JOURNAL OF NATURAL HISTORY, 1992, **26**, 675–688

Taxonomic status of *Pseudosiphonops ptychodermis* Taylor and *Mimosiphonops vermiculatus* Taylor (Amphibia: Gymnophiona: Caeciliaidae) with description of a new species

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(*Accepted 9 March 1992*)

Pseudosiphonops ptychodermis Taylor is designated a junior synonym of *Mimisiphonops vermiculatus* Taylor, and *Pseudosiphonops* Taylor is designated a junior synonym of *Mimosiphonops* Taylor. A new species of *Mimosiphonops* is described and taxonomy of the genus reviewed. Relationships between *Mimosiphonops* and the closely related caecilian genera *Siphonops* and *Lutkenotyphlus* are discussed.

KEYWORDS: Caecilians, taxonomy, *Pseudosiphonops*, *Mimosiphonops*, Caeciliaidae.

Introduction

Basic understanding of caecilian diversity and phylogeny is hampered by taxonomic problems that abound at the specific and generic levels (Nussbaum and Wilkinson, 1989; Wilkinson, 1989). One such set of problems concerns the taxonomy of the widespread South American genus *Siphonops* and some related forms that Taylor (1968) described as distinct monotypic genera. The status of one of these genera (*Lutkenotyphlus*) was reviewed by Nussbaum (1986). In this paper we show that the species *Pseudosiphonops ptychodermis* Taylor and *Mimosiphonops vermiculatus* Taylor are based on specimens of the same species, and that both these specific names and the monotypic genera *Pseudosiphonops* and *Mimosiphonops* are thus synonymous. We also describe a new related species.

Taxonomic history

Pseudosiphonops ptychodermis was described by Taylor (1968) from a single specimen in the Museum National d'Histoire Naturelle, Paris (MNHNP 593) collected by Lecomte from 'Brazil'. This specimen had been assigned to *Siphonops indistinctus* (= *Chthonerpeton indistinctum*) by Dumeril (1863). Dumeril's interpretation of this specimen was subsequently questioned by Keferstein (1867) and Hensel (1868). Dunn (1942) assigned this specimen to *S. annulatus* and noted that the tentacular aperture was nearly equidistant between the eye and naris rather than close to the eye as is typical for *S. annulatus*. No further specimens of *P. ptychodermis* have been reported since the type description, but Dunn (1942) listed a number of other specimens, assigned by him to *S. annulatus*, in which the tentacular aperture was also in a relatively anterior position.

Mimosiphonops vermiculatus was described by Taylor (1968) from a single specimen in the University of Kansas Museum of Natural History (KU 93271) collected in 1964 from Teresopolis, Rio de Janeiro, Brazil. No further specimens have been reported since the type description.

Reference to these genera has been very limited. Laurent (1986) provided terse diagnoses, based on those provided by Taylor (1968), as part of a review of caecilian systematics. He considered *Mimosiphonops* to be a genus of doubtful status. Nussbaum and Wilkinson (1989) also presented diagnoses based on a standard core set of characters that were comparable across all genera of the Caeciliaidae. Information for the diagnoses of *Pseudosiphonops* and *Mimosiphonops* was drawn from Taylor (1968) and, because of the paucity of material and thus opportunity for study, some of the core set of characters were not known.

Both Laurent (1986) and Lescure *et al.* (1986) presented phylogenetic hypothesis for the genera of Gymnophiona. In Laurent's hypothesis, *Pseudosiphonops* was figured as the sister-genus of *Mimosiphonops*, with these genera forming a sister-group of a holophyletic group composed of *Siphonops* and *Lutkenotyphlus*. In the hypothesis of Lescure *et al.* these four genera are not united into a holophyletic group. *Pseudosiphonops* is figured as the sister-genus of *Lutkenotyphlus*, with *Brasilotyphlus* the sister-group of these two. The group comprising these three genera is figured as the sister-taxon of a group comprising *Mimosiphonops* and *Siphonops*. Lescure *et al.* (1986) used their results as the basis of a radical reclassification of caecilians. This reclassification included names for taxa at the ranks of Subtribe and Infratribe which used the generic name *Pseudosiphonops* as a root. The fact that *Mimosiphonops* and *Pseudosiphonops* are monotypic genera based on the same species (see below), further demonstrates that the phylogenetic hypothesis and classification of Lescure *et al.* (1986) are seriously flawed (see Nussbaum and Wilkinson, 1989).

Diagnostic characters of *Pseudosiphonops* and *Mimosiphonops*

Holotypes of *Pseudosiphonops ptychodermis* and *Mimosiphonops vermiculatus* do not differ significantly in characters that are often relied upon for distinguishing closely related caecilian species (see Table 1). Taylor (1968) listed four characters in his generic and specific diagnoses that appear to distinguish *Pseudosiphonops* and *Mimosiphonops*. Lescure *et al.* (1986) gave two additional characters in their diagnoses of these genera, and Nussbaum and Wilkinson (1989) listed one other. There are problems with all of these characters.

