Abbreviated larval development of *Macrobrachium jelskii* (Miers, 1877) (Crustacea: Decapoda: Palaemonidae) from the Rio Solimões floodplain, Brazil, reared in the laboratory.

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Abstract

The larval development of the palaemonid shrimp *Macrobrachium jelskii* (Miers, 1877) collected in the Rio Solimões floodplain, central Amazon region, was described and illustrated on the basis of specimens reared in the laboratory. Larval development was abbreviated and metamorphosis was accomplished after seven or eight days. The yolk-rich larvae do not feed until metamorphosis. The newly-hatched larvae had sessile eyes and all pereiopods and pleopods, even though in a rudimentary state. Descriptions and detailed illustrations of the three larval and first juvenile stages are presented. Comparisons are made between the larval development of specimens of this species from different localities in Brazil (Amazon basin) and Venezuela (Orinoco basin).

Key words: Crustacea, Palaemonidae, *Macrobrachium jelskii*, larval development, Amazon region

Introduction

The freshwater palaemonid shrimp, *Macrobrachium jelskii* (Miers, 1877), has a wide distribution throughout South American inland waters. It occurs in the Orinoco, Amazon and Paraguay river basins, as well as in the coastal river basins of North and Northeastern South America (Rodríguez, 1980, 1981, 1982; Coelho and Ramos-Porto, 1985). In the Amazon basin, the species occurs either in the acidic, plankton-poor black water river systems or in the neutral, nutrient-rich waters of the white water rivers and their floodplains (Holthuis, 1966; Kensley and Walker, 1982).

Studies on *M. jelskii* have already been made for the populations occurring in Venezuela, for which there are information on larval development (Gamba, 1980, 1984; Tucci, 1994) and reproductive biology (Gamba, 1997). In the central Amazonian region, except for some notes on the taxonomy and geographic distribution (Holthuis, 1966; Kensley and Walker, 1982), there is no further information about this species. However, other palaemonid species from this area have had their larval development already studied: *Eurythynchus* spp. by Magalhães (1988a), *Macrobrachium amazonicum* (Heller, 1862) by Magalhães (1985), *Macrobrachium nattereri* (Heller, 1862) by Magalhães (1989), *Palaemonetes* spp. by Magalhães (1986 and1988b), and *Pseudopalaemon* spp. by Magalhães (1986/87) and Magalhães and Medeiros (1998). In this paper, the morphological descriptions and illustrations of the three larval and first juvenile stage of *M. jelskii* are provided, and comparisons are made between the larval development of populations of this species from Orinoco and middle Amazon river basins.

Material and methods

In April 1994, two ovigerous females of *M. jelskii* were collected among floating vegetation roots (mainly *Paspalum repens* Berg) in lago Camaleão, Marchantaria island (03° 15'S 59° 58'W), Solimões river, near Manaus, Brazil. The specimens were transported to the laboratory in a plastic container and were kept in a 680x300x400mm aquarium with some aquatic plants (small specimens of *Eichornia* sp.) for shelter. The newly-hatched larvae were transferred to 80 ml transparent plastic vials for

individual rearing. Food was not provided. Water of the vials was partially changed once a day and temperature ranged from 26.0 to 27.5°C.

Larvae were reared just up to the first juvenile stage. Measurements, drawings, dissections and morphological descriptions were performed in relaxed specimens initially kept in 10% alcohol for about 15 minutes. A stereoscopic microscope with a micrometer objective set and a microscope equipped with a drawing tube were used to perform those tasks. Total length (TL) was measured from the tip of the rostrum to the posterior margin of the telson, excluding setae. For greater clarity, plumose setae are depicted as simple naked setae in the dorsal view drawings and, where plumes are represented, they can be denser and longer than it is indicated. Due the small number of rearing larvae, the descriptions were based on two or three specimens from each stage, which prevented from a better information on the individual variation. The description depicts the major morphological characters of each stage, emphasizing the main additions to the previous one. One spent female and some remainder larvae and juveniles were deposited in the Crustacean Collection of INPA (INPA 494).

Results

The species goes through three larval stages which possess enough yolk supplies to nourish them until metamorphosis. Larvae are benthic and used to stand still on the bottom or in the aquarium corners. Larval period lasted from 7 (35 %; n = 14) to 8 days (65 %). The description of the larval and first juvenile stages follows:

First larval stage (mean TL 5.95 mm, n = 2; duration: 1-2 days) (Figs. 1-21)

Eyes sessile. Rostrum straight, reaching about midway of the antennular peduncle, with a small tooth proximally on the dorsal margin. Carapace with a small spine on the anteroventral corner. Abdomen smooth, segmentation between the 6th abdominal somite and telson not very distinct.

Antennule: Peduncle unsegmented. Inner flagellum simple and setaceous, proximally broader but sharply tapering in the distal half. Outer flagellum broad, with 1 subdistal weakly plumose seta, 1 distal aesthete, 1 large and 2 small naked setae.

Antenna: Protopod unsegmented. Scaphocerite fringed with 20-21 plumose setae along inner and distal margins. Endopod as a bisegmented flagellum, about 1.5 times longer than the scaphocerite.

Mandibles: Rudimentary. Molar and incisor processes not clearly defined, with a large conic tooth on the incisor process and some denticles along the obtuse molar process.

Maxillula: Rudimentary. Endopod, coxal and basal endites with some distal protuberances.

Maxilla: Protopod rudimentary; endopod slightly bilobed and tipped with a naked seta. Scaphognathite large, with 10-11 long, slender plumose setae along anterior margin, 2 strong, weakly plumose setae on the posterior margin; outer margin smooth, only plumed.

Maxilliped 1: Protopod with a large epipod and inner margin smooth, slightly bilobed. Endopod short and unsegmented, bearing 1 subdistal and 3 distal plumose setae. Exopod long, with 4 distal plumose setae.

