

***Ikosipodoides seychellensis*, a new genus and species of interstitial polychaetes (Dorvilleidae) from the island of Mahé, Indian Ocean**

Wilfried WESTHEIDE

University of Osnabrück, Department of Biology/Chemistry, Systematic Zoology,
D-49069 Osnabrück, Germany

Fax: (49)-541-9692587, e-mail: westheide@biologie.uni-osnabrueck.de

Abstract: The dorvilleid *Ikosipodoides seychellensis* gen. et sp. nov. from shallow sands on a reef flat of the island of Mahé is described. The new species is in general very similar to the taxon *Ikosipodus* Westheide, 1982 but lacks a jaw apparatus and has 7 instead of 10 chaetigerous segments. Its evolutionary origin is discussed.

Résumé : *Ikosipodoides seychellensis*, nouveau genre, nouvelle espèce de Dorvilleidae, Polychète interstitiel de l'Ile de Mahé, Océan Indien. Le Dorvilleidae *Ikosipodoides seychellensis*, gen. et sp. nov. vivant dans des sables peu profonds d'un platier récifal de l'île de Mahé est décrit. La nouvelle espèce est dans l'ensemble très semblable au taxon *Ikosipodus* Westheide, 1982 mais elle en diffère par l'absence de mâchoires et le nombre de segments sétigères qui est de sept au lieu de dix. Son origine évolutive est discutée.

Keywords : Polychaeta, Dorvilleidae, interstitial animals, progenesis.

Introduction

Lower intertidal or shallow subtidal regions of sand beaches throughout the world are inhabited by one or another species of tiny dorvilleid polychaetes, a group for which an evolutionary origin by progenesis is currently under discussion (Westheide, 1982, 1987; Westheide & Riser, 1983; Eibye-Jacobsen & Kristensen, 1994). Extensive collections from a narrow sand beach adjacent to a reef flat on the Seychelles island of Mahé have now revealed a representative of this taxon here as well. Phylogenetic analysis of these species is complicated to no slight extent

by their lack, whether complete or partial, of a mosaic of structures ordinarily belonging to the basic morphological plan of adult Eunicida (Westheide, 1982; Westheide & Riser, 1983; Orensanz, 1990; Hilbig, 1991; Eibye-Jacobsen & Kristensen, 1994). In the shape of the prostomium and the chaetation the new species most closely resembles the extant taxon *Ikosipodus* Westheide, 1982; however, it differs fundamentally from the latter in that it has no jaw structures. One possible conclusion to be drawn, namely that there have been multiple independent reductions of jaws within the Dorvilleidae, is not without crucial implications for phylogenetic reasoning in the evolutionary analysis of this group and also affects the taxonomic decision of Eibye-Jacobsen & Kristensen (1994) to include the dinophilid genera in the Dorvilleidae.

Material and methods

The animals were extracted from the sand with a $MgCl_2$ solution isotonic to seawater (for details see Westheide & Purschke, 1988) and sorted under a stereo microscope at high magnification. Initial investigation with a compound microscope (Leitz Dialux), tracing with a camera lucida, and photography took place while the animals were still alive but immobilized by $MgCl_2$. Fixation was carried out by adding a drop of Bouin's fluid at one side of the coverslip.

Results

Ikosipodoides, new genus

Diagnosis. Dorvilleid with a prostomium, a two-part peristomial region, seven chaetigerous segments, and a pygidium. One pair of ventrolateral prostomial appendages (= palps); three anal appendages. Uniramous parapodia, with acicula and compound chaetae. Muscular pharyngeal bulb, without jaw elements.

Etymology. Generic name refers to the similarity to the taxon *Ikosipodus*.

Ikosipodoides seychellensis, new species

Figs 1-3

Type locality

Republic of Seychelles, Mahé Island, southern part, east coast, 50°31'E and 4°47'S. Reef flat in front of the beach "Anse Forbans" (22nd February 1999). Relatively coarse coral sand, at 0.3 m depth (at low tide).

Material examined

Two living specimens, both photographed (Figs 1, 2), one of these fixed and whole-mounted (holotype).

Type material

Holotype: a mounted mature female specimen deposited at the Senckenberg Museum, Frankfurt/Main (SMF 8890), on which the description is based.

Description and species diagnosis

Almost colourless and transparent. Epidermis dappled with irregularly rounded, strongly refractive glandular inclusions, especially in the prostomium (Figs 1, 2A, B). Length of mature specimen, with seven chaetigerous segments, 0.7 mm; width 75 μ m (base of prostomium) to 100 μ m (middle of body, without parapodia); juvenile specimen (with four chaetigerous segments) 0.4 mm long.

