

The First Zoeas of *Actaeodes hirsutissimus* (Rüppell, 1830) and *A. tomentosus* (H. Milne Edwards, 1834) (Crustacea: Decapoda: Brachyura: Xanthidae: Actaeinae)

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ABSTRACT. The first zoea of *Actaeodes hirsutissimus* (Rüppell, 1830) is described, figured and compared with that of *A. tomentosus* (H. Milne Edwards, 1834). Three characters appear to separate the first stage zoeas of these two species; the size of the second lateral spine on the telson, the spinulation of the rostral spine and the morphology of the antennal exopod. In all other aspects of appendage setation the two zoeas are identical. The carapace spines, antennal morphology and the telson armature of these two actaeine zoeas are compared with others from the subfamily Actaeinae and from the xanthid zoeal groups.

Introduction

Three first stages zoeas of the Actaeinae Alcock, 1898 have been described; *Actaea semblatae* Guinot, 1976 [as *Actaea savigny* (H. Milne Edwards, 1834)] (by Terada 1987), *Novactaea pulchella* (A. Milne Edwards, 1865) (by Terada, 1990) and *Gaillardius orientalis* (Odhner, 1925) (by Ng & Clark, 1994). The second author of this present study collected ovigerous crabs of two species of *Actaeodes* from North Jeddah. These were identified as *A. hirsutissimus* (Rüppell, 1830) and *A. tomentosus* (H. Milne Edwards, 1834). The purpose of this paper is to describe the first stage zoeas of these two species and to compare them with the three other actaeine larval descriptions.

Materials and Methods

The ovigerous crabs of *Actaeodes hirsutissimus* (Rüppell, 1830) and *A. tomentosus* (H. Milne Edwards, 1834) were collected from shallow water under rocks at Obhor Creek, 21°40'N, 39°12'E, Red Sea about 20 km north of Jeddah, Saudi Arabia on the 23rd of July, 1990. The specimens were kept in aquaria at the King Abdulaziz University with sea water at room temperature of 27°C. *A. hirsutissimus* hatched larvae of the 26th of July and *A. tomentosus* on the 4th

of August, 1990. The first zoeas were preserved in alcohol. The females and the undissected zoeas have been preserved in The Natural History Museum, London; *Actaeodes tomentosus* (1994.3229) and *A. hirsutissimus* (1994.3230).

Larval specimens were dissected and drawn in polyvinyl lactophenol using a WILD stereoscope and an OLYMPUS BH-2 with Normarski interference contrast and attached camera lucida. At least seven replicates of each structure or appendage were observed to determine variation. The zoeal appendage of *Actaeodes hirsutissimus* are described in full while only the characters that differ are commented upon for *A. tomentosus*.

Description of First Zoeas

Actaeodes hirsutissimus (Rüppell, 1830) (Fig. 1a, b, d, e, h; 2a-d; 3a-d)

Carapace (Fig. 1a, b): dorsal spine long, straight and curved distally, devoid of setae; rostral spine straight, shorter than dorsal spine and the protopod of antenna, devoid of setae, sparsely spinulate; lateral spines present, straight and short; 1 pair of post-erodorsal setae; each ventral margin without setae;

eyes sessile.

Antennule (Fig. 1d): endopod absent; exopod unsegmented with 2 broad, long, 1 short, slender terminal aesthetascs and 2 unequal terminal setae.

Antenna (Fig. 1e, h): protopod distally spinulate and longer than rostral spine; endopod spine minute; exopod small, 1-segmented with 1 terminal seta.

Mandible: palp absent.

Maxillule (Fig. 2a): coxal endite with 7 setae; basal endite armed with 5 processes, inner margin with 2 teeth, single seta absent from outer margin; endopod 2-segmented, proximal segment with 1 seta; distal segment with 2 subterminal setae and 4 terminal setae.

Maxilla (Fig. 2b); coxal endite bilobed with 4 + 4 setae; basal endite bilobed with 5 + 4 setae; endopod bilobed with 3 + 2 subterminal and 3 terminal setae; exopod (scaphognathite) margin with 4 setae and 1 distal stout process.

