Explorations of the systematics and deep history of stygobiont amphipods
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Citation for published version (APA):
Vonk, R. (2003). Explorations of the systematics and deep history of stygobiont amphipods Amsterdam: IBED, Universiteit van Amsterdam

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Part C

Mid-Atlantic sea mount relicts and beach inhabitants of the Canary Islands.
Caecostenetroides ascensionis n. sp., a blind marine interstitial isopod (Asellota Gnathostenetroidoidea) from Ascension island, South Atlantic

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Received 30 May 1990, accepted 7 February 1991

The marine interstitial of the mid-Atlantic island Ascension yielded a new stygobiont isopod, Caecostenetroides ascensionis. It is thought to be a descendant of populations already present in the area at the opening of the Atlantic.

KEY WORDS: blind Isopoda, marine interstitial, Ascension island.

INTRODUCTION

The family Gnathostenetroididae Fresi et al. 1980, consists of four marine genera. Caecostenetroides Fresi & Schiecke 1968, is one of them and contains four species, all found in marine interstitial habitats in the intertidal zone. These species range from Japan (C. nipponicum Nunomura 1975) through the Mediterranean (C. ischitanum Fresi & Schiecke 1968) and Canary islands (C. ruderalis Stock & Vonk 1990) to Ascension.

Ascension is a mid-Atlantic volcanic island with a subaerial part of Pleistocene origin and a rather impoverished invertebrate fauna due to its isolated position and
young age (DUFFEY 1964). The rocky shore harbours few fine-grained beaches in which the infraunal crustaceans are mainly represented by tanaidaceans and some micro-oculat amphipods (*Elasmopus*).

**SYSTEMATIC PART**

**Caeccostenetroides ascensionis** n. sp.

*Material.* One \( \delta \) holotype, 1 \( \varphi \) allotype, 5 paratypes. Station 89/944,950: Ascension island, Hummock Point, extreme SE end of beach (UTM coordinates 57400 \times 912470), Bou-Rouch biophysical pump (see Bou 1975) in coarse quicksands, probe at 100 cm below the substrate surface, 16 November 1989 (deposited in Zoölogisch Museum Amsterdam, IS 105.455). Accompanying fauna: Ostracoda.

*Description.* Body length (cephalic frons to distal margin pleotelson) 3.2 mm (\( \varphi \) paratype) and 2.2 mm (\( \delta \) holotype). Body (Fig. 1A-B) about 10 times as long as wide, almost colourless, without eyes. Cephalic frons with rounded rostral process, not prominent.

Antennae 1 (Fig. 2A) 5-segmented; 1 long aesthetasc on apex of segment 5. Antenna 2 (Fig. 1C) peduncle segment 3 with small 1-segmented exopodite; flagellum 20 to 30-segmented.

Labrum (Fig. 2B) rounded; labium (Fig. 2C) with groups of subapical setae. Mandibles (Fig. 2D-E) with heavy incisors; left mandible (Fig. 2E) with 3-dentate lacinia mobilis; 4 serrated spines between incisor and molar; molar conical, with 4-5 subapical setae; palp 3-segmented, segment 2 with 2 barbed spines, segment 3 with 10-12 small spinules on inner margin and 1 heavy apical spine. Right mandible (Fig. 2D) with 7 spines between incisor and molar. No lacinia observed.

Maxilla 1 (Fig. 2F): outer lobe with 11-12 spines; inner lobe with 12 distal and subdistal setae and setules.

Maxilla 2 (Fig. 2G) with 3 lobes, outer and central lobe each with 3 pennate spines; inner lobe with 13 distal and mediiodistal setae, some of them barbed.

Maxilliped (Fig. 3C) with bald, tapering epipodite. Endite with straight medial margin with 3 coupling hooks opposing 2 on the other side; anterior margin with 4 short, rounded spines. Palp 5-segmented, segments 4 and 5 narrow.

Pereopod 1 (Fig. 3A-B): propodus elongate-rectangular, twice as long as wide, 1 long palmar angle spine, finely serrate on inner margin; palmar margin slightly convex with 3 axe-shaped finely serrate spines in \( \delta \), 4 in \( \varphi \). Dactylus with 4 denticulate teeth on inner margin; unguis less than half as long as dactylus.

Pereopods 2 to 7 (Fig. 4A-F) subsimilar. Ischium with 1 seta on widest part of anterior margin. Merus with 1 large seta on either distal end. Carpus with 2 setae on posterior margin except on P6 with 3 setae. Propodus with 4 heavy spines on inner margin, each tipped with a fine seta \( \delta \) P3 with 3 such spines, and 2 on carpus (Fig. 4B), P7 with 5 spines on propodus, without setae. Dactylus with 2 subequal claws. Remaining setation rather irregular.