Body divided into head (prostomium and peristomium), trunk, and pygidium. All regions, including each segment, distinctly delimited. Prostomium almost as long as basal width (75 μ m); posteriorly becoming distinctly narrower,

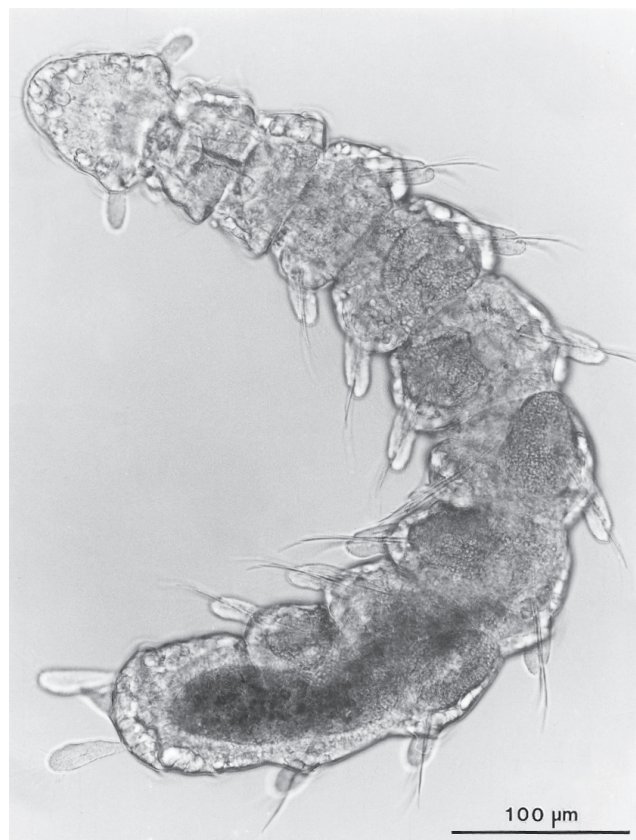


Figure 1. *Ikosipodoides seychellensis*, gen. et sp. nov.. Photomicrograph of a living specimen (holotype).

Figure 1. *Ikosipodoides seychellensis*, gen. et sp. nov.. Microphotographie d'un spécimen vivant (holotype).

with smoothly rounded anterior end. Two slender ventrolaterally attached palps (length ca. 25 μ m) on posterior part of prostomium. Peristomium distinctly subdivided into two regions of almost equal length and

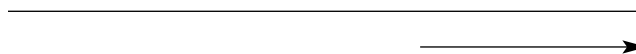
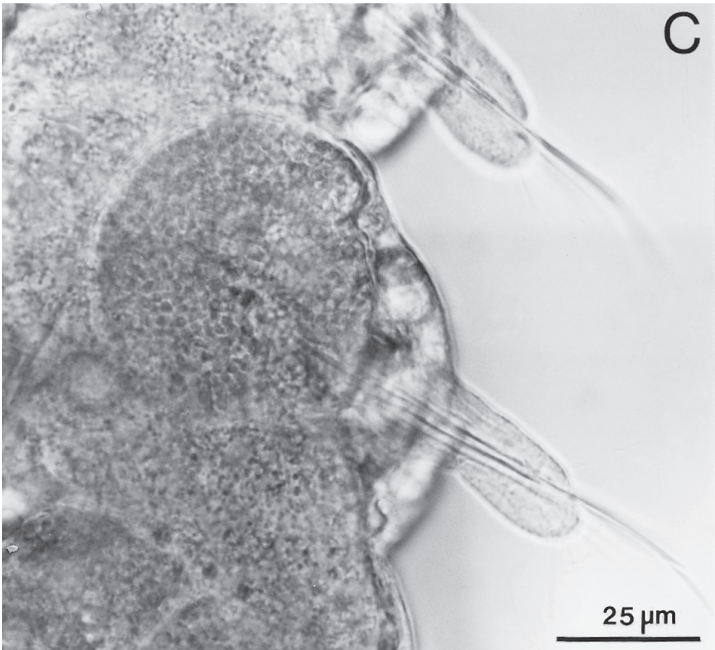
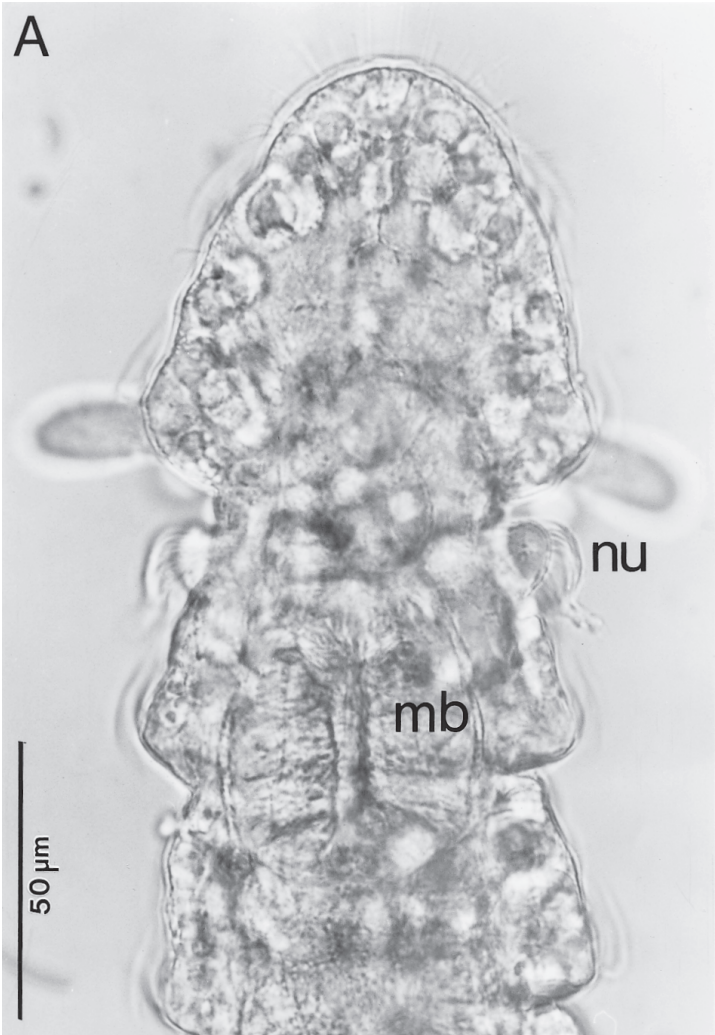


