

## Elongate Dermal Appendages in Species of *YoZIA* (Syngnathidae) with Remarks on *Trachyrhamphus*

C. E. Dawson, Fujio Yasuda and Chifumi Imai

(Received August 28, 1978)

**Abstract** Elongate dermal appendages occurring on dorsum of brood-pouch and/or planktonic young of the Indo-Pacific pipefishes *YoZIA bicoarctata*, *Y. tigris* and *Y. intermedia* are described and illustrated. Functionally, these are considered to be buoyant processes which serve in floatation and distribution of planktonic young. Comments on the closely related *Trachyrhamphus serratus* are included.

Newly hatched and early juvenile pipefishes have generally been thought to essentially replicate subadults and adults and few major morphological adaptations for planktonic existence have been recognized. Among syngnathine (tail pouch) forms, planktonic young of the Indo-Pacific genus *Corythoichthys* Kaup may have spiny ridges and hyaline dorsal and ventral finfolds may persist on the tail (Dawson, 1977a). Planktonic young of some western Atlantic species of *Syngnathus* Linnaeus (e.g. *S. louisianae* Günther, *S. springeri* Herald) may have distinctly spiny ridges, whereas those of adults are smooth to minutely denticulate. Juveniles of the doryrhamphine (trunk pouch) genus *Oostethus* Hubbs are typically spiny, whereas ridges are finely denticulate to nearly smooth in adults. In addition, planktonic young may have a strikingly enlarged caudal fin and this character was largely responsible for the description of a planktonic *O. aculeatus* (Kaup) as a separate species (Poll, 1953: 250, fig. 101). It has been shown recently (Dawson and Allen, 1978) that brood-pouch young of the "finless" pipefish genera (*Penetopteryx* Lunel, *Apterygocampus* Weber) have well-developed dorsal and pectoral fins although these fins are absent in adults.

We here report on previously undescribed dermal processes occurring on brood-pouch young or planktonic juveniles in three species of the Indo-Pacific syngnathine genus *YoZIA* Jordan et Snyder.

### Methods

Counts and measurements, in mm, follow

those of Dawson (1977b); descriptions are from specimens preserved in alcohol. Brood-pouch young (larvae and postlarvae sensu Hubbs, 1943) were removed from adults by the senior author. Drawings of straightened specimens were prepared with the aid of a camera lucida. The Sagami Bay specimens were collected between 1835 and 1932 hrs with a 1.3×4.5 meter (1.5×1.8 mm mesh) round larvae net (Type A); tow depths approximated 0.5 meter. Specimens examined are deposited in the Gulf Coast Research Laboratory Museum (GCRL) and the Museum, Tokyo University of Fisheries (MTUF).

### Descriptions

*YoZIA bicoarctata* (Bleeker)  
(Japanese name: Wakayōji)

**Material.** Several brood-pouch young (GCRL 13882), about 10~11 mm standard length (SL), removed from 366 mm SL male from Gulf of Aqaba, Red Sea (Fig. 1).

**Description.** Pectoral and anal fins vestigial; dorsal and caudal fins well developed, the latter evidently with 9 rays. Little ossified, rings and most head and body ridges essentially undeveloped. Dorsum with six pairs of elongate, round, flexible fleshy dermal processes; one pair on anterior third of trunk and five pairs, more or less equally spaced, on posterior third of tail. Paired processes originate bilaterally from separate bases and, undamaged, are of about equal length.

Head and body sprinkled with brown microchromatophores, most numerous dorsad and on

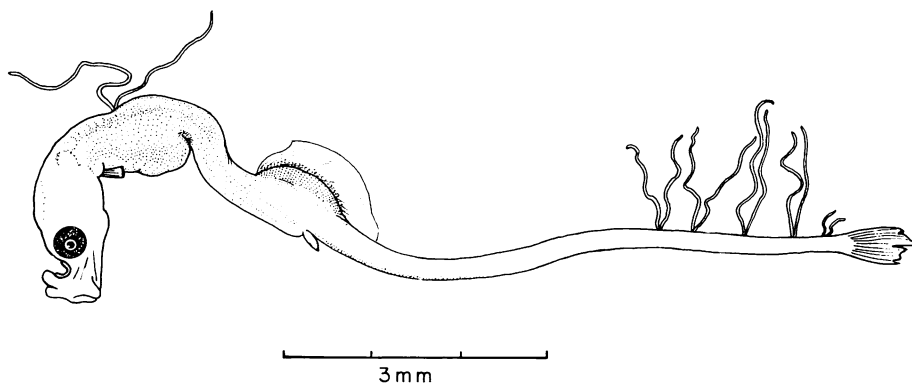


Fig. 1. Brood-pouch young of *Yozia bicoarctata* with paired dermal processes arranged to clarify relative positions.

