

A REMARKABLY VARIABLE PHREATIC AMPHIPOD FROM MALLORCA,
RHIPIDOGAMMARUS VARIICAUDA N. SP.

IN WHICH THE THIRD UROPOD CAN ASSUME THE "PARVIRAMUS" OR THE "VARIIRAMUS" CONDITION

by

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ABSTRACT

A new species of the genus *Rhipidogammarus*, *Rb. variicauda*, is described from phreatic fresh waters of two wells in the western part of the isle of Mallorca (Mediterranean). The new species has a highly variable third uropod: about 80% of the specimens possesses a typically "parviramus" appendage, but 20% shows the "variiramus" condition. Apparently, a classification based on the structure of the third uropod should be used with caution.

INTRODUCTION

During two trips exploring the crustacean fauna of epi- and hypogean continental waters of the isle of Mallorca in the western Mediterranean, various interesting forms were observed. The epigean Amphipoda form the subject of a note published elsewhere (Stock, in press). As is well known, Mallorca possesses a varied subterranean fauna as well. This fauna comprises an isopod, several amphipods, a thermosbaenacean and a bathynellid. In our catches, the isopod *Typhlocirolana moraguezi* Racovitza, 1905, was represented in wells at Santa Ponsa, Sa Porassa and San Francesco (near Ca'n Pastilla), thus outside the caves of Drach and Hams, in the Porto Cristo region, from which this remarkable species was previously recorded. Furthermore, *Metacrangonyx longipes* Chevreux, 1909 (Amphipoda) was re-discovered, likewise outside the Porto Cristo cave area, viz. in wells at San Francesco and at Sometimes, in the agricultural plain east of Palma, the capital of Mallorca. Members of the genus *Monodella* (Thermosbaenacea), recorded before from Mallorca by Orghidan et al. (1975), were extremely abundant in certain wells near Sa Porassa and Sometimes. The amphipod genera *Bogidiella* and *Salentinella* were found in hyporhean conditions of the Torrente de Pareis, near La Calobra; the latter genus was also found in a well north of Santa Ponsa. Apparently, these materials are not identical with the species of

Bogidiella and *Salentinella* described by Dancău (1973a & b) from Mallorca.

In the present paper I will describe a gammarid amphipod found in phreatic waters of two wells near Andraitx, in the western part of the island. It is an undescribed species of *Rhipidogammarus*, a genus of which the members prefer hypogean conditions, such as the intersticia of marine gravel beaches or gravel banks of estuaries, springs or wells, mostly but not always in the proximity of the sea. The genus is not known outside the Mediterranean region. The representative of the genus found in western Mallorca shows various stages of depigmentation of the smallish eyes, has a white body combined with a large body size, and has an elongate third uropod. Superficially, it looks in the field like a *Niphargus*, and like several members of that hypogean genus, it appears to inhabit macroporous substrata in karstic regions. Unlike *Niphargus*, it does not show worm-like movements, whereas another easily observed difference is that *Rhipidogammarus*, just as other members of the family Gammaridae s. str. to which it belongs, passes through a long-lasting precopula phase before fertilization, whilst *Niphargus* does not.

The most noteworthy feature of the new *Rhipidogammarus* is no doubt the extreme variability found in the development of the endopodite of the third uropod. The length of this endopodite is usually considered a character of high taxonomic value. Before World War II, gammarid students like Schellenberg or Sexton based subgeneric divisions on this character; later, most of the subgeneric divisions have been elevated to generic rank. In the recent discussions on family demarcation inside the gammarid group (e.g. in Bousfield's, 1977, or Barnard's, 1976, papers) the

uropodal morphology is used as one of the taxonomic characters on the family level. The Mallorcan species described in this paper appears to have fundamentally a "parviramus" type of third uropod, i.e., an endopodite that is very much shorter than the exopodite, usually scale-like, and lacking medial armature. In some 20% of the adult specimens, male and female alike, the endopodite is grown out and may attain a linear shape having about 60% of the length of the exopodite and being elaborately armed at both margins. This condition is usually designated as the "variiramus" type. I am not aware of any species of gammarid showing such an enormous variation in the relative length and armature of the endopodite of uropod 3. As a matter of fact, if only specimens with the elongate type of endopodite had been found, it would have been hard to place them in the genus *Rhipidogammarus* or any of the closely related genera, which all are characterized by a "parviramus" type of third uropod.

