

Review of the Indo-Pacific Doryrhamphine Pipefish Genus *Doryichthys*

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Abstract The tropical Indo-Pacific trunk-pouch pipefish genus *Doryichthys* Kaup is reviewed. The genus is, in part, characterized by the presence of a single longitudinal ridge on the opercle, by typically failing to have the lateral trunk ridge confluent with the inferior tail ridge and by having a modal count of 9 caudal-fin rays. Included species (*D. deokhatoides*, *D. martensii*, *D. boaja* and *D. heterosoma*) are presently known from freshwater habitats at insular and mainland localities from Indonesia to Vietnam. A key, synonymies, diagnoses and illustrations are provided for all species.

Kaup (1856) included two morphological lineages in his diagnosis of the doryrhamphine (trunk-pouch) pipefish genus *Doryichthys*, and failed to clearly differentiate this taxon from the genus *Microphis* Kaup. Duncker (1910, 1912, 1915) discussed these genera but failed to examine critical type material, perpetuated some of Kaup's original errors, and added further confusion by introducing major nomenclatural problems. Duncker initially (1910) referred these genera to his nominal subfamily Doryichthyina (=Doryichthyinae), but later (1915) changed this name to Doryrhamphina (=Doryrhamphinae). As a result, subsequent authors have, with little consistency, referred some 15 or more nominal species of predominantly freshwater or estuarine Indo-Pacific pipefishes to one or the other of these genera. In addition, species diagnoses are largely inadequate, some species have never been illustrated, and available literature generally fails to allow identification of individual specimens. In continuation of studies on Indo-Pacific pipefishes, I here review the genus *Doryichthys* Kaup and include therein four species which typically fail to have the lateral trunk ridge confluent with the inferior tail ridge. This treatment differs from those of Kaup (1856) and Duncker (1915) in that one, rather than two, lateral ridge configurations are included in the generic diagnosis. Although there is some individual variation, the typical ridge configuration is here considered a primary character distinguishing *Doryichthys* from nominal genera characterized by having the lateral trunk ridge

confluent with the inferior tail ridge (e.g. *Microphis*, *Oostethus*, etc.). Although available museum specimens have been examined, study material is limited for some species. Nevertheless, the present treatment should provide a basis for identification of included species as well as for future studies on variation and distribution.

Some species have entered the international aquarium trade (Sterba, 1959; Wheeler, 1975) and introduction of species of *Doryichthys* to extralimital freshwater habitats is to be expected.

Methods and materials

Methods are those of Dawson (1977). Measurements are in millimeters (mm); proportional data are referred to standard length (SL) or head length (HL); some measurements are given for total length (TL), whereas those given for damaged specimens in Materials Examined refer to present overall length; color descriptions are from specimens preserved in alcohol. As used here, the term "venter" refers to the ventral surface of head or body. Distribution is based largely on specimens examined.

Abbreviations for repositories of material examined follow: AMS—Australian Museum, Sydney; ANSP—Academy of Natural Sciences of Philadelphia; BMNH—British Museum (Natural History), London; CAS-SU—former Stanford University specimens, housed at California Academy of Sciences, San Francisco; GCRL—Gulf Coast Research Laboratory Museum; MCZ—Museum of Comparative

Zoology, Harvard University; MNHN—Muséum National d'Histoire Naturelle, Paris; MZB—Museum Zoologicum Bogoriense, Bogor; NMW—Naturhistorisches Museum Fischsammlung, Wien; RMNH—Rijksmuseum van Natuurlijke Historie, Leiden; SMF—Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt am Main; UMMZ—University of Michigan Museum of Zoology; USNM—National Museum of Natural History, Smithsonian Institution; WAM—Western Australian Museum, Perth; ZMA—Zoölogisch Museum, Amsterdam; ZMB—Zoologisches Museum, Museum für Naturkunde der Humboldt Universität, Berlin; ZSI—Zoological Survey of India, Calcutta.

Doryichthys Kaup 1856

Doryichthys Kaup, 1853: 233 (nomen nudum).
Doryichthys Kaup, 1856: 56 (type-species: *Doryichthys bilineatus* Kaup 1856 (= *Syngnathus deokhatoides* Bleeker 1853), by subsequent designation of Jordan and Evermann 1896).
Doryrhamphinarum Kaup, 1856: 62 (nomen nudum).

Kaupia Smith, 1963: 533 (type-species: *Syngnathus boaja* Bleeker 1851, by original designation).

Diagnosis. Superior trunk and tail ridges discontinuous near vertical through rear of dorsal-fin base, not arched dorsad below dorsal-fin base; lateral tail ridge ends near anal ring; lateral trunk ridge ends with or without deflection near anal ring, typically fails to unite with confluent inferior trunk and tail ridges (Figs. 2, 4); venter of trunk more or less V-shaped in adult females; median ventral trunk ridge begins on pectoral ring, typically distinct, sometimes keel-like in large females; median dorsal snout ridge entire, mainly low, usually ends near vertical through rear of nares but may continue on anterior part of interorbital; lateral snout ridge not arched strongly dorsad; anterior supraorbital ridges end at or before vertical through middle of orbit, infrequently confluent with posterior supraorbital ridges; median dorsal head ridges low to somewhat elevated; typically with 1~3 supraopercular ridges and a ridge above gill opening; opercle with a complete or incomplete median longitudinal ridge, otherwise ornamented with minute striae but without prominent sup-

plemental ridges; pectoral-fin base not protruding strongly laterad, the superior and inferior ridges usually distinct; scutella without longitudinal keels; principal body ridges low to somewhat elevated, notched or indented between rings, the margins entire, denticulate or serrate under $\times 30$ magnification; rings with or without a prominent spine on posterior third of each principal ridge; head and body without dermal flaps or papillae; dorsal fin originates on trunk, its base not elevated; pectoral fins emarginate (unknown in *D. heterosoma*), the median rays shorter than those above and below. Head length 4.6~9.2 in SL; snout length 1.4~2.4 in HL; length of dorsal-fin base 1.0~2.5 in HL; trunk rings 15~26; total rings 45~62; total subdorsal rings 5.0~12.5, mostly on tail; dorsal-fin rays 27~69; pectoral-fin rays 16~27; anal-fin rays usually 4; caudal-fin rays typically 9 (unknown in *D. heterosoma*). Brood pouch originates on 1st~3rd trunk ring; pouch plates well developed, with or without a narrow marginal membranous fold; pouch plates vertical to somewhat convergent in brooding fish, fail to completely enclose developing eggs and do not meet on ventral midline; eggs deposited in 1~5 transverse rows within membranous compartments lining dorsum of pouch (Fig. 4), evidently in single layer (unknown in *D. boaja* and *D. heterosoma*). Without odontoid processes in jaws (Dawson and Fritzsche, 1975) or bony inclusions in gill membranes (Dawson, 1978). Maximum size at least 470 mm TL. Indonesia, Malay Peninsula, Cambodia, Thailand and (questionably) Taiwan; presumably freshwater, not definitely recorded from marine or estuarine habitats.

Comparisons. Among trunk-pouch pipefishes, the *Doryichthys* configuration of principal body ridges is shared only with the endemic Australian monotypic, marine, genus *Leptoichthys* Kaup. This genus lacks the opercular ridge and pouch protective plates present in *Doryichthys* and typically has 5 anal-fin rays and 11 caudal-fin rays (respectively, 4 and 9 in *Doryichthys*). Species of several nominal doryrhamphine genera (e.g. *Coelonotus* Peters, *Microphis* Kaup, *Oostethus* Hubbs, *Paramicrophis* Klausewitz) may also occupy Indo-Pacific freshwater or estuarine habitats and may be superficially similar to those of *Doryichthys*. Unlike *Doryichthys*, these genera are, in part, characterized by typically