Maxilliped 2: Coxa naked; basis with a mesial naked seta. Endopod with segmentation between distal and subdistal joints not distinct; distal segment with a long, slender terminal spine, 1 naked and 2 weakly plumose subterminal setae, 1 short weakly plumose median seta; penultimate segment with 2 weakly plumose setae on distal margin. Exopod longer than the endopod, bearing 8, terminal and subterminal, plumose setae.

Maxilliped 3: Coxa naked; basis with 2 mesial naked setae. Endopod 5-segmented, with 1/1/2/4/3, naked and weakly plumose, setae from proximal to distal segment; distal segment also bearing a long, slender terminal spine. Exopod slightly shorter than endopod, bearing 9, terminal and subterminal, plumose setae.

Pereiopods 1-2: Well developed, birramous buds. Protopod with segmentation between coxa and basis not distinct. Endopod glabrous, with only segmentation between merus and carpus clearly distinct. Exopod glabrous, about 0.6 times as long as endopod.

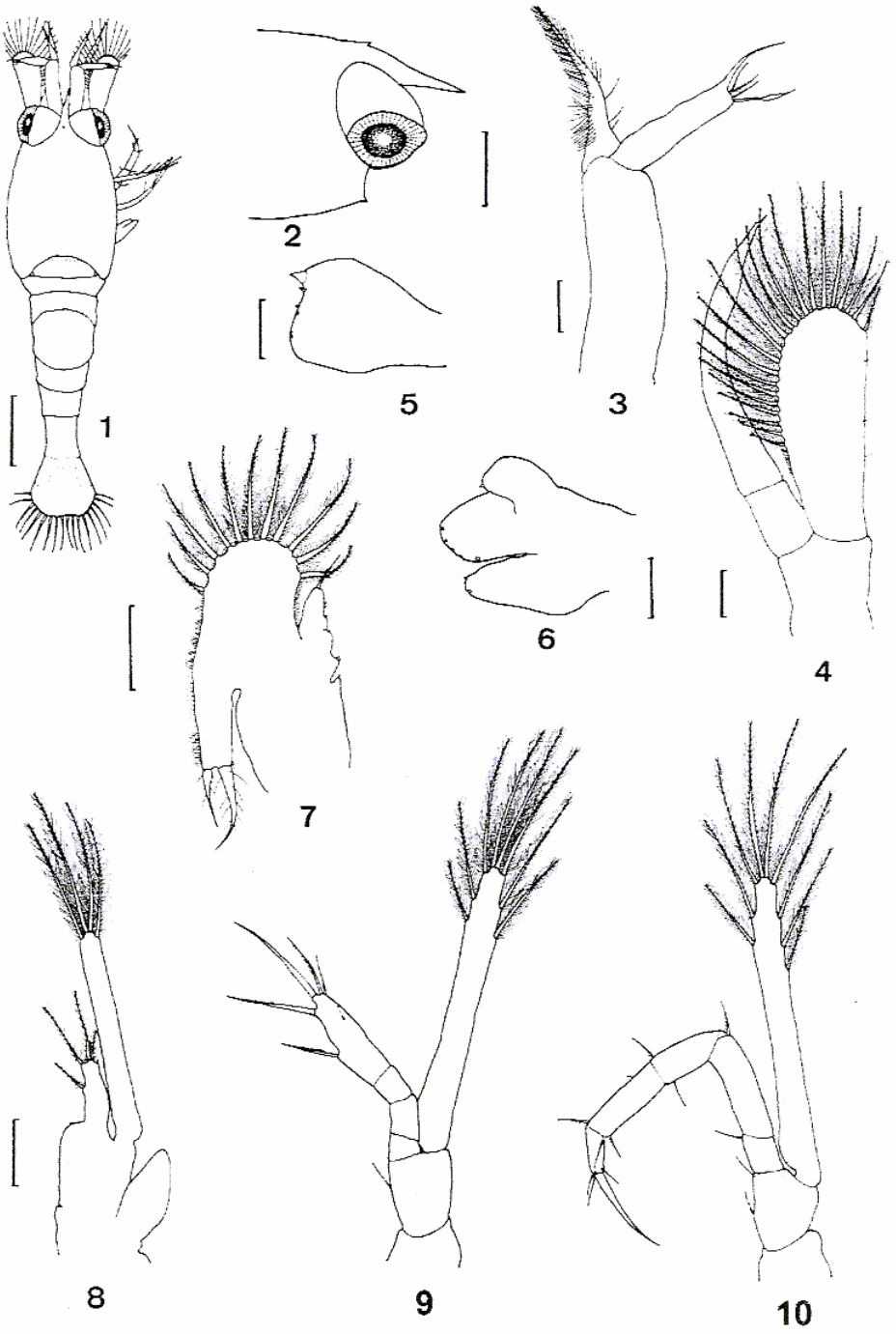
Pereiopods 3, 4 and 5: All as glabrous, uniramous buds, bearing no trace of future segmentation between joints.

Pleopodos 1 - 5: All as small, birramous buds; glabrous, not functional.