Genus *Rhipidogammarus* Stock, 1971

Rhipidogammarus variicauda n. sp. (Figs. 1-18, 20, 22, 24-27)

Material examined. — One ♂ (holotype), 1 ♀ (allotype), and 30 ♂♂, 15 ♀♀ (partly ovigerous) and 44 juveniles (paratypes). Mallorca, covered well of Huerto de Son Esteva. This well is situated on the left bank of the valley of the Torrente de Salmat, on the N. side of road C 719 (running from Andraitx to Puerto de Andraitx), just W. of Andraitx. Altitude 90-100 m. Depth to the water surface nearly 4 m, depth to the bottom 8 m. Rather clean water with some twigs and leaves; chlorinity 230 mg/l. Dec. 30, 1977. Accompanying fauna: Cyclopoida, diverse species (ZMA Amph. 107,299-300).

Three ♂♂, 2 ♀♀, 16 juveniles. Mallorca, open well with ruined waterwheel ("noria"), about 500 m N.E. of Puerto de Andraitx, on the N. side of road C 719 and on the left bank of the valley of the Torrente de Salmat. Depth to water surface about 4½ m, water depth 0.4 m. Almost at sea level. Filamentous algae; *Asellus* (Isopoda). Chlorinity 810 mg/l. Dec. 30, 1977. (ZMA Amph. 107,301).

Amongst the species of *Rhipidogammarus* actually known, the present material resembles most closely *R. rhipidiophorus* (Catta, 1878), which has a similar degree of setosity of the antennae and of the third uropods. In the following description, the new species will be compared with *R. rhipidiophorus* (referred to as *R. r.*).

Description. — Male: Body length (cephalic segment to telson) up to 9 mm; third uropod 2½-3 mm; first antenna 6-7 mm. The body is whitish, the intestine brownish; the eye is darkly pigmented. The eyes show various degrees of depigmentation (figs. 2, 3, 4): sometimes almost all ocelli are pigmented, but starting from the outside, a varying number of ocelli may get depigmented. Entirely depigmented eyes have not been found. The eye spot is small, rounded, slightly oval. The lateral lobes of the cephalic somite are roundedly truncate (fig. 1); the antennal sinus is rather shallow.