Figure 2. *Ikosipodoides seychellensis*, gen. et sp. nov.. Photomicrograph of living specimens A-C, holotype. **A** Prostomium and peristomium, (nu) nuchal organ, (mb) muscular bulb. **B** Interference micrograph of head region showing refractive glandular inclusions. **C** Third and fourth chaetigerous segments: vitellogenic oocyte, parapodia and chaetae. **D** Juvenile specimen.

Figure 2. *Ikosipodoides seychellensis*, gen. et sp. nov.. Microphotographies de spécimens vivants A-C, holotype. **A** Prostomium et péristomium, (nu) organe nuchal, (mb) bulbe musculaire. **B** Région céphalique et ses inclusions glandulaires réfringentes en microscopie interférentielle. **C** Troisième et quatrième segment sétigère: ovocyte en vitellogenèse, parapodes et soies. **D** Spécimen juvénile.



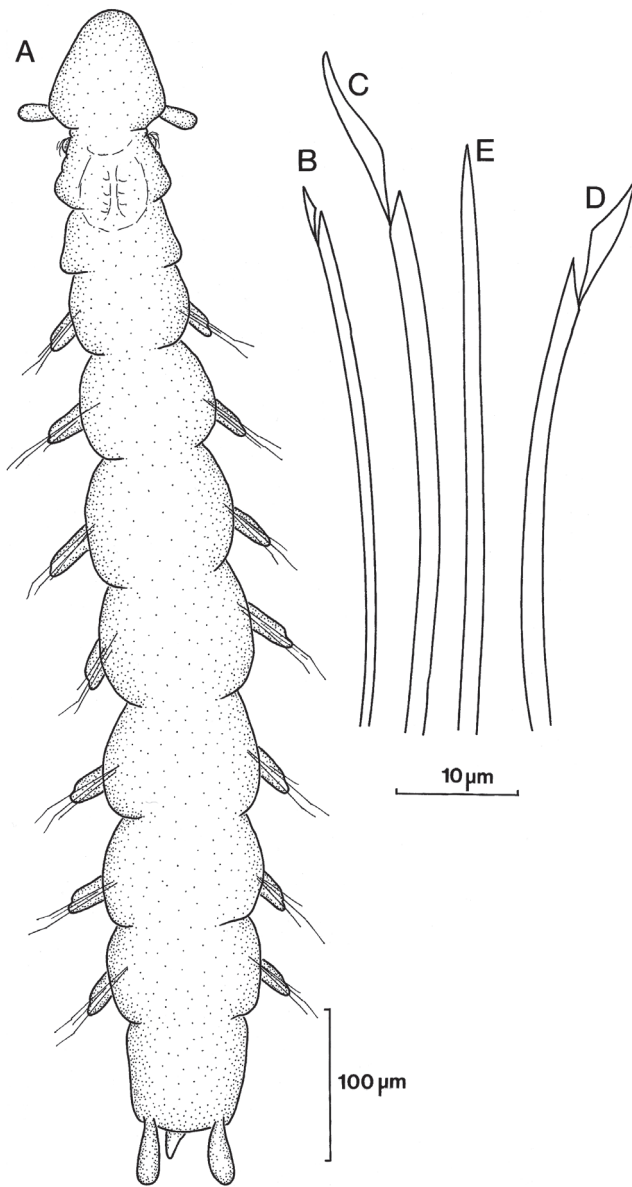


Figure 3. *Ikosipodoides seychellensis*, gen. et sp. nov. A Habitus, dorsal view. B, C, D Compound chaetae. E Acicula.

Figure 3. *Ikosipodoides seychellensis*, gen. et sp. nov. A Habitus, vue dorsale. B, C, D Soies composées. E Acicule.

shape, without any appendages. First region anteriorly much narrower than posterior part of prostomium, becoming gradually wider posteriorly. Second part similarly constructed. Pigmented eyes absent. Paired nuchal organs forming distinct hemispherical projections, laterally situated in anterior part of the first region of peristomium; each with tuft of relatively long, posteriorly oriented cilia (Fig. 2A). Prostomium with two rings of cilia, two regions of the peristomium each with one such ring. On tip of prostomium several short stiff, probably sensory cilia (sensoria).

Muscular bulb in first apodous region, projecting into following one (Fig. 2A). Jaw-like structures not detected.

Chaetigerous trunk segments barrel-shaped. Parapodia uniramous, inserted laterally at about the middle of the segments; undivided simple rami with apparently round cross-section, distally with anterior notch; with several stiff cilia. Each parapodium with completely straight, tapering acicula (Fig. 3E) and three to four protruding chaetae, compound heterogomphs. Distal appendages unidentate with different lengths (Figs 3B-D).

