

LARVAL DEVELOPMENT OF *Porcellana sayana* (LEACH, 1820) (CRUSTACEA: DECAPODA: PORCELLANIDAE) UNDER LABORATORY CONDITIONS

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ABSTRACT

The complete larval development of *Porcellana sayana* (Leach, 1820), reared under laboratory conditions from hatching through megalopal phase, is described and illustrated. Development consists of a prezoaea of ephemeral duration and two zoeal stages before the attainment of the megalopa. At 25 °C and 35 salinity, the megalopa appeared 13-14 days after hatching. The zoeae and megalopa of *P. sayana* are compared with those of other species of *Porcellana* [i.e. *P. sigsbeiana* A. Milne Edwards, 1880 and *P. platycheles* (Pennant, 1777)] and with those of the closely allied species *Ancylocheles gravelei* (Sankolli, 1963) and *Enosteoides ornatus* (Stimpson, 1858), which was previously assigned to the genus *Porcellana*. A key for identifying zoeae of the *Porcellana* group from the Caribbean is provided.

Keywords: Zoea, Megalopa, Larval Development, Porcellanidae, Caribbean

INTRODUCTION

Porcellana sayana (Leach, 1820) is one of four species of *Porcellana* known to inhabit Western Atlantic waters (Haig, 1978). It is distributed along Cape Hatteras (NC, USA), around Gulf of Mexico and Caribbean Sea to near the border between Brazil and Uruguay (Gore, 1982). It is usually found in symbiotic relations with several species of hermit crabs or the decorator crab *Stenocionops furcata* (A. Milne Edwards, 1878), but rarely with the queen conch *Strombus gigas* or with the sea cucumber *Astichopus multifidus* (see Telford & Daxboeck, 1978; Gore, 1982; Scelzo, 1982; Williams, 1984).

Brooks & Wilson (1881) described and illustrated both the prezoaea and first zoea of *P. sayana* (as *P. ocellata*); this description and its respective illustrations are considered inconsistent (Gore, 1971) and do not satisfy today's standards.

The present study describes the complete larval development of *P. sayana* from laboratory-reared material. Its zoeae and megalopa are compared with those of other known species from both the same and closely related genera. A key for identifying zoeae of *Porcellana* group (Lebour, 1943) from the Caribbean is provided.

MATERIAL AND METHODS

Five ovigerous females of *P. sayana*, symbiotic of the hermit crab *Petrochirus diogenes* (Linnaeus, 1758), were collected off Punta Mosquito (South Margarita Island, Venezuela), and were held separately in 19-cm diameter glass bowl filled with non flowing sea water (room temperature, 37 salinity) until hatching occurred. Individual

zoeae were placed in compartmented plastic trays, one for each compartment. Each compartment was filled with about 25 cc of filtered sea water at a temperature of 25 °C and salinity 35. The temperature and salinity were controlled by means of a thermostatic bath (approximation 0.1 °C) and a refractometer (approximation 1.0), respectively. Illumination was not controlled.

The number of larvae in the series fluctuated between 90 and 126. Water and feed (newly hatched *Artemia* nauplii) were renewed daily, and survival and exuviae were checked. Exuviae, dead specimens, and some healthy individuals were preserved in 70% isopropyl alcohol for subsequent description. Drawings and measurements were made by means of a camera lucida and a calibrated ocular attached to an Olympus BMAX-50 microscope. The carapace of both zoeal stages and of the megalopa was measured following the usual criteria employed in Porcellanidae (see Gore, 1968, 1971; Gonor & Gonor, 1973; González-Gordillo *et al.*, 1996). The spent females and samples of their progeny are deposited in the Carcinology Laboratory, Universidad de Oriente (Venezuela).

The term seta is used as defined by Thomas (1960) and Gonor & Gonor (1973). Nevertheless, in order to standardize the criteria employed in the present study with those of other research works, the term "process" was preferred in the comparative tables, to indicate any projection of the endites of the maxillulae and maxillae. The setae classification system is based on the proposal by Stuck & Truesdale (1988). Setal formulae follow a proximal-distal order. Both dorsal setae on the endopodite of the maxillipeds and apical ones of the scaphognathite were designated with roman numeral. Some setulae were omitted in order to facilitate the interpretation of the illustrations.

RESULTS

Porcellana sayana hatches as a prezoaea and remains as such for no longer than 105 minutes; it then passes through two subsequent zoeal stages before attaining the megalopal phase. No first crab stage was obtained. Setal types are illustrated in Fig. 1.

Description of zoeae and megalopa of *Porcellana sayana*

Zoea I

Carapace length: 1.25-1.48 mm; mean: 1.38 mm. Rostrum length: 7.50-10.05 mm; mean: 9.08 mm. Posterior spines length: 2.60-3.55 mm; mean: 2.84 mm. Number of specimens measured: 6; number of specimens examined: 12. Duration: 5-10 days; mean: 6.3 days.

Carapace (Fig. 2A,C). Typically porcellanid, with elongate rostral and posterior spines; former sinuous, armed overall with spinules and up to eight times carapace length (CL); latter divergent, 2.5 X CL, with spinules on ventral and dorsal margins. Posterolateral margin of carapace armed with 2-3 spinules. Two pairs of setae dorsally on carapace, one pair anterior to eyes, second pair above midgut. Eyes sessile.

Antennule (Fig. 3A). Unsegmented, with 3 subequal aesthetascs plus 2 setulose setae and 1 short simple seta on distal portion.

Antenna (Fig. 3D). Endopodite fused to peduncle, with 1 setulose seta subterminally. Exopodite 1.5 times longer than endopodite, with 1 spine and 1 setulose seta subterminally.