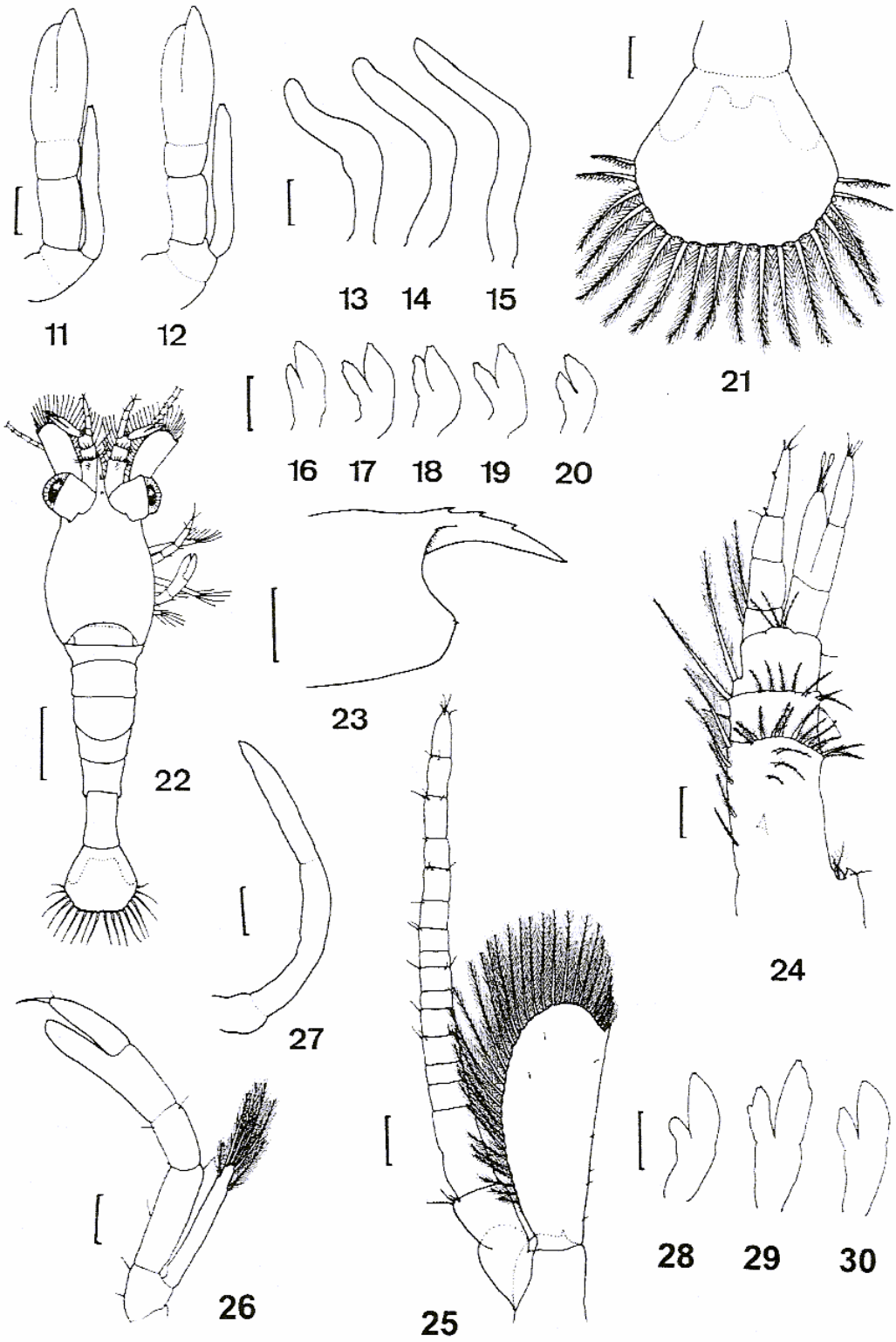
Uropod: Not yet freed; bud visible through the telsonal culticle.

Telson: Fan-like; posterior margin broadly convex, bearing 18 plumose setae (2 outermost pairs plumose only on their inner side).

Second larval stage (mean TL 6.31 mm, n = 2; duration: 2 days) (Figs. 22-30)



Figures 1 - 10: *Macrobrachium jelskii* (Miers, 1877), larva I. 1, Dorsal view (left thoracic appendages not represented); 2, Lateral view of the anterior region of the carapace; 3, Antennule; 4, Antenna; 5, Mandible; 6, Maxillule; 7, Maxilla; 8, Maxilliped 1; 9, Maxilliped 2; 10, Maxilliped 3. (Scale bars: 1 = 1mm; 2 = 0.5mm; 3, 4, 7-10 = 0.2mm; 5, 6 = 0.1mm)



Figures 11 - 30: *Macrobrachium jelskii* (Miers, 1877), larva I. 11, Pereiopod 1; 12, Pereiopod 2; 13, Pereiopod 3; 14, Pereiopod 4; 15, Pereiopod 5; 16, Pleopod 1; 17, Pleopod 2; 18, Pleopod 3; 19, Pleopod 4; 20, Pleopod 5; 21, Telson. *Macrobrachium jelskii*, larvae II. 22, Dorsal view (left toracic appendages not represented); 23, Lateral view of the anterior region of the carapace; 24, Antennule; 25, Antenna; 26, Pereiopod 2; 27, Pereiopod 5; 28, Pleopod 1; 29, Pleopod 3; 30, Pleopod 5. (Scale bars: 11-21, 24-30 = 0.2mm; 22 = 1mm; 23 = 0.5mm)

Eyes stalked. Rostrum with distal half curved downwards, with 3 dorsal teeth. Carapace with 1 supraorbital spine and 1 spine on the anterolateral border. Abdomen with 6th somite clearly distinct.

Antennule: Peduncle 3-segmented, showing several, short and long, plumose setae as illustrated. Proximal segment longest, with an incipient stylocerite and a median ventral spine. Inner flagellum 3 or 4-segmented, about as long as the outer one. Outer flagellum birramous; mesial branch simple and shorter, tipped with 2 aesthetes and a minute naked seta; lateral branch bisegmented, with 4 apical naked setae.

Antenna: Protopod with a sharp spine on the distoventral margin. Scaphocerite with 30-31 plumose setae along most of the inner and distal margins, with a distolateral spine and some setules on the dorsal surface and along the lateral margin. Endopod just as a long, multiarticulated flagellum, about 2.3 times longer than the scaphocerite.

Mandible, maxillule, maxilla and maxillipeds: Maxilla with outer margin of scaphognathite setaceous. Otherwise, all structures without noteworthy changes.

