

Redescription of the freshwater amphipod *Hyaella faxoni* from Costa Rica (Crustacea: Amphipoda: Hyaellidae)

Exequiel R. González¹ and Les Watling²

1 Facultad de Ciencias del Mar, Universidad Católica del Norte, Casilla 117, Coquimbo, Chile, Ph.: 56-51-209931, Fax: 56-51-209812, e-mail: egonzale@ucn.cl

2 Darling Marine Center, University of Maine, 193 Clark's Cove Rd., Walpole, Maine 04573, USA, Ph.: 207-563-3146, Fax: 207-563-8407, e-mail: watling@maine.edu

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Abstract. *Hyaella faxoni* Stebbing, 1903 from Costa Rica is redescribed. The species was previously in the synonymy of *Hyaella azteca* (Saussure, 1858). The morphological differences between these two species are discussed.

Key words: Amphipoda, freshwater, *Hyaella*, epigean, South America.

Hyaella faxoni Stebbing, 1903 is part of what has been called the "azteca complex" named after *Hyaella azteca* (Saussure 1858), a common freshwater organism generally thought to be found all over North America, Central America and probably also in northern South America. The original description by Saussure (1858), based on samples from a "cistern" in Veracruz and Mexico City in Mexico, was poorly documented and figured. In North and Central America, most of the freshwater species of *Hyaella* recorded were assigned to *H. azteca*, however, seven other related species are known from the region (González and Watling 2002).

The lack of evident morphological variation and detailed study of *H. azteca* resulted in all the authors believing that the species was present all over America (Shoemaker 1933, Ruffo 1947) and many species have been placed in the synonymy of *H. azteca*.

Stebbing (1903) described *H. faxoni* from Costa Rica and reestablished the genus name after it was synonymized under *Allorchestes* by Faxon (1876). Stebbing (1906) syn-

onymized *H. knickerbockeri* (Bate 1862), *H. dentata* Smith, 1874, *H. inermis* Smith, 1875 and *Lockingtonia fluvialis* Harford, 1877, under *H. azteca*, but did not mention *H. faxoni*. Weckel (1907) put *H. faxoni* in the synonymy of *H. knickerbockeri*, which she thought had precedence over *H. dentata*. She did not see Stebbing (1906) who had already put *H. knickerbockeri* under *H. azteca*. She also does not mention Saussure's species, indicating that she considered it a valid separate species in the sense of Smith (1874, 1875).

Several species in the "azteca complex" have been the subject of genetic studies using allozyme (Duan *et al.* 1997, 2000, Hogg *et al.* 1998,) and allozymes and PCR (Thomas *et al.* 1994, 1997, 1998, Witt and Hebert 2000). Most of the results show that populations of what has been identified as *H. azteca* from North America have low levels of gene flow, reduction in genetic variability, low heterozygosity, unique alleles, and strong genetic differentiation and divergence among the populations. From these genetic studies it is clear that *H. azteca* is a species complex. None of the

studies, however, mention any morphological differences among the populations included in the analysis.

After the redescription of *H. azteca* based on material from the syntype series (González and Watling 2002), the morphology of the species described by Saussure (1858) was clearer. The new detailed morphology used for the latter description, the lack of detail in Stebbing's description, and considering Weckel (1907) nomenclatural changes, it is necessary to redescribe *H. faxoni* and establish the differences with *H. azteca*.

MATERIALS AND METHODS

The 32 specimens examined are deposited in the National Museum of Natural History, USA, under the Accession Number 96617. The morphological characters were coded and descriptions generated, using the taxonomic database DELTA (Dallwitz *et al.* 1999). The terminology for setae follows Watling (1989) and Oshel and Steele (1988). Measurements of the specimens were made from the tip of the head to the base of the telson. This convention was chosen because of the variable position of the tip of the telson in different specimens. The computer program Image-Pro Plus (Media Cybernetics 1997) was used to measure the specimens. Latitude and longitude were determined from a gazetteer. Localities, whose record indicates a wide region, were assigned to a middle point of that region.

RESULTS

Hyalella faxoni Stebbing, 1903
Figs. 1-4

Hyalella faxoni Stebbing, 1903: 928-930, Fig. 61.

Type material: United States National Museum.

Type locality: Volcan Reventado, Costa Rica (9°50'N, 83°56'W).