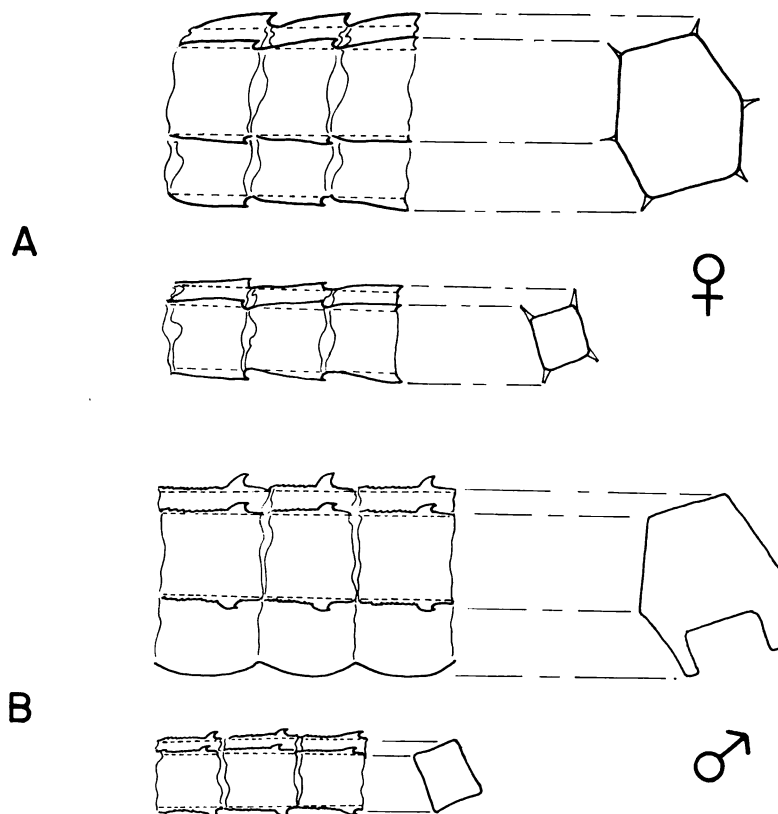


Fig. 1. Lateral and cross-sectional aspects of trunk and anterior tail rings, illustrating location of enlarged spines on principal ridges in *Doryichthys boaja* (A) and *D. heterosoma* (B).

having the lateral trunk ridge confluent with the inferior tail ridge. The *Doryichthys* ridge configuration is shared with a number of syngnathine (tail-pouch) genera (*Syngnathus* Linnaeus, *Corythoichthys* Kaup, *Bhanotia* Hora, etc.) but these have modally 10 rather than the 9 caudal-fin rays typical of *Doryichthys*.

Remarks. The name *Doryichthys* was introduced by Kaup (1853) but the ten specific names then listed for the genus were nomina nuda. Although the type-species was not indicated, the generic name was validated by Kaup (1856) with the description of nine species in two groups ("A" and "B") with different principal body ridge configurations. Within the A-group (lateral trunk ridge not confluent with inferior tail ridge), Kaup included only *D. bilineatus* Kaup 1856 (= *Syngnathus deokhatoides* Bleeker 1853) and *D. spinosus* Kaup 1856 (= *Syngnathus boaja* Bleeker 1851). The B-group (lateral

trunk ridge confluent with inferior tail ridge) included *D. pristipeltis* (a nomen dubium, probably conspecific with *Syngnathus brachyurus* Bleeker 1853) and six nominal species subsequently shown (Dawson, 1979) to be conspecific with *Syngnathus brachyurus*. Kaup diagnosed *Doryichthys* inadequately and it was synonymized with *Microphis* Kaup 1853 by Duméril (1870). In contrast, Günther (1870) synonymized *Microphis* and three other doryrhamphine genera (*Doryrhamphus* Kaup, *Choeroichthys* Kaup, *Belonichthys* Peters) with *Doryichthys*. Duncker (1910) incorrectly employed *Doryichthys* as the name for a new genus and later (1912) designated *Syngnathus cunocalus* Hamilton Buchanan 1822 as its type-species. Hubbs (1929) noted that Duncker's type-species selection was inadmissible due to the earlier designation of *Doryichthys bilineatus* as the type-species of *Doryichthys* Kaup by Jordan and Evermann

(1896), but failed to mention that *Doryichthys* Duncker 1910 is a junior homonym of *Doryichthys* Kaup 1856. The B-group species of *Doryichthys* Kaup (1856) are presently referred to *Oostethus* Hubbs 1929.

The four species here referred to *Doryichthys* include two rather different morphological groups. Subadults and adults of *D. deokhatoides* and *D. martensii* have rounded caudal fins, lack prominent spines on the principal body ridges, brood-pouch eggs are usually in 1~2 transverse rows, pouch plates are sometimes slightly convergent and these species evidently fail to reach 200 mm SL. In contrast, *D. boaja* and *D. heterosoma* have enlarged spines on the principal ridges of subadults and adults (Fig. 1), the median caudal-fin rays are elongate in adult *D. boaja* (unknown in *D. heterosoma*), pouch eggs are in 3~5 transverse rows, pouch plates are typically vertical and both species may exceed 275 mm SL. Furthermore, these spiny forms have higher values for most meristic features than either *D. deokhatoides* or *D. martensii*. I find no character combination among present material which justifies separate treatment for these species groups. However, comparative samples of early juveniles are not available and there are no undamaged specimens of *D. heterosoma*. Should future studies provide a firm basis for subgeneric or generic treatment of the spiny forms, *Kaupia* Smith 1963 (type-species: *Syngnathus boaja* Bleeker) is the first available name. Kaup's (1856) name "Doryrhamphinarum" (proposed for *Syngnathus heterosoma* Bleeker) is a genitive plural rather than a noun and thereby fails to meet the requirements of Article 11 of the International Code of Zoological Nomenclature.

Although the configuration of principal body ridges is rather stable in examined specimens of *D. boaja* and *D. heterosoma*, there is considerable variation in the lateral trunk ridge and less frequent variation in the inferior ridges of both *D. deokhatoides* and *D. martensii*. Among 81 specimens of *D. martensii*, 67 lateral ridges ended without deflection, 69 were deflected slightly ventrad and 17 were strongly deflected so as to nearly reach the inferior ridge. Five lateral trunk ridges were confluent with the continuous inferior ridge and, in four unilateral cases, the inferior trunk ridge terminated near the anal ring and the lateral trunk ridge was confluent with the

inferior tail ridge. Careful bilateral examination of the lateral ridge configuration is recommended, since occasional aberrant specimens could be incorrectly referred to genera wherein the lateral trunk and inferior tail ridges are typically confluent (e. g. *Microphis*, *Oostethus*, etc.).

Key to the species of *Doryichthys*

- 1a. Trunk rings 15~20; total rings 45~53; dorsal-fin rays 27~39; subadults and adults without a prominent spine on principal ridges of each ring2
- 1b. Trunk rings 22~26; total rings 56~64; dorsal-fin rays 43~69; subadults and adults with a prominent spine on principal ridges of each ring.....3
- 2a. Trunk rings 17~20; tail rings 28~34; pectoral-fin rays 19~23, 20 or more in 90% of specimens examined; total subdorsal rings 5.0~6.75, usually 6.0 or less; HL averages 6.1 in SL; snout length averages 1.8 in HL; snout depth averages 7.6 in snout length; usually with large dark spots above lateral trunk ridge*D. deokhatoides*
- 2b. Trunk rings 15~17; tail rings 31~37; pectoral-fin rays 16~22, 19 or less in 96%; total subdorsal rings 6.25~9.0, usually 6.75 or more; HL averages 8.1 in SL; snout length averages 2.1 in HL; snout depth averages 5.2 in snout length; usually with small dark spots on lateral trunk ridge.....*D. martensii*
- 3a. Trunk rings 22~24; subdorsal trunk rings 4.75~2.0; rings of subadults and adults with a prominent terminal spine on principal ridges (Fig. 1A)...*D. boaja*
- 3b. Trunk rings 25~26; subdorsal trunk rings 6.25~5.5; trunk rings and anterior tail rings of adults with a prominent spine on posterior third of each principal ridge (Fig. 1B).*D. heterosoma*

***Doryichthys deokhatoides* (Bleeker)**

(Figs. 2, 3)

Syngnathus deokhatoides Bleeker, 1853: 5, 11, 17 (orig. descr.; Palembang, Sumatra and Pontianak, Borneo; in rivers).

Syngnathus fluviatilis (not of Peters, 1852) Bleeker, 1853: 5, 11, 18 (orig. descr. from unpublished Van Hasselt figure, Batavia).