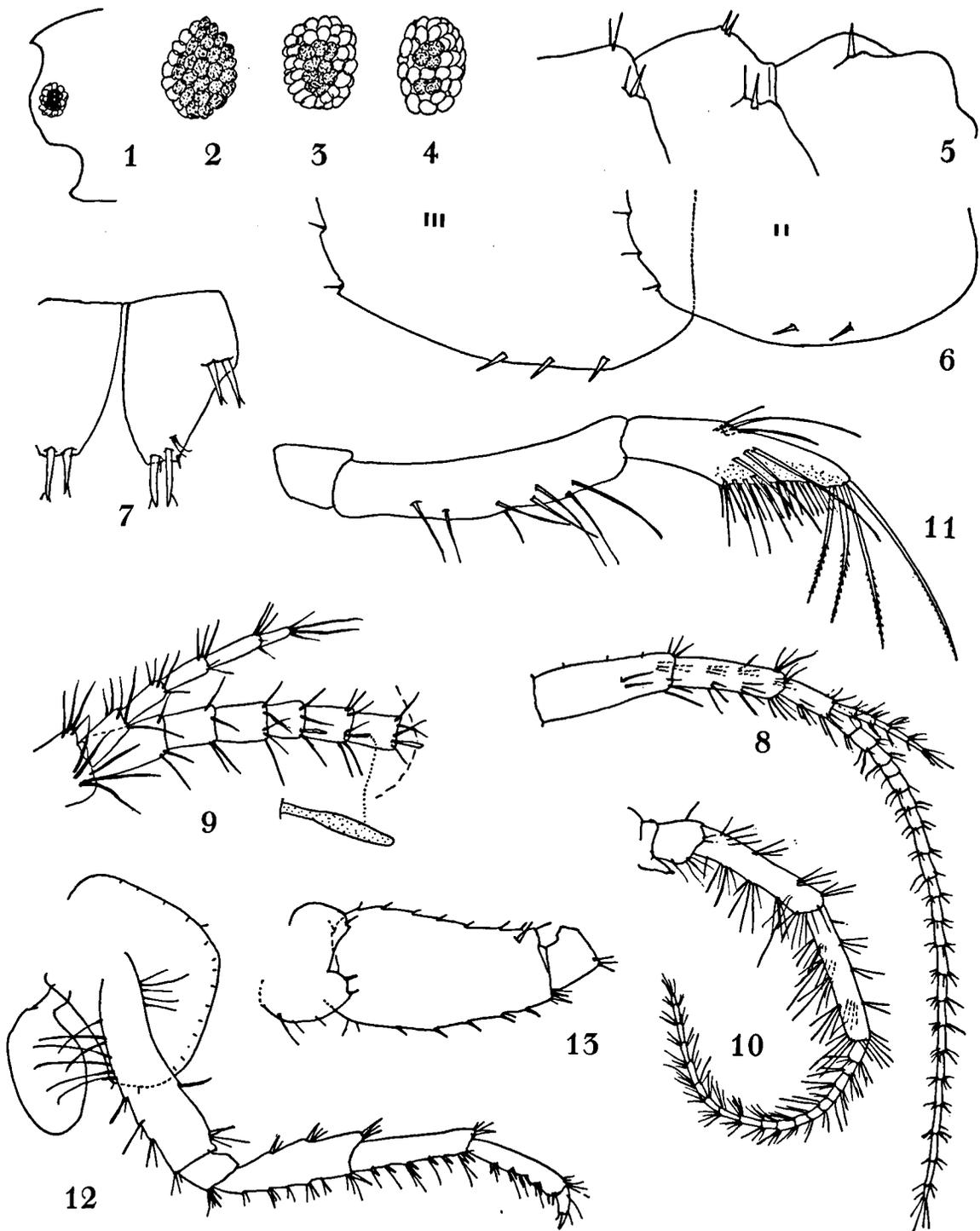
The dorsal armature of the urosome (fig. 5) consists on somite I of 2 mid-dorsal setules and a lateral group on either side of 1 spine and 1 setule; on somite II there are 2 mid-dorsal spines, and a lateral group on either side of 1 spine and 1 setule; on somite III, only the lateral group, composed of 1 spine, is present.

The first antenna (fig. 8) is slender. The length of peduncle segments 1 to 3 is 830, 665, and 320 μm, respectively. The accessory flagellum (fig. 9) is long: it reaches to the fifth flagellar segment and is 581 μm long (in *R. r.* it reaches to the end of the third flagellar segment). The flagellum may have up to 23 segments. The armature of the first antenna is similar to that of *R. r.* Club-shaped aesthetascs occur on all flagellum segments, but for the proximal three (fig. 9).

