind the second one, always bears a curved spine on its peduncle (fig. 2 f).

Like in the other species within this genus, the relative length of the endopod of uropod 3 is variable. A figure (fig. 2 g) is given of a more elongate type of endopod than that illustrated by Sexton & Spooner, 1940.

The posterior angles of the epimeres are never produced into a point in the studied specimens (fig. 2 e).

The number of spines, forming the dorsal armature of the three urosome segments is variable.

Distribution and ecology.-

The species occurs along sea-coasts from the Barents Sea to Brittany (France), in general in the intertidal zone, under stones and sea-weeds, often in places with some freshwater influence. It is often accompanied by Chaetogammarus marinus (Leach) and/or Gammarus finmarchicus Dahl.

Eulimnogammarus anisocheirus (Ruffo, 1959). Fig. 2 h - k.

Gammarus anisocheirus Ruffo, 1959 : 435 - 439, figs. I - III.

Material examined.-

France : Neste d'Aure, near St. Lary, dépt. Hautes-Pyrénées, 7 paratypic specimens (M.N.H.N.).

Morphology.-

A good description of the species, with figures of most of the characteristic features is given by Ruffo, 1959. The species is immediately distinguishable from the other two freshwater species, treated in this paper, because of the absence of curled setae on the A 2 of the male (fig. 2 h). Moreover, the mandibular palp, which looks like the normal gammarid type in other characters, has 7 long terminal setae on its third segment, against 4 or 5 in most other species (fig. 2 i).

The basis of leg 7 does not project backward, and at its distal end is almost as wide as the next segment.

The third uropod is relatively short. The length of the endopodite is variable. It can attain 1/3 of the length of the first exopodal segment. The interior and exterior margins of the exopodite are provided with several long setae, which are never plumose in the specimens studied (fig. 2 k).

Distribution.-

The type-locality is the only record in literature. Efforts by one of the authors (S.P.) to find back this species in the type-locality and adjacent water-systems were in vain.

Eulimnogammarus macrocarpus Stock, 1969. Figs. 3 - 5.

Material examined.-

Spain: Rio Piedra, near its confluence with the river Jalon, east of Alhama de Aragon, province of Zaragoza, 3♂ (holotype and paratypes, Z.M.A. Amph. 102.138).
Arroyo de la Cavina, S.W. of Aranjuez, province of Madrid, 10 July 1969, small, fast-running stream with gravel, Cl 57 mg/l, Ca 540 mg/l, Ca + Mg 781 mg/l, many specimens.

Nameless confluent of Rio Tajo between La Puebla de Montalban and Toledo, province of Toledo, 10 July 1969, very shallow, muddy stream with marsh-plants, width about 60 cm, Cl 30 mg/l, Ca 70 mg/l, Ca + Mg 96 mg/l, many specimens.
Rio Mezquin, 8 km S. of Alcaniz, near village Castelseras, province of Teruel, 12 July 1969, stream about 40 cm wide, 30-40 cm deep with Rorippa spec., threadlike algae and grass, Cl 50 mg/l, Ca 100 mg/l, Ca + Mg 191 mg/l, many specimens.
Spring of the Rio Mora, 3.5-4 km E. of Mora de Rubielos, province of Teruel, 11 July 1969, muddy stream of about 30 cm wide, with Chara and pondweed, Cl 17 mg/l, Ca 78 mg/l, many specimens.

Morphology.-

A good description of the male was given by the senior author (1969). This description was based on only three, probably immature males. Since then, we have collected about a thousand specimens of the species from 4 different localities, allowing us to give more details, especially concerning the variability within the species, as well as the description of the hitherto unknown female.

Male. The description of the male given by Stock as a whole fits the figures given in this paper. Differences will be discussed under Variability.

Female. The female differs from the male in the following characters:

1) The second antenna never bears curled setae.
2) The propodus of the first leg is much smaller than in the male (fig. 4 d). The oblique palm gradually merges into the posterior margin. Except for a group of 5 to 6 palmar angle spines, two other groups of strong spines are implanted along the posterior margin. The setation along the posterior and anterior margin of the propodus is more dense than in the male.
3) The propodus of the second leg (fig. 4 e) is even more elongated than in the male bearing 8 or more groups of setae along the anterior margin. The spines of the palmar angle group are reduced in size in comparison with the male.
4) The third uropod (fig. 5 h) is relatively short compared with the other sex. The third to seventh legs do not show noteworthy differences from those of the male (figs. 4 a, b, c), although they are in general relatively shorter.

Variability.-

Most characters of this species show variability. So, the groups of setae implanted on the second antenna (fig. 3 d) vary largely in number while the length of the setae and the degree of curliness are also very variable.

The length of the carpus and the propodus of the second gnathopod (figs. 3 f, g) is variable with age. In adult males they are generally much longer than figured by Stock, 1969. Moreover, there are in general many more groups of setae along the anterior margins of both carpus and propodus than indicated in the earlier publication.

The number of setae found on the second segment of the mandible palp (fig. 3 b) and the number of lateral groups on the third segment are age-dependent. Consequently there often are much more setae than figured by Stock, 1969.