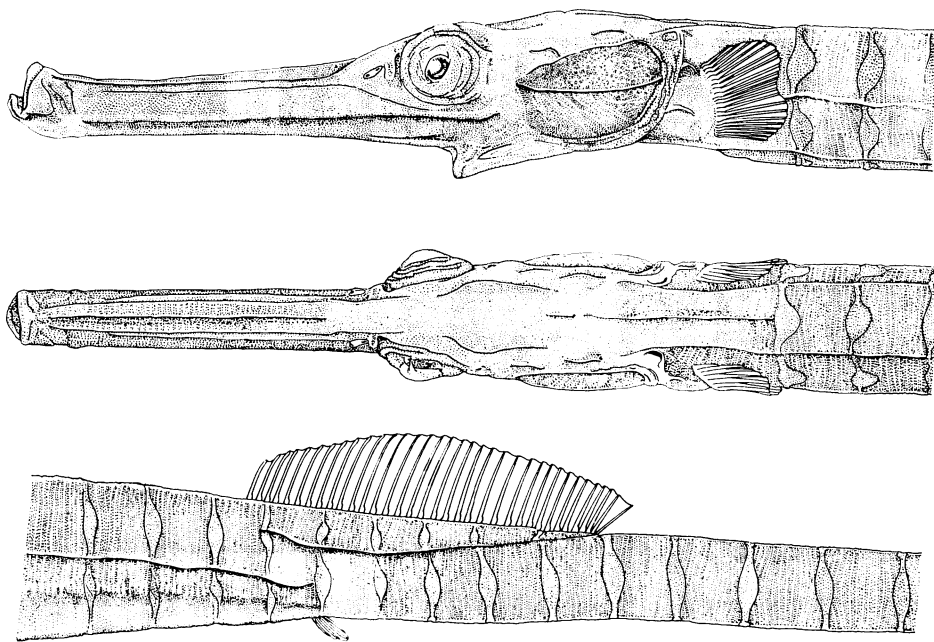


Fig. 2. *Doryichthys deokhatoides*. Lateral and dorsal aspects of head and anterior trunk rings, together with section of body illustrating ridge configuration and dorsal and anal fins. From 125 mm SL adult male (CAS-SU 30914).

Doryichthys bilineatus Kaup, 1856: 56, 75, pl. 1, fig. 8 (orig. descr.; type locality not stated).

Doryichthys Hasselti Kaup, 1856: 57, 75 (in part. Java record only).

Doryichthys deokhatoides: Bleeker, 1859b: 188 (n. comb.).

Doryichthys fluviatilis (not of Peters): Bleeker, 1859b: 188 (n. comb.).

Microphis deokhatoides: Duméril, 1870: 589, 596 (n. comb.).

Microphis fluviatilis (not of Peters): Duméril, 1870: 589, 598 (n. comb.).

Microphis bilineatus: Duméril, 1870: 589, 598 (n. comb.).

Doryichthys deokhatoides: Volz, 1903: 412 (misspelling).

Doryichthys fluviatilis (not of Peters; not of Bleeker, 1853) Duncker, 1904: 188, pl. 2, figs. 10, 10a (orig. descr.; Kuala Lumpur, Malaya).

Microphis annandalei Hora, 1924: 472, fig. 1 (orig. descr.; near lake at Lampam, Talé Sap, Siam).

Diagnosis. Rings $17 \sim 20 + 28 \sim 34 = 45 \sim 53$ (usually $17 \sim 18 + 33$ or less); dorsal-fin rays $27 \sim 35$; pectoral-fin rays $19 \sim 23$, usually $20 \sim 22$;

subdorsal rings $2.25 \sim 0.5 + 3.75 \sim 6.0 = 5.0 \sim 6.75$. Proportional data based on 19 specimens $80 \sim 159.5$ ($\bar{x} = 118.7$) mm SL follow: HL in SL $5.7 \sim 6.6$ (6.1); snout length in HL $1.6 \sim 1.9$ (1.8); snout depth in snout length $5.9 \sim 9.9$ (7.6); length of dorsal-fin base in HL $1.8 \sim 2.25$ (2.0); anal ring depth in HL $5.1 \sim 7.0$ (6.1); trunk depth in HL $2.9 \sim 5.6$ (4.1); pectoral-fin length in HL $0.8 \sim 1.3$ (1.0). See Tables 1~4 for additional counts.

Without prominent spines on trunk or tail ridges in subadults and adults (Fig. 2).

Mainly brownish, the dorsum usually lighter than sides; side of snout irregularly shaded or blotched with dark brown; opercle with a pale stripe on longitudinal ridge, elsewhere mottled brown; lateral trunk and tail ridges outlined faintly with small pale streaks or spots; 6th-16th trunk rings typically with prominent dark brown spots or blotches between the lateral and superior ridges (Fig. 3), blotches sometimes continued for a short distance on dorsum; venter of trunk tan, the median ridge brownish; sides and venter of tail often with small irregular pale blotches along inferior ridges; dorsal fin immaculate; pectoral-

Table 1. Frequency distributions of trunk, tail and total rings in species of *Doryichthys*.

| Species | Trunk rings | | | | | | | | | | | | Tail rings | | | | | | | | | | | |
|------------------------|-------------|-----|----|----|----|----|----|----|----|----|----|----|------------|----|----|----|----|----|----|----|----|----|----|--|
| | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | |
| <i>D. martensii</i> | 11 | 87* | 5 | | | | | | | | | | | | | 1 | 6* | 29 | 25 | 24 | 13 | 5 | | |
| <i>D. deokhatoides</i> | | | 10 | 11 | 2 | 1 | | | | | | | 1 | 2 | 2 | 6 | 7 | 4 | 2 | | | | | |
| <i>D. boaja</i> | | | | | | | | 4 | 12 | 9 | | | | | | | 1 | 2 | 6 | 4 | 8 | 2 | 2 | |
| <i>D. heterosoma</i> | | | | | | | | | | | | 1 | | | | | | | | | 1 | | | |

| Species | Total rings | | | | | | | | | | | | | | | | | |
|------------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 |
| <i>D. martensii</i> | | | | 9* | 32 | 20 | 24 | 13 | 5 | | | | | | | | | |
| <i>D. deokhatoides</i> | 1 | 2 | | 4 | 8 | 3 | 3 | 1 | 2 | | | | | | | | | |
| <i>D. boaja</i> | | | | | | | | | | | | 2 | 5 | 4 | 9 | 3 | 2 | |
| <i>D. heterosoma</i> | | | | | | | | | | | | | | | | | 1 | |

* Holotype.

Table 2. Frequency distributions of dorsal- and pectoral-fin rays in species of *Doryichthys*.

| Species | Dorsal-fin rays | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|-----------------|----|----|----|----|----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | |
| <i>D. martensii</i> | | | | 5 | 17 | 22 | 26* | 21 | 10 | 4 | 4 | | 1 | | | | | | | | | | | | |
| <i>D. deokhatoides</i> | 1 | 5 | 1 | 4 | 6 | 5 | 5 | 2 | 2 | | | | | | | | | | | | | | | | |
| <i>D. boaja</i> | | | | | | | | | | | | | | | | 1 | 2 | 6 | 3 | 5 | 7 | 2 | 5 | | |

| Species | Dorsal-fin rays cont'd. | | | | | | | | | | | | | | | | | | |
|----------------------|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 |
| <i>D. boaja</i> | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | | 1 | 1 | 1 | | | | |
| <i>D. heterosoma</i> | | | | | | | | | | | | | | | 1 | 1 | | | 1 |

| Species | Pectoral-fin rays | | | | | | | | | | | |
|------------------------|-------------------|----|----|-----|----|----|----|----|----|----|----|----|
| | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| <i>D. martensii</i> | 1 | 84 | 73 | 18* | 4 | 2 | 1 | | | | | |
| <i>D. deokhatoides</i> | | | | 5 | 17 | 25 | 6 | 1 | | | | |
| <i>D. boaja</i> | | | | | | | 4 | 6 | 28 | 38 | 9 | 1 |
| <i>D. heterosoma</i> | | | | | | | 1 | 2 | 2 | | | |

* Holotype.

Table 3. Frequency distributions of subdorsal trunk and tail rings in species of *Doryichthys*.

| Species | Subdorsal trunk rings | | | | | | | | | | | | | |
|----------------------|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 6.25 | 6.00 | 5.75 | 5.50 | 5.25 | 5.00 | 4.75 | 4.50 | 4.25 | 4.00 | 3.75 | 3.50 | 3.25 | 3.00 |
| <i>D. boaja</i> | | | | | | | 1 | | 2 | 4 | 5 | 2 | 3 | 14 |
| <i>D. heterosoma</i> | 1 | 1 | 1 | 1 | | | | | | | | | | |

| Species | Subdorsal trunk rings cont'd. | | | | | | | | | | | |
|------------------------|-------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| | 2.75 | 2.50 | 2.25 | 2.00 | 1.75 | 1.50 | 1.25 | 1.00 | 0.75 | 0.50 | 0.25 | 0.00 |
| <i>D. martensii</i> | | 1 | | 6 | 17 | 31* | 20 | 25 | 10 | 2 | | 1 |
| <i>D. deokhatoides</i> | | | 1 | | 1 | 7 | 3 | 13 | 3 | 6 | | |
| <i>D. boaja</i> | 4 | 2 | 6 | 1 | | | | | | | | |

| Species | Subdorsal tail rings | | | | | | | | | | | | | | | | |
|------------------------|----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 3.75 | 4.00 | 4.25 | 4.50 | 4.75 | 5.00 | 5.25 | 5.50 | 5.75 | 6.00 | 6.25 | 6.50 | 6.75 | 7.00 | 7.25 | 7.50 | 7.75 |
| <i>D. martensii</i> | | | | | | 1 | 6* | 3 | 19 | 28 | 29 | 9 | 14 | 3 | 1 | | |
| <i>D. deokhatoides</i> | 2 | 4 | 4 | 4 | 5 | 11 | 2 | 1 | | 1 | | | | | | | |
| <i>D. boaja</i> | | | | | 2 | 1 | 5 | 4 | 4 | 11 | 3 | 5 | 3 | 3 | | 2 | 1 |
| <i>D. heterosoma</i> | | | | | | | | | | | 1 | 2 | | 1 | | | |

* Holotype.