Material Examined: Volcan Barva, Costa Rica. 2000 m.a.s.l (10° 08' N, 84° 06' W). Material from Smithsonian Institution (Acc. # 96617).

Diagnosis: Body surface smooth. Coxa 4 excavated posteriorly. Eyes pigmented. Antenna 1 shorter than antenna 2. Antenna 2 less than half body length. Mandible incisor toothed. Maxilla 1 palp minute, reaching less than half length the distance between base of palp and tip of setae on outer plate; inner plate slender, with four strong and pappose apical setae. Maxilla 2, inner margin of inner plate with two closely together strong pappose setae. Gnathopod 1 propodus length less than two times maximum width (quadrangular), hammer shape, inner face with five pappose setae, setose scales on disto-posterior and disto-anterior border. Gnathopod 2 propodus ovate, palm shorter than posterior margin, slope slightly oblique, anterior edge with a wide truncated or rounded process. Peraeopods 3 and 4 merus and carpus posterior margin with three hind marginal clusters of long setae; propodus posterior margin with five to eight groups of setae. Uropod 3 peduncle with five strong distal setae; outer ramus same length as peduncle, basal width more than two times tip of ramus. Telson wider than long, apically rounded, with two widely apart, long simple setae, symmetrically distributed. Sternal gills on segments 3 to 7. **Female.** Gnathopod 1 similar in size, and different in shape to gnathopod 2. Gnathopod 2 different from male gnathopod 2 in shape and smaller, propodus length two to three times maximum width, normally subchelate, palm slightly reverse oblique.

Description of male: Size, 8.7 mm. Body surface smooth. Epimeral plate 1, 2 and 3 acuminate (Fig. 1 E). Coxae 1 to 4 subequal in size and shape, slightly overlapping. Acumination in coxae absent. Coxa 1 same as 2 and 3. Coxa 3 narrower than 4. Coxa 4 deeper than wide, excavated posteriorly. Coxa 5 posterior lobe deeper than anterior. Coxa 6 anterior lobe small.

Head smaller than first two thoracic segments, typically gammaridean, rostrum absent.