Pereiopods 1-2: Segmentations better marked, except for the one between isquium and merus. Endopod with a few naked seta and a curved terminal spine on the dactylus. Exopod shorter than in the preceding stage, bearing 6-8, terminal and subterminal, plumose setae.

Pereiopods 3-5: Uniramous, smooth buds a little longer than in the preceding stage.

Pleopods: Biramous buds more developed, still glabrous; incipient appendix interna present on the pleopods 2, 3 and 4.

Uropod and Telson: Similar to those of the preceding stage.

Third larval stage (mean TL 6.54 ± 0.03 mm, n = 3; duration: 3-4 days) (Figs. 31-42)

Rostrum longer, reaching the distal margin of the 2nd antennular segment, bearing 4 dorsal teeth and 1 ventral tooth. Carapace with 1 additional spine on the anteroventral corner.

Antennule: Proximal segment with stylocerite a little more proeminent and showing a spine on the distolateral corner. Inner flagellum 5-segmented, with a few minute aesthetes and small naked setae placed median and distally on most of the joints. Outer flagellum with mesial branch bearing 2 spatulate aesthetes; lateral branch longer, 3-segmented, with a few small naked setae.

Antenna: Similar to that of the preceding stage, except for the longer exopod, about 3.7 times as long as the scaphocerite.

Mandible: Still rudimentary; incisor and molar processes distinctly cleft, the former bearing 1 acute tooth, the latter stout, subquadrate.

Maxillule: Still rudimentary; endopod clearly bilobed, with a rudimentary spine on the lower lobe.

Maxilla: Without noteworthy change.

Maxilliped 1, 2 and 3: Endopod of the maxilliped 2 with distal half incurved and broader, otherwise without noteworthy changes.

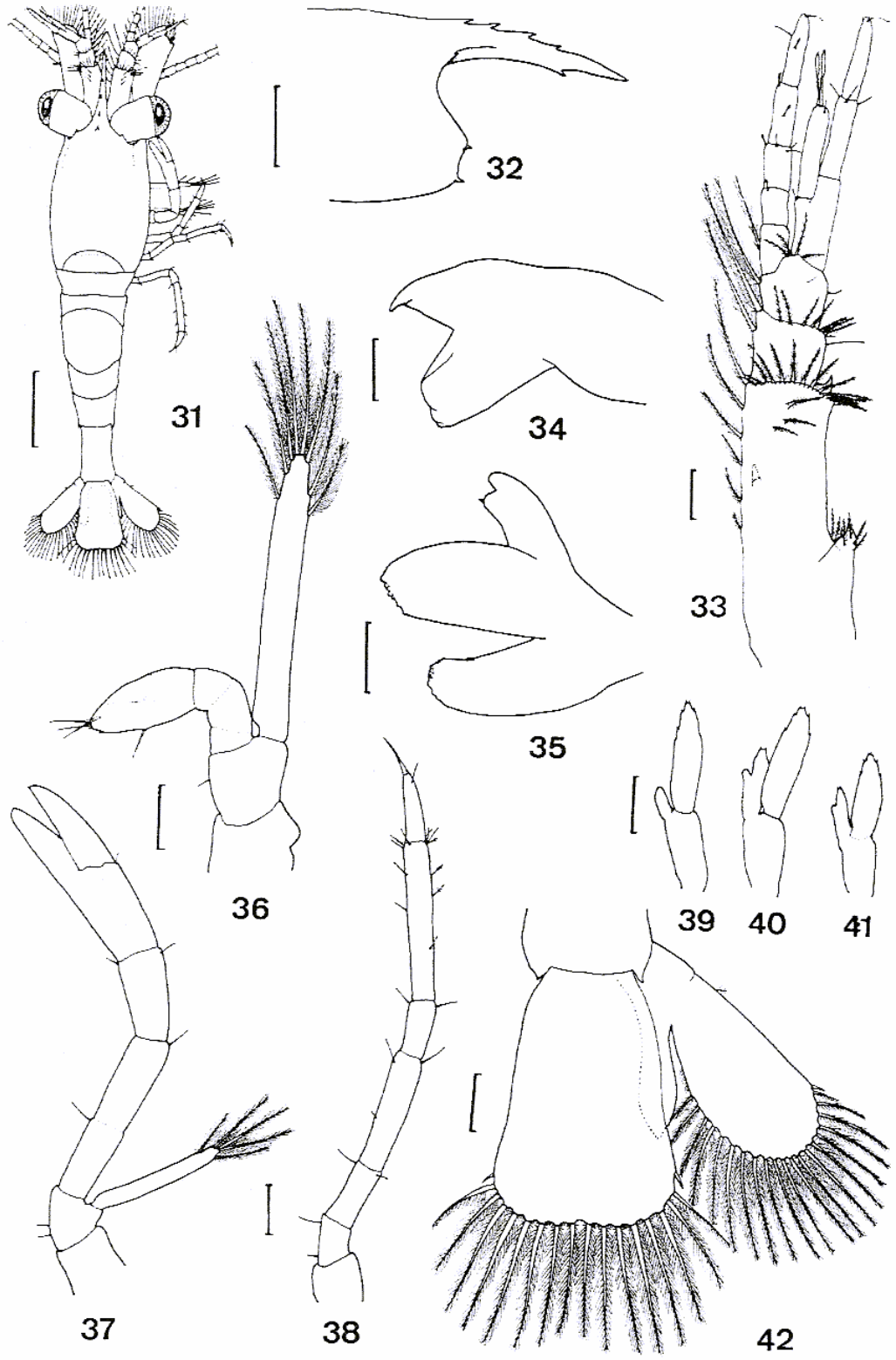
Pereiopods 1-2: Pereiopod 2 longer than the pereiopod 1. Endopod with faint segmentation between isquium and merus; dactylus with terminal spine much reduced. Exopod slightly shorter than in the preceding stage.