Pleopods. Pleopods 1 (Fig. 6B) present in \( \delta \), lacking in \( \varphi \); large and operculiform, deeply cleft, covering all remaining pleopods. Pleopods 2 \( \delta \) (Fig. 5B) separate; basipodite with 1 medial spine; exopodite 1-segmented; endopodite segment 2 with a bundle of fine distal setae, no longitudinal grooves along the segments observed.
Fig. 1. — *Caecostenetroides ascensionis* n. sp. A, ♀ allotype 2.4 mm body lateral; B, ♀ paratype 2.5 mm antenna 2; C, ♂ holotype 2.2 mm body dorsal.
Fig. 2. — *Caecostenetroïdes ascensionis* n. sp. A, δ holotype 2.2 mm antenna 1; B, labrum; C, labium; D, right mandible; E, left mandible; F, maxilla 1; G, maxilla 2.
Caecostenetroides ascensionis n. sp.

Fig. 3. — Caecostenetroides ascensionis n. sp. A, ♂ holotype 2.2 mm pereopod 1; B, ♀ allotype 2.4 mm pereopod 1; C, ♂ holotype 2.2 mm maxilliped.
Fig. 4. — Caecostenetroides ascensionis n. sp. A, ♀ paratype 3.2 mm pereopod 2; B, ♂ holotype 2.2 mm pereopod 3; C, ♀ paratype 3.2 mm pereopod 4; D, pereopod 5; E, ♂ holotype 2.2 mm pereopod 6; F, pereopod 7.
Caecostenetroides ascensionis n. sp.

Fig. 5. — Caecostenetroides ascensionis n. sp. A, ♀ allotype 2.4 mm pleopod 2; B, ♂ holotype 2.2 mm pleopod 2; C, ♂ paratype 3.2 mm pleopod 3; D, pleopod 4; E, pleopod 5; F, ♀ allotype 2.4 mm uropod.
Pleopods 2 ♀ (Fig. 5A) fused, operculiform, with inconspicuous mediatorial notch. Pleopod 3 ♂ , ♀ (Fig. 5C) with 2-segmented exopodite and 1-segmented endopodite; endopodite with 2 plumose distal setae, exopodite with 2 distal setae. Pleopod 4 ♂ , ♀ (Fig. 5D) exopodite 2-segmented with 1 plumose distal seta; endopodite vaguely 2-segmented with 1 medial setule. Pleopod 5 ♂ , ♀ (Fig. 5E) uniramous, unsegmented, with 1 short plumose distal seta.

Uropod (Figs 5F, 6A); peduncle and rami richly setose; exopodite about 3/4 as long as endopodite.

Pleonites and pleotelson (Figs 1A-B, 6A): 2 free pleonites, well developed, not enclosed by pereonite 7. Lateral margin of pleotelson with numerous longer and shorter setae.

Marsupium (Fig. 1A) consisting of large overlapping heart-shaped, translucent plates without hairs, attached lateral to pereonites 2-5. On sternum of pereonites 2-4 smaller plates, probably also oostegites but with hairs, can be observed (Fig. 1A). Genital papillae not observed.

*Etymology.* The specific name refers to the type locality. Ascension island, South Atlantic.
Caecostenetroides ascensionis n. sp.

**Remarks.** The ♂ differs from the ♀ in the following respects:

(i) 3 barbed axe-shaped spines on palmar margin, versus 4 in ♀;
(ii) 2 spines tipped with setae on propodus and carpus of P2 in ♂, versus 4 on propodus and none on carpus in ♀;
(iii) gill-like processes only observed on P2-P4 in ♀.

*C. ischitanum* differs from *C. ascensionis* in having: 8 pectinate spines on the outer lobe of the first maxilla (versus 11-12); 3 apical spines on the mandible palp (versus 1); lacinia mobilis with 4 teeth (versus 3); shorter first antennae; gnathopod with 3 short spines on the inferior margin of dactylus (versus 4); ♂ pleopod 1 with lateral indentation (versus none); ♂ pleopod 2 endopodite without bundle of distal setae, exopodite 2-segmented (versus fused into 1 segment); ♀ pleopod 3 with 3 distal plumose setae on endopodite (versus 2); ♀ pleopod 4 with 2 distal plumose setae on exopodite (versus 1).

*C. ruderalis* differs from *C. ascensionis* in having: 13 spines on the outer lobe of maxilla 1 (versus 11-12); 2 apical spines on the mandible palp (versus 1); lacinia mobilis with 4 teeth (versus 3); distal sharp thin spines on outer lobes of maxilliped (versus blunt and broad); outer lobes of maxilla 2 with 4 pennate spines (versus 3); ♂ pleopod 1 with 4 distal spines (versus 3); ♂ pleopod 2 with 1 barbed distal spine on endopodite (versus brush-like bundle of setae), exopodite 2-segmented (versus fused into 1 segment); pleopod 3 with 3 distal plumose setae on endopodite (versus 2); pleopod 4 with 2 distal plumose setae on exopodite (versus 1).

*C. nipponicum* differs from *C. ascensionis* in having: 4 apical setae on the mandible palp (versus 1 spine); lacinia mobilis with 2 teeth (versus 3); 2 short aesthetascs on tip of antenna 1 (versus 1 long); thin palp of maxilliped (versus broad); outer lobes of maxilla 2 with 4 pennate spines (versus 3); ♂ pleopod 2 exopodite 2 segmented (versus fused into 1 segment).