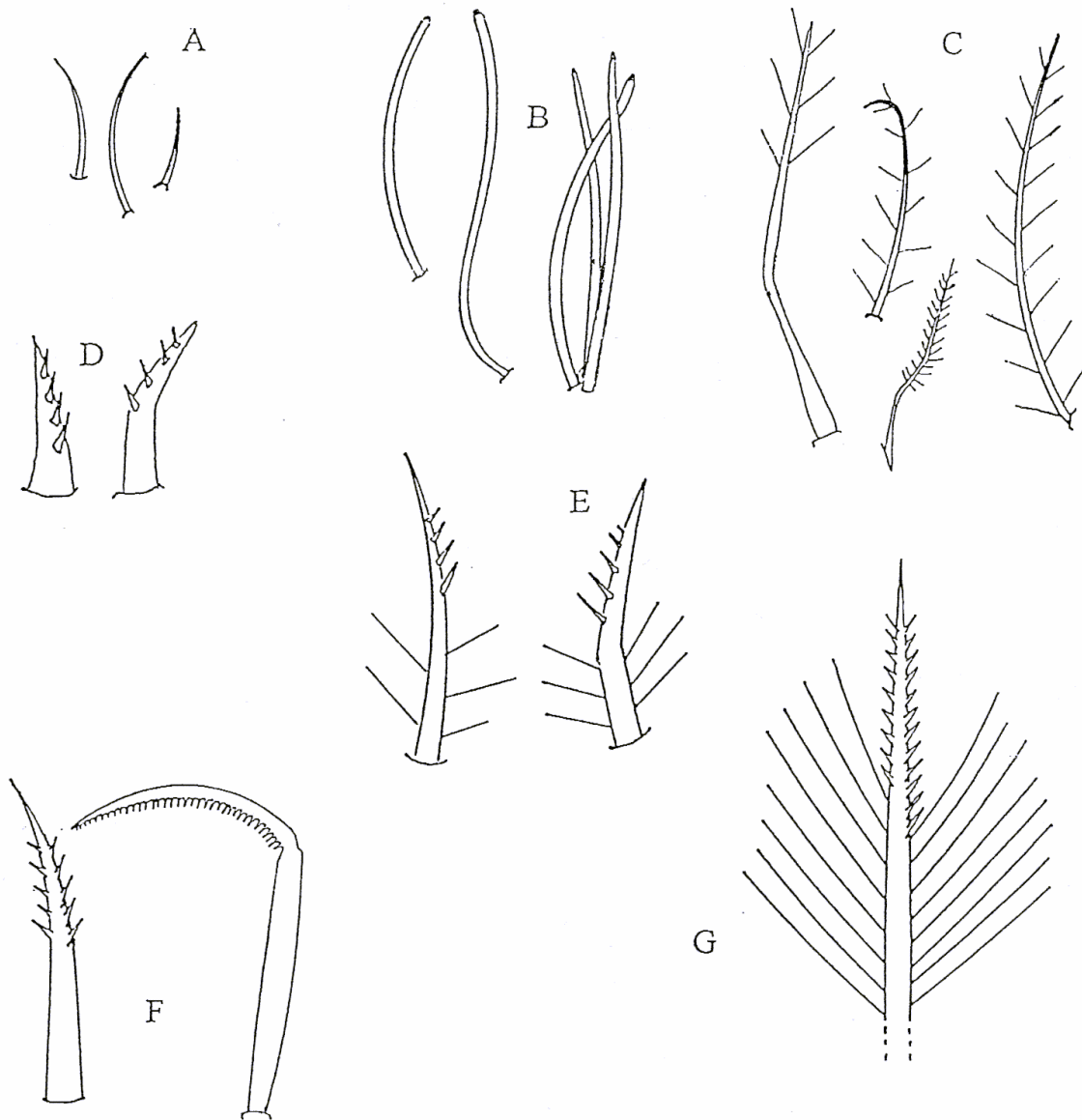


Figure 1. Setal types of the zoeae and megalopa de *Porcellana sayana*: simple (A), aesthetascs (B), setulose (C), denticulate (D), setulodenticulate (E), serrate (F), y setuloserrate (G)

Mandibles (Fig. 3G). Asymmetrical dentate processes; incisor process with distinct large teeth, molar process bearing smaller and blunter ones; palp absent.

Maxillule (Fig. 4A). Coxal endite with 5 setulose and 5 setulodenticulate setae. Basal endite with 4 setulose and 6 denticulate setae. Endopodite unsegmented, with 1 setulose seta (occasionally 2) subterminally and 2 setulose setae terminally; microtrichia on external margin. Exopodite absent.

Maxilla (Fig. 4D). Coxal endite with 6 setulose and 1 setulodenticulate setae on proximal lobe; 5 setulose and 1 denticulate setae on distal lobe. Basal endite with 5 setulose and 2 denticulate setae on proximal lobe; 6 setulose, 2 denticulate and 1 setulodenticulate setae on distal lobe. Endopodite unsegmented, with 3+2+4 setulose setae. Scaphognatite with 6 setulose setae on anterior lobe, plus 1 apical setulose seta on posterior lobe. Microtrichia on all the endites and both rami.

Maxilliped 1 (Fig. 5A). Coxopodite with 2 setulose setae. Basipodite with 1+2+2+3 setulose setae ventrally, the first one inserted on a spine-like process. Endopodite 4-segmented, with 3, 4, 4, 8+1 setulose setae; microtrichia on dorsal margins of segments 2-3. Exopodite 2-segmented, with 4 setulose setae distally.

Maxilliped 2 (Fig. 5D). Coxopodite unarmed. Basipodite with spine-like process and 1+2 setulose setae. Endopodite 4-segmented, with 2, 2 (or 3), 2, 9+1 setulose setae; microtrichia on dorsal margins of segments 2-3. Exopodite as in maxilliped 1.

Maxilliped 3 (Fig. 5G). Two unequal unarmed rami; increases in size as stage progresses.

Pereiopods (Fig. 6A). Undifferentiated buds, without signs of segmentation; increase in size as stage progresses.

Abdomen (Fig. 7A). Consisting of 5 somites, with ventrolateral spines on somites 3-5. Fifth somite with 2 setulose setae posterodorsally. Pleopods absent.

Telson (Fig. 7D). Longer than wide. Posterior margin with 8 + 8 processes; first process a serrated spine; second a setulose seta; next 5 processes long setuloserrate setae (the seventh off the central prominence); the eighth a short setulose seta located on the emarginate central prominence. Dorsal surface with 2 minute setulose setae. Anal spine present ventrally.

Zoea II

Carapace length: 2.23-2.44 mm; mean: 2.38 mm. Rostrum length: 10.00-12.94 mm; mean: 11.97 mm. Posterior spines length: 2.60-3.18 mm; mean: 3.17 mm. Number of specimens measured: 12; number of specimens examined: 12. Duration: 7-12 days; mean: 9.7 days.

Carapace (Fig. 2B,D). Now more inflated; rostral spine sinuous, up to five times CL, with spinules longer than in zoea I; posterior spines 1.2-1.4 times CL. Posterolateral margin of carapace with 4 minute spines. Dorsal setae as in zoea I. Eyes now mobile.

Antennule (Fig. 3B). Biramous. Protopodite with 2 setulose setae subproximally and 4 setulose setae on the confluence of the rami. Endopodite fused to protopodite, unarmed. Exopodite 1.7 times longer than endopodite, with 2-3, 3, 3, 3-2, 3 aesthetascs, plus 4 setae terminally (2 simple, 2 setulose).

Antenna (Fig. 3E). Endopodite slightly longer than exopodite, with 1 setulose seta and 1 short minute spine subterminally. Exopodite with 1 setulose seta and 1 short spine on distal third.

Mandibles (Fig. 3H). Longer than in the first stage. Palp absent.

Maxillule (Fig. 4B). Coxal endite with 12 setae (exceptionally 11) (8 setulose, 4 setulodenticulate). Basal endite with 12 setae (5 setulose, 7 denticulate). Endopodite with 1+2 setulose setae; microtrichia on outer margin.