1. *Size of the head relative to the body*

Taylor (1968) described the head of *Pseudosiphonops* as wider than the body and considered this to be diagnostic of the genus. Typically, caecilians have heads that are about equal in width to the body or slightly narrower. The holotype of *Pseudosiphonops ptychodermis* has an extremely narrow body; much narrower than the head. This reflects undoubtedly a combination of poor physiological or physical condition at the time of preservation, and subsequent desiccation and distortion of the specimen in preservative rather than a specific or generic character. This inference is supported by correlated features of the holotype. The skin of the holotype is stretched across the vertebral column such that the vertebrae can be seen and felt in relief. In addition, coelomic fat bodies are poorly developed. The poor condition of the specimen had been noted previously. Dumeril (1863) considered that the specimen was desiccated, and that this was possibly due to preservation in alcohol that was too highly concentrated.

Table 1. Morphometric and meristic data for specimens of the genus *Mimosiphonops* Taylor (all measurements in mm).

	M. vermiculatus			*M. reinhardti*
	KUMNH 93271 Holotype	MNHNP 593 Holotype of *P. ptychodermis*	BMNH 55.11.18.17	ZIL 1078 Holotype
Total length	186	256	290	254
Sex	female	?	female	male
Primary annuli	87	88	88	74
Vertebrae	96	98	96	83
Head length to jaw angle	6·7	7·0	6·9	7·3
Head width to jaw angle	5·5	5·6	5·9	6·1
Head length to first nuchal groove	7·7	9·5	8·9	10·2
Head width at occiput	5·8	5·9	6·5	6·7
Mid-body width	7·7	5·3	7·1	10·3
Terminal shield	5·0	5·5	6·5	6·6
Disc width	2·2	1·1	2·7	3·5
Disc length	2·1	1·6	2·3	3·7
Interorbital distance	4·3	4·5	4·5	5·2
Internarial distance	2·4	2·6	2·5	2·4
Eye–narial distance	2·4	3·0	2·7	2·9
Eye–tentacle distance	1·5	1·8	1·8	1·8
Tentacle–lip distance	0·4	0·5	0·5	0·8
Tentacle–narial distance	1·1	1·2	1·1	1·1
Snout tip–eye level distance	3·6	3·8	3·5	3·6
First nuchal collar width	2·3	2·5	2·3	2·2
Second nuchal collar width	2·9	3·6	3·4	3·8
Rostral projection of snout	1·7	1·9	1·8	2·1
Premaxillary–maxillary teeth	21	24	23	24
Vomeropalatine teeth	14	23	18	27
Dentary teeth	16	21	20	25

Dunn (1942) referred to this specimen as 'dried somewhat'. Taylor (1968: 588) wrote that 'The specimen (marked "dry") is slightly desiccated but is flexible, and the slenderness is not the result of preservation'. He apparently did not consider the possibility that the slenderness of the specimen was due primarily to poor physiological condition prior to preservation. A parallel oversight contributed to Taylor's (1970) description of a new species based on an aberrant specimen of *Typhlonectes natans* which, as with the holotype of *Pseudosiphonops ptychodermis*, also has poorly developed fat bodies and the atypical condition of a head that is wider than the body (Wilkinson, 1988). The slenderness of the holotype of *Pseudosiphonops ptychodermis* cannot be considered a diagnostic character for the taxon, and other, less aberrant members of the taxon would be expected to have a body shape more similar to other caecilians, such as that of the holotype of *Mimosiphonops vermiculatus*.

2. *Size of the tentacular aperture*

As described by Taylor (1968), the tentacular aperture is noticeably larger in the holotype of *Pseudosiphonops ptychodermis* than in that of *Mimosiphonops vermiculatus* and most other caecilians. This is most probably due to the stretching of the skin forming the border of the tentacular aperture that accompanied the drying of the

specimen noted by previous authors, and cannot therefore be considered a character that distinguishes *Pseudosiphonops ptychodermis* from *Mimosiphonops vermiculatus*.

3. *Arrangement of the vomeropalatine teeth*

Taylor (1968) described the vomeropalatine teeth of *Pseudosiphonops* as forming a somewhat angular rather than a rounded series. For *Mimosiphonops* he reported the presence of a diastema between the vomerine and palatine teeth series. Taylor's figure 318 also shows the reported lack of the vomeropalatine diastema and the more angular teeth series attributed to the holotype of *Pseudosiphonops ptychodermis*, but this figure is inaccurate. In the holotypes of both *Pseudosiphonops ptychodermis* and *Mimosiphonops vermiculatus* there is a well-developed diastema between the vomerine and palatine tooth series, and the teeth of the vomerine series form rounded arcs. There is thus no basis for distinguishing these nominate genera on characteristics of these dental series. The presence of a vomeropalatine diastema is not found in any species of *Siphonops*, or in *Lutkenotyphlus*.

4. *Visibility of the eye*

Taylor (1968) reported that in *Pseudosiphonops ptychodermis* the eye is clearly visible and is covered by a transparent region of skin, whereas in *Mimosiphonops vermiculatus* the eye is not visible and is covered by a milky white spot. We do not consider this difference significant, for the following reasons. Intraspecific variation in the visibility of the eye occurs in other species of caecilians such as the typhlonectid *Chthonerpeton indistinctum* (personal observation), but more importantly it is only the left eye of the holotype of *Pseudosiphonops ptychodermis* that is clearly visible through a transparent window of skin. The right eye is obscured partially by a milky white spot that is less dense but otherwise similar to that seen in the holotype of *Mimosiphonops vermiculatus*.