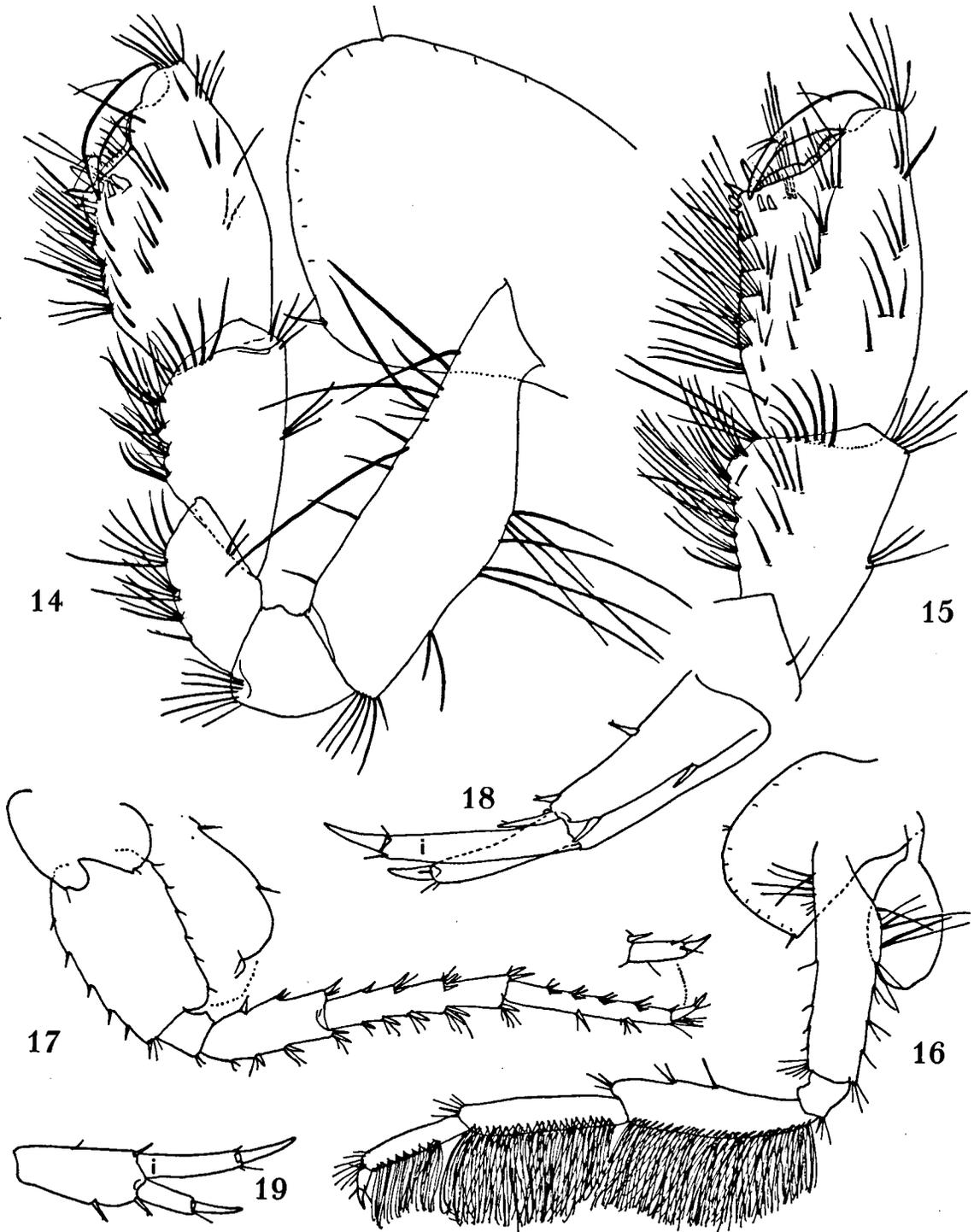
The second antenna has a slender gland cone (fig. 10). Peduncle segments 4 and 5 have a length of 796 and 786 μm, respectively, and are 6 to 7 times as long as wide, thus very elongate; they are ventrally armed with 4 groups (+ 1 terminal group) of long setae. The flagellum has up to 20 segments, armed with long setae. Calceoli absent.

The mouth parts are unmodified (see Stock, 1971). The mandible palp (fig. 11) has an elongate, slender second segment (this segment is 4.6 times as long as wide, versus <3.8 × in *R. r.*). The distal palp segment is also slender (3.6 × as long as wide, versus 3.2 × in *R. r.*). A few (2 or 3) A- and B-setae are present on segment 3; about 4 C-setae, a regular row of D-setae and 4 E-setae are also visible.