**ZOOGEOGRAPHIC REMARKS**

Prior to our study, only two stygobionts were known from Ascension: the caridean shrimps *Typhlatia rogersi* Chase & Manning 1972, and *Procaris ascensionis* Chase & Manning 1972. These shrimps are thought to be descendants of epibenthic marine forms that colonized the island in recent times.

The asellote isopod superfamily Gnathostenetroidoidea Kussakin 1967 (correct. BOWMAN & ABELE 1982) derived early from the Asellota stem (KUSSAKIN 1973; FREST et al. 1980; WÄGELE 1983, 1990; WILSON 1987) and must have reached the island in a different way. The Asellota show a clear gradient of evolutionary advancement from freshwater (Aselloidea) through shallow marine (Gnathostenetroidoidea Stenetrioida) to deep sea habitats (Janiroidea) (HESSLER & WILSON 1983). The primary habitat of the Gnathostenetroidoidea is supposed to be in shallow marine waters and it is likely that radiation into e.g. blind *Caecostenetroides* — with a probably circumtropical distribution — took place in a continuous coastal environment, conditions such as prevailed during the existence of the Tethys Sea. Although the subaerial part of Ascension is not older than 1.5 million years (MITCHELL-THOMÉ 1982), there is no evidence against the supposition that a seamount might have existed in the area since the opening the Atlantic.
ACKNOWLEDGEMENTS

For financial support of the Ascension groundwater programme we are indebted to: NATO collaborative Grants Programme, Brussels, contract SA.5-2-05 (RG 001/88); Foundation for Scientific Research in the Tropics (WOTRO), The Hague, file W 09-99.122.89; Maatschappij voor Wetenschappelijk Onderzoek in de Tropen, Amsterdam; Amsterdamse Universiteits Vereniging, Amsterdam.

The contacts with Ascension were carefully prepared by Mr E. Mattey, Foreign and Commonwealth Office, West Indian and Atlantic Department, London. In Ascension we received greatly appreciated assistance from H.H. the Administrator, Mr J.J. Beale; various officers of the Police Office; Mr Graham Avis of Ascension island Services (B.B.C.); Mr Pat Booth, B.B.C. Power Manager; Mr Aubrey Peters (The Farm); and various members of the Ascension Historical Society. Transportation to and from Ascension was provided by the Royal Air Force.

Thanks are due to Drs H.P. Wagner who offered to stain the material which greatly enhanced the visibility of important characters.

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Psammogammarus stocki n. sp. (Crustacea, Amphipoda, Melitidae) from beach interstitia on Tenerife

Stygofauna of the Canary Islands, 21

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Keywords: Amphipoda, Melitidae, marine stygobiont, Tenerife, Psammogammarus, taxonomy

Abstract

A description is given of Psammogammarus stocki n. sp. from the interstitial of loose sediments in heavily exposed rockpools in the mediolittoral zone of Tenerife, Canary Islands. The species apparently represents the ultimate apomorphic condition within the genus and co-occurs with Psammogammarus initialis Stock & Sánchez, 1987, a species that exhibits more primitive features.

Résumé


Psammogammarus stocki n. sp. was sampled from coarse sediments in mediolittoral rockpools on the north coast of Tenerife. The samples also contained Psammogammarus initialis Stock & Sánchez, 1987, a remarkable fact since this species represents the most plesiomorphic condition within the genus, while Ps. stocki holds the opposite one. Both species are marine stygobionts, the usual habitat for Psammogammarus S. Karaman, 1955. The genus now comprises nine species occurring along the warm-temperate and tropical coasts of the Pacific, the Atlantic and the Mediterranean.

Material. – 1 ♂ holotype, 1 ♀ allotype, 11 paratypes. Canary Islands, Tenerife, Punta del Hidalgo.


Station 88-620B: 1 ♀ allotype, 2 ♀ ♀ paratypes, between cape Punta del Hidalgo and Punta el Guingo (UTM coord. CS 37050 x 316175), rockpool at high-water mark, BR pump 0.4 m under substrate surface; 2 Jan. 1989 (ZMA Amph. 108.693). Accompanying fauna: Melitidae.

Station 88-625: 1 ♀ holotype, 1 ♀ paratypes, 2 ♀ ♀ paratypes, boulevard of Punta del Hidalgo (UTM coord. 36987 x 316120) in gravel of rockpool in mediolittoral zone, 0.2 m under substrate surface, BR pump; 4 Jan. 1989 (ZMA Amph. 108.694). Accompanying fauna: Idunella spec., Melitidae, Bogidiellidae.

Station 88-630: 3 ♀ ♀ paratypes, between cape Punta del Hidalgo and Punta el Guingo (UTM coord. CS 37050 x 316175), rockpool at high-water mark, BR pump 0.3 m under substrate surface; 14 Jan. 1989 (ZMA Amph. 108.695). Accompanying fauna: Melitidae, Lysianassidae.