Pereipods 3, 4 and 5: Fully developed and functional. Coxa naked; basis with 2 naked setae. Endopod 5-segmented, with several, naked and weakly plumose, small setae from ischuium to dactylus; dactylus with a terminal curved spine.

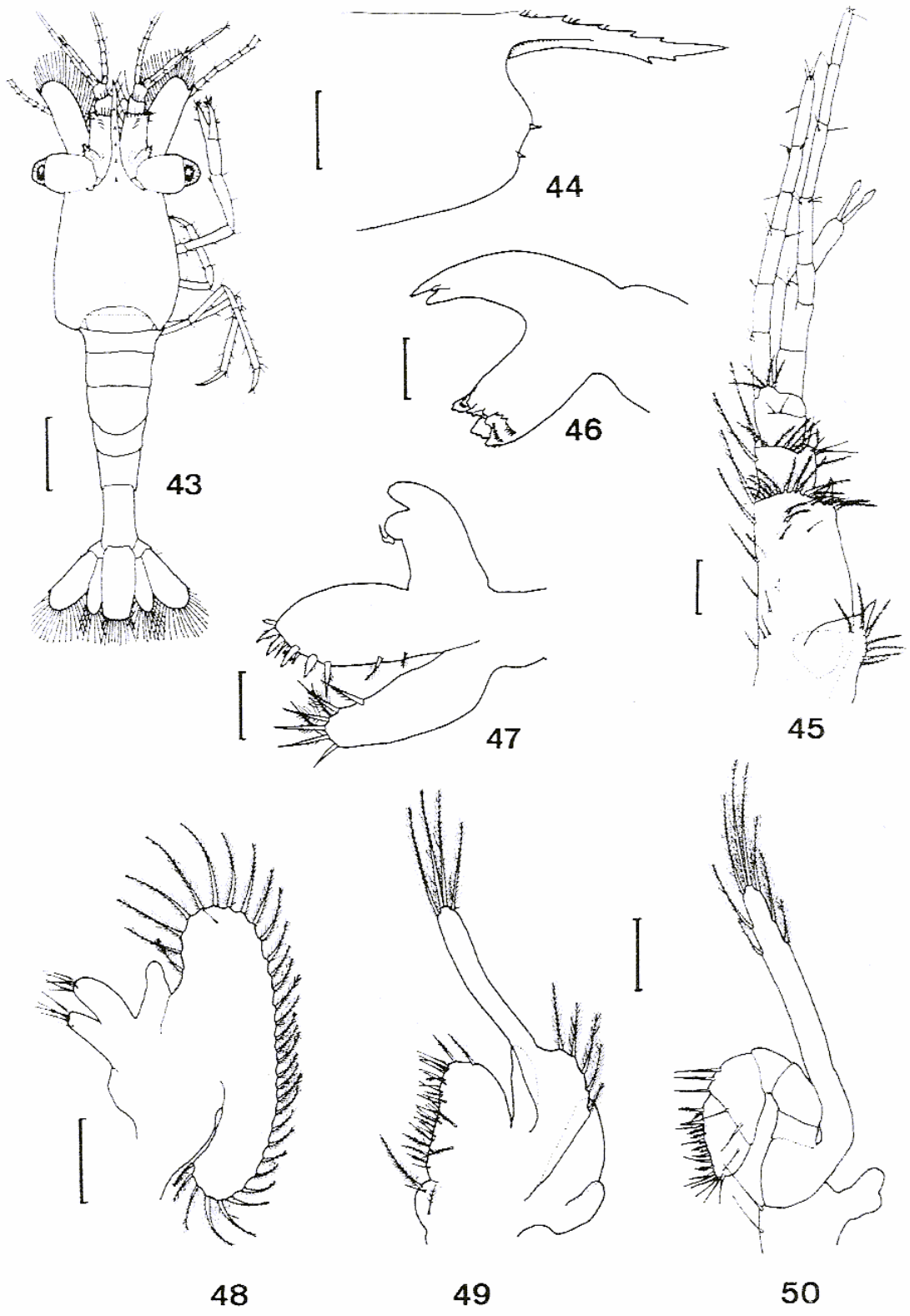
Pleopods 1-5: All as well developed buds; endopod of pleopods 2-5 with developing appendices internae; endopod and exopod devoid of setae.

Uropod: Birramous. Protopod with distal segmentation not clearly marked. Endopod bud-like, devoid of setae. Exopod developed, with lateral margin bearing 1 small plumose seta proximally and 1 short spine on the distal corner; distal and mesial margins fringed with 20 plumose setae.