The first gnathopod (fig. 14) is similar to that of *R. r.*; the posterior margin of the propodus



Figs. 1-13. *Rhipidogammarus variicauda* n. sp., ♂ (paratype). 1, cephalic somite from the left (scale AB); 2, 3, 4, eye spots of different specimens, showing various stages of depigmentation (freehand sketches); 5, dorsal contour of urosome from the left (AD); 6, epimeral plates II and III from the right (AD); 7, telson (AD); 8, first antenna (AB); 9, accessory flagellum (AD), one aesthetask more strongly enlarged; 10, second antenna (AB); 11, mandible palp (AE); 12, fourth pereiopod (AB); 13, proximal segments of sixth pereiopod (AB).



Figs. 14-18. *Rhipidogammarus variicauda* n. sp., ♂ (paratype). 14, first gnathopod (scale AD); 15, distal segments of second gnathopod (AD); 16, third pereiopod (AB), plumosity of the setae not shown; 17, fifth pereiopod (AB), posteroventral corner of basis and claw more strongly magnified (AD); 18, first uropod (AD) (i = inner ramus).
 Fig. 19. *Rb. rhipidiophorus* (Catta, 1878), first uropod (AD) (i = inner ramus).

bears rather numerous setae; the palm is concave, lacking a mid-palmar spine; there are 3 + 2 palmar angle spines.

The second gnathopod (fig. 15) is about as strong as the first; the propodus is somewhat more rectangular and elongate in shape than that of the first gnathopod. The posterior margin of the propodus is armed with 6 rows of setae; the number of palmar angle spines is 3 or 4 + 2; as in the first gnathopod, there is no mid-palmar spine. The palm is concave, with 3 slight swellings.

The third pereiopod (fig. 16) is characterized by its very setose meral, carpal, and propodal segments. The posterior margin of these segments bears about 29, 24, and 10 transverse rows of long, plumose setae, respectively. The coxal gills, on the third through the sixth pereiopods, are elliptical, with a well-demarcated basal stalk (fig. 12).

The fourth pereiopod (fig. 12) has distinctly more elongate basal, meral, carpal and propodal segments than in *R. r.* The ventroposterior corner of the basis is produced into a rounded, unarmed lobe. The armature of the fifth pereiopod (fig. 17) consists on the longer segments of spines and some setae, which do not considerably overreach the spines.

The sixth pereiopod is also slender. The basis (fig. 13) has a slightly concave posterior margin; the ventroposterior corner is armed with a strong spine, placed at some distance from the margin.

The seventh pereiopod (fig. 20) is very slender. The basis is tapering, with an almost straight posterior margin; the latter is armed with about 8 small setules and 2 subdistal spines (1 in *R. r.*, fig. 21) near the hind corner. The merus is about 2.5 × as long as its distal diameter (much less, usually about 1.8 ×, in *R. r.*). The greater elongation of the carpus and propodus, in comparison with *R. r.*, is also noteworthy. The spinose armature of the longer leg segments is slightly more elaborate than in *R. r.*

The epimeral plates II and III have rounded posterior corners (fig. 6).

The first uropod is shorter than the second. The exopodite is shorter than the endopodite (fig. 18), but the difference in length is much less clearly marked than in the other species of *Rhipidogammarus* (the ratio exopodite/endopodite is about