Table 4. Frequency distributions of total subdorsal rings in species of *Doryichthys*.

| Species | Total subdorsal rings | | | | | | | | | | | | | | | | |
|------------------------|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 5.00 | 5.25 | 5.50 | 5.75 | 6.00 | 6.25 | 6.50 | 6.75 | 7.00 | 7.25 | 7.50 | 7.75 | 8.00 | 8.25 | 8.50 | 8.75 | 9.00 |
| <i>D. martensii</i> | | | | | | 2 | 3* | 18 | 32 | 26 | 23 | 4 | 2 | | 1 | 1 | 1 |
| <i>D. deokhatoides</i> | 2 | 5 | 6 | 8 | 9 | | 3 | 1 | | | | | | | | | |
| <i>D. boaja</i> | | | | | | | | | | | | 3 | 1 | 4 | 3 | 5 | 10 |

| Species | Total subdorsal rings cont'd. | | | | | | | | | | | | | |
|----------------------|-------------------------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 9.25 | 9.50 | 9.75 | 10.00 | 10.25 | 10.50 | 10.75 | 11.00 | 11.25 | 11.50 | 11.75 | 12.00 | 12.25 | 12.50 |
| <i>D. boaja</i> | 3 | 5 | 2 | | 1 | | 3 | 2 | | 2 | | | | |
| <i>D. heterosoma</i> | | | | | | | | | | | | | 1 | 3 |

* Holotype.

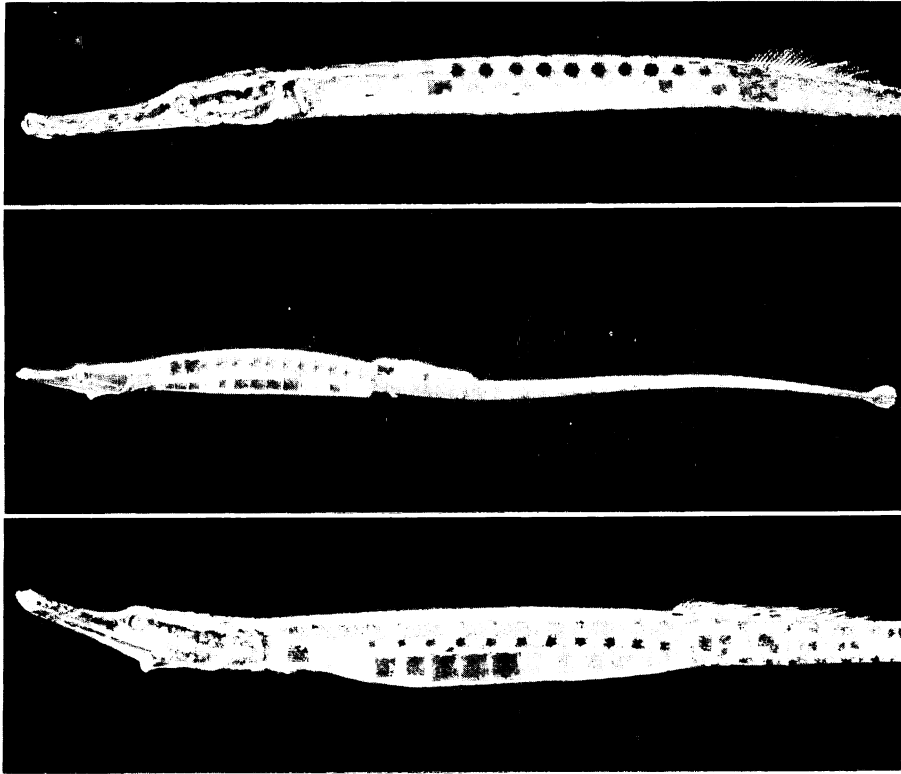


Fig. 3. Top: *Doryichthys deokhatoides*. GCRL 15538 (94 mm SL, female). Middle and bottom: *Doryichthys martensii*. GCRL 15759 (97.5 mm SL, female) and GCRL 15536 (95.5 mm SL, male).

fin rays edged with brown; caudal fin mainly brown, with 3~4 minute pale spots on the fin rays and a narrow pale margin.

Comparisons. This species has fewer trunk rings than either *D. boaja* or *D. heterosoma* (17~20 against 22~26) and lacks the prominent spines present on the principal ridges of subadults and adults of these species. Characters in the accompanying key show that *D. deokhatoides* differs from its most similar congener, *D. martensii*, in a number of meristic and proportional features as well as in preserved coloration. Most subadult and adult *D. deokhatoides* are readily distinguished by the relatively long and slender snout (snout short in *martensii*) and by the large dark spots (Fig. 3) located above the lateral trunk ridge (spots small, located on ridge in *martensii*).

Remarks. Pouch plates are not clearly convergent in immature males. They are angled somewhat inward in brooding fish but the developing eggs remain largely exposed. The smallest

examined male was 101.5 mm SL, the smallest with eggs or membranous egg-compartments within the pouch was 136 mm SL. A 158 mm SL male had a total of 38 pouch eggs deposited in a single layer of two transverse rows, beginning on the 5th trunk ring; maximum egg diameter was about 1.9 mm.

Herre and Meyers (1937) gave lengths of 225 and 235 mm for two Malayan specimens but this is evidently an error; these fish (CAS-SU 30914) now measure ca. 125~135 mm SL. Maximum size probably fails to exceed 170~180 mm SL.

Types. Bleeker's (1853) description was based on four fish (131~158 mm TL) from Sumatra and Borneo but there are now six fish cataloged as Bleeker specimens of *D. deokhatoides*. Bleeker mentioned the species in several later publications (1854a, 1855, 1857, 1858, 1859a, 1859b, 1860a, 1860b), but I have not found any definitive remarks relating to additional specimens. Günther (1870) noted "one of the typical specimens" in the British Museum collection

but this fish (BMNH 1867.11.28.356) is longer (159.5 mm SL) than any syntype and cannot be regarded as such. Auction Catalogue specimens listed by Hubrecht (1879) included two (A series) which went to Leiden and one (B series) whose subsequent history is uncertain. There are now four Bleeker specimens of this species (90~156 mm SL) included in a single lot (RMNH 7242) in the Leiden collection. The largest and smallest of these are not within the length range of the syntypes and the latter is a regenerated specimen with only 9 tail rings. The two remaining fish (males, 127 and 136 mm SL) agree with the syntypes in length, and the larger is pencil-marked and appears to be the model for the illustration (pl. 451, fig. 2) of *D. deokhatoides* in the unpublished Bleeker Atlas. Finally, there is a 137 mm SL female specimen in the Amsterdam collection (ZMA 115.989) bearing the label notation "Indonesia, 1842~1860, det. P. Bleeker." This fish also agrees with the syntypes in length and it may be the remaining Auction (B series) specimen. In view of the foregoing, I consider it best to treat two fish (127 and 136 mm SL) in RMNH 7242 and the single specimen in ZMA 115.989 as presumptive syntypes of *Syngnathus deokhatoides* Bleeker.

Kaup (1856) described *Doryichthys bilineatus* from a single female fish of unstated origin, then located in the Vienna Museum. Reexamination of this specimen has not been indicated by subsequent workers and Duncker (1915) treated this as a doubtful species, possibly conspecific with *Microphis pleurostictus* Peters. Kaup did not state the length of the holotype of *Doryichthys bilineatus* but the following counts were given: body rings 17, tail rings 25, dorsal-fin rays 33, dorsal fin located on 6 tail rings, pectoral-fin rays 18, anal-fin rays 3, caudal-fin rays 10. The Vienna Museum has a 141 mm SL female specimen (NMW 40150) labeled *Doryichthys bilineatus*, with the additional notation "Borneo-1852 XVII 49," in what appears to be Kaup's handwriting. My counts from this specimen show 18+24 rings, 34 dorsal-fin rays, 1+5 subdorsal rings, 22×21 pectoral-fin rays, 4 anal-fin rays and there are 10 rays in the regenerated caudal fin. Allowing for different methods of counting rings, these counts (except for the difficult to enumerate pectoral and anal rays) agree closely with those given by Kaup and there is

little doubt that this fish is the holotype of *D. bilineatus*. The principal ridge configuration is that of *Doryichthys*, there is a single ridge on the opercle, snout length is 1.7 in HL and the specimens is conspecific with *D. deokhatoides*.