Pygidium nearly twice as long as last chaetiger. Posterior border smoothly rounded. With two rings of cilia. Two paired, club-shaped, distally wider, anal appendages (length ca. 40 µm). Between these, a completely different stubby, tapered median stylus (length ca. 20 µm), ventrally situated. One vitellogenic oocyte each in chaetigers 2 to 7.

Discussion

Although the available material is scant, comprising one adult and one juvenile specimen, the description of a new taxon appears justified. The presence of oocytes identifies the adult animal as sexually mature and hence as fully grown. All relevant characters are detectable and can be documented by photographs. Less well documented characters such as the ciliature have previously had no diagnostic relevance at generic or specific levels and are clearly very similar to those of other taxa in this family, e.g. *Ikosipodus carolensis* Westheide, 1982. It is fortunate that there are no jaw structures to analyze, as such analysis is difficult in dorvilleids of this size and usually requires several specimens. In other respects, neither placing of the new species in the Dorvilleidae nor differentiating it unequivocally from the extant dorvilleid generic taxa is problematic. Its overall resemblance to *Ikosipodus* Westheide, 1982, *Pusillotrocha* Westheide & von Nordheim, 1985, *Arenotrocha* Westheide & von Nordheim, 1985, and *Petrocha* von Nordheim, 1987 (Westheide, 1982; Westheide & von Nordheim, 1985) is clearly evident in the combination of several features such as the shape of the prostomium, with one pair of lateroventrally situated simple palps, and trunk segments with simple uniramous parapodia. Of these taxa, *Arenotrocha* also possesses a midventral stylus (Westheide & von Nordheim 1985). Parapodia with exclusively compound protruding chaetae are shared, however, only with *Ikosipodus*. This taxon has conspicuous jaw structures, a constant number of ten chaetigerous segments and only two pygidial appendages (Westheide 1982). The number of seven such segments in the new taxon, though not observed in more than one specimen, is probably also a constant taxon-specific character: most of the very small-sized dorvilleids,

including the dinophilid genera, exhibit constancy of segment number. The differences in chaetal morphology between *Ikosipodus carolensis* and the new taxon are of minor significance. However, the lack of a jaw apparatus is highly relevant and especially supports the erection of a new generic taxon for the species presented.