The third uropod, especially the relative length of the endopod, is extremely variable (figs. 5 b, c). In adult specimens this relative length can vary from 1/5 to 1/2 of the length of the first exopodal segment. All intermediates have been found within one sample. Moreover, the absence or presence of plumose setae on the exopodite seems to be rather accidental.

Like in most other gammarids, the armature of the telson (figs. 5 d, e) and of the legs, the shape of the epimeral plates (fig. 5 g), and the number of spines participating in the dorsal armature of the urosome, are variable characters.

Ecology.-

This is a species from small running waters with a raised calcium ion content. It is possible that the streams in which it lives, partially dry out during the summer months, forming stagnant pools and swamps. Attempts to find the species back at the type - locality (the lower ranges of the Rio Piedra) failed, since the drainage system of this river has been altered into an artificial lake by damming for some time past.

Eulimnogammarus toletanus n.sp. Figs. 6 - 8.

Material examined.-

Spain: Arroyo Escorchon, a small, muddy stream with marsh - plants, near bridge in highroad N IV, 11 km S. of Ocaña, province of Toledo, 10 July 1969, many specimens. Cl 225 mg/l, Ca 528 mg/l, Ca + Mg 878 mg/l.
One male has been selected as a holotype, the other specimens become paratypes (Z.M.A. Amph. 102.269).

Description.-

Male. The maximum length observed in an adult male, excluding the antennae but including the uropods, is about 13 mm. The first antenna, which is slightly longer than the second one, overreaches half the body length (fig. 6 a). The lateral lobes of the head (fig. 6 b) are rounded. The small eyes are always less than twice as long as wide, and separated from the middorsal line by a distance, about equal to the length of the eyes. The sinus is shallow.

The mesosome and first metasome segments are unarmed while the last two metasome and the urosome segments (fig. 6 c) are set with some spines and setae, the number of them being somewhat variable. As in E. macrocarpus, the dorsal contour is very flat.

The peduncle segments of the first antenna (fig. 6 d) are short and bear very few setules. The flagellum and the assessory flagellum are 20 - to 24 - and 3 - segmented, respectively.

The second antenna (fig. 6 e) offers one of the characteristic features of the new species. It has a rather short gland cone while the 4th and 5th peduncle segments are short and compact, 2 to 2.5 times as long as wide. These peduncle segments, and most articles of the 8 - to 10 - segmented flagellum, are ornamented with groups of densely implanted, very long and often curled setules (which are longer than in E. macrocarpus), with thick, shorter setae in between them.

The mandible palp (fig. 7 a) has an unarmed first segment. The inferior margin of the third segment is armed with a row of subequal spinules. Moreover, a group of setae is implanted on each side of the segment. The number of setae on the second segment of the palp is age dependant, the third segment bears 5 - 6 terminal setae. The other mouthparts do not show noteworthy differences when compared with the normal gammarid type (as illustrated for Chaetogammarus pirloti by Sexton & Spooner, 1940, fig. 9, and for Echinogammarus berilloni by Pinkster, 1969, fig. 2).

The first leg (fig. 7 b) has an almost rectangular coxal plate with some setae near its corners. The strong pyriform propodus (fig. 7 c) is more than twice as long as the carpus and has a rather oblique palm. There is a distinct medial palmar spine. The spines normally forming the palmar angle group are implanted in a row in this species. The anterior and posterior margin of the propodus are set with some groups of setae, containing only few elements per group.

The second leg (fig. 6 f) is somewhat shorter than the first and resembles that of E. macrocarpus in having the same elongate carpus and an almost trapezoidal propodus (fig. 6 g), the latter being much smaller than the propodus of the first leg. The angle of the almost transverse palm is indicated by a group of 5 or 6 spines. The medial palmar spine is lacking completely.

The third and fourth legs have angular coxal plates (figs. 8 a, b) and resemble E. macrocarpus in being sparingly setose in comparison with most other gammarids.

Leg 5 (fig. 8 c) has an almost rectangular basal segment with a backward projecting ventroposterior angle, and with fine crenulations along the posterior margin.

In leg 6 (fig. 8 d), the ventro-posterior margin is less rectangular, less projecting backward than in leg 5.

The basis of leg 7 (fig. 8 e), is more elongate than in legs 5 and 6 and has a rounded ventro-posterior corner. The setules along the posterior margin are much longer than in P 5 and P 6. The merus and carpus of P 5 through P 7 only bear very few, short setae, intermixed with spines.

The epimeral plates (fig. 6 h) are almost naked, with pointed posterior corners.

The uropods are slender. The third uropod bears 4 to 5 groups of spines along the outer margin of the exopod. The inner margin of it bears some spines and many long, often plumose setae. The second exopodal segment is short with a cluster of long setae implanted near its top. The one-segmented inner ramus can vary in length from 1/5 to almost 1/2 of the length of the first exopodal segment (see figs. 6 i and 7 d).

The telson which is cleft to the base, has two elongate lobes. The ornamentation of the lobes can vary largely. In most specimens a terminal and one or more lateral groups of spines are present, often accompanied by one or more setae (figs. 6 k and 7 e).