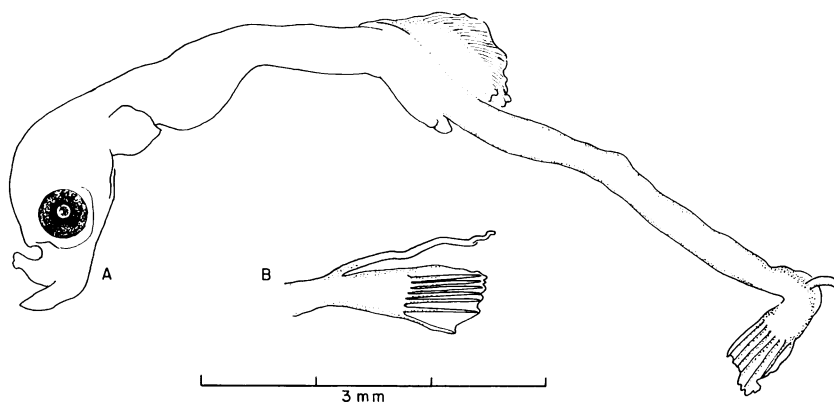


Fig. 2. A: Brood-pouch young of *Yozia tigris* with short dermal process on tail; snout and posterior part of tail distorted. B: Detail of posterior part of tail of specimen with elongate dermal process.

posterior third of tail; dermal processes largely brownish; without indication of banded color pattern.

*Yozia tigris* (Castelnau)

**Material.** Numerous brood-pouch young, about 8 mm SL, removed from six males, 226 ~266 mm SL (GCRL 15324), from New South Wales, Australia (Fig. 2).

**Description.** Degree of ossification and development of rings, ridges and fins somewhat less than that of *Y. bicoarctata* reported above; caudal fin with 7~8 developed rays. Tail with single median dorsal fleshy process located a short distance in advance of caudal-fin base. Length of process variable among specimens of similar size; absent in some, most are short (Fig. 2A), whereas process extends past tip of caudal fin in others (Fig. 2B).

Head and body with dark brown microchromatophores, most abundant on dorsal midline; tail with indications of about five rather narrow dark bands between rear of dorsal fin and caudal-fin base; caudal-fin rays lined faintly with brown; dermal process plain or with a few microchromatophores.

*Yozia intermedia* (Kaup)  
(New Japanese name: Itohikiyōji)

**Material.** Three planktonic juveniles collected in Sagami Bay, Honshu Island, Japan.

**Descriptions.** A) 16.5 mm SL (MTUF 23835). 35°15'N, 139°34'E, water temperature 23.7°C, 12 Aug. 1977 (Fig. 3).

Dorsal-fin rays 29, fin base elevated; pectoral fins well developed, rays not counted; anal-fin rays 4; caudal fin damaged or anomalous, evidently with 8 developed rays. Specimen

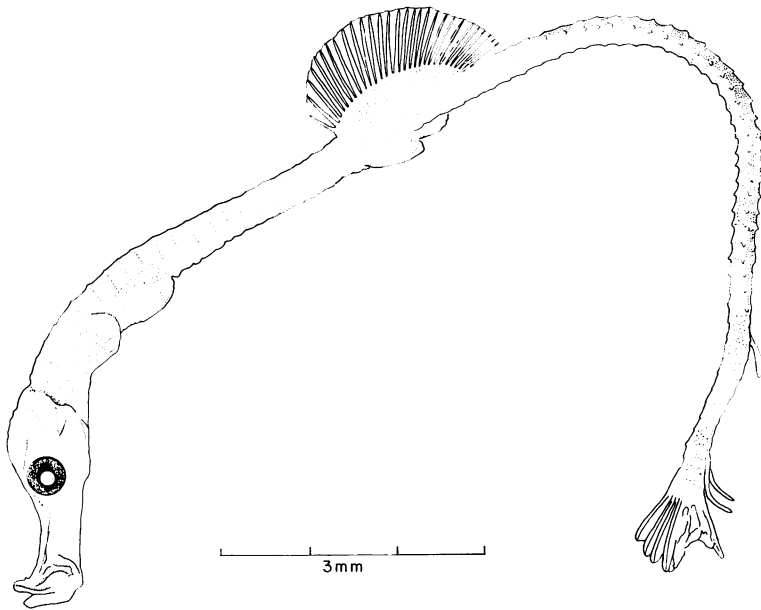


Fig. 3. Planktonic juvenile (16.5 mm SL) of *Yozia intermedia* with three dermal processes in advance of caudal-fin base.