2 ♂ ♀ paratype specimens are also deposited in the Museo Nacional de Ciencias Naturales, Madrid, Spain, nr. 20.04/2.

Description. – Melitidae sensu Bousfield, 1973, emend. Stock, 1986. Length ♂ holotype 2.0 mm, ♀ allotype 1.9 mm. White, blind. Head lobes not incised (fig. 1a).

Antenna 1 (fig. 1d): peduncle segments 1 and 2 slightly inflated, second subequal to first. Acces-
Fig. 1. *Psammogammarus stocki* n. sp.: a, holotype 2.1 mm; b, pereopod 7 ♀ paratype 2.0 mm; c, pereopod 6 ♀ paratype 1.9 mm; d, antenna 1 ♀ paratype 1.8 mm; e, uropod 3 ♀ paratype 1.9 mm; f, id., pleopod 2; g, id., pleopod 1; h, pleopod 2 retinacula ♀ paratype 2.0 mm (after SEM photograph).
Fig. 2. *Psammogammarus stocki* n. sp.: a, gnathopod 1 \( \sigma \) paratype 1.9 mm; b, id., gnathopod 2; c, pereopod 3 \( \sigma \) paratype 1.8 mm; d, left mandible \( \varphi \) paratype 1.8 mm; e, maxilla 1 \( \sigma \) paratype 1.9 mm; f, id., maxilliped; g, id., right mandible with palp; h, lower lip \( \sigma \) paratype 2.0 mm; i, maxilla 2 \( \sigma \) paratype 1.9 mm.
sory flagellum 2-segmented, not overreaching tip of first flagellum segment. Flagellum 7-segmented; aesthetasc longer than corresponding segment, present on first through penultimate segment.

Antenna 2 (fig. 3d) slightly shorter than antenna 1. Peduncle segments 4 and 5 slender, subequal. Flagellum 5-segmented.

Upper lip (fig. 3i) triangular, with few setules on distal margin.

Mandible palp (fig. 2g) 3-segmented. Segment 1 naked, segment 2 with 4 ventral setae, segment 3 with 5 strong ventral setae; palp segment 3 slightly longer than 2.

Mandibular body (figs. 2d, g): Left mandible with 4, right mandible with 3 barbed spines between molar and pars incisiva. Left lacinia mobilis (fig. 2d) with 5 teeth; right lacinia (fig. 2g) smooth. Molar simple, without setae.

Lower lip (fig. 2h) with inner lobes, setulose.

Maxilla 1 (fig. 2e): Palps symmetrical; distal margin with row of 4 elements and 1 subterminal seta. Outer lobe with 7 spines; 4 spines barbed, 2 forked, outermost bold. Inner lobe small, oval, with 2 short and 2 long setae.

Maxilla 2 (fig. 2i) inner lobe with rudimentary oblique row of 4 setae.

Maxilliped (fig. 2f): Claw of palp longer than last segment. Outer plate with a row of paired setae on medial margin; no distal spines. Inner plate with 5 distal plumose setae.

Gnathopod 1 (fig. 2a): Coxal plate wider than long, with posterodistal notch. Merus swollen, rugose, with one long seta and 6 to 8 shorter ones. Carpus shorter than propodus, with serrate setae irregularly placed. Propodus with finely serrate palmar margin, margin delimited by 2 palmar angle spines which are almost split, a sensory hair protruding from it; palmar margin with 9 spines in \( \sigma \), 3 in \( \varphi \); palma transverse.

Gnathopod 2 (fig. 2b): Coxal plate wider than long, with posterodistal notch. Coxal gill oval, stalked, half as long as basis. Merus not swollen. Carpus of \( \sigma \) shorter than that of \( \varphi \). Propodus of \( \sigma \) larger than propodus of \( \varphi \), with bisinuate palm; 2 palmar angle spines. Palm of \( \varphi \) convex; 2 palmar angle spines; regular row of 4 to 5 palmar spines. Claw of \( \varphi \) more slender than that of \( \sigma \).

Pereopod 3 (fig. 3e) resembles P4 (fig. 3f). Coxal plates wider than long. Coxal gills elongate-oval, large, not stalked.

Pereopod 5 (fig. 2c): Coxal gill elongate-oval, longer than basis, not stalked. Coxal plate anterolobate. Posteroventral corner of basis lobate. Propodus with long distal spine. Claw small.

Pereopod 6 (fig. 1c) much longer than P5. Coxal gill elongate-oval, smaller than in P5, not stalked. Coxal plate slightly anterolobate. Basis lobate, slightly overhanging. Propodus with long distal spine.

Pereopod 7 (fig. 1b) longer than P6. Coxal plate non-lobate, no coxal gill. Merus and carpus with groups of heavy distal spines. Claw long and sturdy.

Epimeral plates 1 to 3 (fig. 1a) with 2 setules on posterior margin. Ventral margin with 1 spine.

Pleopods 1 to 3 (figs. 1a, f, g): Peduncle naked, except for two retinacula (fig. 1h); exopodite of pleopod 2 with swelling on first segment.