5. *Presence of postcloacal vertebrae*

Lescure *et al.* (1986) included the presence of a 'true' tail, defined by the presence of postcloacal vertebrae, in their diagnosis of *Pseudosiphonops*, and they scored *Mimosiphonops* as lacking postcloacal vertebrae in their data matrix. Although the holotype of *Pseudosiphonops ptychodermis* differs from that of *Mimosiphonops vermiculatus* in having postcloacal vertebrae, this cannot be considered a diagnostic feature. The terminal soft tissues of caecilians are known to sometimes shrink, with consequent movement of the cloaca relative to the vertebral column. Thus, where there were no postcloacal vertebrae in life, preservation and drying can lead to the artificial appearance of postcloacal vertebrae (Nussbaum, 1988; Nussbaum and Wilkinson, 1989; Wilkinson, 1989). This appears to be exactly what has happened in the case of the holotype of *Pseudosiphonops ptychodermis*.

6. *Number of nuchal vertebrae*

Lescure *et al.* (1986) listed the presence of four nuchal vertebrae as diagnostic for *Mimosiphonops*, with *Pseudosiphonops* having three. Our determination of the numbers of nuchal vertebrae in the holotypes of *Pseudosiphonops ptychodermis* and *Mimosiphonops vermiculatus*, following the method of Wilkinson (1989), shows there to be three nuchal vertebrae in both specimens.

7. *Position of the tentacular aperture*

In the diagnoses of these genera given by Nussbaum and Wilkinson (1989), we indicated a difference in the position of the tentacular aperture as the only difference found among the core set of characters used. This was based upon the measurements of Taylor (1968), who reported the two distances, between the eye and tentacular aperture and between the tentacular aperture and naris, as 2·1/1·2 and 1·2/1·0 mm for the holotypes of *Pseudosiphonops ptychodermis* and *Mimosiphonops vermiculatus*, respectively. Our measurements differ from Taylor's and do not indicate any significant difference in the position of the tentacular aperture in the two holotypes (Table 1). The anterior position of the tentacular aperture is not a characteristic of any species of *Siphonops* or of *Lutkenotyphlus*.

We were able to identify only a single unreported difference in the holotypes of *Pseudosiphonops ptychodermis* and *Mimosiphonops vermiculatus* that requires further comment. In the holotype of *Pseudosiphonops ptychodermis* there is a single tooth present on the pseudoectopterygoid of each side, which represents the last member of the 'palatine' series. In the holotype of *Mimosiphonops vermiculatus* there are no teeth on the pseudoectopterygoid. We do not consider this difference to be taxonomically significant because teeth on the pseudoectopterygoid are variably present or absent in the closely related *Siphonops annulatus* (personal observation) so that parallel intraspecific variation is to be anticipated in other taxa.

Status of *Pseudosiphonops* and *Pseudosiphonops ptychodermis*

The above considerations lead us to conclude that synonymy exists between the generic names *Pseudosiphonops* and *Mimosiphonops* and between the specific names *Pseudosiphonops ptychodermis* and *Mimosiphonops vermiculatus*. All these names were established in the same publication, and thus no one name has automatic priority over any other. In such cases the International Code of Zoological Nomenclature states that the relative precedence of synonyms is to be determined by the first reviser. There are several criteria which might be used to help determine the choice of which name is to be regarded as the senior synonym. Recommendation 24A of the Code counsels that if there is no special advantage with regard to stability or other special appropriateness in the choice of names, the reviser should give precedence to the name that appears first. In the present case the names *Pseudosiphonops* and *Pseudosiphonops ptychodermis* appear first, but we consider there to be a number of points in favour of giving precedence to *Mimosiphonops* and *Mimosiphonops vermiculatus*. Firstly, the latter name is associated with a more precise locality, and precision in type localities is desirable. Secondly, the holotype of *Mimosiphonops vermiculatus* was collected over 100 years after the holotype of *Pseudosiphonops ptychodermis* and is in a much better state of preservation. Thirdly, the holotype of *Pseudosiphonops ptychodermis* lies at an extreme of the range of possible physiological states, which makes it a poor representative of the species. Fourthly, the specific name *ptychodermis* was formulated by Taylor in reference to the folded nature of the skin. This condition appears to be due to the desiccation of the specimen and, therefore, is an inappropriate name for the species. Against precedence being conferred upon *Mimosiphonops* and *Mimosiphonops vermiculatus* is the relative immaturity of the holotype of *Mimosiphonops vermiculatus*. Weighing these factors, we believe the best nomenclatural action that can be taken is to consider *Pseudosiphonops* a junior synonym of *Mimosiphonops* and *ptychodermis* a junior synonym of *vermiculatus*.