Duncker's (1904) description of *Doryichthys fluviatilis* (synonymized with *deokhatoides* by Duncker, 1915) was based on two lots of syntypes in the Selangor State Museum (nos. 1237, 1324) and two lots in the Hamburg Museum. The fate of the Selangor Museum material is unknown to me, but the Hamburg specimens were destroyed during World War II.

The holotype of *Microphis annandalei* (ZSI F. 10377/1) now lacks the caudal fin and part of the tail. My counts differ somewhat from those given by Hora (1924) but they essentially coincide with those of his illustrated male "Type specimen." This fish retains some dark blotches above the lateral trunk ridge, there is a single ridge on the opercle and it is conspecific with *Doryichthys deokhatoides*.

Distribution. Literature records and available specimens indicate that the species is known only from freshwater habitats in Sumatra, Borneo and the Malay Peninsula. There are no records from eastern Thailand but, elsewhere, *D. deokhatoides* appears to be sympatric with *D. martensii* and *D. boaja*.

Material examined. 34 specimens, 50~159.5 mm SL, including three presumptive syntypes.

Presumptive syntypes: RMNH 7242 (2 males, 127~136 mm SL), ZMA 115.989 (female, 137 mm SL, Indonesia).

Other material: INDONESIA, Sumatra: RMNH 27594 (1, 101.5), ZMA 115.988 (2, ca. 133.5~141.5), ZMA 116.047 (1, 101.5). Borneo: BMNH 1868.1.28.34 (1, 158), MZB uncat. (2, 105.5~157), NMW 40150 (141.5, holotype of *D. bilineatus*), USNM 218069 (3, 111.5~136), USNM 218070 (2, 114~131). Loc. uncertain: BMNH 1867.11.28.356 (1, 159.5), RMNH 7242 (2, 90 and 156). MALAYSIA: BMNH 1905.5.6.17-18 (2, 50.5~82.5), CAS-SU 30914 (2, ca. 125~128), CAS-SU 34960 (3, 101~115). THAILAND: GCRL 15538 (1, 94), MCZ 47134 (2, 80), USNM 109798 (2, ca. 114~122), ZSI F. 10377/1 (damaged holotype of *Microphis annandalei*). LOC. UNKNOWN: WAM P. 24779 (2, ca. 85.5~97), rec'd from tropical fish

dealer.

Doryichthys martensii (Peters)
(Figs. 3, 4)

Syngnathus Martensii Peters, 1869a: 459 (orig. descr.; Pulo Matjan, Borneo).

Syngnathus Martensi: Martens, 1876: 308 (misspelling, emendation).

Microphis caudatus (?) (not of Peters, 1869b): Vaillant, 1893: 62 (misident.).

Microphis ignoratus Vaillant, 1902: 28, 40, figs. 1~2 (orig. descr.; Mandai R., Borneo).

Doryichthys (Microphis) ignoratus: Popta, 1906: 211 (n. comb.).

Doryichthys Martensi: Duncker, 1915: 53 (n. comb.).

Doryichthys martensii: Weber and de Beaufort, 1922: 50 (emendation).

Doryichthys brachyrhynchops Fowler, 1934: 145, figs. 119~120 (orig. descr.; Chantaboon, SE Siam).

Doryichthys brevidorsalis (not of de Beaufort, 1913): Herre and Meyers, 1937: 9, 18 (misident.).

Doryichthys martensii: Smith, 1945: 444 (emendation).

Doryichthys sp. Dawson, 1979: 469 (ref. only).

Diagnosis. Rings 15~17+31~37=48~53

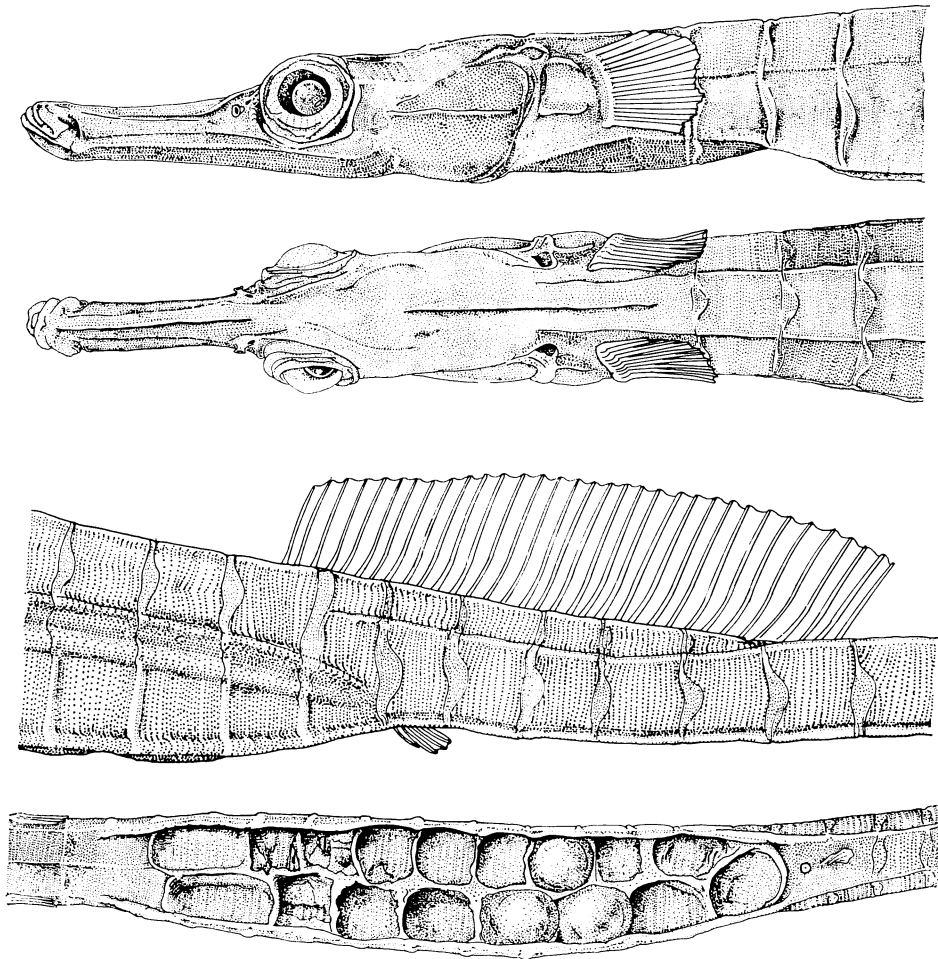


Fig. 4. *Doryichthys martensii*. Upper pair.—Lateral and dorsal aspects of head and anterior trunk rings. Lower pair.—Top: Section of body illustrating ridge configuration and dorsal and anal fins. Bottom: Ventral aspect of brood pouch illustrating membranous egg-compartments and three eggs in situ. From 100 mm SL adult male (CAS-SU 34961).

(usually 16+33~36); dorsal-fin rays 30~39; pectoral-fin rays 16~22, usually 17~19; subdorsal rings 2.5~0.0+4.75~7.0=6.25~9.0. Proportional data based on 80 specimens 51~123 (\bar{x} =98.6) mm SL follow: HL in SL 6.5~9.2 (8.1); snout length in HL 2.0~2.4 (2.1); snout depth in snout length 4.0~8.4 (5.2); length of dorsal-fin base in HL 1.0~1.5 (1.2); anal ring depth in HL 4.1~5.7 (4.7); trunk depth in HL 2.3~4.9 (3.2); pectoral-fin length in HL 4.7~7.9 (5.4); length of pectoral-fin base in pectoral-fin length 0.9~1.4 (1.2). See Tables 1~4 for additional counts.

Without prominent spines on trunk or tail ridges in subadults and adults (Fig. 4).

Mainly brownish, the dorsum usually lighter than the sides; side of snout blotched with dark brown; opercle often with small irregular pale blotches, occasionally with a diffuse pale stripe on the longitudinal ridge; lateral trunk and tail ridges often pale, usually with small dark brown spots between trunk rings (Fig. 3); body elsewhere variously spotted or mottled with pale, some fish with small pale blotches along inferior tail ridges; dorsal and pectoral-fin rays edged or shaded with brown microchromatophores; caudal fin brown, with a moderately broad pale margin.