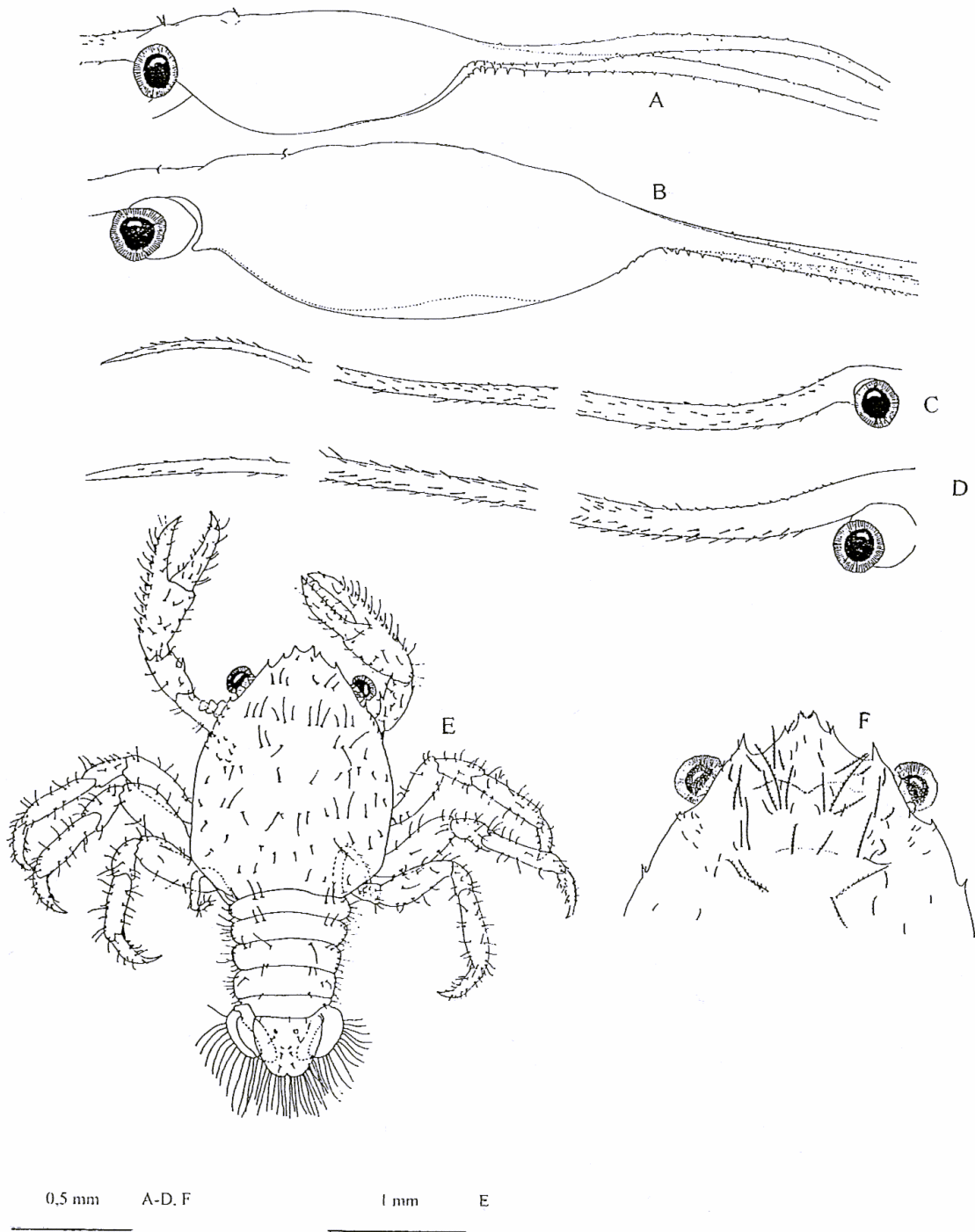


Figure 2. *Porcellana sayana*. Lateral view of carapace and posterior spines of zoea I (A) and zoea II (B); distal, middle and proximal portions of the rostrum of zoea I (C) and zoea II (D); dorsal view of megalopa (E) and detail of the front (F).

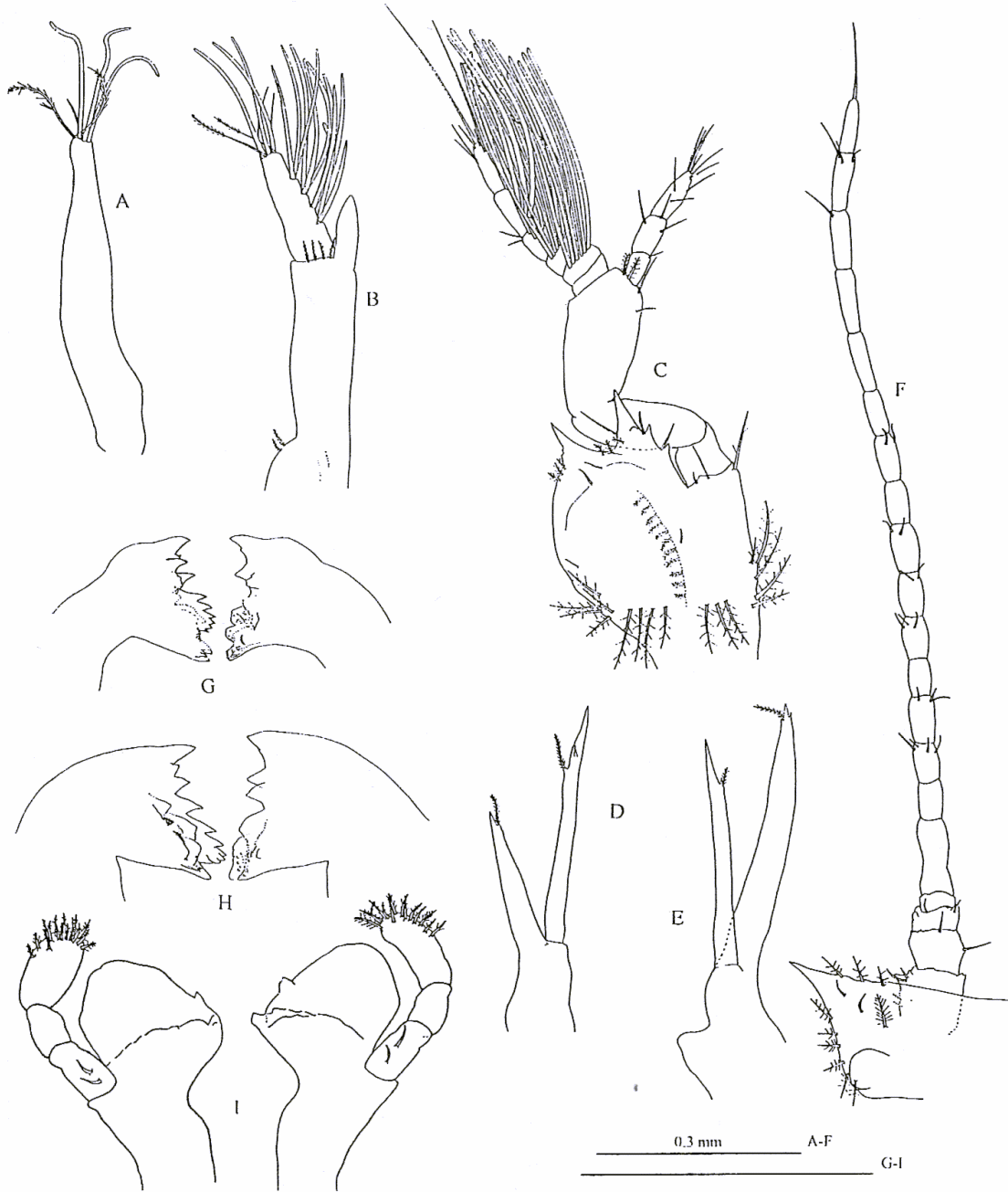


Figure 3. *Porcellana sayana*. Antennule of zoea I (A), zoea II (B) and megalopa (C); antenna of zoea I (D), zoea II (E) and megalopa (F); mandibles of zoea I (G), zoea II (H) and megalopa (I).