Validity of *Mimosiphonops vermiculatus*

In order to assess the validity of *Mimosiphonops vermiculatus* it is necessary to compare this form with the related genera *Siphonops* and *Lutkenotyphlus*. Nussbaum (1986) considered the monotypic *Lutkenotyphlus* to be distinct from *Siphonops*, primarily because it has an unusually short series of premaxillary–maxillary teeth, a feature not seen in any other genus of caecilian with the possible exception of *Parvicaecilia*. Additional morphological support for the validity of this genus was drawn from the unique appearance of an anterior diastema between the vomerine teeth series late in ontogeny. In these respects *Lutkenotyphlus* also differs from *Mimosiphonops vermiculatus*.

Mimosiphonops vermiculatus also differs from the species of *Siphonops* and from *Lutkenotyphlus* in having tentacular apertures that are more distant from the eye, and which are positioned on the border of the maxillopalatines and nasopremaxillae rather than completely enclosed within the maxillopalatines, a diastema between the vomerine and palatine teeth series, a more prominent rostral projection of the snout, a distinctive, ventral and longitudinal white stripe that extends anteriorly from the second nuchal groove, and anterolateral cloacal denticulations that are not greatly enlarged. These morphological features provide complete justification for the continued recognition of *Mimosiphonops vermiculatus* as a distinct species.

A single caecilian specimen in the collections of the Zoological Institute, Leningrad represents a previously undescribed species that, based on its morphological features, appears to be more closely related to *Mimosiphonops vermiculatus* than to any other caecilian species. This undescribed species differs from *M. vermiculatus* in a dental feature that has previously been considered a generic level character. However, we reject the *a priori* designation of characters as 'generic' and we do not consider the option of establishing a new genus to receive this species to be a good one. Based on its apparent relationship to *M. vermiculatus*, we describe this form as a new species of *Mimosiphonops*.

Synopsis

Mimosiphonops Taylor

Mimosiphonops Taylor, 1968: 592. Type species *Mimosiphonops vermiculatus* Taylor, 1968, by original designation.

Pseudosiphonops Taylor, 1968: 583. Type species *Pseudosiphonops ptychodermis* Taylor, 1968, by original designation. *New Synonym.*

Diagnosis. Caeciliaids with the eye not covered by bone; no temporal fossa; a large mesethmoid exposed dorsally; no splenial teeth; no secondary annuli; no scales; primary annuli and nuchal collars and grooves strongly marked with a white border; tentacular aperture slightly closer to naris than to eye, about level with the anterior margin of the mouth (closer to the eye in *Siphonops* and *Lutkenotyphlus*); as unsegmented terminal shield; premaxillary–maxillary tooth series extending just beyond the choanal apertures (shorter in *Lutkenotyphlus*); no anterior diastema between the vomerine tooth series (present in *Lutkenotyphlus*); a process of the vomer extending anteriorly beyond the vomerine tooth series; no narial plugs; no vertical keel on the body terminus; snout with moderately strong rostral projection beyond the anterior margin of the mouth (weaker in *Siphonops* and *Lutkenotyphlus*); suborbital process of the squamosal well developed; anterolateral cloacal denticulations not enlarged (enlarged in *Siphonops* and *Lutkenotyphlus*).

Content. Two species *Mimosiphonops vermiculatus* Taylor and *Mimosiphonops reinhardti* n. sp.

Distribution. Known only from the region of Teresopolis; Rio de Janeiro; Brazil and from 'Brasilia'.

Mimosiphonops vermiculatus Taylor

(Fig. 1)

Mimosiphonops vermiculatus Taylor, 1968: 592. Type locality, Teresopolis, Rio de Janeiro; Brazil. Holotype, KU 93271, an immature female, collected in November 1964.

Pseudosiphonops ptychodermis: Taylor, 1968: 584. Type locality, Brazil, Holotype MNHNP 593, collected prior to 1863 by Lecomte. *New synonym.*

Referred specimens. KU 93271 (holotype); MNHNP 593 (holotype of *Pseudosiphonops vermiculatus*); BMNH 55.11.18.17.

Diagnosis. A *Mimosiphonops* with known ranges of 87–88 primary annuli and 96–98 vertebrae; tentacular groove open, not roofed with bone; pre- and postchoanal processes of the maxillopalatine in contact along the anteromedial border of the choanal aperture but not fused; a diastema between the vomerine and palatine teeth series.

Description of the holotype. Some morphometric and meristic data are given in Table 1. The specimen, an immature female, is in good condition except that the jaws have been cut, the skin has been removed from over the left eye, some palatal tissue is missing, and there is a ventral incision from the cloacal disc to a point about 2 cm anterior to the disc, a further 1·5 cm ventral incision beginning 1·5 cm anterior to the former, and a short mid-dorsal incision on the head. The body is slightly dorsoventrally compressed throughout and narrows gently over the anteriormost 9 annuli; ratio of length to width at mid-body 24·2, and at the occiput 32·1. The sides of the head are nearly straight and converge anteriorly up to the level of the nares in dorsal view; the rostral tip is gently rounded in dorsal view; rather angular in lateral view. Eyes are very slightly elevated, dorsolaterally oriented, and positioned just above the mid-lateral line of the cranial part of the head; the right eye is covered by a milky white eyespot and is just visible through this; the eyespot is drawn out anteriorly over the unroofed tentacular groove towards the tentacular aperture forming a faint eye–tentacle stripe. Tentacular apertures are horseshoe-shaped due to the projection into an otherwise subcircular aperture of a subcircular tissue mass that is continuous with the skin at the posterior edge of the aperture; each aperture is surrounded by a broad white spot that is continuous on the right side with the eye–tentacle stripe; the apertures are slightly closer to the nares than to the eyes and closer to the lip than to an imaginary eye–naris line; the apertures are clearly visible in ventral view, just behind the anterior margin of the mouth; the tentacular region is elevated and just visible in dorsal view. Nares are subcircular, each surrounded by a white spot, with the skin at the posterior margin forming a flap that extends into the narial aperture. The nares are dorsolateral, slightly more dorsal than the eyes, positioned slightly above the mid-lateral line of the cranial part of the head, visible in dorsal and not in ventral view. The mouth is recessed with the snout projecting strongly beyond the anterior margin of the mouth. The teeth are small, monocuspid, pointed and recurved; the premaxillary–maxillary tooth series extends posteriorly to about the level of the posterior margin of the choanal apertures; the vomeropalatine series extends a little further posteriorly; there are no teeth on the