Comparisons. This species lacks the prominent spines present in *D. boaja* and *D. heterosoma* and is further separable from these by the lower trunk ring count (15~17 against 22~26). For other comparisons, see key and this section under *D. deokhatoides*.

Remarks. The dark spots on the lateral trunk ridge are indistinct or obsolete in some specimens, but others may have dark spots continued on the lateral tail ridge.

Pouch plates are vertical to slightly convergent in examined males and the eggs are largely exposed in brooding fish (Fig. 4). The smallest examined male was 76.5 mm SL and the smallest brooding fish was 103.5 mm SL. There were 11~19 eggs or membranous egg-compartments in 7 brooding males (105.5~118 mm SL) and maximum egg-diameters were 2.7~3.0 mm in a 112 mm SL male. Maximum size probably fails to exceed 140~150 mm SL.

Herre (1940) notes feeding on mosquito larvae.

Types. The holotype of *Syngnathus martensii* (ZMB 6789) is a faded 112 mm SL female with

the following counts and measurements (mm): rings 16+32, dorsal-fin rays 33 (fin damaged), subdorsal rings 1.5+5, right pectoral-fin rays 19, anal-fin rays 4, caudal-fin rays 9, HL 15.8, snout length 7.9, length of dorsal-fin base 11.1, anal ring depth 2.7. Peters (1869a) reported 17+33 rings, 2+5 subdorsal rings and 3 anal-fin rays for this specimen but such differences from my counts are not unusual.

The syntypes of *Microphis ignoratus* (RMNH 7855) consist of two male specimens (78 and 118 mm SL) with 16+34~35 rings and with persistent dark spots on the lateral trunk ridges.

Fowler's (1934) description of *Doryichthys brachyrhynchops* notes that the 124 mm "Type" was cataloged as ANSP 59832 but fails to indicate the sex of the holotype or the number of specimens upon which the description was based. There are now 16 specimens in a single lot numbered ANSP 59832-47 and the largest of these (123 mm SL, male) is the presumptive holotype. The remaining specimens in this lot (15, 87.5~116.5) probably contributed to the original description but are best considered topotypes.

Distribution. Literature records and examined material indicate that *D. martensii* is known from freshwater habitats in Sumatra, Borneo, Malaysia and Thailand. The species is evidently sympatric with *D. deokhatoides* and *D. boaja* throughout most of its range.

Material examined. 114 specimens, 36.5~134.5 mm SL, including holotype.

Holotype: ZMB 6789 (112 mm SL, female), Borneo, Pulo Matjan, from freshwater, Dr. E. von Martens.

Other material: INDONESIA, Sumatra: ZMA 115.994 (4, 47~112). Borneo: GCRL 15759 (2, 97.5~104.5), MNHN 91-222 (1, 79.5), NMW 40153 (1, 134.5), RMNH 7855 (2, 78~118, syntypes of *Microphis ignoratus*), USNM 218071 (9, 36.5~100.5), USNM 218072 (2, 75~82.5), USNM 218073 (7, 52~97.5), USNM 218074 (2, ca. 44~99), USNM uncat. (5, 54~114). **Loc.** uncertain: RMNH 27702 (1, 94.5, removed from RMNH 7249, syntypes of *Syngnathus brachyurus* Bleeker). MALAYSIA: CAS-SU 30915 (2, ca. 60~61), CAS-SU 34961 (14, ca. 51.5~100), CAS-SU 34962 (4, 76.5~95), CAS-SU 39419 (1, 81.5), CAS-SU 39420 (123 mm presumptive holotype of *Doryichthys brachyrhynchops* and 15 (87.5~116.5) topotypes), GCRL 15536 (2,

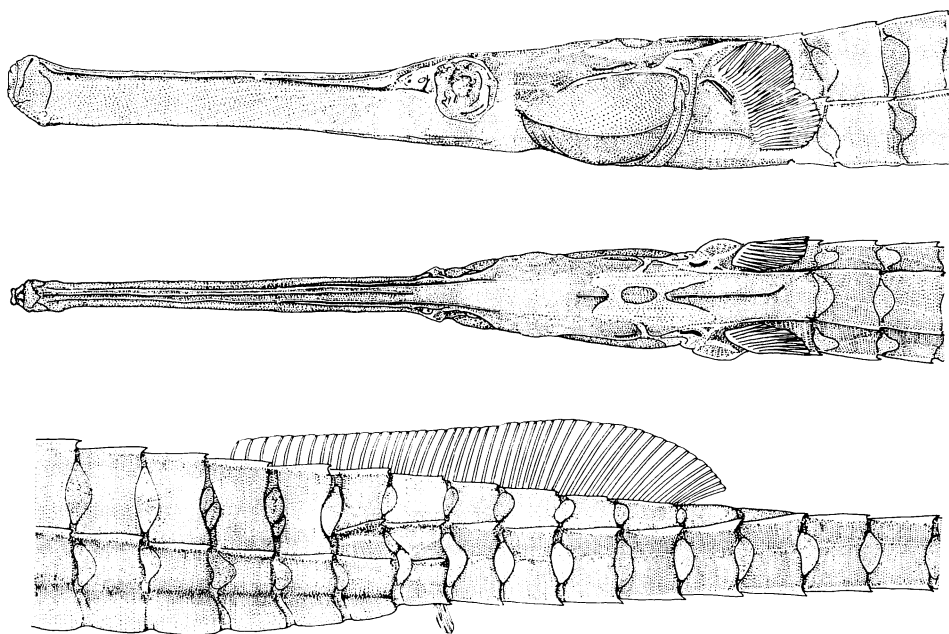


Fig. 5. *Doryichthys boaja*. Lateral and dorsal aspects of head and anterior trunk rings, together with section of body illustrating ridge configuration and dorsal and anal fins, From 299 mm SL (61.3 mm HL) adult male (GCRL 16091).

95.5~111), MCZ 47221 (8, 51~120.5), SMF 13356 (3, 98~112).

Doryichthys boaja (Bleeker)
(Figs. 5, 6)

Syngnathus boaja Bleeker, 1851a: 3, 5, 6, 16 (orig. descr.; Banjermassing, Borneo).

Doryichthys spinosus Kaup, 1856: 57, 75 (orig. descr.; Java, Borneo).

Microphis boaja: Bleeker, 1859b: 188 (n. comb.).

Doryichthys boaja: Peters, 1869b: 276 (n. comb.).

Microphis heterosoma (not of Bleeker, 1851): Günther, 1870: 180 (misident. in part, b spec. only).

Syngnathus Jullieni Sauvage, 1874: 338 (orig. descr.; Cochín China).

Syngnathus zonatus Károli, 1882: 185 (orig. descr.; Borneo).

Dorichthys boaja: Volz, 1903: 411 (misspelling).

Diagnosis. Rings 22~24+32~38=56~61; dorsal-fin rays 43~65; pectoral-fin rays 22~27, usually 24~25; subdorsal rings 4.75~2.0+4.75~7.75=7.75~11.5. Proportional data based on 16 specimens 90.5~321 (\bar{x} =238.9)

mm SL follow: HL in SL 4.6~6.3 (5.3); snout length in HL 1.5~1.8 (1.6); snout depth in snout length 7.7~12.8 (9.5); length of dorsal-fin base in HL 1.3~2.0 (1.6); anal ring depth in HL 5.6~9.0 (7.3); trunk depth in HL 3.6~7.6 (5.5); pectoral-fin length in HL 8.8~12.4 (10.4); length of pectoral-fin base in pectoral-fin length 0.8~1.0 (0.9). See Tables 1~4 for additional counts.

Principal trunk and tail ridges somewhat elevated, produced distally as prominent spines at posterior angles of rings (Figs. 1A, 5); ridge margins entire to finely denticulate in subadults and adults.