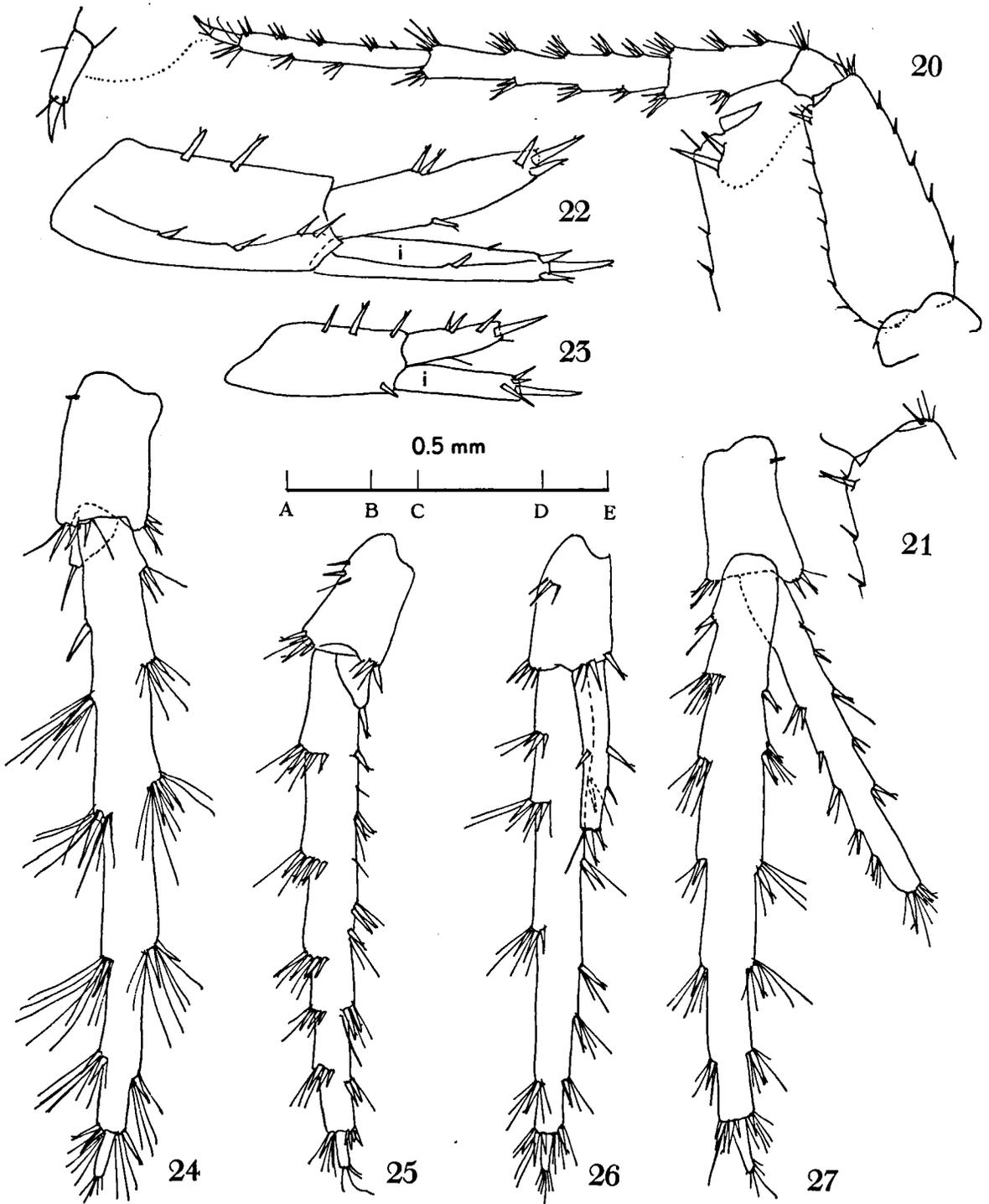
3/4 in the new species, versus 1/2 in *R. r.*, cf. fig. 19). The long, claw-like, terminal spine on the endopodite is about 1/3 as long as the endopodite itself in the new species, versus about 1/2 as long in the other species.

In the second uropod, the exopodite is only slightly shorter than the endopodite. The endopodite usually bears 1 or 2 spines on its dorsal margin (none in *R. r.*). The terminal exopodal and endopodal spine is relatively shorter than in *R. r.* (cf. figs. 22 and 23).