The new taxon readily fits into cladogram I of the carefully conducted cladistic analysis of Eibye-Jacobsen & Kristensen (1994: 9) as the sister group of *Ikosipodus*. Strong autapomorphic characters are (1) number of chaetigerous segments reduced from 10 to 7, and (2) absence of jaw structures. Loss of mandibles and maxillary elements has been used by the two authors to characterize a monophyletic group within the cladogram comprising *Parapodrilus* Westheide, 1965, *Apodotrocha* Westheide & Riser, 1983, *Apharyngtus* Westheide, 1971, *Trilobodrilus* Remane, 1925, and *Dinophilus* O. Schmidt, 1848. Thus, complete reduction of a jaw apparatus must be regarded as having taken place more than once during evolution. Another slightly more parsimonious solution (D. Eibye-Jacobsen, pers. comm.) would be to position the new taxon between *Neotenotrocha* Eibye-Jacobsen & Kristensen, 1994 and *Parapodrilus* as the sister group of the clade *Parapodrilus* – *Apodotrocha* – *Apharyngtus* – *Trilobodrilus* – *Dinophilus*. This position, however, would depend on the assumption that palps, parapodia, and chaetae must have been lost twice.

In general, the assumptions needed to construct such a cladogram — namely that several characters of the numerous taxa of Dorvilleidae – Dinophilidae must have been lost separately or that others reappeared during evolution — should call into question the entire hypothesis of one common stem species of the whole group, its origin in a single evolutionary event, and a step-by-step progenetic evolution of the different taxa. The fact that it is possible for the different dorvilleid and dinophilid taxa to be incorporated into a morphological series with increasingly pronounced juvenile and larval characters does not convincingly prove this phylogenetic relationship (see Westheide, 1982, 1987). Indeed, it cannot be decided on the basis of morphology alone whether a taxon with more marked juvenile features derived from another with less juvenile features or whether both evolved separately by progenesis from larger forms in completely independent evolutionary steps.

Thus, in contrast to the opinion of Eibye-Jacobsen & Kristensen (1994), there appears to be no larger body of

evidence for the common origin of all dorvilleid taxa now than in previous years. Nor, correspondingly, is the taxonomic incorporation of the Dinophilidae into the Dorvilleidae supported for the time being (but see Åkesson, 1977). Only molecular genetic investigations may contribute to resolving this problem.

Acknowledgements

I appreciate the valuable comments of Dr. Danny Eibye-Jacobsen, Copenhagen, on the manuscript. Sincere thanks are due to Mrs. Anna Stein for preparing figures and Mrs. Andrea Noël for carefully typing the manuscript.

References

- Åkesson B. 1977. Parasite-host relationships and phylogenetic systematics. The taxonomic position of dinophilids. In: The Meiofauna Species in Time and Space. Workshop Symposium, Bermuda, 1975. – *Mikrofauna Meeresboden*, 61: 19-28.
- Eibye-Jacobsen D. & Kristensen R.M. 1994. A new genus and species of Dorvilleidae (Annelida, Polychaeta) from Bermuda, with a phylogenetic analysis of Dorvilleidae, Iphitimidae and Dinophilidae. *Zoologica Scripta*, 23: 107-131.
- Hilbig B. 1991. Reconsideration of the genus *Exallopus* Jumars, 1974 (Polychaeta: Dorvilleidae) with descriptions of two new species from the western North Atlantic. *Ophelia Supplement*, 5: 101-110.
- Orensanz J.M. 1990. The eunicemorph polychaete annelids from Antarctic and Subantarctic seas. With addenda to the Eunicemorphs of Argentina, Chile, New Zealand, Australia and the Southern Indian Ocean. *Biology of the Antarctic Seas* 21, Antarctic Research Series, 52: 1-183.
- Westheide W. 1982. *Ikosipodus carolensis* gen et sp. n., an interstitial neotenic polychaete from North Carolina, U.S.A., and its phylogenetic relationships within Dorvilleidae. *Zoologica Scripta*, 11: 117-126.
- Westheide W. 1987. Progenesis as a principle in meiofauna evolution. *Journal of Natural History*, 21: 843-854.
- Westheide W. & Riser N.W. 1983. Morphology and phylogenetic relationships of the neotenic interstitial polychaete *Apodotrocha prognerans* n. gen., n. sp. (Annelida). *Zoomorphology*, 103: 67-87.
- Westheide W. & von Nordheim H. 1985. Interstitial Dorvilleidae (Annelida, Polychaeta) from Europe, Australia and New Zealand. *Zoologica Scripta*, 14: 183-199.
- Westheide W. & Purschke G. 1988. Chapter 8. Organism processing. In: *Introduction to the Study of Meiofauna*. (H. Thiel, R. Higgins, eds), pp. 146-160. Smithsonian Press: Washington.