Juveniles (Fig. 6) with brown shading on snout and opercle; dorsum and venter of head and trunk mainly pale; side of trunk with brown stripe just above lateral ridge and with narrow triangular areas of brown extending dorsad between some rings, remainder of side largely pale; dorsum of tail pale in front but shading to brown caudad; side and venter of tail mainly brown. Well-marked adults with irregular brown stripes, blotches or spots on snout and dorsolateral part of head, opercle brown; dor-

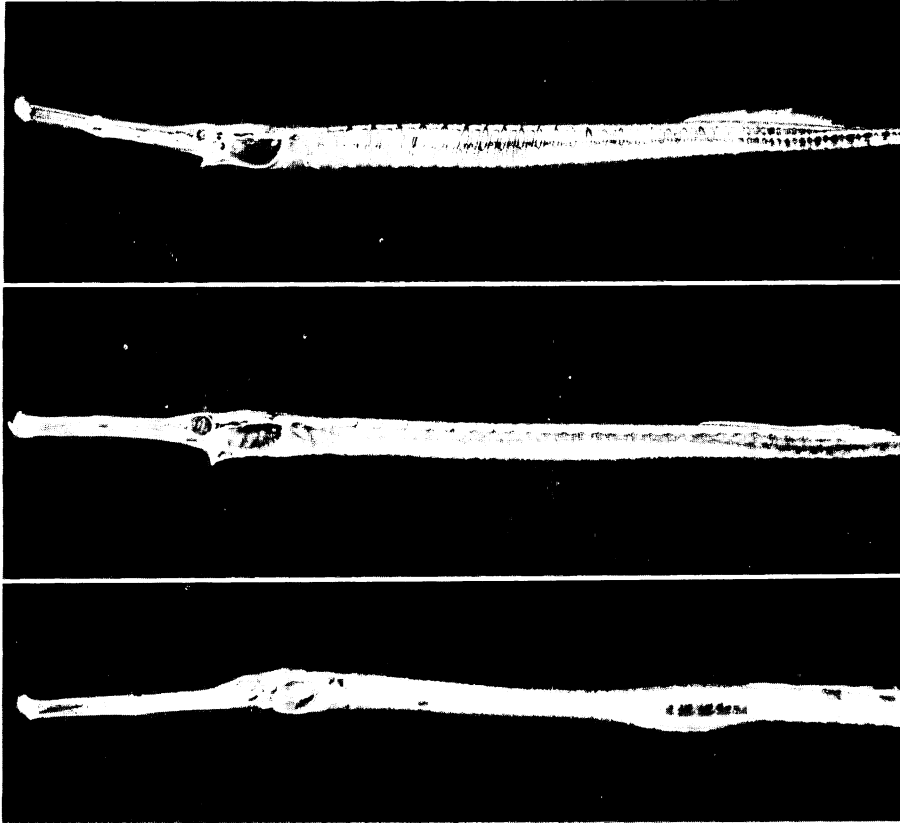


Fig. 6. Top: *Doryichthys boaja*. MZB uncat. (340 mm SL, adult female). Middle: *D. boaja*. MZB uncat. (191.5 mm SL, juvenile). Bottom: *D. heterosoma*. RMNH 7240 (ca. 53.7 mm HL, damaged female, presumptive syntype).

sum of body pale to tan, with small dark brown spots or blotches on superior ridges between most trunk rings; side of trunk with a series of narrow pale bars alternating with broader, dark-margined, brown bars or blotches; side and venter of tail mainly brown.

Comparisons. *Doryichthys boaja* is readily separable from *D. deokhatoides* and *D. martensii* by the presence of prominent spines which are lacking in these species, as well as by higher trunk ring counts (22~25 against 15~20) and other meristic differences (Tables 1~4). Compared to its most similar congener, *D. boaja* is a more robust species than *D. heterosoma* (Fig. 6), it has fewer subdorsal trunk rings (4.75~2.0 against 6.25~5.5), and lacks the hook-like subterminal spines (Figs. 1B, 7) present on the principal ridges of trunk and anterior tail rings in adult *D. heterosoma*. Adult females apparent-

ly fail to develop the swollen or enlarged trunk rings found in *D. heterosoma* (Fig. 6).

Remarks. Margins of principal body ridges are finely denticulate in some of the smaller specimens examined (ca. 175 mm) but these margins are essentially entire in most large fish. The principal ridges are angled somewhat laterad on the distal third or more of the tail in most fish and the median ventral trunk ridge may lack the prominent spines commonly found on other ridges. The brood pouch usually originates on the 1st trunk ring and egg-deposition begins on 2nd~4th; pouch plates are usually vertical and there is no obvious marginal membranous fold. A 300 mm SL male has 4~5 transverse membranous egg-compartments crossing the dorsum of the pouch, there are 53 compartments in the left row and maximum diameter is about 2.2 mm. Eggs are lost from all examined males but they

appear to be deposited in a single layer. Dorsal-fin rays are 43~54 in material from mainland localities (Malaya, Thailand, Cambodia) but this count is 48~64 in specimens from Indonesia. Similarly, there are 4.0~2.25 subdorsal trunk rings and 7.75~10.25 total subdorsal rings in mainland specimens, whereas the respective counts are 4.75~2.0 and 8.5~11.5 in Indonesian material.

Types. Bleeker's (1851a) description of *D. boaja* was based on a single, presumably female, fish with 23+37 rings, 51 dorsal-fin rays, 25 pectoral-fin rays, 5 anal-fin rays, 8 caudal-fin rays and a total length of 370 mm. Hubrecht (1879) listed five A-series specimens in the Auction Catalogue, but there are now only four Auction specimens in the Leiden collection (RMNH 7241) and the fate of the fifth is unknown. There are three other extant Bleeker specimens (BMNH 1867.11.28.343, MNHN 6057, ZMA 115.986) but, among these seven, only the British Museum specimen agrees closely with the description of the holotype. This fish is an adult female with damaged caudal fin, with the distal 6-7 tail rings detached from the body and an estimated standard length of 348 mm. Counts and other measurements (mm) follow: rings 23+36, subdorsal rings 4+7, dorsal-fin rays 61, pectoral-fin rays 25 and 26, anal-fin rays 5, HL 75.2, snout length 48.9, snout depth 4.8, length of dorsal-fin base 46.2, anal ring depth 9.0, trunk depth 12.8, pectoral-fin length 6.5, length of pectoral-fin base 8.3. Present counts of subdorsal rings agree with those of the adult female of *D. boaja* figured (pl. 451, fig. 1) in Bleeker's unpublished Atlas. Furthermore, the atypical count of 5 anal-fin rays agrees with the original description and counts of rings and pectoral-fin rays are also in close agreement. The principal discrepancy lies in the presence of 61 rather than 51 dorsal-fin rays and this may well reflect a counting error or a misprint in the original description (ca. 55 dorsal-fin rays are shown in the unpublished Bleeker fig.). In view of close correspondence with the description, I treat the adult female specimen in BMNH 1867.11.28.343 as the presumptive holotype of *Syngnathus boaja* Bleeker.

Although mentioning specimens from Java, Borneo and Macassar in the Paris, London and Leyden museums, Kaup (1856) did not clearly

identify the syntypes of *Doryichthys spinosus*. Two damaged adults of *D. boaja* (RMNH 3846), collected at Macassar by D. M. Piller and received at Leiden circa 1848-1851, are presumptive syntypes of *D. spinosus* Kaup.

The syntypes of *Syngnathus jullieni* (MNHN 8527) are represented by two immature specimens (178 and 207 mm SL) with 22+36 and 24+35 rings, 45 and 47 dorsal-fin rays and 9 subdorsal rings.

I have not seen the type material of *Syngnathus zonatus* but the description is clearly diagnostic of *Doryichthys boaja*.

Distribution. This species is presently known from rivers and streams of Indonesia, the Malay Peninsula, Thailand, Cambodia and Vietnam. Records of *D. boaja* from China (Günther, 1870) and Taiwan or Formosa (Weber and de Beaufort, 1922) require verification.

Material examined. 48 specimens, 33 to over 352 mm SL, including the presumptive holotype.

Presumptive holotype: BMNH 1867.11.28.343 (ca. 348 mm, damaged, adult female), Borneo, P. Bleeker.

Other material: INDONESIA, Sumatra: ZMA 115.984 (1, 269), ZMA 116.046 (1, 184). Java: RMNH 27608 (1, damaged). Borneo: MNHN 6057 (1, 321), MZB uncat. (1, ca. 340), MZB uncat. (1, 191.5), RMNH 7854 (3, 179~310). Celebes: RMNH 3846 (2, damaged adults, presumptive syntypes of *Doryichthys spinosus*). Loc. uncertain: RMNH 7241 (4, ca. 245~285), ZMA 115.986 (1, damaged, 352). MALAYSIA: AMS IA.3168. THAILAND: CAS 39819 (2, ca. 225~254), GCRL 15719 (1, 210), GCRL 16091 (3, 238~299), MCZ 47108 (1, ca. 226), MCZ 47086 (1, 33), MNHN A.474 (2, 252~300), UMMZ 195387 (1, 244), UMMZ 195526 (1, 236.5), UMMZ 197044 (9, 90.5~283.5), UMMZ 197068 (3, 191~251). CAMBODIA: GCRL 15718 (1, 261), UMMZ 181148 (3, 245~276). VIETNAM: MNHN 8527 (2, 178~207, syntypes of *Syngnathus jullieni*).