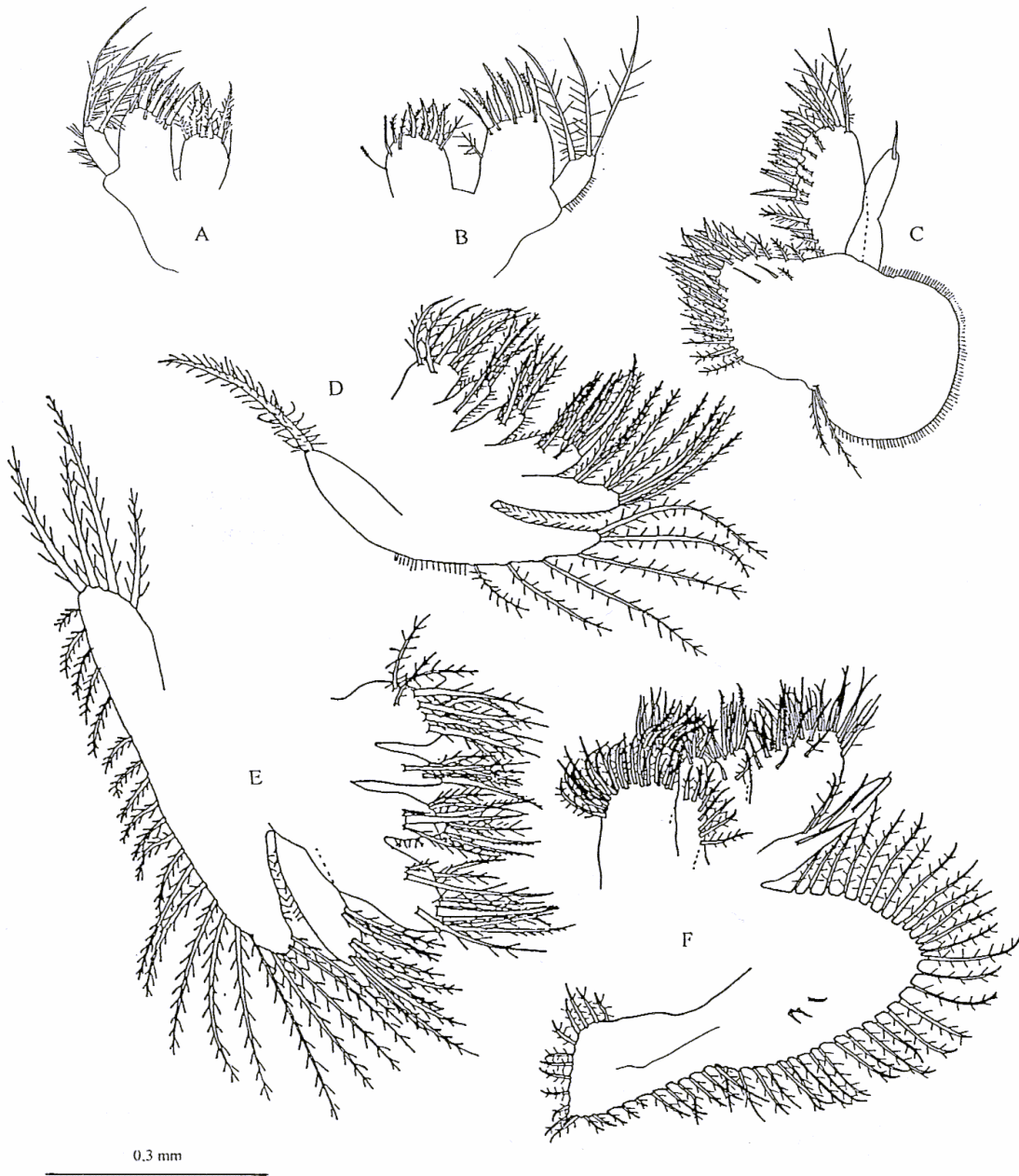


Figure 4. *Porcellana sayana*. Maxillule of zoea I (A), zoea II (B) and megalopa (C); maxilla of zoea I (D), zoea II (E) and megalopa (F).

Maxilla (Fig. 4E). Coxal endite with 10 setae (8 setulose, 2 denticulate) on proximal lobe, 7 setae (5 setulose, 1 denticulate, 1 setulodenticulate) on distal lobe. Basal endite with 9 setae (6 setulose, 3 denticulate) on proximal lobe, 11 setae (7 setulose, 4 setulodenticulate) on distal lobe. Endopodite with 3+2+4 setulose setae. Scaphognathite with 22-23 setulose setae on anterior lobe, plus 4 setulose setae on posterior lobe. Microtrichia on basal endite and both rami.

Maxilliped 1 (Fig. 5B). Coxopodite and basipodite unchanged. Endopodite 4-segmented with con 3+1, 4+1, 4+1, (10-11)+1 setulose setae. Exopodite 2-segmented, with 12 setulose setae distally.

Maxilliped 2 (Fig. 5E). Coxopodite and basipodite as in zoea I. Endopodite 4-segmented, with 2+1, 2+1, 2+1, 10+1 setulose setae. Exopodite as in maxilliped 1.

Maxilliped 3 (Fig. 5H). Endopodite naked, twice as long as exopodite, indistinctly segmented. Exopodite indistinctly 2-segmented, with 5 setulose setae terminally.

Pereiopods (Fig. 6B). Still unsegmented buds in early stage. Segmentation outline and gill bud enlargement proceeds throughout stage.

Abdomen (Fig. 7B). Posterolateral spines reduced; setae on somite five retained. Pleopod buds present on somites 2-5, enlarging as stage progress.

Telson (Fig. 7E). Additional pairs of long setulose setae on central prominence, and minute setulose on dorsal surface.

Megalopa

Carapace length: 1.43-1.80 mm; mean: 1.65 mm. Carapace width: 1.25-1.50 mm; mean: 1.38 mm. Number of specimens measured: 10; number of specimens examined: 6. Duration: not recorded.