First maxilliped (Fig. 2c): basis with 10 setae arranged 2, 2, 3, 3; endopod 5-segmented with 3, 2, 1, 2, 4 + 1 setae respectively; exopod 2-segmented, distal segment with 4 terminal plumose natatory setae.

Second maxilliped (Fig. 2d): basis with 4 setae; endopod 3-segmented, with 1, 1, 4 + 2 respectively; exopod 2-segmented, distal segment with 4 terminal plumose natatory setae.

Third maxilliped: absent.

Pereiopods: absent.

Abdomen (Fig. 3a, b): 5 somites; somite 2 with 1 pair of lateral processes directed anteriorly, somite 3 with 1 pair of lateral processes directed posteriorly; somites 3-5 each with short postero-lateral processes; somites 2-5 with 1 pair of posterosdorsal setae; pleopod buds absent.

Telson (Fig. 3c, d); each fork long, gradually curved, not spinulate; with 2 pairs of lateral spines (1 pair minute) and 1 pair of dorsal medial spines; posterior margin with 3 pairs of stout spinulate setae.

***Actaeodes tomentosus* (H. Milne Edwards, 1834) (Fig. 1c, f & g; 3e)**

Carapace (Fig. 1c): rostral spine spinulate.

Antenna (Fig. 1f, g): exopod comparatively elongate, 1-segmented with 3 terminal unequal setae.

Telson (Fig. 3e): 2 pairs of lateral spines relatively pronounced.

Discussion

Except for three characters, the morphology of the first stage zoea of *Actaeodes hirsutissimus* and of *A. tomentosus* are identical. The characters which distinguish these two zoeas are the degree of spinulation on the rostral spine (*A. hirsutissimus* is sparsely spinulate, cf. Fig. 1b & c), the morphology of the antennal exopod (cf. Fig. 1g & h) and size of the second lateral spine of the telson fork (the second lateral spine is minute in *A. hirsutissimus*, cf. Fig. 3d & e). Such differences, according to Christianses (1973) and Clark (1980, 1983, 1984) would suggest that these two *Actaeodes* species should be referred to separate genera, or alternatively, that the adults females have been misidentified. Although female xanthids are difficult to identify, males collected from the same locality indicate that the determinations, with reference to Guinot (1976) and Serène (1984), are correct.

Recently Ng and Clark (1994) described the first stage zoea of another Actaeinae, *Gaillardiellus orientalis* (Odhner, 1925). The *Actaeodes* larvae differ from those of *Gaillardiellus* in the following features. In *G. orientalis* the carapace spines (Ng and Clark, 1994; Fig. 1a) are longer and the tips of the dorsal and lateral spines are swollen. In addition, the lateral spines are curved ventrally and the rostral spine is approximately equal in length to the protopod. The antennal morphology also differs. In *Gaillardiellus* the protopod (Ng & Clark, 1994; Fig. 1c, d) is not spinulate, the endopod is absent and the exopod morphology is similar to that of *A. tomentosus*. Another difference is the armature of the telson; in *Gaillardiellus* the forks have two lateral and one dorsal medial setae. In all other aspects of morphology the two genera are identical.

Terada described the first stage zoea of two additional Actaeinae genera, *Actaea semblatae* Guinot, 1976 [as *Actaea savignyi* (H. Milne Edwards, 1934)] (Terada, 1987) and *Novataea pulchella* Guinot, 1976 (Terada, 1990). The morphology of first stage zoea of these genera is identical to those of *Actaeodes* of this present study and *Gaillardiellus* of Ng and Clark (1994) but can be distinguished by the following characters. With reference to *A. semblatae*, the carapace spinature (Terada, 1987, Fig. 11 AI) is similar to *Gaillardiellus* (Ng & Clark 1994, Fig. 1a) but the lateral and dorsal spines do not have swollen tips. The antennal morphology (Terada, 1990, Fig. 11 CI) partially agrees with that of *Gaillardiellus* (Ng & Clark, 1994, Fig. 1c, d) but differs because an endopod bud is present and the exopod is represented by a seta. The telson fork armature (Terada, 1990, Fig. 11 HI) is identical to that of *Gaillardiellus* (Ng & Clark, 1994, Fig. 2c). In *Novactea*, the carapace armature (Terada,

