

DIACRIA PICCOLA AND *DIACRIA MACULATA*:
TWO NEW PTEROPOD MOLLUSC SPECIES FROM
THE ATLANTIC AND PACIFIC OCEANS

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Abstract.—A few specimens of *Diacria* from the northwestern Pacific Ocean were described as intermediates between *D. trispinosa* forma *trispinosa* and *D. rampali* (cf. Van der Spoel 1982). New records from this *Diacria* form from the Pacific and Atlantic prove that these 'intermediates' are a common phenomenon, not an incidental occurrence. The co-occurrence of this *Diacria* form with other related species of the genus made it acceptable that a good species is involved, for which the name *Diacria maculata* is proposed.

In one of the Northwestern Pacific Ocean sediment samples very small *Diacria trispinosa*-like specimens were found. Though it is known that the western Pacific representatives of *D. trispinosa* may be small (Rampal 1975), the present material, twice as small as the smallest previously known specimen, is considered to represent a species new to science for which the name *D. piccola* is proposed.

Diacria piccola, new species
Figs. 2-4

Material.—Locality data of *D. piccola* with numbers of specimens in parentheses: Holotype USNM 276782 and paratype USNM 859098, both from *Albatross* sta 5236, Philippines, off Magabao Is., E. Mindanao, 8°50'45"N, 126°26'52"E, 494 fms, fine gray sand, 12 feet Agassiz beam trawl, 11 May 1908 (2).

Description.—The specimens collected from the sediment are subfossils or Recent specimens which have been buried in the sediment for a long period, as evidenced by decalcification. No color patterns remain visible. In the holotype the caudal spine is broken off below the closing septum, the width near the septum (> 15% of shell width) is relatively large compared to other species (< 15% of shell width). The lateral spines are worn off. The dorsal side shows 3 ribs; the central one is especially broad and flattened. The lateral sides between the closing septum and the lateral spines are nearly

straight and meet at an angle of 66°. The dorsal lip is curled dorsally. The ventral lip is slightly curved ventrally. The 2 lateral ribs on the ventral side are indistinct. Measurements of the holotype: shell width 2.52 mm, shell length 3.32 mm, length between lateral spines and closing septum 1.60 mm, distance between lateral spines and closing septum 2.00 mm, distance between lateral spines and centre of upper lip 1.80 mm, width of shell aperture 1.08 mm, height of shell aperture 0.49 mm, angle of lateral sides 66°.

The paratype is slightly smaller than the holotype and damaged at the upper shell lip; it is filled with sediment.

Type material.—Deposited at the Smithsonian Institution. The holotype USNM 276782 and one paratype USNM 859098 are both from *Albatross* sta 5236, 494 fms, fine gray sand.

Type locality.—Philippines, off Magabao Is., E. Mindanao, 8°50'45"N, 126°26'52"E.

Etymology.—The small size and resem-

blance to a small pipe is reflected in the Italian word *piccolo*. It is here treated as a neo-Latin adjective.

Diacria maculata, new species

Figs. 4, 5, 8, 9

Material.—Locality data of *D. maculata* with numbers of specimens in parentheses; geographic positions between square brackets are added by the present authors: Holotype USNM 283052 and paratypes USNM 859099 (8), both from: *Albatross* sta 5470, Philippines, Lagonoy Gulf, E. Luzon, 13°37'30"N, 123°41'09"E, 560 fms (estimate), 18 Jun 1909 (9).