Doryichthys heterosoma (Bleeker)

(Figs. 6, 7)

Syngnathus heterosoma Bleeker, 1851b: 417, 421, 441 (orig. descr.; Sambas (River), Borneo).

Microphis heterosoma: Bleeker, 1859b: 188 (n. comb.).

Doryichthys heterosoma: Günther, 1870: 180

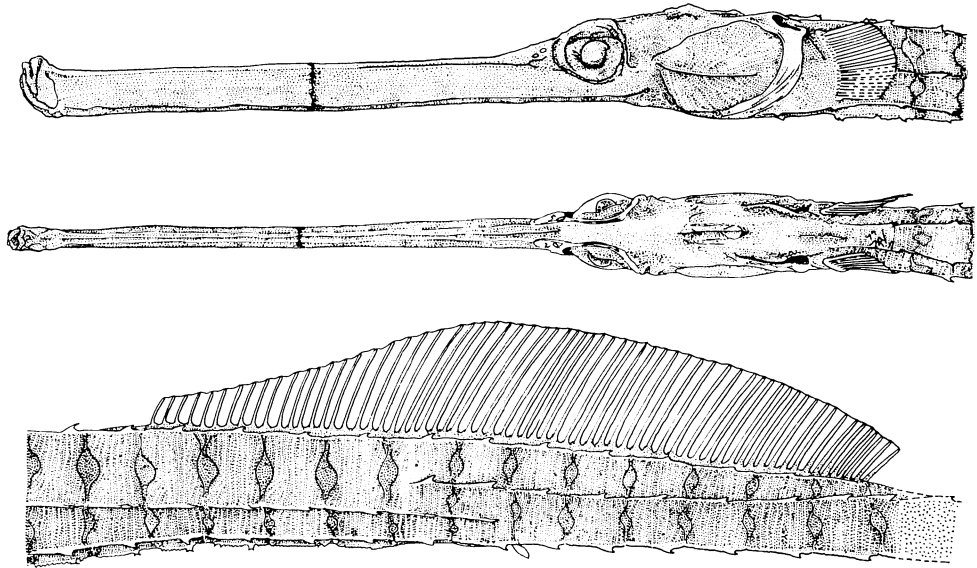


Fig. 7. *Doryichthys heterosoma*. Lateral and dorsal aspects of head and anterior trunk rings, together with section of body illustrating ridge configuration and dorsal and anal fins. From damaged female, ca. 53.7 mm HL, presumptive syntype (RMNH 7240).

(n. comb.).

Diagnosis. Rings $25 \sim 26 + 36 = 61 \sim 62$; dorsal-fin rays $65 \sim 69$; pectoral-fin rays $22 \sim 24$; subdorsal rings $6.25 \sim 5.5 + 6.25 \sim 7.0 = 12.25 \sim 12.5$. Proportional data from one damaged subadult or adult female with a head length of 53.7 mm follow: snout length in HL 1.4; snout depth in snout length 12.6; length of dorsal-fin base in HL 1.3; anal ring depth in HL 9.9; trunk depth in HL 7.1. See Tables 1~4 for additional counts.

Body mainly slender, venter of trunk slightly V-shaped; some posterior trunk rings (ca. 14th~20th) swollen or enlarged in mature females (Fig. 6). Principal head ridges, excluding median dorsal snout ridge, a little elevated and more or less denticulate in subadults and adults. Principal ridges of trunk and anterior third or more of tail with a prominent hook-like spine on posterior third of each ring, without spines at posterior angles of rings (Fig. 1B); ridges somewhat elevated, the margins denticulate to spiny on trunk and anterior half of tail but more or less entire on distal part of tail.

Study material is faded and stained in preservative. Bleeker (1851b) described the body as green with yellowish or silvery venter, with an

oblong vertical spot or bar on each ring and with a black dot at base of the spines on the lateral trunk ridge; dorsal and pectoral fins greenish, anal fin yellowish and caudal fin blackish.

Comparisons. *Doryichthys heterosoma* is separable from *D. deokhatoides* and *D. martensii* by characters in key and diagnoses. Moreover, *D. heterosoma* attains a much greater length than either of these congeners (at least ca. 280 mm SL against an estimated maximum of 170~180 mm SL). For other comparisons, see this section under *D. boaja*.

Remarks. Although this species agrees with *Doryichthys* in the majority of studied characters, there are no undamaged specimens known and some doubt persists regarding its generic status. Bleeker (1851b) gave counts of 31~38 tail rings for his three syntypes and a range of this magnitude in three specimens from the same locality suggests that the tail was regenerated in the fish with 31 rings. In addition, Bleeker described the caudal fin as small and gave the count as “?10”. It is not known whether this count was from a regenerated specimen or whether the caudal-fin rays were counted in all syntypes. In any event, this fin is now missing in all known specimens of *D. heterosoma*. Should the modal

count of caudal-fin rays eventually prove to be other than 9 (characteristic of *Doryichthys*), separate generic treatment may be required for this species.

Both of the available adult females have several swollen or enlarged rings on the posterior part of the trunk (Fig. 6). This condition does not seem to occur in other species of *Doryichthys* but it is commonly found in species of *Trachyrhamphus* and *Yozaia* and in one species currently referred to *Syngnathus* (e. g. *S. folletti* Herald). The enlarged hook-like spines on the principal ridges (Fig. 1B) are located about two-thirds of the ring length behind the anterior margin of most trunk rings but there is a gradual posterior displacement of these spines on the tail so that they are located near the posterior margins of the last 6~8 rings.

Brood-pouch plates are not convergent in the two available males, there is no evidence of marginal pouch membranes, and the free edge of the pouch plates are rough or irregularly denticulate. Both specimens have three transverse rows of membranous egg-compartments across the dorsum of the pouch; maximum compartment diameter is about 1.9 mm.

Types. Bleeker's (1851b) description was based on three syntypes from the Sambas River, Borneo, with counts of 26+31~38 rings, 65~68 dorsal-fin rays, 22 pectoral-fin rays, 4 anal-fin rays and a total length range of 235~290 mm. Bleeker (1854b) reported a fourth specimen from the mouth of a small river in the Natoena (=Natuna) Islands but failed to give either counts or measurements. Although Bleeker included *heterosoma* in several species lists under the genus *Syngnathus* (1853, 1855, 1857) or *Microphis* (1859b, 1860a, 1860b), there is nothing to indicate that he obtained additional specimens of this species. Bleeker's four specimens are apparently now represented by a male and two females in the Leiden collection (RMNH 7240) and a male in the British Museum (BMNH 1867.11.28.345). All are damaged, in poor state of preservation, and only one female (ca. 280 mm SL) is sufficiently complete to permit an accurate count of tail rings. The BMNH male and the two females agree with Bleeker's count of 26 trunk rings and are here considered presumptive syntypes. The remaining male (RMNH), presumably from the Natuna Is., has 25 trunk rings, 5.5+7 subdorsal

rings and is clearly pencil marked. This specimen may have been the model for Bleeker's unpublished Atlas illustration (pl. 451, fig. 4). However, the figured male has 27 trunk rings and 5+6.75 subdorsal rings, a combination not found in either of the present males. Hubrecht's (1879) record of two, rather than three, Auction specimens of *heterosoma* may have resulted from a miscount of the assorted parts of the present RMNH specimens.

Distribution. Known only from the Sambas River, Borneo and the Natuna Islands. A record from Sintang, Borneo (Vaillant, 1902) is based on misidentified *D. boaja*. The apparent absence of this large and distinctive species from collections during the 125 or more years since the capture of Bleeker's material is surprising and somewhat perturbing. The preferred habitat of *D. heterosoma* has apparently not been adequately sampled by subsequent collectors.

Material examined. Four damaged specimens, including three presumptive syntypes.

Presumptive syntypes: BMNH 1867.11.28.345 (damaged and incomplete male, 228 mm). RMNH 7240 (two damaged females; one ca. 280 mm SL; the other incomplete, 199 mm).

Other material: RMNH 7240 (damaged and incomplete male, 251 mm).

Acknowledgments

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インド・太平洋産ヨウジウオ科 *Doryichthys* 属の再検討

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インド・太平洋産ヨウジウオ科 *Doryichthys* 属の分類学的研究を行い4種を認めた。命名規約上の混乱について若干の考察を加えた。本属は主鰓蓋骨に1本の隆起線をもつこと、軀幹部の隆起線は尾部の下隆起線と不連続であること、および尾鰭鱗条が9本であることで他の属と区別される。本属にはインドネシアからベトナムにかけての内陸に分布する淡水性の4種 *D. deokhatoides*, *D. martensii*, *D. boaja* および *D. heterosoma* が含まれる。