Female. The female is much smaller than the male (max. length observed 9 mm) and can easily be distinguished because of the absence of the swollen hand of the first gnathopod and the absence of long curled setae on the second antenna (fig. 8 g). The propodus of the first leg has almost the same size as that of the second leg and lacks a medial palmar spine (fig. 7 f). The propodus of the second leg is still more elongate than in the male (fig. 8 h). The third uropod is much shorter, more compact than in the male, while the endopodite shows the same variability in its length (fig. 8 i).

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Received: December 10, 1969

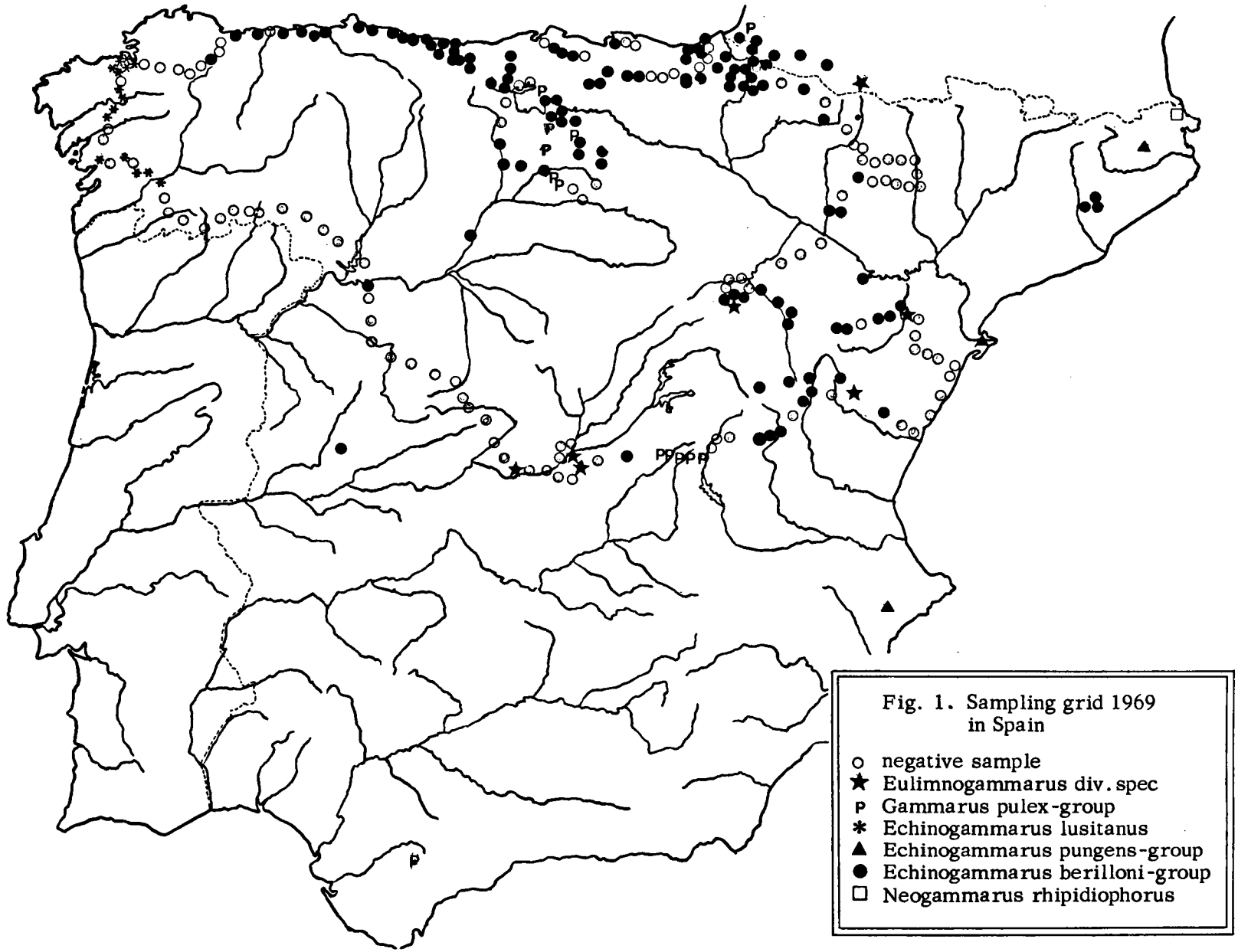
Fig. 1. Sampling grid 1969
in Spain
negative sample
Eulimnogammarus div. spec
Gammarus pulex-group
Echinogammarus lusitanus
Echinogammarus pungens-group
Echinogammarus berilloni-group
Neogammarus rhipidiophorus