USNM 859100: *Fish Hawk* sta 1154, off Martha's Vineyard, 39°55'31"N, 70°39'W, 193 fms (1).—USNM 38491: *Albatross* sta 2222, S of Martha's Vineyard, 39°03'15"N, 70°50'45"W, 1537 fms (2).—USNM 859101, *Albatross* sta 2760, off Bahia, Brazil, 12°07'00"S, 37°17'00"W, 1019 fms, ooze (1).—USNM 859102, *Albatross* sta 5580, Darvel Bay, Borneo, 23 m, W of Sibutu, 4°52'45"N, 119°06'45"E, 162 fms, brown sand and coral (2).—USNM 258143: *Albatross* sta 5238, Philippines, off Pt. Lambajon, E. Mindanao, 7°34'45"N, 126°38'15"E, 380 fms, green mud (4).—USNM 274767: *Albatross* sta 5394, Philippines, off Dumurug Masbate, 12°00'30"N, 124°05'36"E, 153 fms, green mud (5).—USNM 276003: *Albatross* sta 5265, Philippines, off Matocot Pt., W. Luzon, 13°41'15"N, 120°00'50"E, 135 fms, sand and mud (1).—USNM 859103, *Albatross* sta 5236 Philippines, off Magabao Is., E. Mindanao, 8°50'45"N, 126°26'52"E, 494 fms, fine gray sand (4).—USNM 281794: *Albatross* sta 5392, Philippines, off Adyagan Is., E. Masbata, 12°13'15"N, 124°05'03"E, 135 fms, green mud and sand. (5).—USNM 284465: *Albatross* sta 5314, China Sea, off Pratas Is., 21°41'N, 116°46'E, 122 fms, sand and broken shells (1).—USNM 284819: *Albatross* sta 5313, China Sea, off Pratas Is., 21°30'N, 116°49'E, 150 fms, sand (2).—USNM 288113: *Albatross* sta 5425, Phil-

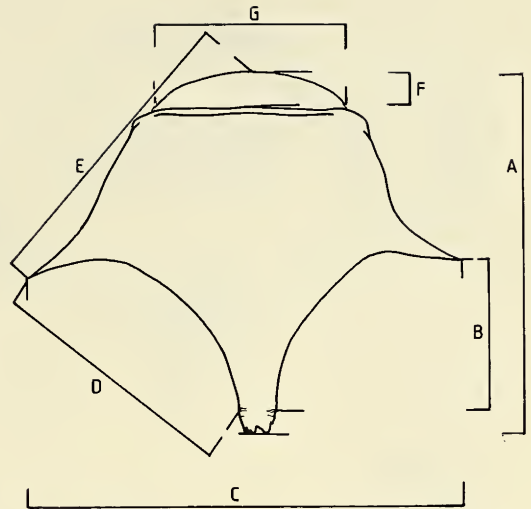
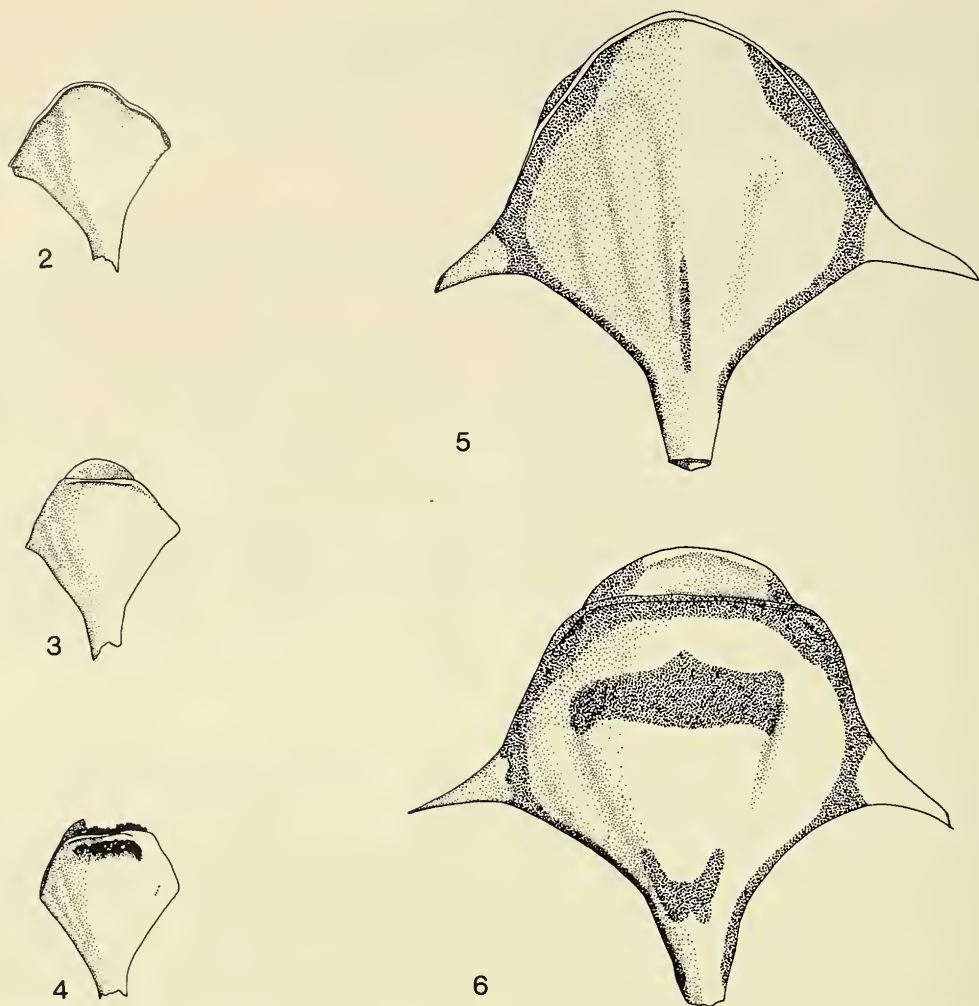