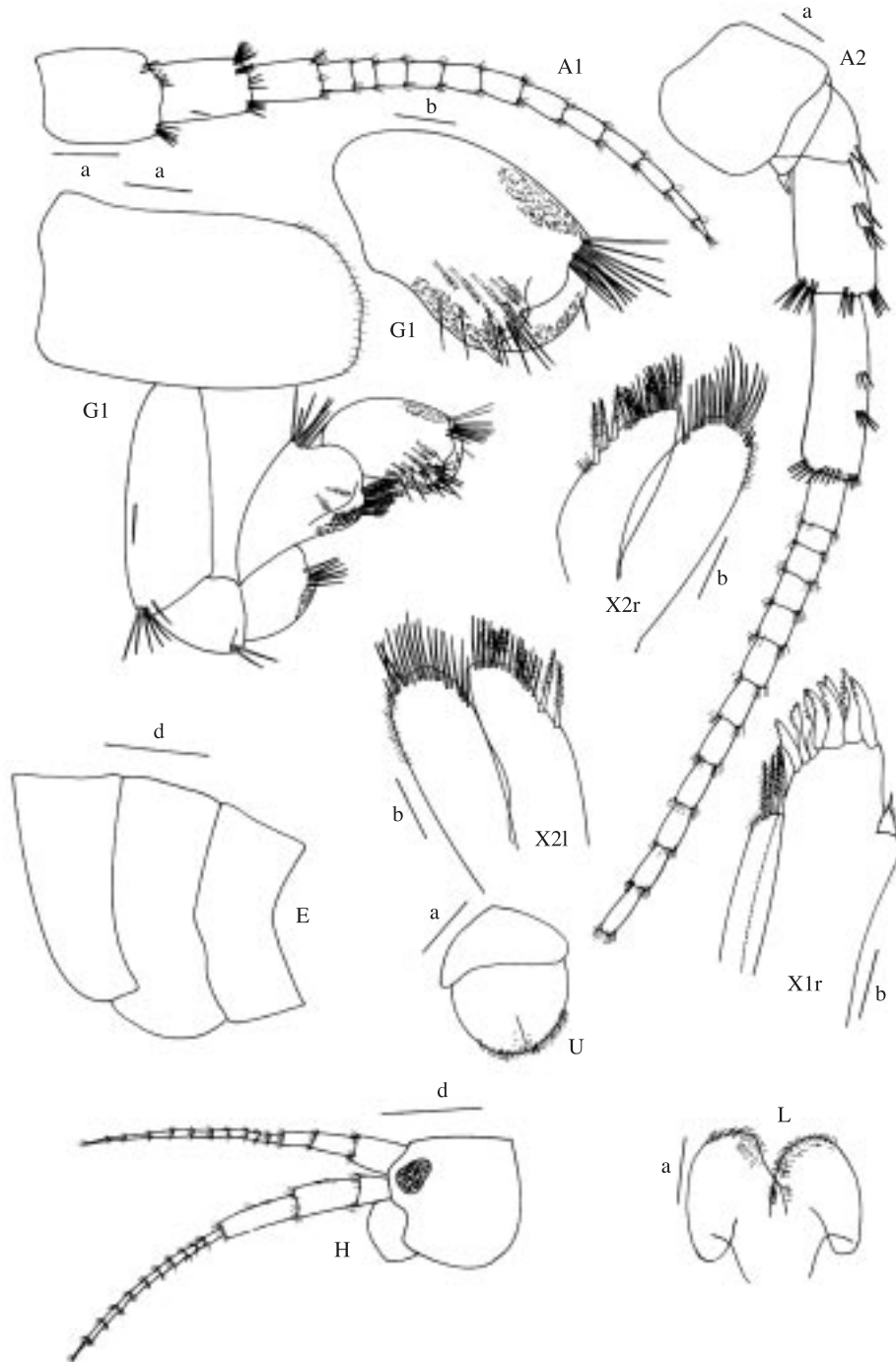


Fig. 1. *Hyalella faxoni* Stebbing, 1903, male 8.7 mm. Symbols for figures are as follow. A, antenna; E, epimeron; G, gnathopod; H, head; L, lower lip; M, mandible; P, pereopod; S, maxilliped; R, uropod; T, telson; U, upper Lip; X, maxilla. Lower case letters on the left side of capital letters refer to specimens cited in captions. Lower case letters on the right are as follow: l, left; r, right. The scale is indicated as a small bar on each appendices, "a" is equivalent to 192 microns; "b" is equivalent to 94 microns; "c" is equivalent to 47 microns; "d" is equivalent to 481 microns.

Eyes pigmented, medium, ovoid, located between insertion of antenna 1 and 2 (Fig. 1 H).

Antenna 1 less than half of body length, shorter than antenna 2, longer than peduncle of antenna 2; peduncle longer than head, article 1 longer than 2, article 3 the shortest; flagellum of 12 articles, longer than peduncle, basal article not elongated; aesthetascs on flagellum, from articles 4 distally (Fig. 1 A1).

Antenna 2 less than half body length; peduncle slender, longer than head, article 4 shorter than article 5, setal groups on article 4 and 5 scarce; flagellum of 15 to 17 articles, longer than article 5, basal article not elongated (Fig. 1 A2).

Basic amphipodan mandible (in the sense of Watling 1993); incisor toothed; left lacinia mobilis with five teeth; setae row on left mandible with three main setae without accessory setae, right mandible with two main setae without accessory setae; molar large, cylindrical, and triturative, accessory seta present. Labrum ventral margin round. Lower lip outer lobes rounded without notches or excavations, mandibular projection of outer lobes round (Fig. 2 Ml; Fig. 1 L, U).

Maxilla 1 palp uniaarticulate, minute, reaching less than half length the distance between base of palp and tip of setae on outer plate, distal setae feeble; inner plate slender, smaller than outer plate, with four strong and pappose apical setae; outer plate with nine stout and serrate setae (Fig. 1 X1r). Maxilla 2 inner plate subequal in length and width to outer plate, two closely together strong pappose setae on inner margin, outer and inner plates with scarce setules (Fig. 1 X2r, X2l).

Maxilliped inner plates apically truncated, with three connate setae, pappose setae apically and medially; outer plates larger than inner plates, apically truncated, apical, medial and facial setae simple; palp longer than outer plate, four articles; article 2 longer than wide, medial margin with long simple setae; article 3 outer distal face with several long simple setae, inner distal face with long plumose setae, inner distal margin with long setae, outer margin with one or two strong and long plumose setae;

dactylus unguiform, shorter than third article, distal setae simple and shorter than nail, inner border with setae, distal nail present (Fig. 2 S).