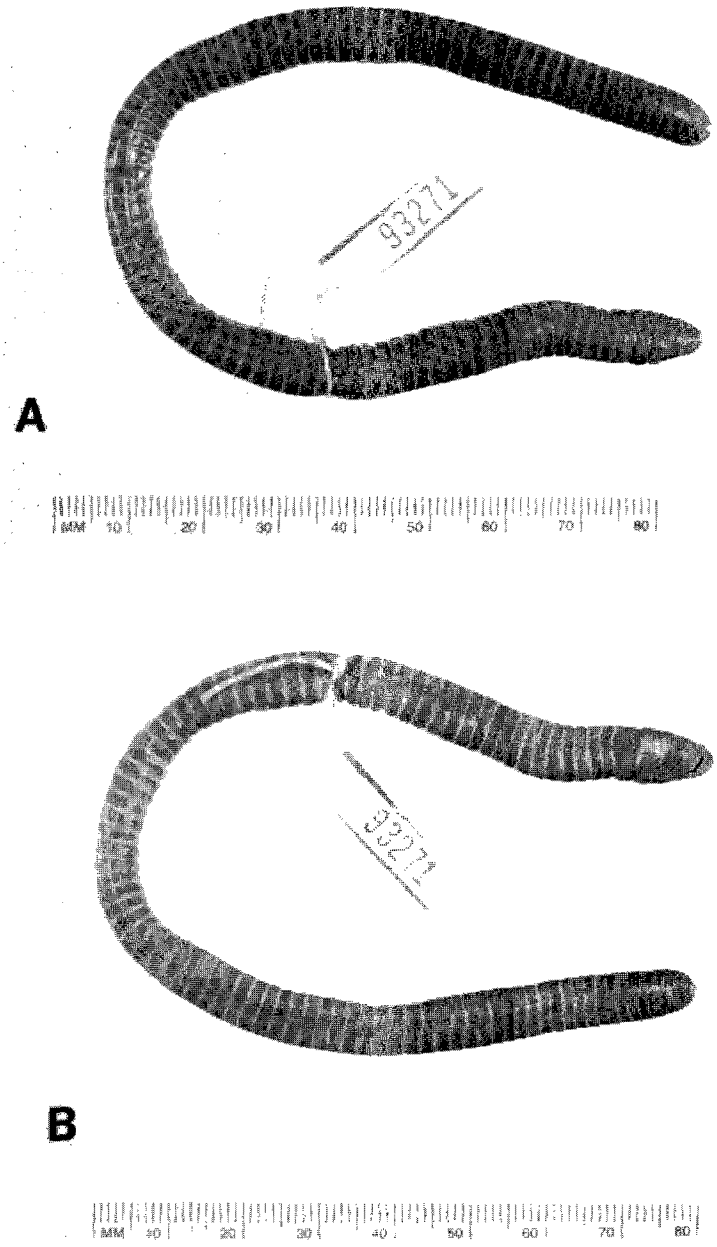

FIG. 1. Holotype of *Mimosiphonops vermiculatus*, KU 93271, (**A**) dorsal and (**B**) ventral views.

pseudoectopterygoids; the vomerine teeth form an almost semicircular arc and are separated from the palatine series, which is splayed out posterolaterally, by a diastema. The choanal apertures are sub-elliptical; they are orientated ventrolaterally so that lines drawn along their long axes and projected anteriorly would meet at about 80°; the choanae lie completely within the palatine shelf of the maxillopalatine with the vomers excluded from their margins; the antero- and posteromedial margins are formed by touching but unfused pre- and postchoanal processes of the maxillopalatine, respectively; choanal valves are deeply recessed but clearly visible in palatal view and appear to be composed of a single lateral valve flap. The tongue is separated from the gingivae by a slight groove laterally but not at its pointed anterior tip; lingual plicae are present posteriorly on the tongue; there are no narial plugs and no longitudinal medial groove on the tongue. The nuchal region is slightly more massive than the adjacent body; the two nuchal collars are well marked by three nuchal grooves; the nuchal grooves completely encircle the body and, except for the first nuchal groove on the dorsum, are marked with white; each nuchal collar bears a dorsal transverse groove, the first shorter and unmarked, the second almost crossing the dorsal surface and marked with white. The grooves which delimit the primary annuli completely encircle the body and are strongly marked with white, except adjacent to the terminal shield; the two posteriormost annuli are incomplete dorsally, with the first of these lacking white markings on the left side of the body. The posteriormost part of the body forms a distinct, unsegmented terminal shield that is slightly accuminate in dorsal and in lateral views. The cloacal disc is subcircular; not elevated or depressed; it lies completely within the terminal shield; it is creamy white and comprises 12 denticulations, 6 anterior and 6 posterior, some of which are partially divided by grooves. There are no cloacal papillae. The ground colour is a light blue–grey; there is a diffuse longitudinal white stripe extending between the first and second nuchal grooves ventrally.