Carapace (Fig. 2E-F). Rectangular subovate, convex from front to rear, sparsely covered with setae. Front 6-dentate; with several setae; spines of the orbital angle extending beyond eyes, sharply pointed; median teeth poorly deflexed, sometimes with several additional smaller spines. Outer orbital angle produced into small spine. Epibranchial spine present; cervical groove seen in adults at epibranchial angle still undeveloped.

Antennule (Fig. 3C). Basal segment longer than wide, anterior margin with 2 large and 4 small spines; numerous setae as illustrated. Peduncle 3-segmented; first and second unarmed, the third with 2-5 setae. Lower ramus 3-segmented, with 1, 3, 9 simple setae. Upper ramus 6-segmented; first segment unarmed, second with 6 aesthetascs and 1 simple seta; third with 6-8 aesthetascs and 1-2 simple setae; fourth with 3+2 aesthetascs and 2 simple setae; fifth with 3 aesthetascs; sixth with 4 subterminal and 2 terminal simple setae.

Antenna (Fig. 3F). Basal segment with lateral projection; posterointernal angle with a rounded lobe, plus 6 setulose setae; anterointernal angle with a acute spine bearing 3 setulose setae; 3 setae (1 setulose, 2 simple) located near this spine. Peduncle 3-segmented; first segment with 4 setae; second with 2-3 setae, third with 2-3 setae and a rounded lobe on outer margin. Flagellum with 18 segments; first four segments unarmed, remaining segments with 1-4 setae as shown.

Mandibles (Fig. 3I). Scoop-shaped processes with thin flattened blades; each with 3-segmented palp; basal segment of palp with 2 setae, second unarmed, third with 14-16 setulodenticulate setae.

Maxillule (Fig. 4C). Coxal endite with about 34 setae (5-7 setulodenticulate, 2-3 simple, others setulose) plus 2 setulose setae on proximal margin; elongate basal lobe fringed with microtrichia. Basal endite with about 29 setae (12 denticulate, 2



Figure 5. *Porcellana sayana*. Maxilliped 1 of zoea I (A), zoea II (B) and megalopa (C); maxilliped 2 of zoea I (D), zoea II (E) and megalopa (F); maxilliped 3 of zoea I (G), zoea II (H) and megalopa (I).

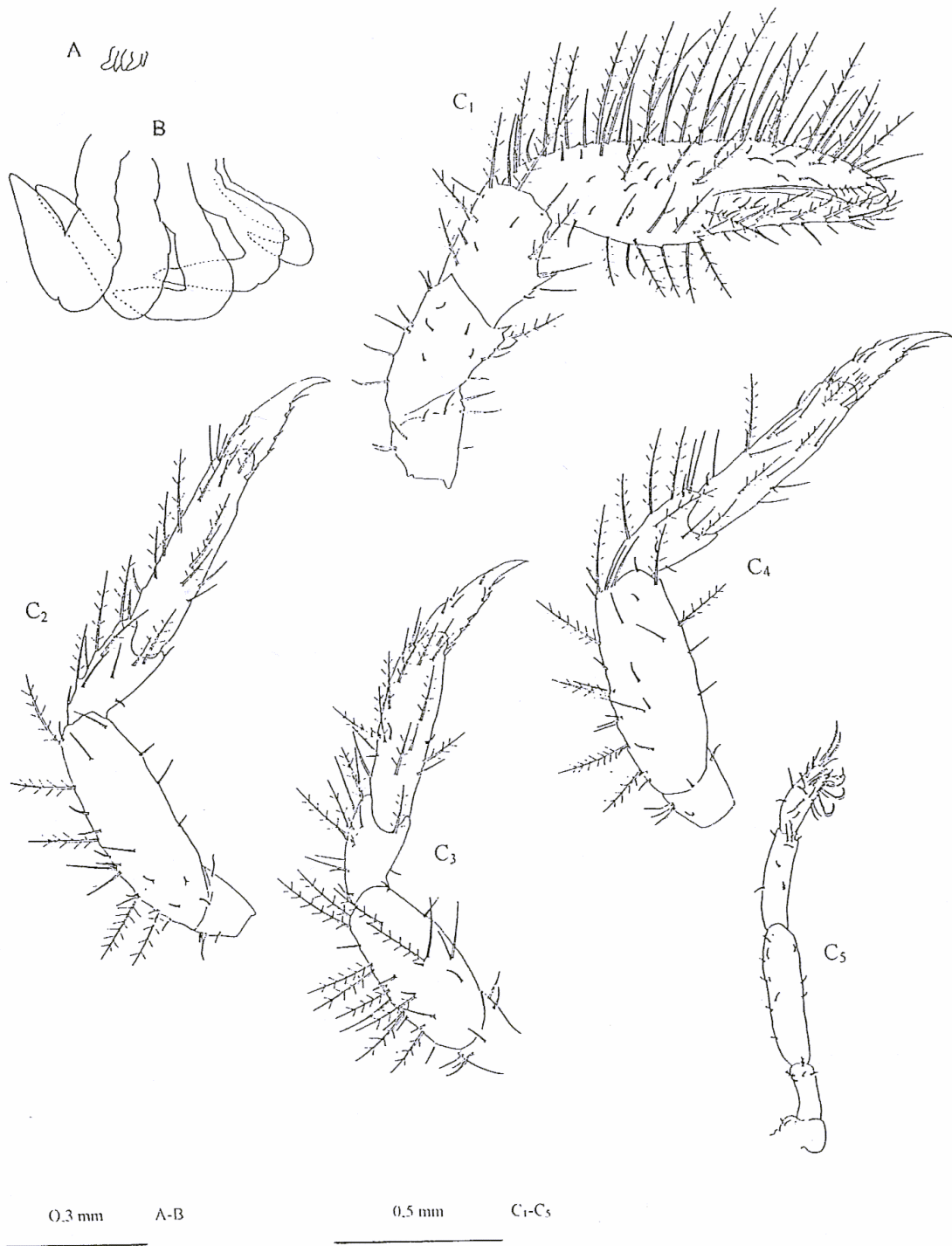


Figure 6. *Porcellana sayana*. Pereiopods of zoea I (A), zoea II (B) and megalopa (C1-C5).