Gnathopod 1 subchelate; carpus longer than wide, longer and wider than propodus, with strong and wide posterior lobe, produced and forming a scoop like structure, open to the inside, inner face with one to three pappose setae, border pectinate and with several pappose setae; propodus length less than two times maximum width (quadrangular), hammer shape, with no setae on anterior border, inner face with five pappose setae, setose scales on disto-posterior and disto-anterior border, palm slope transverse, margin straight, posterior distal corner with robust setae; dactylus claw-like, with one to three endal setae, congruent with palm (Fig. 1 G1).

Gnathopod 2 subchelate; basis hind margin with four to six group of setae; merus with seven or more setae on posterior margin, postero-distal margin straight, distal corner rounded; carpus posterior lobe elongated, produced between merus and propodus, border pectinate with several pappose setae; propodus ovate, scales on disto-posterior border, palm shorter than posterior margin, slope slightly oblique, margin irregular, few long setae, several medium size setae, anterior edge with a wide truncated or rounded process, posterior distal corner with strong setae, and with cup for dactyl; dactylus claw-like, congruent with palm, with a few endal setae (Fig. 2 G2).

Peraeopods 3 to 7 simple. Peraeopods 3 and 4 merus and carpus posterior margin with three hind marginal clusters of long setae; propodus posterior margin five to eight groups of setae; dactylus less than half-length of propodus. Peraeopods 5 to 7 all similar in structure and slightly longer successively; dactylus less than half-length of propodus. Peraeopod 5 subequal to peraeopod 4, basis posterior lobe wider than deep, smaller than posterior lobe of peraeopod 7, merus with two hind marginal setae, proximal setae smaller than more distal. Peraeopod 6 longer than peraeopod 4, basis posterior lobe wider than deep, similar to posterior lobe of peraeopod 5, and