Variation. With the exception of those features affected by the poor physiological condition of MNHNP 593 and other features of this specimen discussed above, the referred specimens agree with the holotype in their most salient features. Comparative morphometric and meristic data for these specimens are included in Table 1. The ranges of primary annuli and vertebrae are expected to be considerably greater with larger sample sizes. Both BMNH 55.11.18.17 and MNHNP 593 have a darker brown colour that is the result of the loss of the outer 'cuticular' layer of the skin. The patterns of annuli proximal to the terminal shield and the patterns of grooves and pigmentation are similar in all three specimens.

Remarks. Some of the specimens reported by Dunn (1942), in his description of *Siphonops annulatus* may belong to this species, as they were reported by him to have more anteriorly placed tentacles, an unusually long snout and an accuminate terminus to the body. At least one of the specimens reported by Dunn is also from the type locality of this species. Dunn's report of the number of annuli of these specimens indicates a range between 82 and 91. Dunn did not distinguish between nuchal collars and annuli, so these numbers are inflated by between two and four, depending on how Dunn treated the incompletely divided nuchal collars. We have been unable to examine these specimens, but it is likely that they belong to this species as the following species has a smaller number of annuli. Similar patterns of nuchal and transverse grooves, but with slightly greater variation than seen in the three referred specimens of this species, are also typical of both *Siphonops annulatus* and *S. paulensis*, except that these species usually lack a longitudinal whitish stripe on the ventral surface of the collars. Nothing is known about the life history or ecological relations of this species.

Mimosiphonops reinhardti n. sp.

(Fig. 2)

HOLOTYPE. Zoological Institute, Academy of Sciences, Leningrad (ZIL) 1078, a mature male from 'Brasilia', collected by Reinhardt, 1878.

Diagnosis. A *Mimosiphonops* with 74 primary annuli and 83 vertebrae; tentacular groove covered with bony projections of the maxillopalatine that are in contact but not fused; pre- and postchoanal processes of the maxillopalatine fused; no diastema between the vomerine and palatine tooth series.

Description of the holotype. Some morphometric and meristic data are given in Table 1. The specimen, a mature male, is in fair condition except that the jaws have been cut, some tissue is missing from the left palatal surface, the skin covering the cranium is thin and transparent; the nares are distorted; the skin and vertebral musculature is badly ruptured at the level of the 33rd primary annulus, the outer 'cuticular' layer of skin is missing from parts of the body and there are two incisions, one stretching anteriorly for about 2 cm from the cloacal disc and another about 3 cm in length beginning about 6 cm anterior to the former. The body is dorsoventrally compressed throughout and narrows considerably over the 12 primary annuli immediately behind the nuchal collars; ratio of length to width at mid-body 24·7, and at occiput 37·9. The sides of the head are nearly straight; they converge anteriorly in dorsal view up to the level of the nares; the rostral tip is blunt and straight in dorsal view; angular in lateral view. The eyes are elevated, dorsolateral and positioned just below the mid-lateral line of the cranial part of the head; the eyes and the lenses of the eyes are clearly visible through the thin skin, which is clear over the right and slightly milky over the left eye; there is no indication of eye–tentacle stripes. The tentacular apertures are horseshoe-shaped; each is surrounded by an extensive white spot; they lie slightly closer to the nares than to the eyes and slightly closer to an imaginary eye–naris line than to the lip; the tentacular region is elevated with the tentacular apertures visible both in dorsal and ventral view just behind the anterior margin of the mouth. The form of the nares is not clear; they are surrounded by white spots; they are dorsolateral and distinctly more dorsal than the eyes, lying above the mid-lateral line of the cranial part of the head; they are clearly visible in dorsal view and barely visible in ventral view. The mouth is recessed with the snout projecting moderately strongly beyond the anterior margin of the mouth. The teeth are monocuspid, pointed, recurved and mostly small; the anterior premaxillary–maxillary teeth are distinctly larger than more posterior teeth in the same series and those of other series; the premaxillary–maxillary series extends posteriorly a little past the posterior margin of the choanae; the vomeropalatine series extends a little further posteriorly; there is a single tooth on the left pseudoectopterygoid (the condition of the right pseudoectopterygoid has not been determined) that constitutes the terminal member of the 'palatine' series; the vomerine teeth form a gentle arc anteriorly and are continuous with teeth of the palatine series which are not splayed out laterally. The choanal apertures are oriented only slightly obliquely so that lines drawn along their long axes and projected anteriorly would meet at about 40°; the choanae lie completely within the palatine shelf of the maxillopalatine with the vomers excluded from their margins; the pre- and postchoanal processes of the maxillopalatine are fused; the choanal valves are very deeply recessed and are not clearly visible in palatal view. The tongue is separated from the gingivae by a shallow groove laterally, but not at its pointed anterior tip; lingual plicae are present on the tongue posteriorly; there are no narial plugs and no longitudinal medial groove on the tongue. The nuchal region is