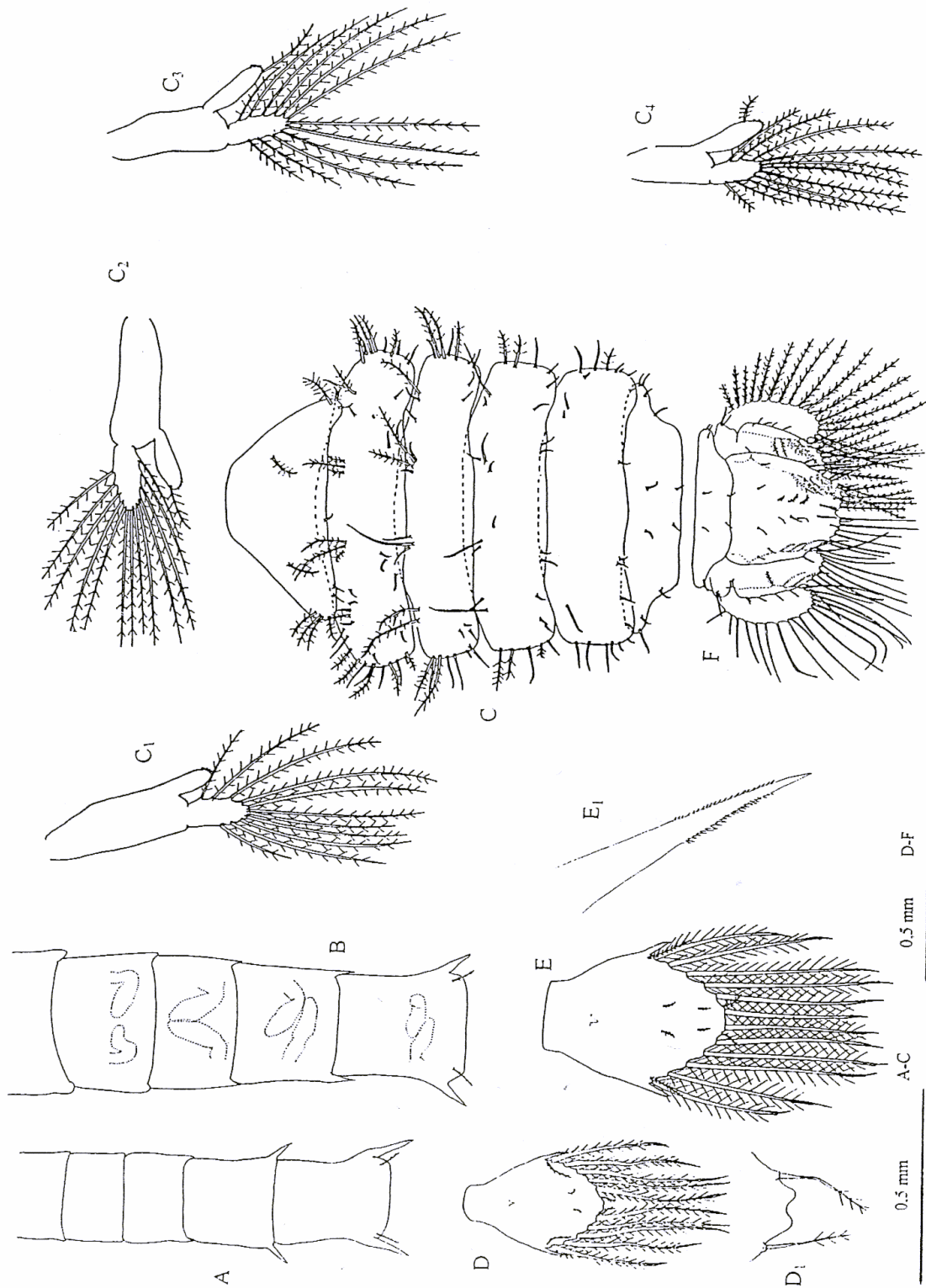


Figure 7. *Porcellana sayana*. Dorsal view of abdomen of zoea I (A), zoea II (B) and megalopa (C); pleopods 1-4 (C1-C4); telson of zoea I (D) (D1: detail of its central prominence) and zoea II (E) (E1: detail of its lateral spine); caudal fan of megalopa (F) (left-hand side setulae omitted).

setulodenticulate, 15 setulose). Endopodite undistinctly 2-segmented with 1 simple seta on distal segment. Exopodite absent.

Maxilla (Fig. 4F). Coxal endite with about 22 setulose setae in a ring around middle, plus 15 setae (6 setulodenticulate, 9 setulose) terminally on proximal lobe; 8 setae, plus 9 interiorly progressing down side on distal lobe. Basal endite with about 15 setulose setae on proximal lobe and 34 setulose setae on distal lobe. Endopodite unsegmented, with 1 setulose seta and 3 simple setae. Scaphognathite with about 55 setulose setae around outer margin, dorsal flattened surface with 4 setae.

Maxilliped 1 (Fig. 5C). Coxopodite with 34-45 setulose setae. Basipodite with 47-50 setae (6 serrate, 41-44 setulose). Endopodite with 2 simple setae subterminally, plus 2 setulose setae proximally. Exopodite with 8 setulose setae.

Maxilliped 2 (Fig. 5F). Coxopodite with 5 setulose setae. Basipodite with 10 setulose setae. Endopodite 4-segmented; first segment with 8 setulose setae, second with 4 setulose setae, third with at least 14 setae (1 serrate, 13 setulose), fourth with at least 18 setae (1 serrate, terminally, and 17 denticulate). Exopodite 2-segmented; each segment with 10 setulose setae.

Maxilliped 3 (Fig. 5I). Coxopodite with 24-25 setae (1 serrate, 23-24 setulose). Basipodite with 5-6 setulose setae. Endopodite 5-segmented; ischium with 20-25 setae, 5 of which are placed sagittally; merus with 19 setae (11 simple, 8 setulose); carpus with 25 setae (11 simple, 10-11 serrate, others setulose); propodus with 18-25 setae (4-5 serrate, 3-4 simple, others setulose); dactylus with 9-13 setae (4 serrate, 1 simple, others setulose). Ischium, merus, and to a lesser extent, carpus, with thin, flattened, blade-like extension. Exopodite 2-segmented, proximal segment with 6-7 setae (3-4 simple, others setulose), distal segment unarmed.

Pereiopods (Fig. 6C). Chelipeds elongated, subequal, with numerous scattered setae; merus with distal flexor margin produced into sharp spine, plus setae as illustrated; carpus with distinct acute spine on inner margin, outer distal angle with 1 spine; propodus with 1 spine on distal inner margin near the origin of dactylus, and with several minute spines interspersed with setae on outer margin; dactylus as long as fixed finger; cutting edges of fingers smooth. Walking legs setose; propodus with 1 spine-like seta distally; dactyl with 3 spine-like setae on flexor margin. Pereiopod 5 chelate, gape dentate; 4 curved serrated setae on fixed finger, plus 2 straight serrate setae on tip of dactylus.

Abdomen (Fig. 7C,F). Now consisting of 6 somites; numerous setae (mostly setulose) on dorsal surface as illustrated. Four pairs of biramous pleopods on somites 2-5; each endopodite with 5 retinacula and 1 seta (except in the first pair where there are no setae, and the fourth where 1-2 setae may be present), exopodite with 11-13 setulose setae. Sixth abdominal somite with biramous uropods; endopodite with 17-18 setae (4-5 simple, others setulose), exopodite with 20-23 setae (1-2 simple, other setulose).

Telson (Fig. 7F). 10-11 setae at each side of posterior margin. Ventral surface with 4 pairs of setulose setae, as shown.