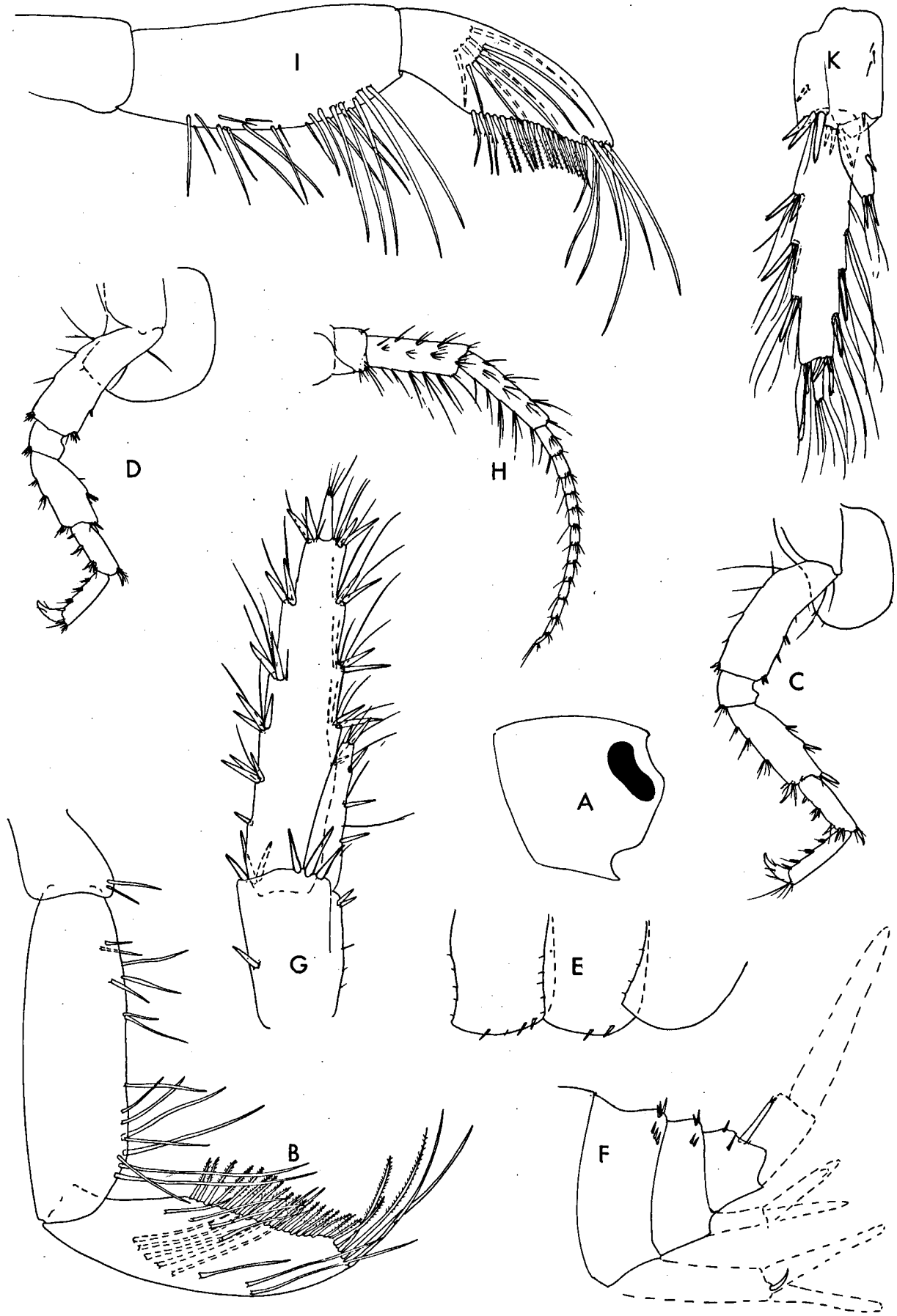

Fig. 2. a-g, Eulimnogammarus obtusatus (Dahl, 1938), ♂ from Roscoff, France. a, head (scale 2); b, mandible palp (4); c, third leg (2); d, fourth leg (2); e, epimeral plates (2); f, urosome (2); g, third uropod (3).
h-k, Eulimnogammarus anisocheirus (Ruffo, 1959), from Neste d'Aure, France. h, second antenna (2); i, mandible palp (4); k, third uropod (3).