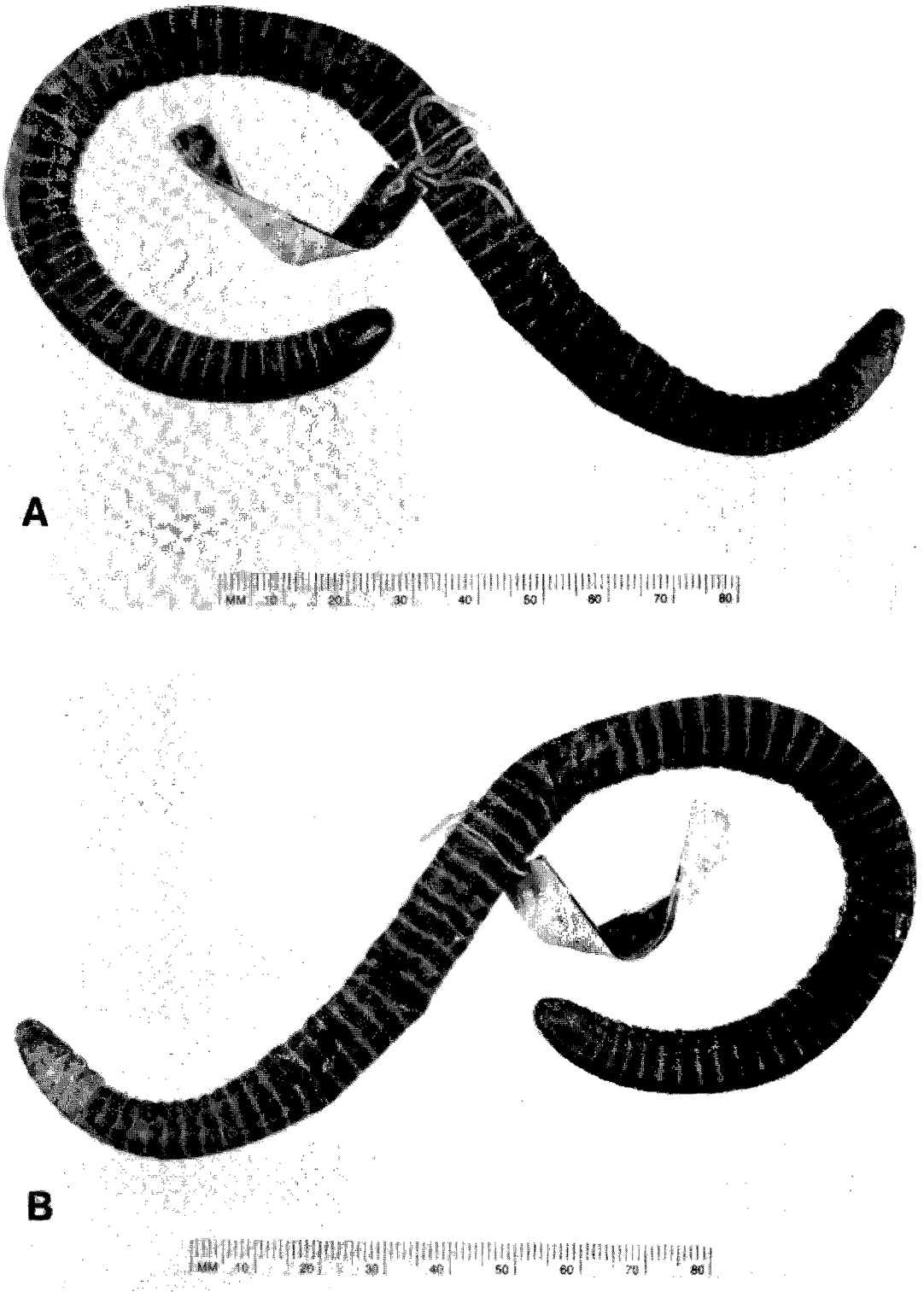

FIG. 2. Holotype of *Mimosiphonops reinhardti*, ZIL 1078, (**A**) dorsal and (**B**) ventral views.

slightly more massive than the adjacent body; the two nuchal collars are well marked by three nuchal grooves; the nuchal grooves completely encircle the body; a dorsal transverse groove is present on each collar, that on the first collar shorter than that on the second; all collar grooves are marked with white. The grooves which delimit the primary annuli are mostly marked with white and completely encircle the body except close to the terminal shield; the three posteriormost annuli are successively more incomplete dorsally; the last annular groove is indicated only ventrally, and is not marked with white; occasional annular grooves are slightly incomplete dorsally on the posterior one-third of the body. The posteriormost part of the body forms a distinct, unsegmented terminal shield that has a blunt tip in dorsal view; its dorsal surface curves strongly towards the ventral surface to give a slightly accuminate appearance in lateral view. The cloacal disc is subcircular and slightly recessed; it lies completely within the terminal shield; it is creamy white and comprises 12 denticulations, 6 anterior and 6 more narrow and elongate posterior; the left and right anterolateral denticulations each bear an elevated white cloacal papillus; many denticulations show signs of partial irregular subdivision. The ground colour is a pale lilac–grey where the cuticular layer of the skin is intact and a darker brown where this layer is missing; a broad and diffuse white patch occupies much of the throat and ventral surface of the nuchal collars; a pair of white mandibular stripes is present.