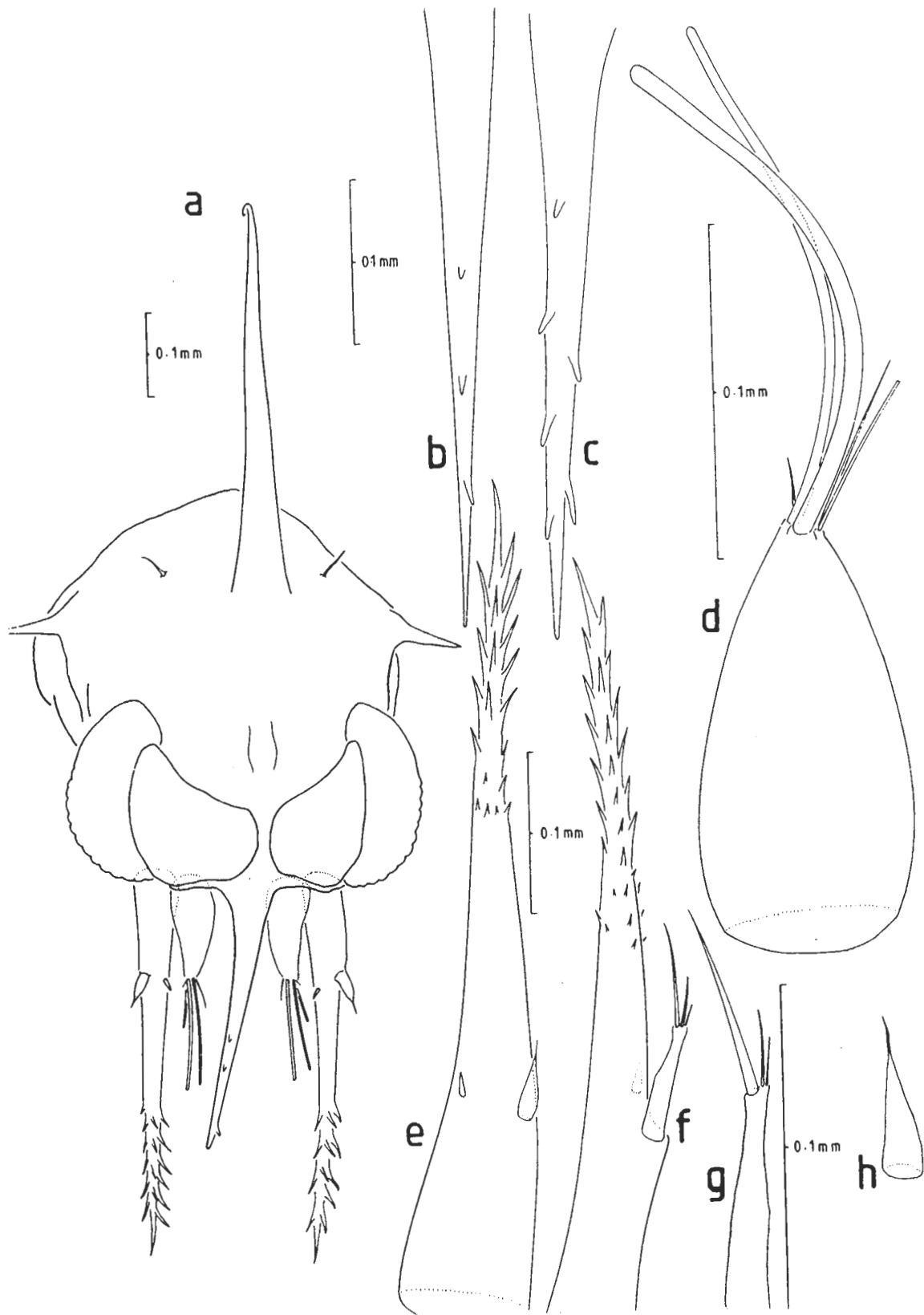


FIG. 1. *Actaeodes hirsutissimus* (Rüppel, 1830); a, anterior view of carapace; b, rostral spine; d, antennule; e, antenna; h, exopod of antenna; *Actaeodes tomentosus* (H. Milne Edwards, 1834); c, rostral spine; f, antenna; g, exopod of antenna.