Fig. 1. *Diacria* shell showing measurements referred to. A, Shell length; B, Length between lateral spines and closing septum; C, Shell width; D, Distance between lateral spines and closing septum; E, Distance between lateral spines and center of upper lip; F, Height of shell aperture; G, Width of shell aperture.

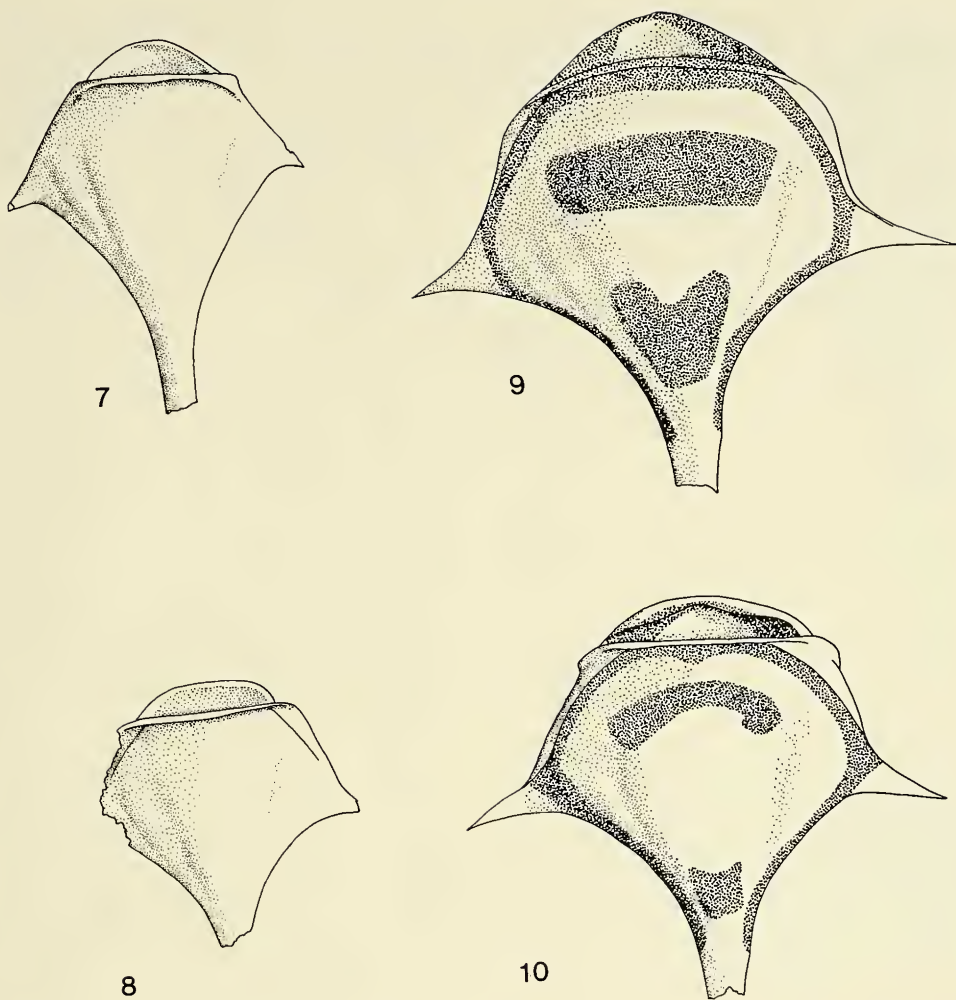
ippines, Jolo Sea off Cagayan Is., 9°37'45"N, 121°11'E, 495 fms, gray sand, mud, coral and sand (9).—USNM 289069: *Albatross* sta 5453, Philippines, Albay Gulf, off Legaspi light, E. Luzon, 13°12'N, 123°49'18"E, 146 fms (1).—USNM 289259: *Albatross* sta 5429 Philippines, off Fondeado Is., E. Palawan, 9°41'30"N, 118°50'22"E, 766 fms, green mud. (1 + cf. 2).—USNM 289640: *Albatross* sta 5459, Philippines, Albay Gulf, E. Luzon, 13°10'21"N, 123°59'54"E, 201 fms (2).—USNM 289802: *Albatross* sta 5582, Borneo, off Si Amil Is., 4°19'54"N, 118°58'38"E, 890 fms, gray mud and fine sand (1).—USNM 334804: [21°15'N, 158°W] *Albatross* sta 3908, Hawaiian Is., S. coast Oahu Is., 304–308 fms, fine white sand and mud. (1).—USNM 859104 *Albatross* sta 2644, off Cape Florida, 25°40'00"N, 80°00'00"W, 193 fms, gray sand (1).—USNM 357699: *Eolis* sta 118, Miami, Florida, off Govt. cut NE, 30 fms (1).—USNM 859105: [25°35'N, 80°05'W] *Eolis* sta 153, off Foway light, Fla., SE 3.5 mi. (1); USNM 859106: [25°35'N, 80°05'W] *Eolis* sta 174,