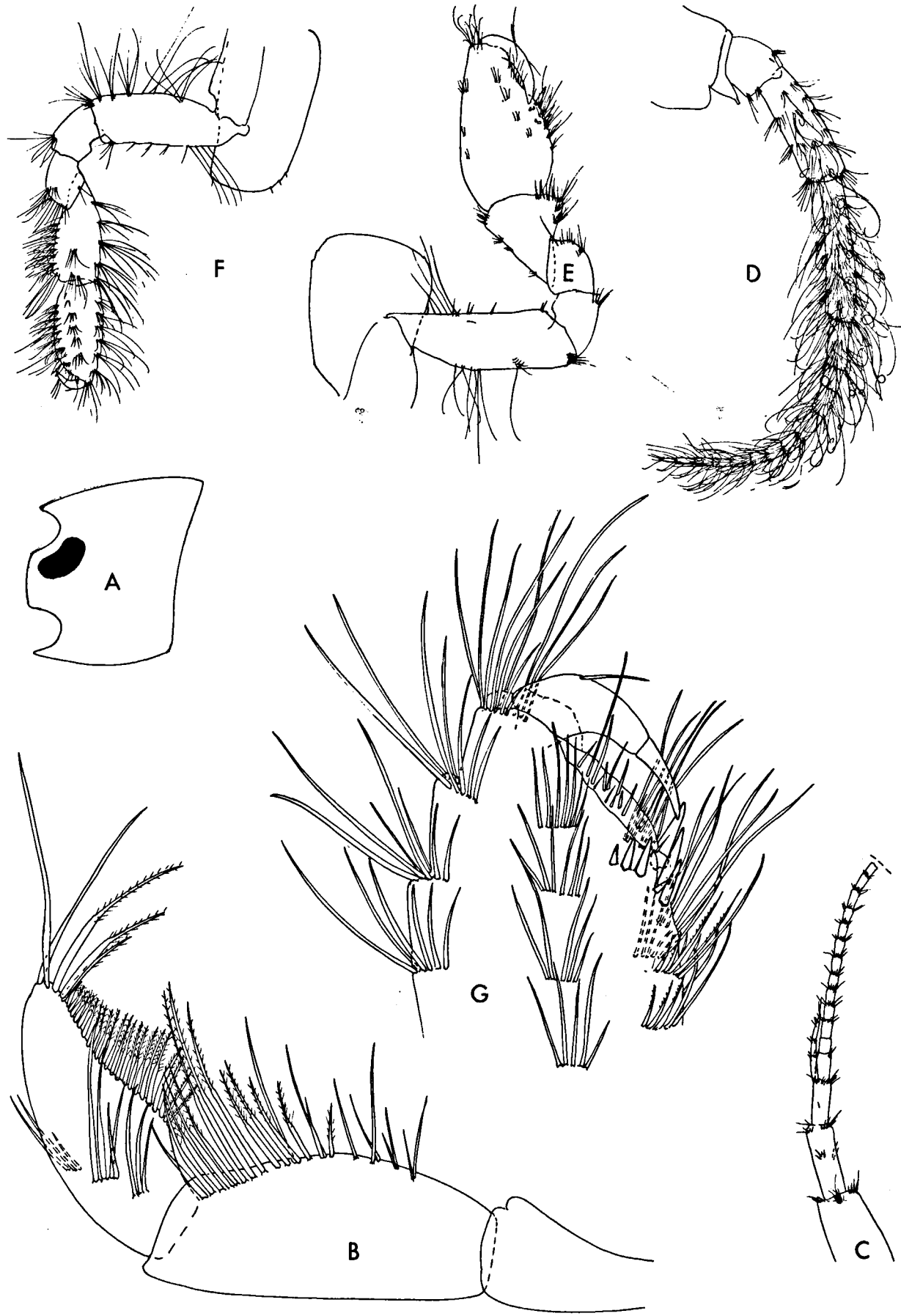

Fig. 3. Eulimnogammarus macrocarpus Stock, 1969, ♂ from Rio Mezquín, Spain. a, head (scale 2); b, mandible palp (4); c, first antenna (2); d, second antenna (2); e, first leg (2); f, second leg (2); g, palm of second leg (4).