Variation. Known only from the holotype.

Remarks. This species is distinguished from *M. vermiculatus* by the bony roof of the tentacular groove, fewer annuli, the lack of a vomeropalatine diastema, and probably by its more robust body shape and more pronounced anterior narrowing of the body on to the nuchal collars. The shape of the snout and absence of an eye–tentacle stripe in the holotype may simply reflect the partial loss of skin from the head. The number of vertebrae of the holotype (83) falls outside the range reported as characteristic of caecilians (95–285) by Duellman and Trueb (1986) and Milner (1988). The caecilian species with the fewest vertebrae (67 or 68) is probably *Grandisonia brevis* (Taylor, 1968). Nothing is known about the life history or ecological relations of *M. reinhardti.*

Etymology. The species is named for J. Reinhardt, the collector of the holotype, in recognition of his early contributions to caecilian systematics and South American herpetology.

Discussion

The three South American genera *Siphonops*, *Lutkenotyphlus* and *Mimosiphonops* appear to form a closely related unit, as judged by their general similarity. We refer informally to these genera as siphonoforms. Siphonoforms share the following features: (1) no secondary annuli; (2) no scales; (3) solidly stegokrotaphic skulls lacking upper temporal fossae; (4) no splenial teeth; (5) no narial plugs; (6) presence of a pseudoectopterygoid; (7) an unsegmented terminal shield; (8) no postcloacal vertebrae (except where this represents an artifact of preservation); (9) no terminal keel; (10) eye not covered by bone; (11) monocuspid teeth; (12) choanal apertures that lie completely within the maxillopalatine (some variation in *Siphonops annulatus*); (13) short vomers that do not extend posteriorly beyond a line joining the centres of the choanal apertures; (14) subterminal mouths; (15) a well-developed suborbital process of the squamosal; (16) relatively short premaxillary–maxillary dental series that extend only as far posteriorly as the posterior margin of the choanae or slightly beyond.

Although none of these features appears to be both derived and unique to siphonoforms, this combination of features is unique and quite distinctive within the Caeciliaidae. We consider the hypothesis that the siphonoforms form a holophyletic group to be well enough supported to be adopted as our working hypothesis.

Phylogenetic relationships within the siphonoforms are unclear for three main reasons. Firstly, little is known about diversity in characters which might have phylogenetic significance within the group. Indeed, only characters 3, 6, 8, 9 and 14 of the above group characters are known for the two poorly known species *Siphonops leucoderus* and *S. insulanus*. Secondly, most of the characters that vary between groups of siphonoform species also vary within non-siphonoform caecilians. This heterogeneity means that the use of non-siphonoform caecilians as an outgroup will not generally provide unambiguous assessments of the polarities of characters. Thirdly, phylogenetic relationships within the Gymnophiona are not sufficiently resolved to allow the identification of a less heterogeneous subgroup of non-siphonoform caecilians which could serve as an appropriate outgroup and hence facilitate less equivocal interpretations of character polarities within the siphonoforms.

Mimosiphonops vermiculatus and *M. reinhardti* share three features—the relatively anterior position of the tentacular apertures, the relatively strong rostral projection of the snout, and anterolateral denticulations of the cloacal disc that are not expanded—that distinguish them from other siphonoforms. More anteriorly placed tentacles are thought to be derived within the Gymnophiona based on their ontogenetic progression away from the eye (Nussbaum, 1977). A parallel argument from ontogeny can be made for the rostral projection of the snout. This assessment of the polarity of these characters suggests a sister-species relationship between *M. vermiculatus* and *M. reinhardti*, hence our placement of the latter species in *Mimosiphonops*. The hypothesized relationships should be considered weak and tentative because it is possible that outgroups to the siphonoforms will have the assumed derived conditions of these characters. This would indicate the probability of error in the assessment of the polarities of these characters based on their ontogenetic transformations. Further understanding of phylogenetic relationships within the siphonoforms will require more detailed comparative studies of both siphonoforms and of other caecilians, and the identification of appropriate outgroups.

Acknowledgements

We are grateful to the following individuals and institutions for the loan of specimens used in this study: E. N. Arnold and B. T. Clarke, British Museum (Natural History) [BMNH]; W. D. Duellman, Kansas University Museum of Natural History (KU); J. Lescure, Museum National d'Histoire Naturelle, Paris (MNHNP); L. Borkin, Zoological Institute, Academy of Sciences, Leningrad (ZIL). This research was supported in part by SERC grant GR/F 87912 and by NSF grant BSR-88 17453.

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