DISCUSSION

Lebour (1943) distinguished two distinct groups of porcellanid larvae: the *Porcellana* group and the *Petrolisthes* group. Subsequent investigators have basically adopted this scheme. Zoeae of *Porcellana sayana* share with other members of the *Porcellana* group the following morphological characters: in the first zoea, fifth major pair of setae off

central prominence of telson, and central prominence with two minute setae; in the second zoea, mandibles without palp, sixth pair of major setae added to central prominence of telson and the 2 minute setae of telson retained; both zoeal stages with telson about 1.5 times longer than wide.

Based on the study of adult morphology, Haig (1978) proposed the genera *Capilliporcellana*, *Ancylocheles*, *Lissoporcellana* and *Heteroporcellana* and the raising of *Enosteoides* Johnson, 1970, formerly described as a subgenus of *Porcellana*, to a generic level, for reassigning several species previously included in the genus *Porcellana*. She postulated that the study of larval development could help to prove or disprove the validity of these and other groupings within the genus *Porcellana*; she included the placing of *Porcellana gravelei* Sankolli, 1963 and *Porcellana ornata* Stimpson, 1858 into the genera *Ancylocheles* and *Enosteoides*, respectively. The zoeae of the two latter genera should be added to *Porcellana* group, hitherto constituted by the genera *Euceramus* Stimpson, 1860, *Minyocerus* Stimpson, 1858; *Pisidia* Leach, 1820; *Polyonyx* Stimpson, 1858; *Porcellana* Lamarck, 1801 and presumably *Eucometes* Ng & Nakasone, 1993.

Both the first zoeal stage of *Enosteoides ornatus* (as *Porcellana ornata*, by Sankolli, 1967) and the two zoeal stages of *Ancylocheles gravelei* (as *Porcellana gravelei*, by Shenoy & Sankolli, 1976) show striking differences when compared to those of *Porcellana sayana*, *Porcellana platycheles* (Pennant, 1777) and *Porcellana sigsbeiana* A. Milne Edwards, 1880 (Tables 1 & 2), supporting thus the proposal by Haig (1978), cited above. In addition to these differences, *Enosteoides ornata* shows a distinct telson pattern since the loss of the pair of minute setae on the central prominence in the second zoeal stage (Shenoy & Sankolli 1976).

The absence of spine-like projection on the basipodite of maxillipeds 1 and 2, lateral spines on abdominal somite 3, and of serrations on lateral spine of telson of both zoeal stages of *P. platycheles* (see Lebour, 1943; González-Gordillo et al., 1996), in contrast with *P. sayana* and *P. sigsbeiana*, prove that the taxon must be object of an exhaustive revision. It is obvious that the two latter species are close related but not *P. platycheles*.

In the Caribbean Sea, the *Porcellana* group is hitherto represented by *Minyocerus angustus* (Dana, 1852), *Polyonyx gibbesi* Haig 1956, *Pisidia brasiliensis* (Haig, 1962), *Porcellana sigsbeiana* and *P. sayana*. The morphology of the two zoeal stages of these species has been documented (see Hernández et al., 1996a; Rengel et al., 1996; Gore, 1968, 1971), except for *P. brasiliensis* in which only the first zoeal stage has been described (Hernández et al., 1996b). The following key facilitates the identification of the zoeae of these species in plankton samples of the area.

Porcellana sayana

Notwithstanding the difficulty to ascertain the number of setae in typically densely setose structures and its inconsistency, the megalopa of *P. sayana* can be distinguished from those of congeneric species and of *Ancylocheles gravelei* by several characters that are summarized on Table 3, being the following the more striking ones: some carapace characters (*i.e.* front, outer orbital angle, cervical groove, epibranchial spine, and lateral margins), number of segments on the upper ramus of antennule, antennal peduncle and endopodite of maxilliped 2, and setal formulae of some appendages. Again, *P. sayana* and *P. sigsbeiana* seem to be conform a distinctive group but not *P. platycheles* and *A. gravelei*.

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Table 1.— Comparison of the morphology of the first zoea in the genus *Porcellana* and other two allied genera.

	<i>Porcellana sayana</i> (Present study)	<i>Porcellana platycheles</i> (González-Gordillo <i>et al.</i> , 1996)	<i>Porcellana sijsbeiana</i> (Gore, 1971)	<i>Enostoidea ornatus</i> (Sankolli, 1967)	<i>Ancylocheles gravelei</i> (Shenoy & Sankolli, 1976)
CARAPACE					
Length (CL)	1.25 — 1.48 mm	0.83 — 1.16 mm	1.12 mm	?	0.9 mm
Rostral spine	6 — 7 x CL	4.5 x CL	8 x CL	5 x CL	4 x CL
Posterior spines	1.8 — 2.4 x CL	2 x CL	3 x CL	1.6 x CL	0.5 x CL
ANTENNULE	3 setae, 3 aesthetascs	3 setae, 3 aesthetascs	3 setae, 3 aesthetascs	3 setae, 3 aesthetascs	3 setae, 3 aesthetascs
ANTENNA					
Exopodite	2 x Endopodite	2 x Endopodite	1.25 x Endopodite	2 x Endopodite	1.5 x endopodite
MAXILLULE					
Coxal endite	10 processes	10 processes	9 processes	9 processes	8—9 processes
Basal endite	10 processes	11 processes	10 processes	10 processes	9—10 processes
Endopodite	(1—2) + 2 setae	1 + 2 setae	3—4 setae	1 + 3 setae	1 + 2 setae
MAXILLA					
Coxal endite	7, 6 processes	8, 7 processes	7, 6 processes	8, 4 processes	7—8, 4 processes
Basal endite	7, 9—10 processes	10, 9 processes	7, 9 processes	7, 7 processes	9—10, 13 processes
Endopodite	3+2+4 setae	3+2+4 setae	3+2+4 setae	3+2+4 setae*	2+2+3—4 setae
Scaphognathite	6 + 1 setae	6 + 1 setae	6—7 + 1 setae	6 + 1 setae	6 + 1 setae
MAXILLIPED 1					
Coxopodite	2 setae	2 setae	2 setae	1 setae*	2 setae*
Basipodite	With spine; 1+2+2+3 setae	Without spine; 1+2+2+3 setae	With spine; 1+2+2+3 setae	Without spine; 2+2+3+3 setae	Without spine; 1+2+2+3 setae
Endopodite	3, 4, 4, 8+1 setae	3, 4, 5, 11+1 setae	3, 3, 3, 7+1 setae	3, 2, 3+2, 7—8+1 setae	2, 3, 3, 6—7+1 setae
MAXILLIPED 2					
Coxopodite	Unarmed	Unarmed	Unarmed	Unarmed*	Unarmed
Basipodite	With spine; 1+2 setae	Without spine; 1+2 setae	Without spine; 1+2 setae	Without spine; 1+2 setae	Without spine; 1+2 setae
Endopodite	2, 2—3, 2, 9+1 setae	2, 3, 3, 9+1 setae	2, 2, 2, 7 + 1 setae	2, 2, 1+2, 5+1 setae	2, 2, 2, 5+1 setae
ABDOMEN	Spines on somites 3—5	Spines on somites 4—5	Spines on somites 2—5	Spines on somite 5	Spines on somite 5
TELSON	Lateral spines serrated	Lateral spines unarmed	Lateral spines serrated	Lateral spines unarmed*	Lateral spines serrated.