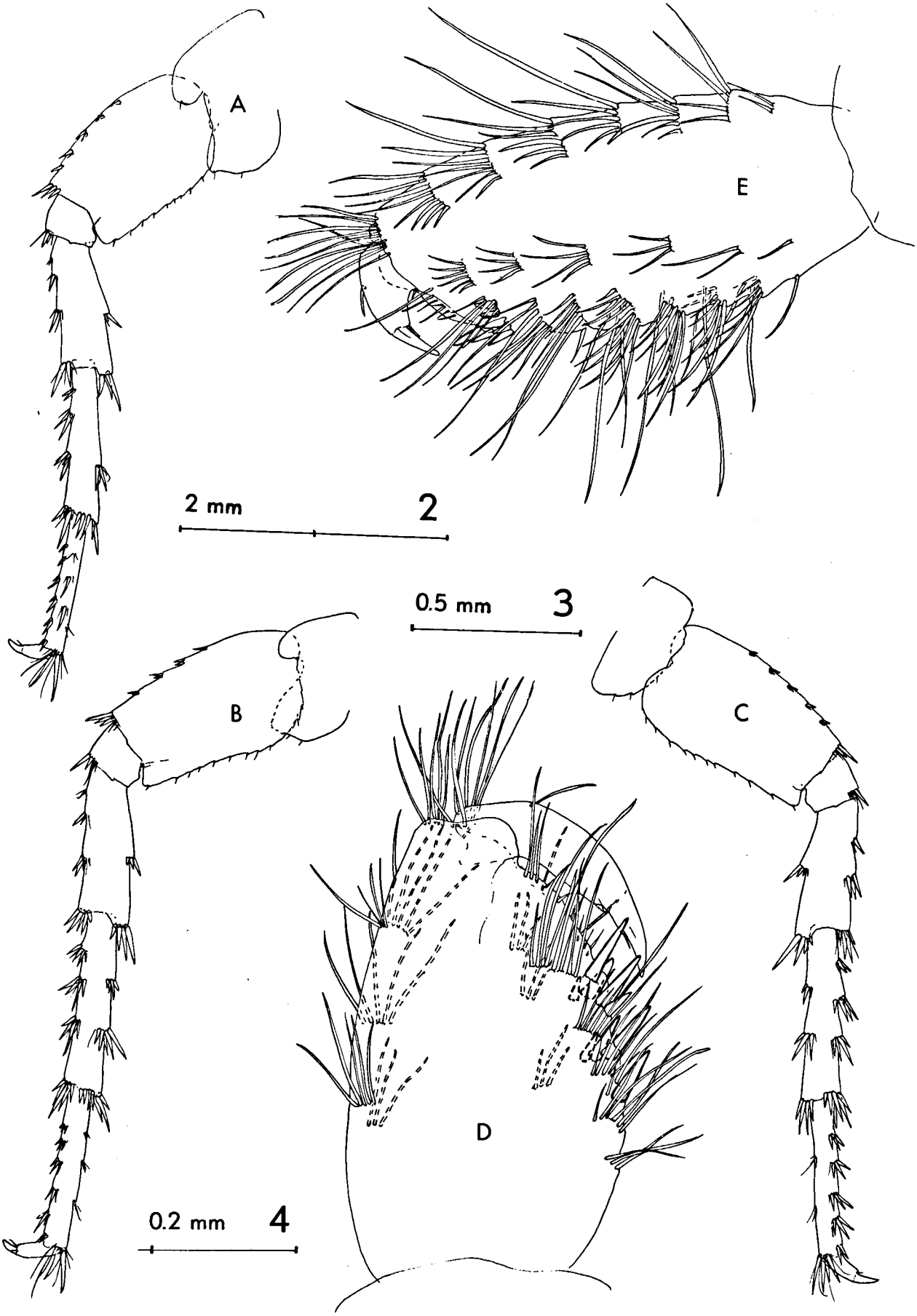

Fig. 4. Eulimnogammarus macrocarpus Stock, 1969, from Rio Mezquin, Spain. a, fifth leg ♂ (scale 2); b, sixth leg ♂ (2); c, seventh leg ♂ (2); d, hand of first leg ♀ (4); e, hand of second leg ♀ (4).