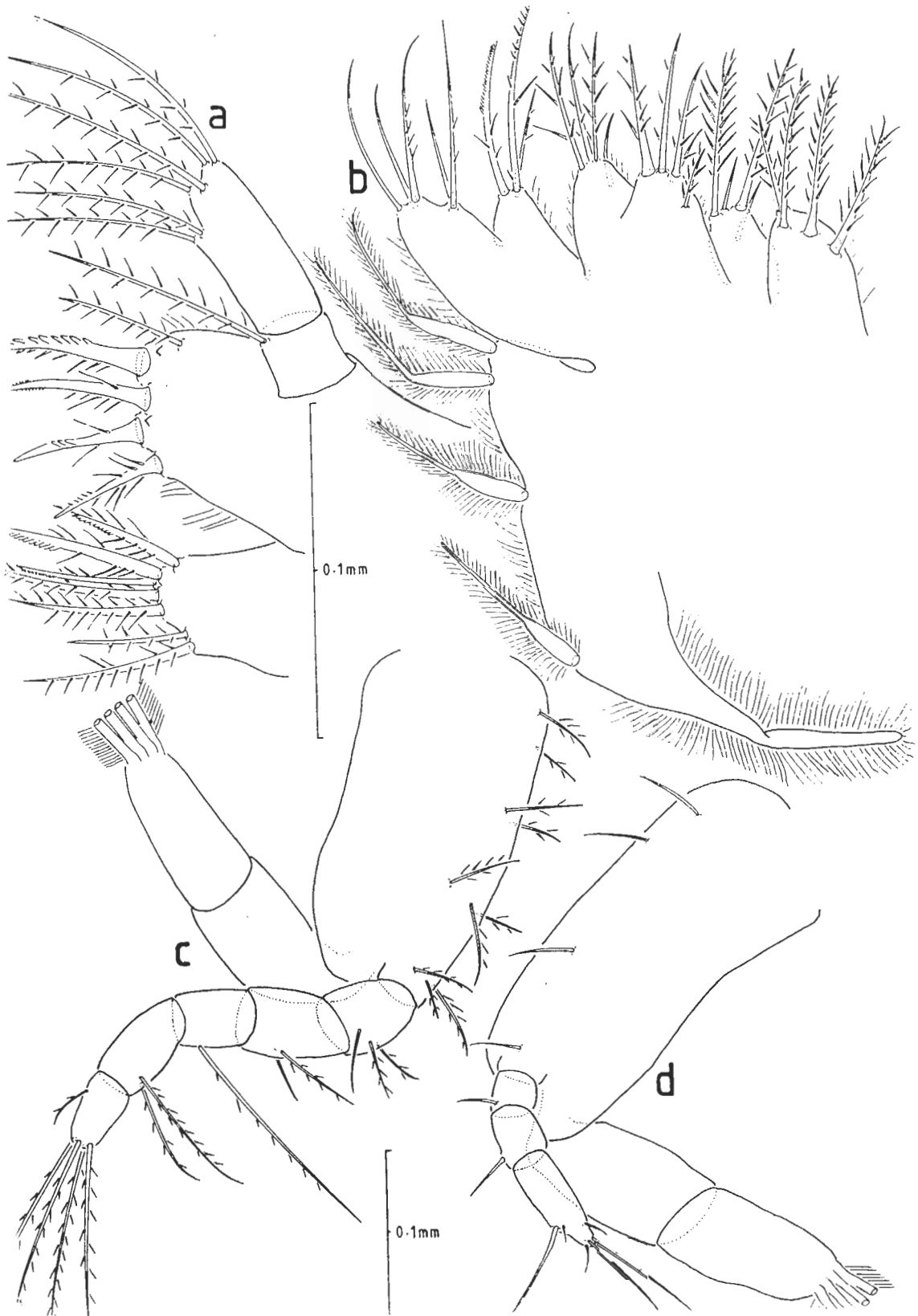


FIG. 2. *Actaeodes hirsutissimus* (Rüppell, 1830); a, maxillule; b, maxilla; c, first maxilliped; d, second maxilliped.