Uropod 1 (fig. 3g) with 1 dorsal peduncular spine. Exopodite slightly shorter than endopodite, both with 3 distal spines.

Uropod 2 (fig. 3h) without dorsal peduncular spine, otherwise resembling U1 but for its shorter length.

Uropod 3 (fig. 1e) long. Exopodite segment 2 as long as segment 1, with 3 thin distal setae. Segment 1 with distal groups of 3 and 4 spines. Endopodite very small, 1 spine distally.

Telson (fig. 3j) almost cleft entirely. Each lobe bluntly pointed, with 3 lateral spines and 1 dorsal pair of setules.

Oostegites (figs. 2c, 3a, e, f) linear, short, with 1 or 2 subdistal setules; present from gnathopod 2 through pereopod 5.

Remarks. — Using the characters described by Notenboom (1988: 170) in a numerical phylogenetic analysis of a large group of genera in the Melitidae (Melitidae sensu Bousfield, 1973, emend. Stock, 1986) an apomorphous state is found for Ps. stocki in 13 out of the 21 described character transformation series. This is the highest count within Psammogammarus except for Ps. gracilis Ruffo & Schiecke, 1976, which equals Ps. stocki. Ps. gracilis
Fig. 3. *Psammogammarus stocki* n. sp.: a, gnathopod 2 ♀ paratype 1.8 mm; b, pereopod 4 ♂ paratype 1.9 mm; c, gnathopod 1 ♀ paratype 1.8 mm; d, antenna 2 ♂ paratype 2.0 mm; e, pereopod 3 ♀ paratype 1.8 mm; f, id., pereopod 4; g, uropod 1 ♂ paratype 1.9 mm; h, id., uropod 2; i, upper lip ♀ paratype 1.8 mm; j, id., telson.
was found in 5 m deep coastal water of the Mediterranean island of Malta.

Stock & Sánchez (1987: 275) used for their delimitation of the genus *Psammogammarus* s. l. some 12 characters in which *Ps. stocki* would have, next to *Ps. gracilis*, 11 apomorphpous states.

As the above predicts — although it does not necessarily have to follow — the phenetic similarities between *Ps. stocki* and *Ps. gracilis* are large. Differences reside in: the palm and armature of the second gnathopod; where *Ps. stocki* has 2 palmar angle spines placed near to each other, *Ps. gracilis* has 1 spine on the angle and 1 spine farther down the curved palm. Pereopods 5 and 6 have distal propodal spines exceeding the length of the claw in *Ps. stocki*, not so in *Ps. gracilis*. Endopodite of uropod 3 has 1 distal spine in *Ps. stocki*, 2 in *Ps. gracilis*.

Palmar shape and armature of the second gnathopod of *Ps. caecus* S. Karaman, 1955, *Ps. garthi* Barnard, 1952, and more so of *Ps. initialis* Stock & Sánchez, 1987, resemble that of *Ps. stocki* quite closely. Other character states, however, are scattered over several species in the genus in a seemingly uncorrelated way (Stock & Sánchez, 1987).

**Etymology.** — The species name is proposed in honour of Dr. Jan H. Stock, Professor of Systematic and Geographic Zoology at the University of Amsterdam, in recognition of his numerous fine contributions to the knowledge of subterranean amphipods.

**Acknowledgements**

In the course of the research project on the origin of insular groundwater biotas in the Atlantic, financial support has come from: NATO Collaborative Research Grants Programme, contract SA.5-2-05 (RG.0011/88); ERASMUS programme, contract ICP 88-0079 NL.

The hospitality of the staff of the Departamento de Zoología, Universidad de La Laguna (Director: Prof. Dr. M. Ibáñez González) is gratefully acknowledged and in particular the help of Elias Sánchez in collecting part of the material.

I wish to thank H.P. Wagner for staining part of the material, D. Platvoet for taking SEM photos and M. Scheepmaker for the French translation. Special thanks are due to Jan Stock for providing the possibilities for the field- and laboratory-work and for the times I was in his inspiring company during collecting trips.

**References**


Received: 3 February 1990
A new marine interstitial ingolfiellid (Crustacea, Amphipoda, Ingolfiellidea) from Tenerife and Hierro

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Key words: Crustacea, Amphipoda, Ingolfiella canadiensis n. sp., Tenerife, marine interstitial

Abstract

Ingolfiella canadiensis n. sp., from coarse sand and gravel in the mediolittoral zone of Tenerife and Hierro, Canary Islands, is described. The new species shares supposedly apomorphous characters with species from comparable habitats from the Andaman Islands, Bermuda and Curacao (Netherlands Antilles). The female of Ingolfiella similis Rondé-Broekhuizen & Stock, 1987, from Fuerteventura is also described.

Introduction

Along the rugged northwest coast of Tenerife many good sampling sites for interstitial stygobionts are present. The narrow volcanic sand beaches sheltered by capes and ridges of recent lava outflows harbor Ingolfiella, Bogidiella, Psammogammarus and other still unidentified eyeless and microphthalmous amphipods.