Figs. 2-6. *Diacria piccola*: 2, Holotype, dorsal view; 3, Holotype, ventral view; 4, Paratype, ventral view. *Diacria maculata*: 5, Holotype, dorsal view; 6, Holotype, ventral view.

off Foway light, Florida, ENE, 58 fms (1).—USNM 859107: [25°30'N, 80°11'W] *Eolis* sta 302, off Sand Key, Florida, 100 fms. (1).—USNM 859108: [25°30'N, 80°11'W] *Eolis* sta 324, off Sand Key, Florida, 100 fms (11).—USNM 859109 *Eolis* sta 329, off Sambo Reef, Florida, 135 fms (8).—USNM 859110: [25°35'N, 80°05'W] *Eolis* sta 340, off Foway light, Florida, 209 fms. (3).—USNM 429577: Johnson Smithsonian Exp. sta 32, 18°25'50"N, 67°14'55"W 200-280 fms (1).—USNM 859115: Johnson Smith-

sonian Exp. sta 93, 18°38'00"N, 65°09'30"W, 350-400 fms (2).—USNM 859111: Johnson Smithsonian Exp. sta 25, 18°32'15"N, 66°22'10"W, 240-300 fms (1).—USNM 859112: State University of Iowa Exp. sta 25, off Pelican Is., Barbados, 80 fms, coarse sand (1).—USNM 859113: [13°57'S, 59°33'W] State University of Iowa Exp. sta 54, off cable station, Barbados, 33 fms rocky (1).—USNM 859114 coarse sand (1); 59°33'W] (1).—USNM 859114 *Albatross* sta 2711, New Jersey, 38°59'00"N,



Figs. 7-10. 7, *Diacria piccola* × *D. rampali*, ventral view; 8, *Diacria piccola* × *D. trispinosa*, ventral view; 9, *Diacria maculata* from the Pacific Ocean; 10, *Diacria maculata* from the Atlantic Ocean.

70°07'00"W, 1544 fms globigerina ooze (1).

Description.—The type series was collected from the sediment but no decalcification has occurred, and the color pattern is well preserved so that very recently sedimented specimens are represented. In the holotype the caudal spine is broken off below the closing septum, the width at the closing septum shows similarity to that in *Diacria trispinosa*, for example. The lateral spines are straight and sharp, slightly directed caudally. The dorsal side shows 3 moderately developed ribs. The central rib

is most elevated in the caudal part, the lateral ones in the middle. The lateral sides between lateral spines and closing septum are nearly straight and form an angle of 109°. Growth lines are evident on both sides. The color pattern on the dorsal side consists of a continuous band along upper and lateral shell margins; a separate patch of color is found on the caudal half of the median dorsal rib. The upper lip is curved only slightly dorsally. The ribs on the ventral side are very indistinct, the ventral aperture lip curves prominently ventrally. The color

pattern on the ventral side also forms a continuous band along upper and lateral shell margins, and a roughly quadrangular color patch is found on the upper half of the ventral side, as well as a patch on the narrowing caudal part of the ventral side. Sizes in the holotype are: shell width 8.80 mm, shell length 7.36 mm, length between lateral spines and closing septum 3.20 mm, distance between lateral spines and closing septum 4.80 mm, distance between lateral spines and center of upper lip 5.68 mm, width of shell aperture 3.20 mm, height of shell 0.72 mm, aperture angle between lateral sides 109°.