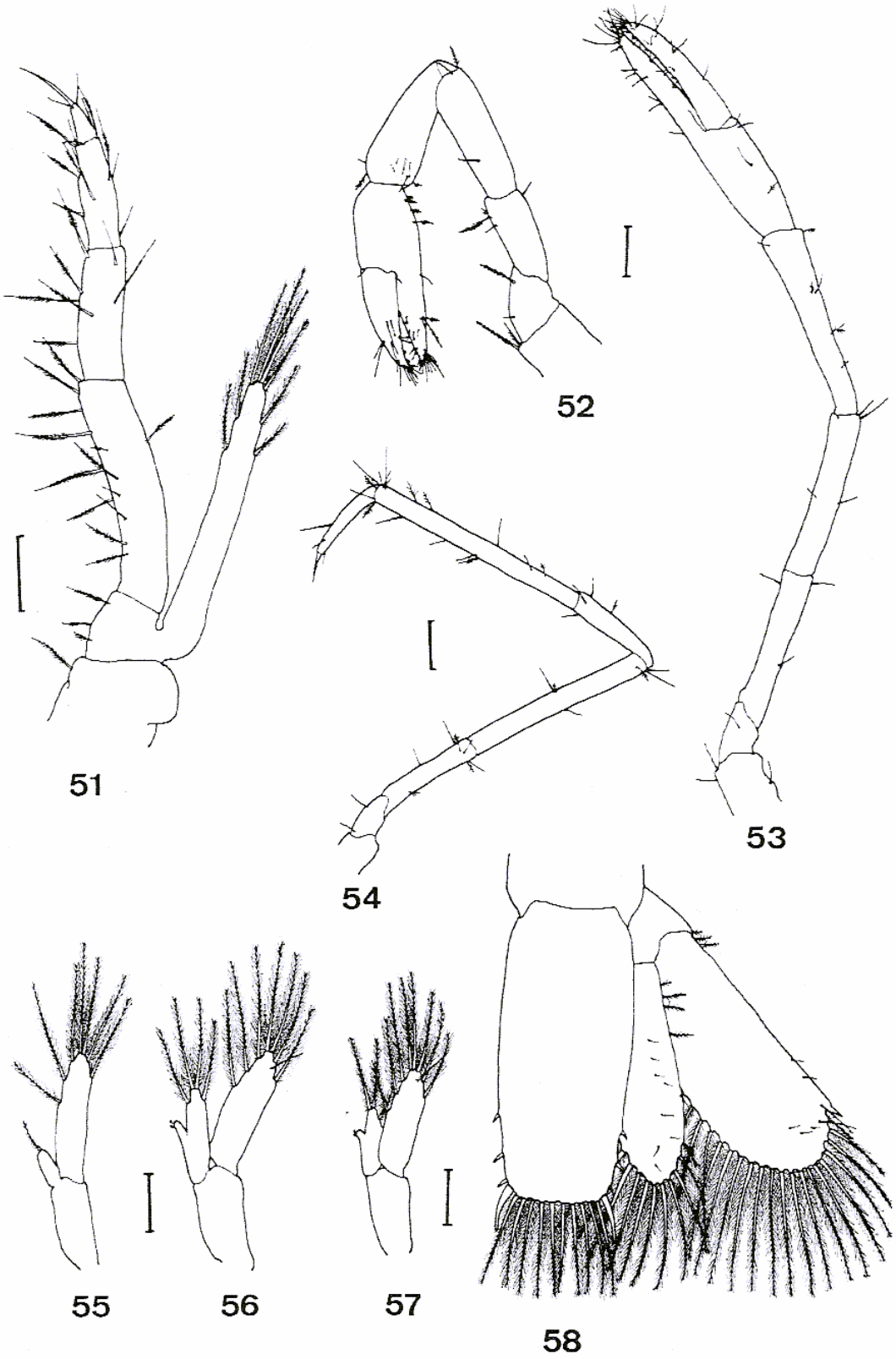
Telson: Narrower and longer than in the preceding stage; wider posteriorly, with 1 pair of short subterminal spines on the lateral margin; posterior margin somewhat concave in the middle, bearing 16 plumose setae.



Figures 31 - 42: *Macrobrachium jelskii* (Miers, 1877), larvae III. 31, Dorsal view (left thoracic appendages not represented); 32, Lateral view of the anterior region of the carapace; 33, Antennule; 34, Mandible; 35, Maxillule; 36, Maxilliped 2; 37, Pereiopod 2; 38, Pereiopod 5; 39, Pleopod 1; 40, Pleopod 3; 41, Pleopod 5; 42, Right uropod and telson. (Scale bars: 31 = 1mm; 32 = 0.5mm; 33, 36-42 = 0.2mm; 34, 35 = 0.1mm)



Figures 43 - 50. *Macrobrachium jelskii* (Miers, 1877), Juvenile I. 43, Dorsal view (left thoracic appendages not represented); 44, Lateral view of the anterior region of the carapace; 45, Antennule; 46, Mandible; 47, Maxillule; 48, Maxilla; 49, Maxilliped 1; 50, Maxilliped 2. (Scale bars: 43 = 1mm; 44 = 0.5mm; 45, 48-50 = 0.2mm; 46, 47 = 0.1mm)



Figures 51 - 58. *Macrobrachium jelskii* (Miers, 1877), Juvenile I. 51, Maxilliped 3; 52, Pereiopod 1; 53, Perciopod 2; 54, Pereiopod 5; 55, Pleopod 1; 56, Pleopod 3; 57, Pleopod 5; 58, Right uropod and telson. (Scale bars: 51-58 = 0.2mm)

First juvenile stage (mean TL 7.24 ± 0.14 mm, n = 11) (Figs. 43-58)

All appendices fully developed and functional. Rostrum straight and longer, reaching or overreaching the end of the antennular peduncle, bearing 5-7 dorsal and 1-2 ventral teeth; minute plumose setae present in between the proximal dorsal teeth. Carapace misses the supraorbital spine.

Antennule: Peduncle with a sharp stylocerite and a developing statocyst. Distal flagella distinctly longer than in the preceding stage. Inner flagellum 6-segmented. Outer flagellum with lateral branch 5-segmented and slightly surpassing the inner flagellum in length.

Antenna: Peduncle bisegmented . Flagellum about 7,5 times as long as the scaphocerite, which bears 31-34 plumose setae along distal and mesial margins.

Mandible: Incisor process curved, with 3 strong teeth; molar process stouter, subquadrate, with rounded teeth and several denticles.

Maxillule: Coxal endite with 8, naked or weakly plumose, setae terminally and subterminally; basal endite with 2 weakly plumose, short setae proximally and 9-11, naked and weakly plumose, terminally and subterminally.

Maxilla: Protopod with a pair of elongated endites, bearing respectively 5 and 6 setae on the lower and upper endites. Endopod smooth.