The genus Ingolfiella now consists of 28 species, I. canadiensis n.sp. included. Recently Ruffo & Vigna-Taglianti (1989) divided the genus into 7 subgenera. They drew the conclusion from their cladogram that Ingolfiella is divided into two distinct groups of subgenera characterized by the presence or absence of ocular lobes. The first group occurs in the marine environment (Ingolfiella s. str., Hansenliella, Tethydiella). The second group is associated with fresh- and anchihaline waters. The two groups seem well defined from an ecological point of view.

Biogeographically, they are less well defined for information about the male is often lacking in species from marine shallow waters. This may account for the disjunct areas in which species of these subgenera occur.

Since I. canadiensis could not be placed in either the subgenera Tethydiella Ruffo & Vigna-Taglianti or Gevgelia S. Karaman (sensu Stock, 1976) to which it comes closest when character states are compared, we refrain from subgeneric division.

Ingolfiella canadiensis n. sp.

Material

TENERIFE (Canary Islands), 1 ♂ holotype. Station 88-594: Punta del Hidalgo, Playa de los Troches (UTM coordinates CS 37170 x 316110), 0.3 m under sediment surface, low-tide mark, Bou-Rouch (BR) biophsreatical pump (see Bou, 1975); 12 Dec. 1988 (Zoologisch Museum Amsterdam, ZMA, Amph. 108.650).
7 ♀ ♂ paratypes. Stn. 88–592: Punta del Hidalgo, beach in harbor (UTM coord. CS 36985 x 316015), 0.5 m under sediment surface, low-tide mark, BR pump; 10 Dec. 1988 (ZMA Amph. 108.651).

2 ♀ ♂ paratypes. Stn. 88–593: Punta del Hidalgo, beach left of harbor (UTM coord. CS 36975 x 316015), 0.4 m under sediment surface, low-tide mark, BR pump; 11 Dec. 1988 (ZMA Amph. 108.652).

4 ♀ ♂ paratypes. Stn. 88–596 B: boulevard of Punta del Hidalgo (UTM coord. CS 36987 x 316120), in gravel of rockpool in mediolittoral zone, 0.5 m under sediment surface, BR pump; 12 Dec. 1988 (ZMA Amph. 108.653).

3 ♀ ♂ paratypes. Stn. 88–616 A: Punta de Teno, small bay (UTM coord. CS 31175 x 313630), 0.4 m under sediment surface, low-tide mark, BR pump; 29 Dec. 1988 (ZMA Amph. 108.654).

1 ♂, 1 ♀ paratypes. Stn. 88–616 B: same locality as previous station, a few metres higher on the beach in coarse volcanic debris, 0.5 m under sediment surface, BR pump; 29 Dec. 1988 (ZMA Amph. 108.655).

1 ♀ paratype. Stn. 88–617; Punta de Teno, north beach (UTM coord. CS 31175 x 313655), strong swell, 0.2 m under sediment surface in coarse gravel between boulders, BR pump; 29 Dec. 1988 (ZMA Amph. 108.656).

1 ♂, 10 ♀ ♂ paratypes. Stn. 88–635: Mesa del Mar, beach left of hotel Sol y Mar (UTM coord. CS 36060 x 315325), tidepool at high-water mark, fine volcanic gravel, 0.3 m under sediment surface, BR pump; 16 Jan. 1989 (ZMA Amph. 108.657).

7 ♀ ♂ paratypes. Stn. 87831: boulevard of Punta del Hidalgo (UTM coord. CS 36987 x 313120), in washings of gravel and sand in rockpools in the mediolittoral zone; 23 Apr. 1987 (ZMA Amph. 108.658).

1 ♀ paratype. Stn. 87–20: same as previous station; 19 Apr. 1987 (ZMA Amph. 108.659).

EL HIERRO (Canary Islands)

1 ♂, 5 ♀ ♂ paratypes. Stn. 87–47: Tamaduste, harbor (UTM coord. BR 21515 x 308120), Karaman-Chappuis method (digging a hole) in muddy sand in mediolittoral zone; 29 Apr. 1987 (ZMA Amph. 108.660).

4 ♀ ♂ paratypes. Stn. 88–560: La Restinga, Jameos del Puerto (UTM coord. BR 20590 x 306075), in volcanic debris of anchialine cave, washings of gravel, conductivity 50.5 mS/cm; 13 Nov. 1988 (ZMA Amph. 108.661).

Description

Body length up to 1.8 mm. Body (Fig. 1) elongate; body somites about as long as high, bearing few setules. ‘Ocular lobe’ present, triangular.

First antenna (Fig. 3d) with 3 stout peduncle segments and 4-segmented flagellum; aesthetasc on 3 last flagellar segments and also a ribbed small aesthetasc-like structure on distal margin of terminal flagellum segment.

Second antenna (Fig. 3i) with 5-segmented peduncle (Fig. 1) and 5-segmented flagellum; terminal segment with aesthetasc-like structure on distal margin.

Right mandible (Fig. 4i) with 7 teeth on pars incisiva; lacinia mobilis with several small teeth; pars molaris sharply pointed. Left mandible (Fig. 4h) with fewer teeth on pars incisiva and lacinia mobilis; barbed spinules at base of lacinia mobilis.