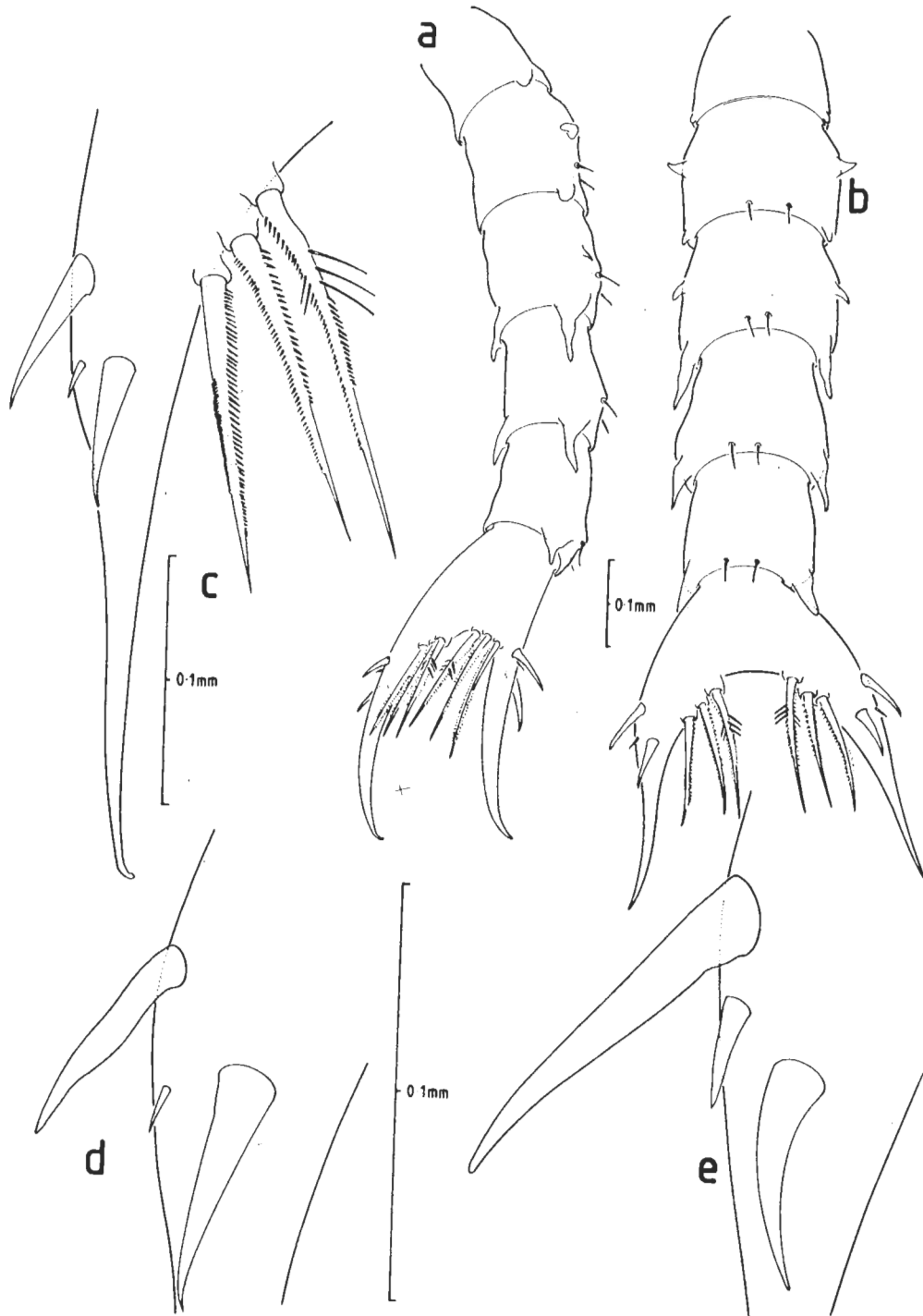


FIG. 3. *Actaeodes hirsutissimus* (Rüppel, 1830); a, lateral view of abdomen; b, dorsal view of abdomen; c, telson; armature of telson fork; *Actaeodes tomentosus* (H. Milne Edwards, 1834); e, armature of telson fork.