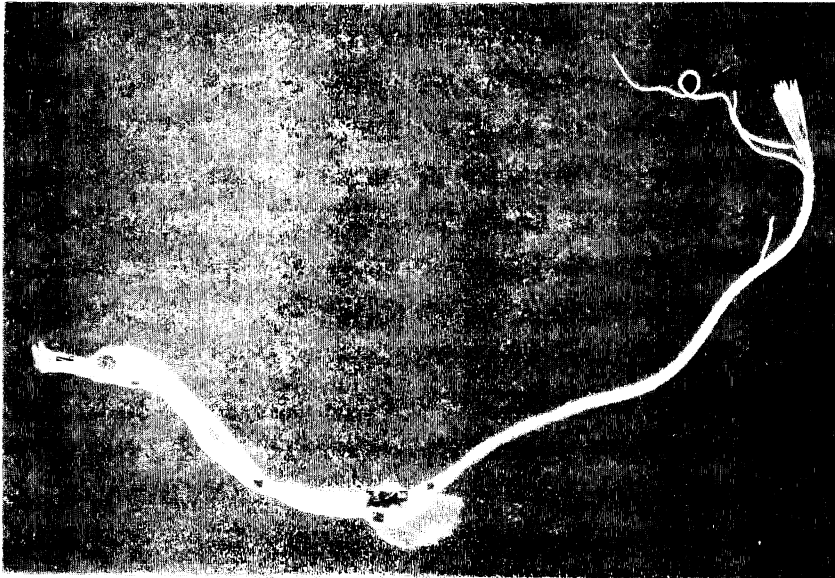


Fig. 4. Planktonic juvenile (29.5 mm SL) of *Yozia intermedia* (specimen twisted in preservation: dermal processes originate on dorsum of tail).

rather well ossified but pattern of principal body ridges not clearly defined; rings difficult to count at  $\times 90$  magnification, apparently 23 + 48; posterior angles of most rings produced as short, somewhat triangular, spines; opercular ridge indistinct. Dorsum of right side of 37th

tail ring with short dermal process, the distal portion apparently missing; left side without trace of companion process. Paired dermal processes, separate to their bases, present on dorsum of 45th ring.

Venter of trunk with moderate shading of

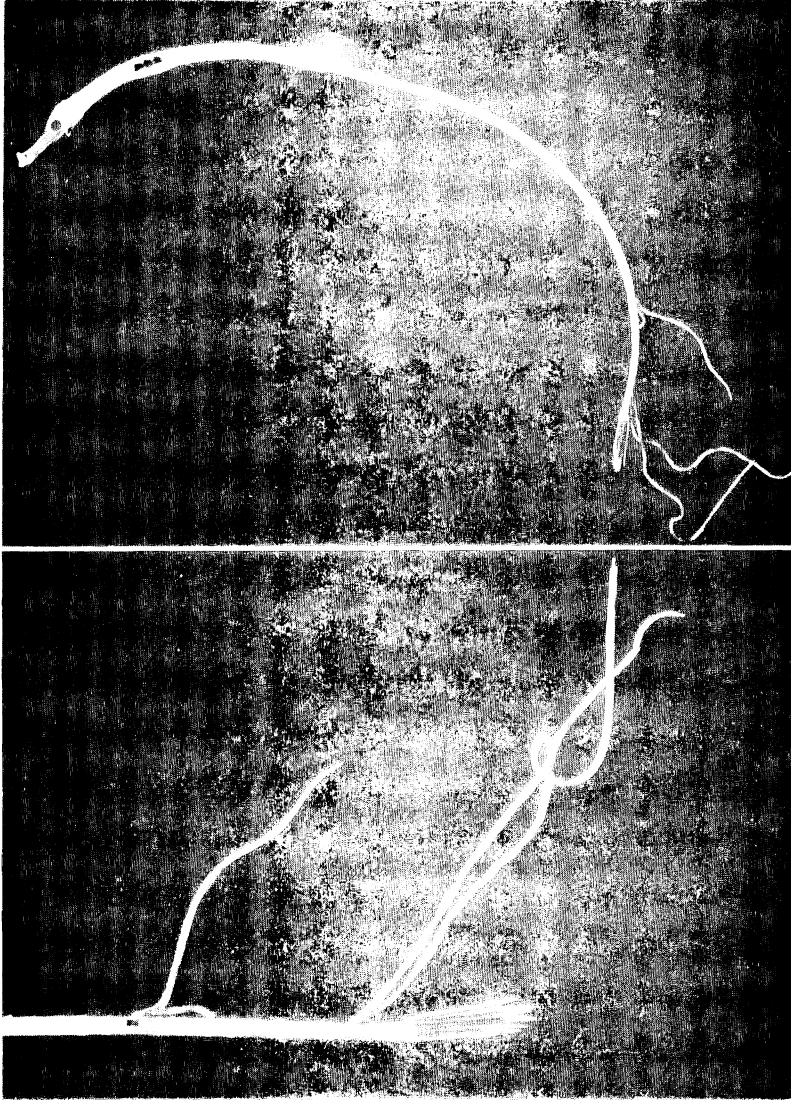


Fig. 5. Planktonic juvenile (78 mm SL) of *Yozia intermedia*. Lower figure shows posterior part of tail with dermal processes arranged to approach assumed life-positions. Narrowed or pinched areas in longer processes are due to twisting.

brown microchromatophores; tail with indications of brown bands on rings 25~27, 36~39 and 44~47; caudal fin largely brownish, distal third pale.