First maxilla (Fig. 4a, j) with rounded inner lobe bearing 3 setae (2 in ♂); outer lobe with 6 spines of which innermost denticulate and the second trifid; 2-segmented palp with 2 apical setae.

Second maxilla (Fig. 4f) with 5 naked apical setae on outer lobe and 4 on inner lobe.

Maxillipeds (Fig. 4d) with pointed endite bearing one seta; palp 5-segmented with 2 apical setae.

Coxal gills (Fig. 1, 4e) present on pereopods 3 to 5.

First gnathopod (Fig. 2d, e) with basis longer
Fig. 1. *Ingolfiella canariensis* n. sp., male holotype, 1.8 mm. Playa de los Troches, Tenerife.

Fig. 2. *Ingolfiella canariensis* a. sp., paratypes. a, second gnathopod♀, a' inset drawn after a SEM photo; b, second gnathopod♂; c, third pereopod♀; d, first gnathopod♂; e, first gnathopod♂; f, telson,♂; g, first uropod♂.

than ischium and merus combined; merus with 1 seta anterodistally; carpus relatively elongate, palm bearing 4 spines: 1 long, 3 short and 3 Y-shaped spinules with a sensory hair coming out of the core; dactylus with 4 sharply pointed teeth.

Second gnathopod (Fig. 2a, b) carpus more oval than of first gnathopod; palm carrying 3 spines and 3 Y-shaped spinules; margin with 8 serrations (inset a' of Fig. 2a drawn after a SEM photo). In the male a heavy forked spine near the palmar margin is present, as well as a foliaceous structure hanging from the posterior margin of the merus; dactylus with four sharp teeth.

Third pereopod (Fig. 2c) with trifid unguis (Fig. 4g). Fourth pereopod similar to third. Oostegites small and suboval (Fig. 4e), sometimes with 1 seta.

Fifth pereopod (Fig. 3a) robust, short, with broad basis; heavy spines on merus, carpus and propodus; dactylus separated from unguis by a very faint demarcation line; unguis bifid. Oostegite small, suboval. Coxal gill present.

Sixth pereopod (Fig. 3b) more slender and longer than fifth; dactylus faintly separated from unguis; unguis bifid.
Seventh pereopod (Fig. 3c) more slender and longer than sixth; merus with 2 long spines on distoposterior corner; carpus with 6 distal spines and 1 spoon-shaped denticulate element; dactylus faintly separated from unguis; unguis bifid.

Pleopods (Fig. 3f, g, g) triangular. First pleopod in male with two distal spinules.

First uropod (Fig. 2g, 4c) biramous; peduncle with 2 setae; exopodite pointed, bearing 1 seta; endopodite longer and wider than exopodite; medial surface with 7 long setae; apex with 4 to 5 spiniform processes.

Second uropod (Fig. 3e, 4b) peduncle carrying 3 rows of spinules, bifid at tips; rami subequal, curved, pointed; exopodite with 3 setae, endopodite with 2 setae.

Third uropod (Fig. 2f) small, 2-segmented; first segment with 2 setae; second segment square at apex with 1 long distal seta.

Telson (Fig. 2f) with 2 setae.

**Etymology**

Named after the Canary Islands.

**Remarks**

The male differs from the female in the following respects:

- On the carpus of the second gnathopod a
broad, stubby, forked spine is present near the palmar margin.

- On the merus of the second gnathopod a transparent foliaceous process is present in the same position of a normal seta in the female (this process has a different structure than the 'sackartigen Gebilde' on the carpus of I. petkovskii S. Karaman, 1957 where it is clearly made up of two segments - rather like an aesthetasc - or than the spiniform and ciliated process as in, for instance, I. putealis Stock, 1977).

- There are 2 spinules at the distal end of the first pleopod (naked in δ).

- Peduncle of the second uropod with a sub-basal, hook-shaped spine.

Only those species possessing a 4-toothed dactylus on the first and second gnathopods, and having dissimilar claws on the third to seventh pereopods, are considered. These conditions seem to be derived because they stand out against the 'normal' gammaridean condition (Dahl, 1977). Most other species in Ingolfiella have 0–3 teeth on the dactylus of the gnathopods and claws of similar form in the third to seventh pereopods. I. kapuri Coineau & Chandrasekhar, 1972 (Andaman and Nicobar Islands, mediolittoral), I. longipes Stock, Sket & Iliffe, 1987 (Bermuda, anchihaline), and I. quadridentata Stock, 1979 (Curacao, infralittoral) share these character states with I. canariensis. The species are known through females only, however.

I. kapuri differs from I. canariensis in having: 3 palmar spines on the carpus of first gnathopod (versus 4), 7 serrations on palmar margin of carpus of second gnathopod (vs. 8); heavier unguicular spines pereopod dactylus; 1 spine on exopodite of first uropod (vs. 0 in φ, 1 in δ); seventh pereopod with 1 long spine on posterodistal corner of merus (vs. 2). The mouthparts of I. kapuri are not described.