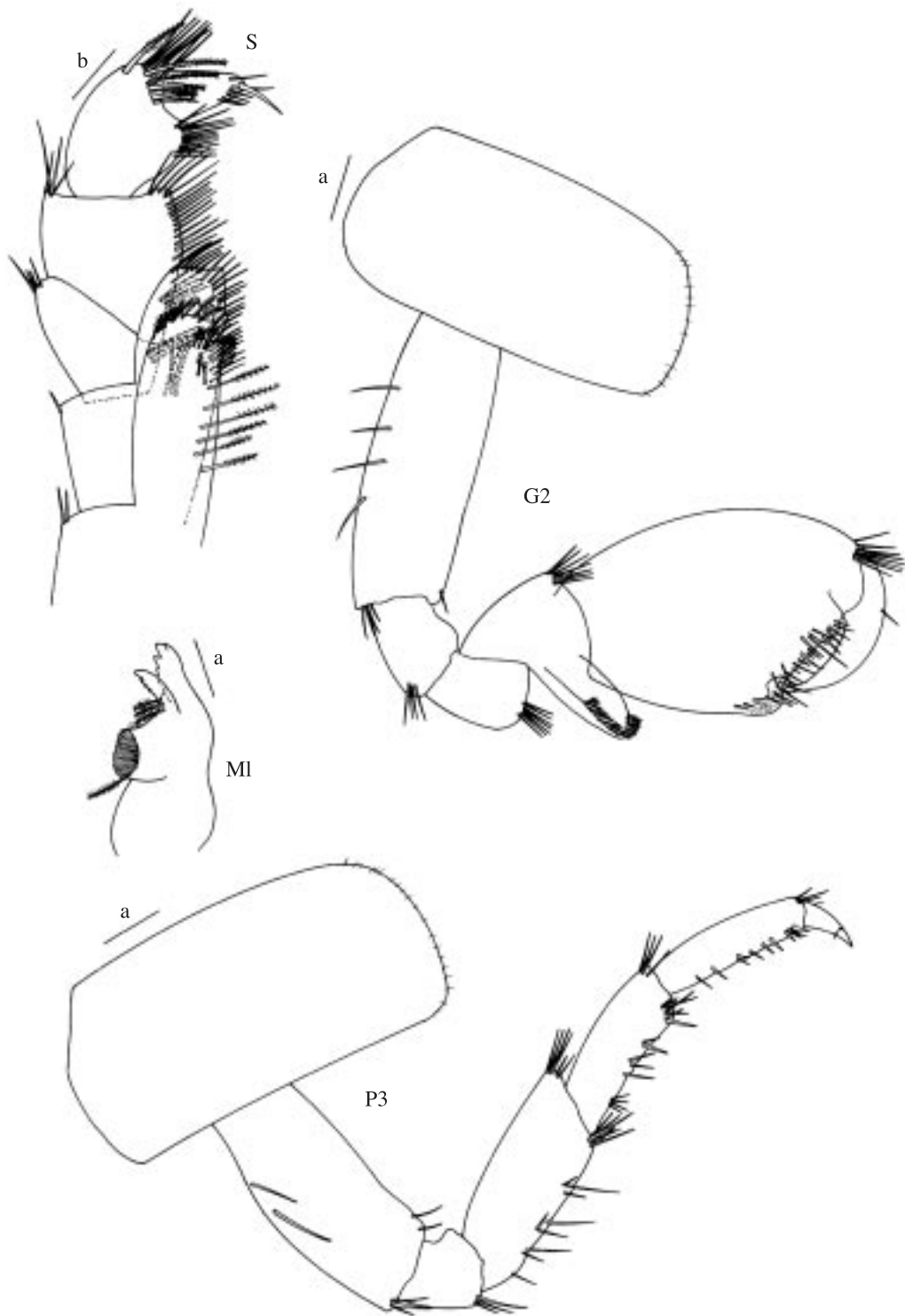


Fig. 2. *Hyalella faxoni* Stebbing, 1903, male 8.7 mm. Symbols and scale as in Fig. 1.