1990, Fig. 5 AI) of its zoea is similar to that of *Actaeodes* (Fig. 1a) of this present study except the dorsal and rostral spines appear proportionately longer, and the rostral spine is not spinulate as with *Actaeodes* (Fig. 1b, c). In addition, the length of the rostral spine and the protopod of the antenna are approximately equal. The morphology of the antenna (Terada, 1990, Fig. 5 CI) is comparable with that of *A. tomentosus* (Fig. 1f, g), but its protopod is devoid of spinules and the endopod is well developed. The armature of the telson forks of *Novactaea* (Terada, 1990, Fig. 3 HI) and *Acteodes hirsutissimus* (Fig. 3c, d) appear to be identical. However, two characters described by Terada may require further clarification. The figures of maxillary coxal endite by Terada (1987, Fig. DI and 1990 Fig. DI) both show 8 setae which is unusual and different from the figures presented by Ng and Clark (1994) and the present study who noted 7 setae. Further, for the maxillary basal endite of *Novactaea pulchella* Terada (1990, Fig. EI) indicates 4 + 4 setae. All other descriptions of the same appendage in Actaeinae first zoeas, (Terada, 1987; Ng and Clark, 1994 and present study) score this character as 5 + 4 setae.

Martin (1984, Fig. 1) considered that the Xanthidae zoeas could be arranged into six groups. The Actaeinae zoea discussed in this present study conform with five of Martin's seven group I characters: the distal segment of the maxillule endopod with two subterminal and four terminal setae; the bilobed endopod of the maxilla with 3 + 5 terminal setae; the proximal endopod segment of the first maxilliped with three setae; the proximal endopod segment of the second maxilliped with one seta and the first and second abdominal somites only with lateral processes. However, two characters defining Martin's group I do not appear to conform to recent descriptions of Actaeinae zoea. Firstly, the reduced antennal exopod is never armed with more than two terminal setae: *Actaeodes tomentosus*, *Gaillardielus* and *Novactaea pulchella* all possess three unequal terminal setae on the antennal exopod. Secondly, the protopod of the antenna being approximately equal to the rostral spine does not apply to *Actaeodes* (Fig. 1a).

The descriptions of the first stage zoeas of four Actaeinae genera suggest that the morphologies of the maxillule, maxilla, first and second maxillipeds and abdominal somites are relatively constant. But the larvae of the four genera, *Actaeodes*, *Actaea*, *Gaillardielus* and *Novactaea* can be distinguished by using combinations of carapace, telson fork and antennal characters. However, the morphology of the antennae does not comply with Martin's group 1 diagnosis.

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الطور اليرقي الأول للأكتيودز هرسيتمس والأكتيودز تومتوسس (القشريات : عشرية الأرجل : براكيورا : زانتيدي : أكتيني)

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المستخلص: تم وصف ورسم ومقارنة الطور اليرقي الأول للأكتيودز هرسيتمس مع الأكتيودز تومتوسس . وجدت ثلاثة فروق رئيسية تميز بين الطور اليرقي الأول لكلا النوعين وهي حجم الشوكة الجانبية الثانية للعقب ، شويكات المنقار وشكل الزائدة الخارجية لقرن الاستشعار ، وفيما عدا ذلك فالأعضاء جميعها متشابهة . تمت مقارنة الأشواك الموجودة في الدرقة ، شكل قرن الاستشعار والعقب للطور اليرقي الأول للنوعين من الأكتيني بالأنواع الأخرى تحت عائلة الأكتينيا وكذلك بالمجموعة اليرقية للزانتيد .