Type material.—Deposited at the Smithsonian Institution. The holotype USNM 283052 and 8 paratypes USNM 859099 are all from *Albatross* sta 5470, 560 fms (estimate).

Type locality.—Philippines, Lagonoy Gulf, E. Luzon, 13°37'30"N, 123°41'09"E.

Etymology.—The color spots (=maculata) on both sides give this species its name.

Discussion.—Sediment samples are used throughout as the forms described as new in this paper are not recorded from the plankton. In the large collections of plankton samples studied from the areas concerned no comparable specimens were found so that it is not excluded that the new species are fossil or subfossils.

The measurements given in the descriptions and table are indicated in Fig. 1.

Diacria piccola is distinct from all related species by its small size and narrow angle between the lateral sides. *D. maculata* is distinct from all other species by its color pattern.

Diacria is composed of the following taxa: the *Diacria trispinosa* group: *Diacria trispinosa* forma *trispinosa* (De Blainville, 1821), between 40°N and 40°S in all oceans.

Diacria trispinosa forma *atlantica* Dupont, 1979, between 40°N and 70°N in the Atlantic Ocean.

Diacria trispinosa forma *atlantica* Du-

pont, 1979 upwelling type (cf. Hilgersom & Van der Spoel 1988) in upwelling area off NW Africa.

Diacria rampali Dupont, 1979, between 30°N and 30°S in all oceans.

Diacria major (Boas, 1886), in Central waters of all oceans.

Diacria maculata, n. sp., in NW boundary currents of Atlantic and Pacific Oceans.

Diacria piccola, n. sp., W tropical Pacific near Philippines.

The *Diacria quadridentata* group (cf. Van Leyen & Van der Spoel 1982):

Diacria quadridentata (De Blainville, 1821). Indo-Pacific between 30°N and 30°S.

Diacria costata Pfeffer, 1879. Central water form (cf. Van Leyen & Van der Spoel 1982) of the Pacific.

Diacria costata Pfeffer, 1879. Equatorial water form (cf. Van Leyen & Van der Spoel 1982) of Indian and Pacific Oceans.

Diacria danae Van der Spoel, 1968. Equatorial waters of all oceans.

Diacria schmidti schmidti Van der Spoel, 1971. Eastern Tropical Pacific.

Diacria schmidti occidentalis Van Leyen & Van der Spoel, 1982. Western Tropical Pacific near Philippines.

Diacria erythra erythra Van der Spoel, 1971. Red Sea and Western Indian Ocean.

Diacria erythra crassa Van der Spoel, 1971. Red Sea.

Variation and distribution.—*Diacria piccola* is known currently only from near the Philippines, thus any conclusion on its distribution is excluded. Further, the two specimens available cannot give an indication of variation. In the sample with the type material, however, two specimens also were found that were somewhat larger and resemble in shape *D. rampali* (Fig. 7) or *D. trispinosa* (Fig. 8). This may indicate that interbreeding of *D. piccola* with related species is still possible. Deformation or abnormal growth are not expected to generate shells of the type described here as all aberrant shells found show either asymmetry or