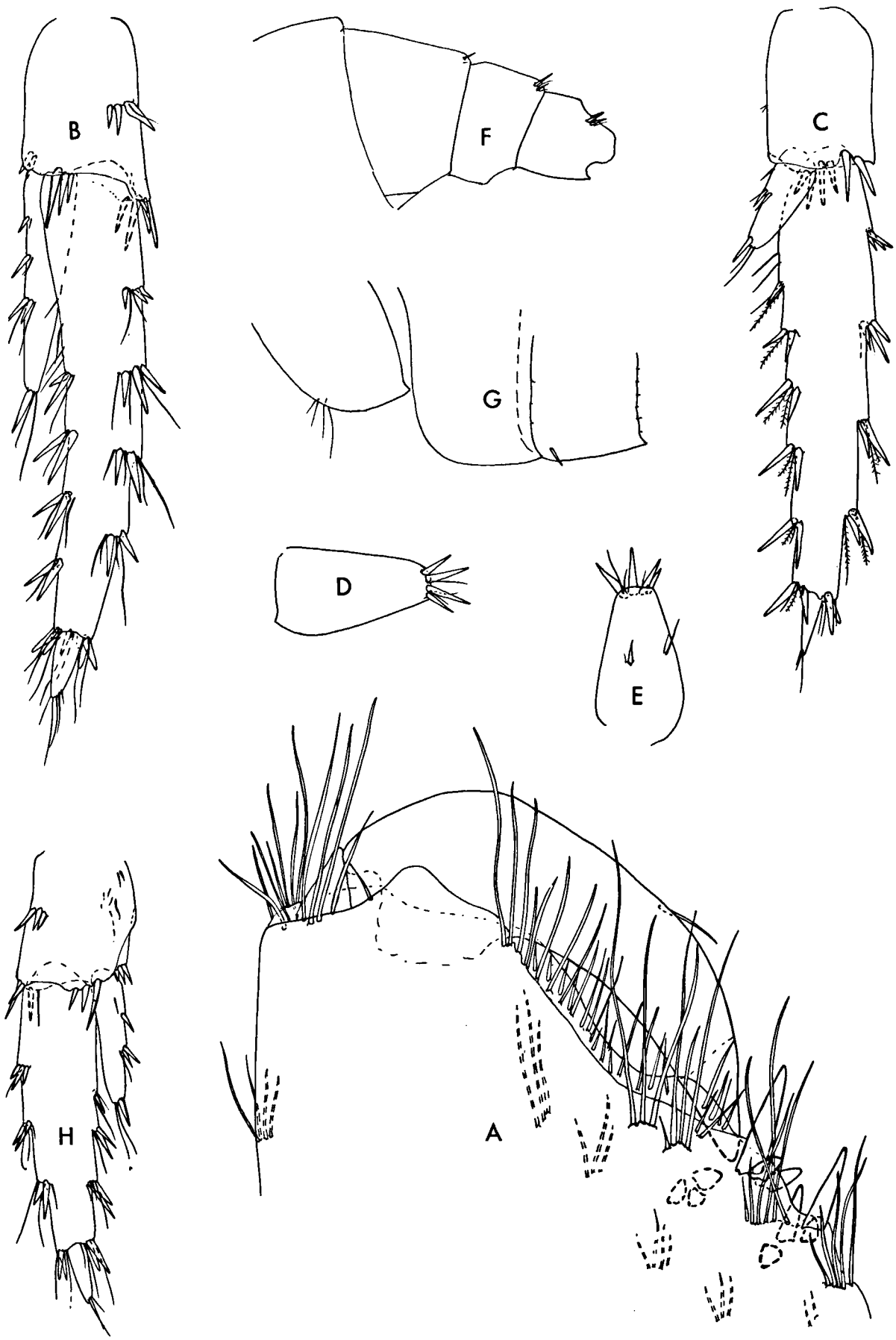

Fig. 5. **Eulimnogammarus macrocarpus** Stock, 1969, from Rio Mezquin, Spain. a, palm of first leg ♂ (scale 4); b, third uropod ♂ (3); c, third uropod of another male (3); d-e, telson ♂ (3); f, urosome ♂ (2); g, epimeral plates ♂ (2); h, third uropod ♀ (3).

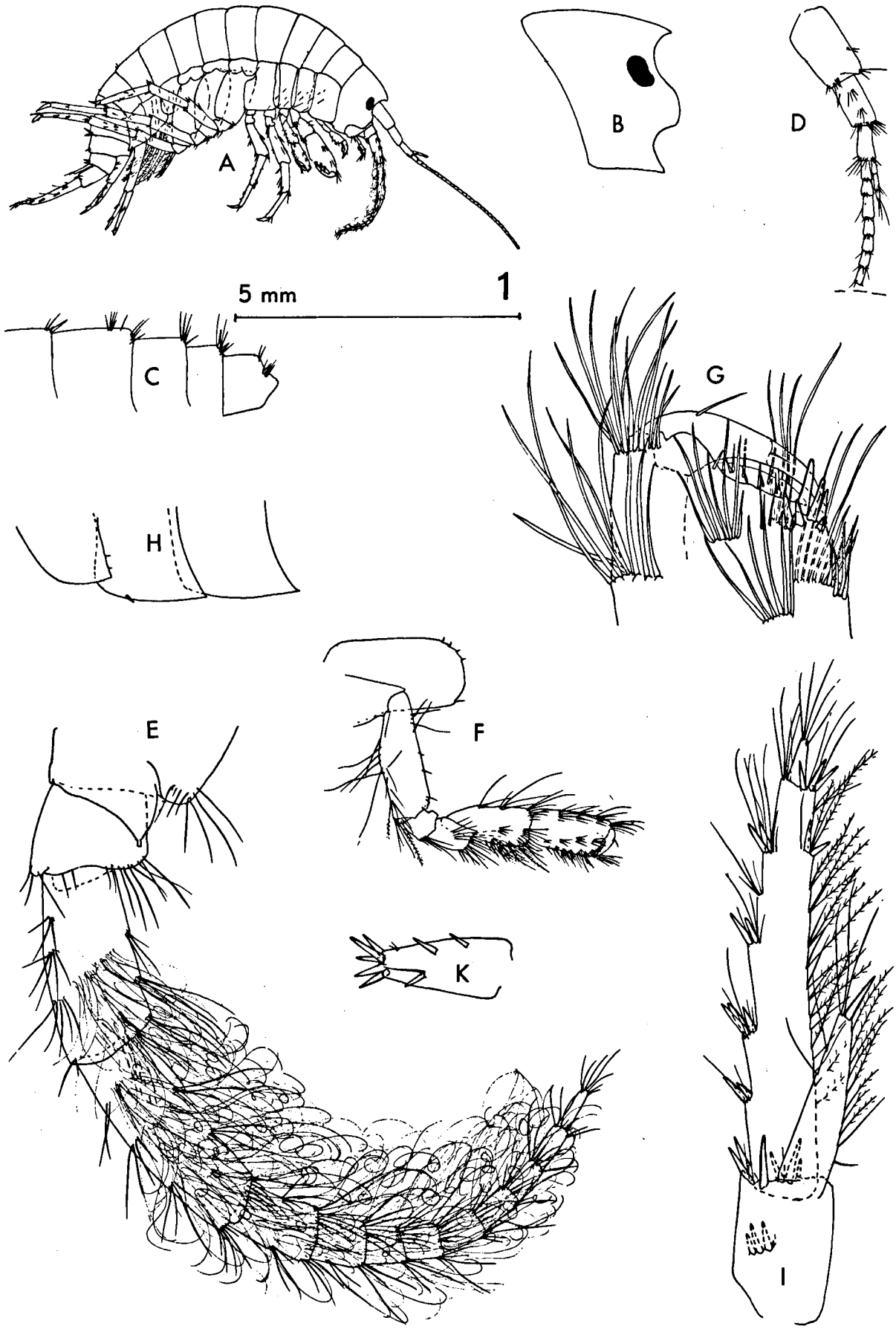

Fig. 6. Eulimnogammarus toletanus n.sp., ♂ from the type-locality. a, habitus (scale 1); b, head (2); c, urosome (2); d, first antenna (2); e, second antenna (3); f, second leg (2); g, palm of second leg (3); h, epimeral plates (2); i, third uropod (3); k, telson lobe (2).