? = information not available; * = interpreted from illustrations

Table 2.— Comparison of the morphology of the second zoea in the genus *Porcellana* and other allied genus.

	<i>Porcellana savana</i> (Present study)	<i>Porcellana platycheles</i> (González-Gordillo et al., 1996)	<i>Porcellana sigsbeiana</i> (Core, 1971)	<i>Ancylocheles gravelei</i> (Shenoy & Sankolli, 1976)
CARAPACE				
Length (CL)	2.23 — 2.44 mm	1.00 — 1.50 mm	1.93 mm	3.5 mm
Rostral spine	4.6 — 6 x CL	4.5 x CL	6.3 x CL	= CL
Posterior spines	1.2 — 1.4 x CL	2 x CL	4.5 x CL	0.3 x CL*
ANTENNULE	Exopodite = 1.6 x Endopodite 2—3,3,3,3—2,3 aesth., 4 setae	Exopodite = 1.7 x Endopodite* 2—3,3,3,3—2,3 aesth., 4 setae	Exopodite = 2 x Endopodite 3,3,2,3 aesth., 4 setae	Exopodite = 1.4 x Endopodite* 2,2,2,3 aesth., 3 setae
ANTENNA	Endopodite = 1.2 x Exopodite Exopodite with 1 seta	Endopodite = 1.6 x Exopodite* Exopodite with 2 setae	Endopodite = 2 x Exopodite Exopodite with 1 seta	Endopodite = 1.8 x Exopodite* Exopodite with 1 seta
MAXILLULE				
Coxal endite	11—12 processes	12 processes	11 processes	10 processes
Basal endite	12 processes	13 processes	12 processes	11 processes
Endopodite	1+2 setae	1+2 setae	1+2 setae	1+2 setae
MAXILLA				
Coxal endite	10, 7 processes	11, 8 processes	12, 7 processes	10, 6 processes
Basal endite	9, 11 processes	11, 13 processes	9, 11 processes	10, 11—12 processes
Endopodite	3+2+4 setae	3+2+4 setae	3+2+4 setae	3+2+4 setae
Scaphognathite	26—27 setae	22 setae	23—25 setae	18 setae
MAXILLIPED 1				
Basipodite	With spine; 1+2+2+3 setae	Without spine; 1+2+2+3 setae	With spine; 1+2+2+3 setae	Without spine; 1+2+2+3 setae
Endopodite	3+I, 4+I, 4+I, 10—11+I setae	3+I, 5+I, 7+I, 11+I setae	3+I, 3+I, 3+I, 9+I setae	2+I, 3+I, 3+I, 6—7+I setae
Exopodite	12 setae	12 setae	12 setae	9—10 setae
MAXILLIPED 2				
Coxopodite	Unarmed	1 seta	1 seta	Unarmed*
Basipodite	With spine; 1+2 setae	Without spine; 1+2 setae	With spine; 1+2 setae	Without spine*; 1+2 setae
Endopodite	2+I, 2+I, 2+I, 10+I setae	2+I, 3+I, 3+I, 9+I setae	2+I, 2+I, 2+I, 9+I setae	2+I, 2+I, 2+I, 5+I setae
Exopodite	12 setae	12 setae	12—13 setae	10 setae
MAXILLIPED 3	Exopodite with 5 setae	Exopodite with 4 setae	Exopodite with 6 setae	Exopodite with 2 setae
ABDOMEN	Pleopods on somites 2—5	Pleopods on somites 2—5	Pleopods on somites 2—5	Pleopods on somites 2—4
TELSON	With additional pair of setae	With additional pair of setae	With additional pair of setae	With additional pair of setae

aesth. = aesthetascs; * = interpreted from illustrations

Table 3. Comparison of selected morphological characters of the megalopa in the genus *Porcellana* and other allied genus.

	<i>Porcellana sayana</i> (Present study)	<i>Porcellana platycheles</i> (González-Gordillo et al., 1996)	<i>Porcellana sigsbeiana</i> (Gore, 1971)	<i>Ancylocheles graveléi</i> (Shenoy & Sankolli, 1976)
CARAPACE	1.65 x 1.38 mm. Front 6-dentate Epibranchial spine present. Lateral margin unarmed	1.26 x 0.97. Front 4-dentate. Epibranchial spine absent. Lateral margin with 1 spine	2.25 x 1.93. Front 3-dentate. Epibranchial spine present. Lateral margin unarmed	0.80 x 0.60 mm. Front rounded. Epibranchial spine present. Lateral margin with 3-4 spines
ANTENNULE	0, 6, 8, (3+2), 2-4, 0 a	8, 16, 5, 3, 0 a	0, 0, 8, (8+8), (3+2), 3, 0 a	?
ANTENNA	Peduncle 3-segmented	Peduncle 3-segmented	Peduncle 3-segmented	Peduncle 4-segmented
MANDIBLES	Palp: 2, 0, 14-16 setae	?	Palp: 2, 0, 18 setae	Palp: 0, 0, ? setae
MAXILLULE				
Coxal endite	34 + 2 processes	25 + 2 processes	35 + 3 processes	12 + 2 processes
Basal endite	29 processes	26 processes	36 processes	16-18 processes
Endopodite	1 seta	1 seta	1+1 setae	1 seta
MAXILLA				
Coxal endite	37, 17 processes	26, 13 processes	46, 23 processes	?
Basal endite	15, 37 processes	15, 28 processes	24, ± 50 processes	?
Endopodite	4 setae	5 setae	7 setae	2 setae
Scaphognathite	55 marginal setae	± 50 marginal setae	± 70 marginal setae	± 37 marginal setae
MAXILLIPED 1				
Endopodite	4 setae	5 setae	8 setae	1
Exopodite	8 setae	3 setae	19 setae	1-2 setae
MAXILLIPED 2				
Endopodite	4-segmented	5-segmented	4-segmented	5-segmented
Exopodite	10, 10 setae	7, 7 setae	19, 12 setae	5-7, 6 setae
MAXILLIPED 3				
Exopodite 2-segmented	Exopodite 2-segmented	Exopodite 2-segmented	Exopodite 2-segmented	Exopodite unsegmented
CHELIPEDS	Carpus: 1 s on flexor margin	Carpus: 2 ss on flexor margin	Carpus: 1 s on flexor margin	Carpus: 2 ss on flexor margin
PEREIOPOD 5	Propodus: 4 serrate setae Dactylus: 2 serrate setae	Propodus: 5 serrate setae Dactylus: 1 serrate seta	Propodus: 3 serrate setae Dactylus: 1 serrate seta	Propodus: ? Dactylus: ?
PLEOPODS	4 pairs	4 pairs	4 pairs	3 pairs
TELSON	10-11 + 10-11 setae	14 + 14 setae	21 + 21 setae	5-6 + 5-6 setae

a: aesthetascs; ?: information not available