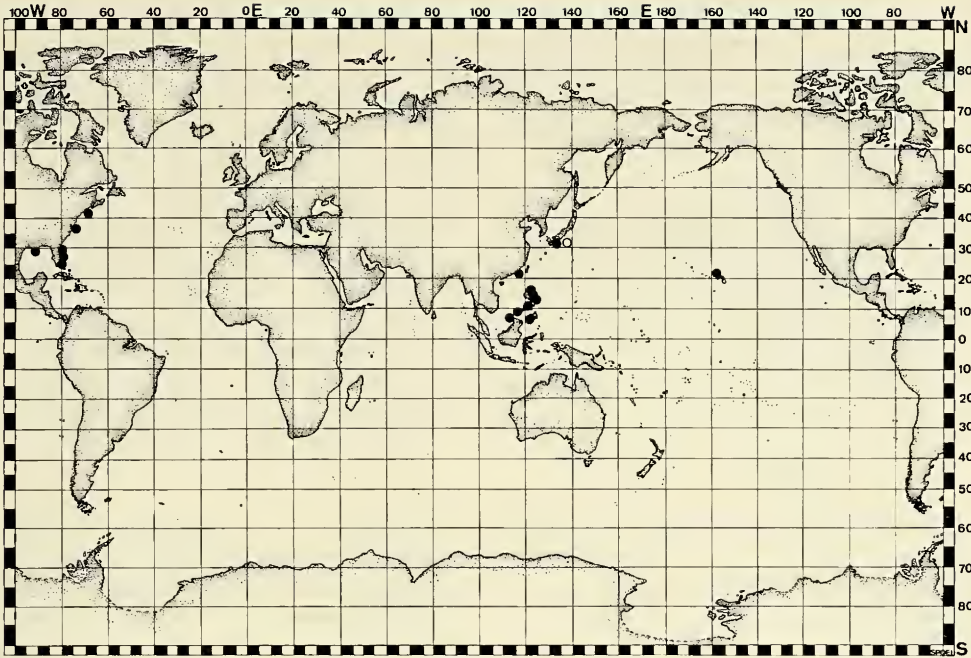


Fig. 11. Distribution of *Diacria maculata* (closed circles) and *D. piccola* (open circles).

different aberrations in different growth regions of the shell, which is not the case in *D. piccola*.

Rampal (1975) described the size variation of *Diacria trispinosa* in the Pacific Ocean, but though a tendency towards smaller sizes is clear, it is not acceptable that *D. piccola* forms the extreme of a size variation of one of the two mentioned species. The gap between the size range of *D. piccola* and the other species is too large and size variation will be binomial with a separate maximum for *D. piccola*.

Diacria maculata is found in the western North Pacific and in the western North Atlantic oceans (Fig. 11). Though the distribution of this species probably is not completely known, it is evident that it does not occur along the eastern borders of the oceans. An endemic occurrence in western boundary waters is not known for other species, though a few (distant) neritic taxa have their range in these water masses. Probably *D.*

Table 1.—Morphometric data (minimum–maximum) in mm based on the present material and literature data showing the unique position of *D. piccola* and the more intermediate position of *D. maculata*.

Species	Shell width	Shell length	Aperture height	Angle of lateral sides
<i>D. major</i> ¹	7.0–11.0	7.5–9.0	0.5–1.0	—
<i>D. t. dark type</i> ²	7.0–10.0	6.0–8.0	—	—
<i>D. maculata</i> ³	9.8	7.4	0.9	100–110°
<i>D. t. atlantica</i> ¹	6.5–12.0	6.0–9.5	0.4–0.8	—
<i>D. major</i>	6.5–8.0	7.2–8.4	0.5–0.9	100–110°
<i>D. maculata</i>	5.5–8.8	5.0–7.2	0.5–0.8	100–110°
<i>D. t. trispinosa</i> ¹	5.5–9.0	5.0–6.5	0.5–0.9	—
<i>D. t. trispinosa</i>	5.6–7.8	5.4–6.8	0.5–0.8	80–90°
<i>D. rampali</i> ¹	5.5–8.5	5.0–7.0	0.5–0.8	—
<i>D. rampali</i>	5.5–6.9	5.5–6.6	0.5–0.7	80–90°
<i>D. piccola</i>	2.0–2.4	2.5–2.8	0.24	65–80°

¹ After Dupont 1979.

² After Hilgerson & Van der Spoel 1988.

³ After Van der Spoel 1982.

maculata is a neritic taxon in the *Diacria trispinosa* group of oceanic species. Atlantic and Pacific specimens do not differ in color pattern and shape, the Pacific ones are only slightly larger than the Atlantic ones, as can be seen in Table 1.

In shape *D. maculata* is closest to *D. major* and in shape to *D. rampali*, but many characters, like the closing membrane in the caudal spine, make it look like a *D. trispinosa*, so that it was originally considered an intermediate between both (Van der Spoel 1982).

Acknowledgments

Dr. C. F. E. Roper and M. Sweeney kindly provided the material on which this publication is based and commented on the manuscript.

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