Fig. 7. Eulimnogammarus toletanus n.sp., from the type-locality. a, mandible palp ♂ (scale 4); b, first leg ♂ (2); c, hand of first leg ♂ (4); d, third uropod of another male (3); e, telson ♀ (3); f, hand of first leg ♀ (3).

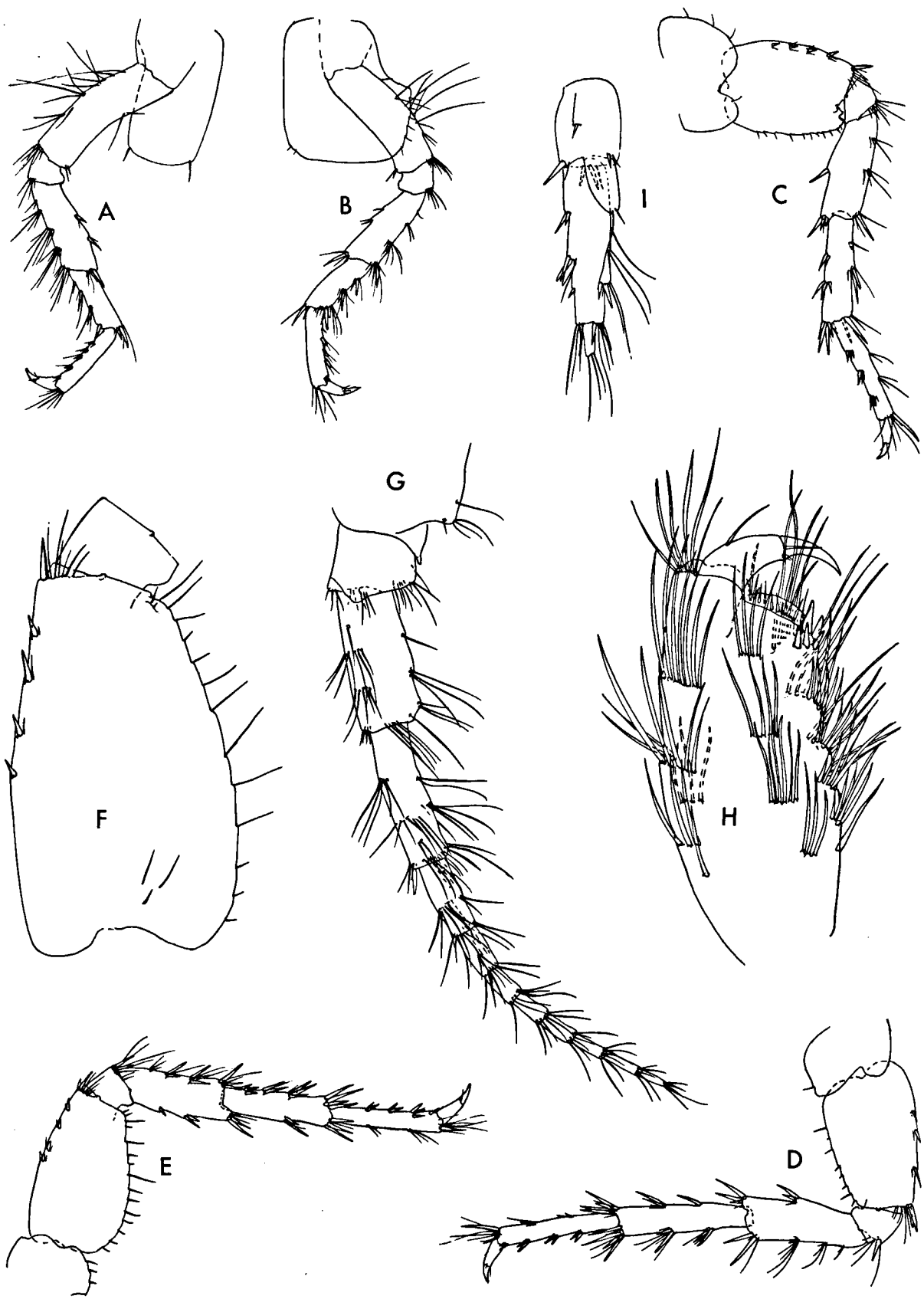

Fig. 8. Eulimnogammarus toletanus n.sp., from the type-locality. a, third leg ♂ (scale 2); b, fourth leg ♂ (2); c, fifth leg ♂ (2); d, sixth leg ♂ (2); e, seventh leg ♂ (2); f, basis of seventh leg ♂ (3); g, second antenna ♀ (3); h, hand of second leg ♀ (3); i, third uropod ♀ (3).