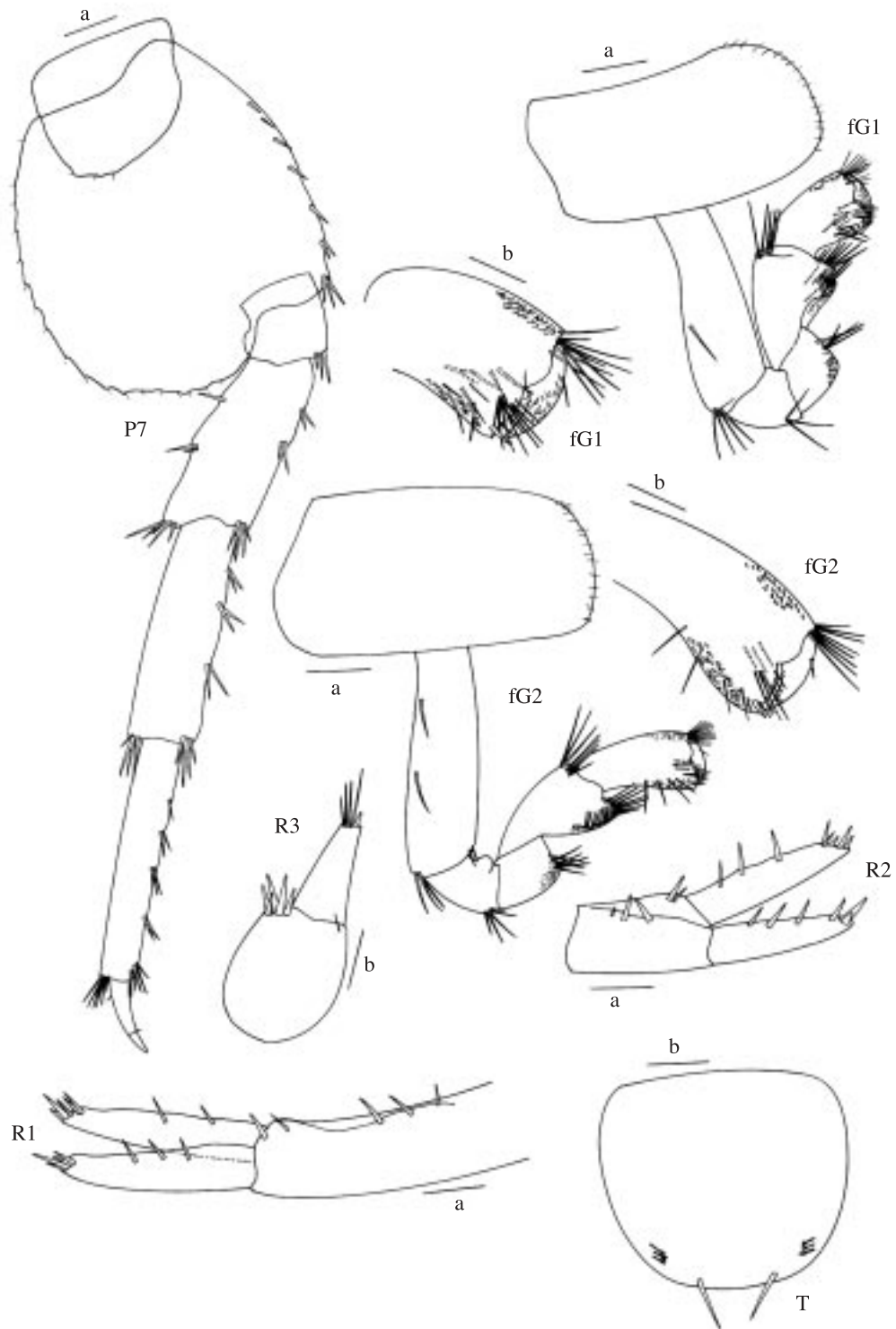


Fig. 4. *Hyalella faxoni* Stebbing, 1903, male 8.7 mm. Female "f" 6.9 mm. Symbols and scale as in Fig. 1.