I. longipes differs from I. canariensis in having: 3 spines and 2 setae on outer lobe of first maxilla (vs. 6); 1 distal spine on terminal segment of maxilliped palp (vs. 2); a spoon-shaped denticulated element on the carpus of the seventh pereopod (vs. absent); 7 serrations on the palmar margin of second gnathopod carpus (vs. 8); first gnathopod without sensorial setae near edge of palmar margin; oval third pleopod (vs. triangular); bifid dactylus of third and fourth pereopods (vs. trifid).

I. quadridentata differs from I. canariensis in having: 1 palmar spine on carpus of first gnathopod (vs. 4); unguis of third and fourth pereopods simple with inner row of spinules (vs. trifid without spinules); carpus with 2 modified spines posterodistally (vs. absent). Of I. quadridentata the mouthparts are not described.

I. xarifae Ruffo, 1966, female, from shallow reefs in the Maldives, has a striking resemblance to I. canariensis especially with respect to gnathopod setation and spination, as well as other features of pereopodal dactylus. However, the dactylus of the first gnathopod has 3 teeth on the inner margin, while the second gnathopod has 4. This character needs to be checked in the two existing specimens, and the mouthparts are to be described.

Ingolfiella similis

Ref.: Rondé-Broekhuizen & Stock, 1987, p. 441–450

Material

FUERTEVENTURA (Canary Islands).

1 φ. Station 87–119: end of Barranco de los Molinos (UTM coord. ES 59175 × 315760) method Karaman-Chappuis, conductivity 12.6 mS/cm; 6 May 1987 (ZMA Amph. 108.690).

1 δ. Stn. 87–77: Las Playitas (UTM coord. ES 59990 × 312315) well about 500 m from the sea, cond. 10.7 mS/cm; 6 May 1987 (ZMA Amph. 108.689).

Description of female

Body similar to that of male; all appendages as in male (see Rondé-Broekhuizen & Stock, 1987)
except for those described below: second gnathopod (Fig. 5a) without reversed element on lower margin of carpus; first pleopod without spines; second uropod without subbasal hook-shaped spine; oostegites oval.

Zoogeographic remarks

Geological data from the Canary Islands suggest that at least the western islands are separate volcanic edifices with an overall irregular and complex decrease in age from east to west. They evolved independently for at least the last 20 million years (Rondé-Broekhuizen, unpublished). Hierro, the youngest and westernmost island has a subaerial existence of 0.75 My, while Tenerife surfaced 15.7 My ago (Pitman & Talwani, 1972). They are separated by 3000 m deep water.

I. canariensis is found in marine groundwater of both islands. This fact suggests three possible explanations:

- I. canariensis spread, actively or passively (ships, not vicariance), from Tenerife to Hierro;
- it lives not only in the mediolittoral but also on the ocean floor and, when seabottom eruptions occur, follows the rise of a volcanic slope until it reaches shallow water;
- or I. canariensis invaded both islands only very recently, having evolved into a mediolittoral stygobiont from a common marine benthic ancestor.

The second explanation requires fewer speculative steps and is favored. In this case it should be possible to find I. canariensis also on the other western Canary Islands, i.e. La Palma, Gomera and Gran Canaria and in the seabed between those islands. For that matter; ingolfiellids have earlier been found in oceanfloor debris at great depths (I. abyssi Hansen, 1903; I. atlantis Mills, 1967) and in dredge samples from bottoms of shallow water (I. britannica Spooner, 1960; I. fuscina Dojiri & Sieg, 1987).

Boxshall (1989) remarks that the idea of a marine crevicular fauna that is interconnected from one island to the other through deep water populations (Hart, Manning & Iliffe, 1985), can be termed a 'continuous crevicular corridor hypothesis'. He considers this hypothesis 'has considerable merit when explaining distributions between different islands within a particular archipelago, such as the Canary islands, but that it is implausible merit when explaining distributions between remote island systems surrounded by ocean floor covered by a significant depth of pelagic sediments'. As to the affinities with such distinctly located species as I. kapuri (Andaman and Nicobar Island), I. longipes (Bermuda) and I. quadridentata (Curaçao); they all live in coastal habitats in the former realm of the circumtropical Tethys Sea (early Cretaceous, Smith et al., 1981) and their phenetic similarities may stem from the time that gene flow was continuous.

Acknowledgements

In the course of the research project on the origin of insular groundwater biotas in the Atlantic financial support has come from NATO Collaborative Research Grants Programme, contract SA. 5–2–05 (RG.0011/88); ERASMUS programme, contract ICP 88–0079 NL; NWO, Den Haag. The hospitality of the staff of the Departamento de Zoología, Universidad de La Laguna (Director: Prof. Dr. M. Ibáñez Genís) is gratefully acknowledged.

Also we wish to thank Drs. H.P. Wagner for staining part of the material, D. Platvoet for taking SEM photos and Prof. Dr. J.H. Stock for critically reading the manuscript and for providing material from Fuerteventura.

References