The third uropod (fig. 24) is extremely elongated, giving the animal an almost *Niphargus*-like aspect. The third uropod is at least twice as long as the three urosomites combined (in the other species of the genus at most 1 1/2 × as long). The exopodite is linear, slightly curved inward; exopodal segment 1 is at least 10 × as long as its proximal diameter (some 6 to 7 × in *R. r.*); segment 2 is small, finger-shaped, and distinctly longer than the distal spines on segment 1. The armature of the first exopodal segment consists of strong spines, placed in 5 or 6 groups, intermixed with long setae. The endopodite is variable in length: in most specimens it assumes the scale-like shape, usual for the genus (fig. 24); its armature consists of 1 distal seta only; in other specimens, the endopodite is more elongate, ranging from 1/3 to almost 2/3 of the length of the first exopodal segment. The armature of these more elongate types of endopodite consists of several groups of marginal and terminal spines and a few setae (figs. 26, 27). Of the 47 adult specimens in the type-lot (31 ♂♂, 16 ♀♀), 9 specimens (6 ♂♂, 3 ♀♀) show an elongate endopodite in the third uropod; in the other specimens, the endopodite is "normal" (i.e., scale-like). Among the 5 adult specimens (3 ♂♂, 2 ♀♀) of the other sample containing this species, one (a ♂) has an elongate endopodite. Consequently, about 1 out of every 5 specimens shows this aberration.

The telson (fig. 7) is completely cleft; the armature consists of one group of lateral spines and one group of distal spines; usually, there are 2 spines in each group, rarely 1 or 3; long setae are absent.

Female: Slightly smaller than the male. Morphologically similar to the other sex, except for the



Figs. 20, 22, 24-27. *Rhipidogammarus variicauda* n. sp. (paratypes). 20, seventh pereiopod, ♂ (scale AB), posteroventral corner of basis and claw more strongly magnified (AD); 22, second uropod, ♂ (AD) (i = inner ramus); 24, third uropod of a "normal" ♂ (AC); 25, do., of a "normal" ♀ (AC); 26, 27, do., of two males with elongate endopodites (AC).
 Figs. 21, 23. *Rb. rhipidiophorus* (Catta, 1878), ♂. 21, posteroventral corner of basis of seventh pereiopod (AD); 23, second uropod (AD) (i = inner ramus).

propodus of the first and second gnathopods (palm not concave but straight), the absence of dense setation on the propodus of the third pereopod, and perhaps a trifle shorter setae on the third uropod (fig. 25).

Remarks. — At first sight, the present species, with its elongate and slender legs and third uropods, looks like a member of the genus *Longigammarus* Karaman, 1969. However, it lacks the modified mouth parts characterizing the latter (*Longigammarus* has widened lobes in the second maxilla, all teeth on the outer lobe of the first maxilla are comb-like, and the outer lobe of the maxilliped is devoid of spines). Morphologically, the Mallorcan specimens belong no doubt to the genus *Rhipidogammarus* Stock, 1971, although it is more slender than the other species of the genus. The differences, in particular from *R. rhipidiophorus*, pertain to the greater elongation of the exopodite of uropod 3, the tendency of the endopodite of uropod 3 to develop from a "parviramus" type into a "variiramus" type, the greater slenderness of the peduncle of the second antenna, the greater elongation of the accessory flagellum of the first antenna, the more slender mandible palp, the greater elongation of the fifth to seventh pereopods, the different proportions of the rami of the first uropod, the shorter distal spine on the rami of the first and second uropods, etc. Moreover, the new species is about $1\frac{1}{2}$ times larger than *R. rhipidiophorus*.

The armature of urosomite I (with only setules in the mid-dorsal line, and no spines) is constant in the present populations of the new species. In several populations of *R. rhipidiophorus*, this somite bears a mid-dorsal group of 1 or 2 spines, but in certain other populations the same configuration as in *R. variicauda* is found. Apparently, this character is too variable to be used for taxonomic purposes in this group.

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