Maxilliped 1: Protopod with a large asymmetrical bilobed epipod; coxal endite short, with 2 plumose and 1 naked setae; basal endite bearing several, naked and weakly plumose, setae terminally and subterminally. Endopod smooth. Exopod with the enlarged proximal outer lobe with 5 plumose setae.

Maxilliped 2: Coxa with 2 naked setae on the inner border and a bilobed small epipod. Endopod 5-segmented, strongly incurved, two distalmost segments more wide than long, penultimate segment with 5 naked setae along the outer and distal margins; last segment bearing several, naked and weakly plumose, setae terminally and subterminally.

Maxilliped 3: Coxa with 1 weakly plumose seta on the inner margin and a small epipod. Basis with 3 weakly plumose setae. Endopod 4-segmented, with several, naked and weakly plumose, setae along the joints, mainly on the mesial side; distal segment bearing a terminal curved spine. Exopod about half of the length of the endopod, with 8 terminal and subterminal plumose setae.

Pereiopods 1-2: All segments with some short and long, naked and weakly plumose, setae; a tuft of setae present at the tip of both fingers. Exopods absent. Pereiopod 1 bearing rows of weakly plumose setae subterminally on the carpus and mesially along the inner margin of the palm. Pereiopod 2 about 1.4 times as long as pereiopod 1.

Pereiopods 3-5: Longer and more setaceous than in the preceding stage.

Pleopods 1-5: Both endopod and exopod with marginal plumose setae; appendices internae present on the inner margin of the endopod of pleopods 2 to 5, bearing 1-3 minute hooks.

Uropod: Protopod with the outer distal corner rounded. Endopod with 12-15 plumose setae along the distal and mesial margins, 4 weakly plumose setae on the outer proximal margin and some others scattered on the dorsal surface. Exopod with an increased number of marginal and superficial setae, bearing 1-2 spines (inner larger than the outer) on the outer distal corner.

Telson: Lateral margins slightly convex, a little narrower posteriorly, with 3 pairs of small lateral spines along the distal quarter. Disto-lateral corners bearing a stout spine. Distal margin straight, with 10 long plumose setae.

Discussion

The wide distribution of *M. jelskii* throughout tropical South America suggests that the populations occurring so far apart in two large river basins such as the Amazon and Orinoco's would exhibit some degree of morphological variation. Indeed, differences in the shape and dentition of the rostrum, and in the apendix masculina can be noticed in some of the taxonomic accounts for the adults of this species (Holthuis, 1952; Rodríguez, 1980; Kensley and Walker, 1982; López and Pereira, 1996). Larval morphology could also be reflecting some variation between allopatric populations, as already pointed out by Chong and Khoo (1987).

Gamba (1980) and Tucci (1994) described the larval development of *M. jelskii* based on larvae hatched from females caught in the Llanos region (Orinoco river basin). Gamba brought her specimens from a lagoon near Mantecal, Apure State, western Venezuela (Gamba, 1980), and Tucci used females collected from a pond in Caracas which was populated with specimens from Río Caris, southern Monagas State, eastern Venezuela (G. Pereira, pers. communication). Larval morphology of these three populations are compared below. However, comparisons should be made cautiously because the studies were done under different conditions and the present description is based on larvae from only two females.

The descriptions of Gamba (1980), Tucci (1994) and this study indicate that there may be some degree of morphological differentiation among the three populations (Table 1). The first stage had more characters bearing differences. The most remarkable ones were those of the segmentation between abdomen and telson (which was not clear in the Amazonian specimens, but was distinct in the Venezuelan's), and the state of development of pereiopods 3-5. These pereiopods were lacking in Gamba's specimens but were seen as rudimentary buds in the other studies. Other rather significant differences were the situation of the uropod rami at the third larval stage and the situation of the chelipeds' exopod at the third larval and first juvenile stages (Table 1). In general, similarities were greater between the specimens from central Amazon and from eastern Venezuela than between these and Gamba's (1980) specimens. Whether the state of the above mentioned characters in Gamba's specimens would be representing interspecific differentiation or intraspecific variability is not quite certain. Gamba´s (1980) descriptions are rather brief and the illustrations are poorly detailed; moreover, voucher specimens of the adult females used in her study were not kept in collections for eventual confirmation of their identity.

The first juvenile stage, and hence the end of the larval period, is usually defined as the stage in which the young shrimp is morphologicaly similar to an adult except for its size. Similarly to Gamba (1980, 1984), I considered that the first juvenile stage was reached at the third molt, after which all mouth parts, chelipeds and uropods are fully formed and functional. However, Tucci (1994) adopted the criterion in which the juvenile period was accomplished when the two pairs of telsonic spines move to a dorsal position and, so, he counted six larval stages. Taking the criterion adopted in this study into account, his results would be the same found by Gamba (1980) and I.

The duration of the larval period was shorter in the Amazonian (seven to eight days) than in the two populations from Venezuela (Gamba's study: nine to 15 days; Tucci's study: 8 to 11 days – considering larval period with three stages). As the larvae of the three populations were reared in water within a small range of temperature (Tucci, 1994: 24°C; Gamba, 1984 and present study: 27,1°C), this discrepancy could either be due to some rearing environmental physico-chemical parameters or be reflecting an endogenous characteristic. The period of seven to eight days is within the expected duration for Amazonian palaemonid shrimps with abbreviated larval development. This was verified for *Pseudopalaemon amazonensis* studied by Magalhães and Medeiros (1998) and *M. nattereri* by Magalhães (1989), while other species accomplish metamorphosis even earlier than that (Magalhães, 1986, 1986/87, 1988b).