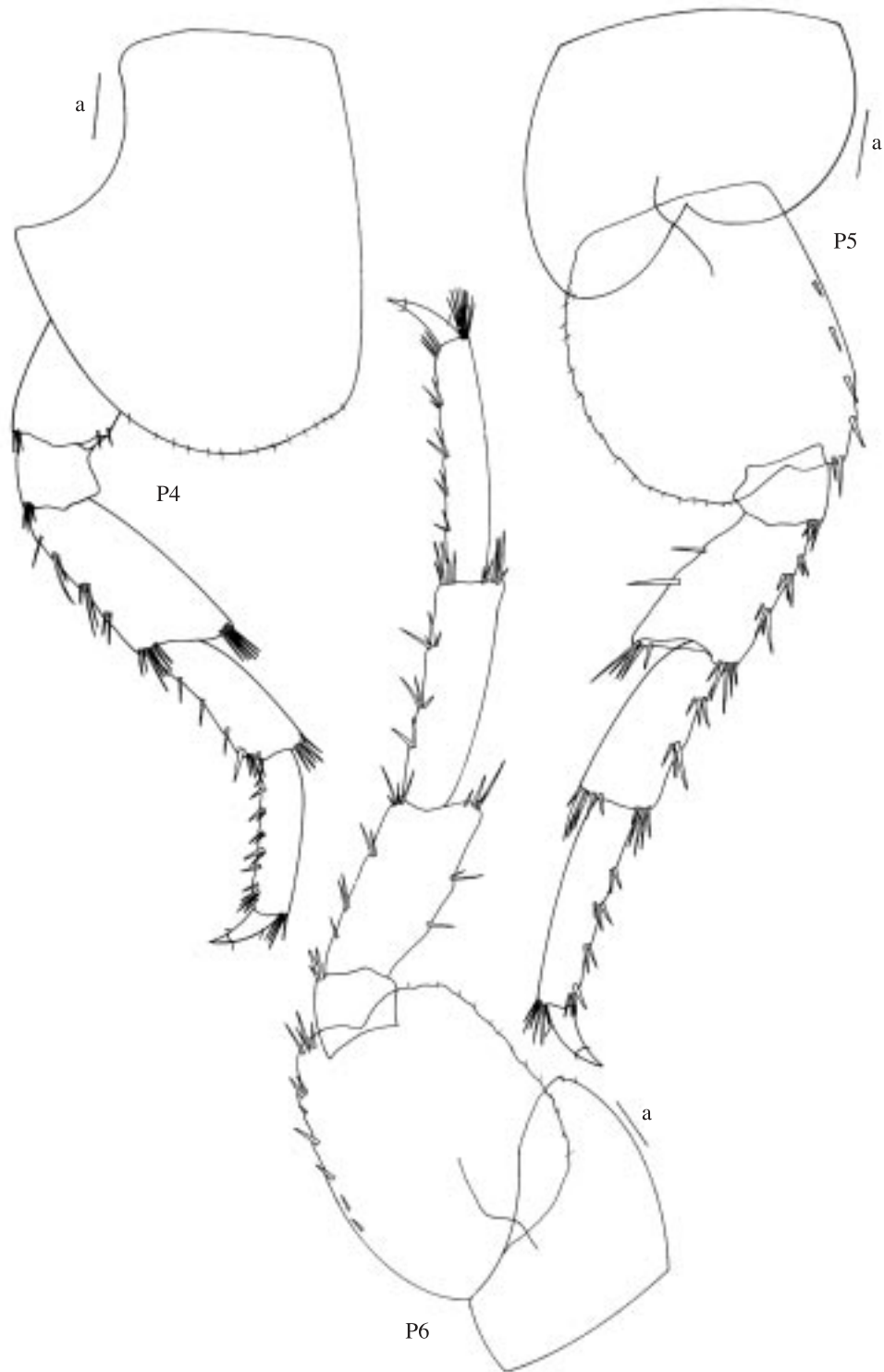


Fig. 3. *Hyalella faxoni* Stebbing, 1903, male 8.7 mm. Symbols and scale as in Fig. 1.

smaller than posterior lobe of peraeopod 7. Peraeopod 7 subequal to peraeopod 6, basis posterior lobe wider than deep (Fig. 2 P3; Fig. 3 P4, P5, P6; Fig. 4 P7).

Pleopods not modified; peduncle slender; longest ramus longer than peduncle.

Uropod 1 longer than uropod 2; peduncle longer than rami; rami subequal; inner ramus with two dorsal and five distal setae, all of them subequal, male without curved setae on inner side of the ramus; outer ramus with three dorsal and four distal setae; peduncle setation present (Fig. 4 R1).

Uropod 2 outer ramus shortened; inner ramus with three dorsal and five distal setae; outer ramus with three dorsal and three distal setae; peduncle setation present (Fig. 4 R2).

Uropod 3 longer than urosomite 3, shorter than peduncle of uropod 1, shorter than peduncle of uropod 2; peduncle globose, wider than ramus, with five strong distal and one marginal seta; inner ramus absent; outer ramus uniaarticulate, same length as peduncle, basal width more than two times tip of ramus, with four simple apical slender setae, and one connate seta (Fig. 4 R3).

Telson wider than long, entire, apically rounded, with two widely apart, long simple setae, symmetrically distributed on the apical margin (Fig. 4 T).

Coxal gills saclike, on segments 2 to 6. Sternal gills tubular, on segments 3 to 7.

Characters of female that differ from male: Size, 6.9 mm. Antenna 1 flagellum with ten articles. Antenna 2 similar in shape to male, flagellum with eleven to fourteen articles. Gnathopod 1 similar in size, and different in shape to gnathopod 2; similar to male gnathopod 1 in size and shape. Gnathopod 2 different from male gnathopod 2 in shape and smaller, propodus length two to three times maximum width, normally subchelate, palm slightly reverse oblique (Fig. 4 fG1, fG2).

Additional material: Volcan Barva, Costa Rica.

Habitat: Freshwater, epigeal, littoral.

Distribution: Volcan Barva and Volcan Reventado (Type material), Costa Rica, Central America.

DISCUSSION

General remarks: After the revision of the genus *Hyaella* (González and Watling, soon to be published elsewhere), the redescription of *H. azteca* (González and Watling 2002), and the redefinition of most of the morphological characters for the group, many of the species formerly in the synonymy of *H. azteca* will prove to be different species. We consider *H. faxoni* among those valid species. Although very similar to *H. azteca*, the species is different enough to be considered a separate species. The main difference is the telson, which is wider than long, apically rounded, with two widely separated long simple setae, whereas in *H. azteca* the telson is as wide as long, entire, apically pointed, with two apposed, long simple setae. Besides this main difference, other differences include: gnathopod 2 in the female has the palm of the propodus only slightly reversed; uropod 3, peduncle globose, wider than ramus, with five strong distal setae; palp in maxilla 1 is ogival; inner plate of maxilla 1 has four pappose setae. *H. faxoni* has smooth pleonites. The conditions where this species lives, isolated at high altitude in a rainforest type of environment, makes the genetic exchange with other populations rather difficult.

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RESUMEN

La especie *Hyaella faxoni* Stebbing, 1903 de Costa Rica es redescrita. Esta especie estaba previamente en la sinonimia de *Hyaella azteca* (Saussure, 1858). Se discuten en este trabajo las diferencias morfológicas entre las dos especies.

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