Although there are at least 17 strictly freshwater South American species of *Macrobrachium* supposed to have abbreviated larval development (Pereira and García, 1995), just a few had their development fully described so far: *M. potiuna* (Müller, 1880) by Bueno (1981), *M. brasiliense* (Heller, 1868) by Vega-Pérez (1984), *M. nattereri* by Magalhães (1989), *M. iheringi* (Ortmann, 1897) by Bueno and Rodrigues (1995), *M. reyesi* Pereira, 1986 by Pereira and García (1995) and *M. petronioi* Lobão, Melo and Fernandes, 1986 by Graça Melo and Brossi-Garcia (1999). Except for *M. reyesi*, they all exhibit a general pattern in which the larval period consists of three larval stages and the newly-hatched larvae have sessile eyes, unarmed rostrum, rudimentary mouth parts, nonfunctional pereiopods and pleopods, absent and broad uropods, spatulate telson; the second stage shows stalked eyes, toothed rostrum; and the uropods are free at the third stage. Among these, *M. iheringi* is the only species also bearing nonfunctional, birramous pereiopods 1 and 2 with glabrous exopods on hatching, as seen in *M. jelskii*; both species have pereiopods 3-5 as glabrous buds, but in *M. iheringi* the third and fourfh pereiopods have a reduced exopod, lacking in *M. jelskii*. In the other species, all five pairs of pereiopods are uniramous at the first larval stage. The posterior margin of the telson is also variable among these species: *M. jelskii*, *M. potiuna*, *M. reyesi* and *M. petronioi* have a broadly convex and uniform margin, while *M. nattereri*, *M. brasiliense* and *M. iheringi* have a distinct

Table 1: Morphological differences between the larval stages of *M. jelskii* from different localities in Brazil (Amazon basin) and Venezuela (Orinoco basin).

Stage	Character	Brazil [1] (Rio Solimões floodplain [4])	Venezuela	
			Apure State [2]	Monagas State [3]
1st larval stage	Segmentation abdomen/telson	Undistinct	Distinct	Distinct
	Dentition of the rostrum	1 dorsal tooth	1 dorsal tooth	Unarmed
	Antennular peduncle	Unsegmented	2-segmented	Unsegmented
	Antennal flagellum	2-segmented	9-segmented	9-segmented
	Maxilliped 1	Endopod and exopod not segmented	Endopod and exopod 2-segmented	Endopod and exopod not segmented
	Maxilliped 2	Coxa and basis distinct	Protopod unsegmented	Coxa and basis distinct
	Maxilliped 3	Coxa and basis distinct	Protopod unsegmented	Coxa and basis distinct
	Pereiopods 3-5	Rudimentary buds (unsegmented)	Not developed	Rudimentary buds (3-segmented)
2nd larval stage	Carapace: anteroventral corner	Smooth	1 spine	Not informed
	Dentition of the rostrum	3 dorsal teeth	3 dorsal teeth	3 dorsal and 1 ventral teeth
	Antennule: inner flagellum	3 to 4-segmented	6-segmented	5-segmented
	Antenna: scaphocerite	30-31 plumose setae	25 plumose setae	24 plumose setae
3rd larval stage	Carapace: supraorbital spine	Present, but reduced	Absent	Not informed
	Dentition of the rostrum	4 dorsal and 1 ventral teeth	4 dorsal and 1 ventral teeth	4 dorsal and 2 ventral teeth
	Pereiopods 1-2	Exopod unsegmented	Exopod 3-segmented	Exopod unsegmented
	Uropods	Birramous; endopod bud-like, exopod: 1 spine + 20 setae	Unirramous; endopod absent, exopod: 0 spine + 20-24 setae	Birramous; endopod bud-like, exopod: 1 spine + 23 setae
1st juvenil	Pereiopods 1-2	Exopod absent	Exopod absent	Exopod present, much reduced

[1] Present paper; [2] Gamba, 1980; [3] Tucci, 1994; [4] Larvae examined were from two females.

notch in the middle of this margin. Pereiopods 3-5 are still nonfunctional at the second larval stage of *M. jelskii*, but they are fully developed and functional in all the other mentioned species.

In the second stage, the uropodal buds of *M. jelskii* are still covered by the telsonic cuticle without interfering with the shape of the telson, as it does in *M. brasiliense* and *M. nattereri*; in these species, the telson is clearly enlarged laterally due to the exopodal buds of the uropods. In most of the *Macrobrachium* species with abbreviated development, the uropods are totally freed at the third stage. This is the case for all the above cited species with the exception of *M. reyesi*, in which the uropods appear at the second larval stage. In *M. jelskii*, *M. petronioi* and *M. potiuna* the endopod is bud-like, while in *M. iheringi*, *M. brasiliense* and *M. nattereri* it shows several marginal plumose setae.

Pereira and García (1995) discussed the differences between the larval features of *M. jelskii* and *M. reyesi*. The latter species has some features that are not usually found among the other South American inland palaemonids with known abbreviated larval development, such as first larval stage with multidentated rostrum, antennular peduncle 3-segmented with two segmented distal flagella, and second stage with functional chelipeds and freed uropods. Another character is the situation of the eyes of the larva on hatching. Although not mentioned explicitly, the illustrations of the first larval stage in dorsal and lateral view (Pereira and García, 1995: 119, fig. 2a,b) suggest that the eyes are already stalked on hatching in *M. reyesi*, while they are sessile in *M. jelskii*. This is a very peculiar character to *M. reyesi*. Sessile eyes are the expected character for those palaemonid shrimps with abbreviated development (bearing at least three larval stages), and the presence of stalked eyes on hatching is usually associated with those species that have direct development (Jalihal and Sankolli, 1975; Magalhães, 1988a,b).

Macrobrachium reyesi also differs from *M. jelskii* in the number of larval stages (five and three, respectively) and larval period duration, which lasted 23-27 days in the former (Pereira and García, 1995) and seven to eight days (present study) or nine to 15 days (Gamba, 1980, 1984) in the latter. However these differences could be credited to the distinct criterion used by the authors in order to define the first juvenile stage.

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