B) 29.5 mm SL (GCRL 16127). 35°12'N, 139°31'E, 25.3°C, 14 Sept. 1977 (Fig. 4).

Dorsal-fin rays 27, fin base elevated; pectoral fins distorted, rays not counted; anal-fin rays 4; caudal fin long, rounded, with 9 rays and rather broad, distally emarginate, membranes; rings 23+47; subdorsal rings 3+3=6.0; head

length about 3.6 mm; snout length 1.8 mm. Median dorsal snout ridge entire; opercle with faint median ridge angled dorsad toward upper posterior angle and with a few faint striae below; principal body ridge pattern indistinct; posterior angles of most rings produced to a short point. Dorsum of 37th tail ring with dermal process (ca. 1.3 mm long) on right side, without trace of companion on left. Dorsum of 45th tail ring with paired dermal processes separate to their bases; that

on right (ca. 9.9 mm long) tapers gradually distad, the left (ca. 3.7 mm) apparently damaged.

Head, trunk and anterior half of tail with light irregular shading of brown microchromatophores; tail with some faint narrow brown bands (about one ring wide) on anterior half and with broad brown bands on rings 25~29, 35~38 and 44~47. Proximal portion of caudal-fin membranes brown, distal third pale; dermal processes banded faintly with brown.

C) 78 mm SL (MTUF 23836). 35°15'N, 139°31'E, 25.9°C, 14 Sept. 1977 (Fig. 5).

Dorsal-fin rays 28, fin base elevated; pectoral-fin rays 16, 16; anal-fin rays 4; caudal rays 9, the fin distally rounded and with emarginate membranes; rings 23+47; subdorsal rings 3.25+2.5=5.75; head length 7.5 mm; snout length 3.9 mm; length of dorsal-fin base 4.9 mm. Median dorsal snout ridge entire; opercle with almost complete longitudinal ridge curving dorsad toward upper angle and with about 18 low striae radiating below; body ridges finely denticulate; posterior angles of rings minutely pointed; 5th~9th trunk rings somewhat enlarged or swollen. Superior trunk and tail ridges interrupted near rear of dorsal fin, the latter continues anteriorly as lateral tail ridge to end on penultimate trunk ring; inferior trunk ridge ends at anal ring; lateral trunk ridge confluent with inferior tail ridge. Dorsum of 27th and 31st tail rings with minute fleshy protrusions, located bilaterally near posterior angles of ring, which may represent bases of lost or undeveloped elongate dermal processes. Dorsum of 36th tail ring with paired processes; the left (13.5 mm long) undamaged, whereas only the basal portion (3.4 mm) persists on the right side. Paired processes present on dorsum of 45th tail ring; that on right side (27.2 mm long) is damaged at tip, whereas that on left (22.3) is apparently complete. Processes on 36th and 45th rings originate near posterior angle of ring, they are round in cross section and separate to their bases.

Head and venter of trunk largely shaded with tan microchromatophores. Dorsum and upper part of sides of trunk crossed by narrow

brown bars (ca. 2/3 of ring length in width) on every 3rd ring from 1st through 13th; sides brownish below dorsal-fin base. Remainder of tail with 10~11 diffuse brown bands which are variously 1~4 rings in width. Dorsal, pectoral and anal fins hyaline; caudal-fin membranes dark brown with wide pale distal margin. Elongate dermal processes distinctly banded with brown.

### Discussion

*YoZIA intermedia* is superficially similar to *Trachyrhamphus serratus* (Temminck et Schlegel), a relatively common pipefish in Japanese waters. These species have the same configuration of principal body ridges, share the elevated dorsal-fin base and overlap in most meristic features; adults lack elongate dermal processes. *YoZIA intermedia* is a more slender species and has an entire median dorsal snout ridge (ridge serrate in *T. serratus*). Furthermore, *Y. intermedia* has a longer snout (length averages 1.99 in head length against 2.46 in *T. serratus*). *YoZIA intermedia* is uncommon in collections and there are few records of its occurrence. Duncker (1915) and Smith (1963) list the species from Zanzibar and Ceylon and the senior author has examined specimens from the Red Sea, the states of Madras and Waltair, India and from Indonesia. Kaup (1856: 24) gave the type locality as "China? or Japan," but present material appears to represent the only confirmed record from Japan.

Duncker (1915), Weber and de Beaufort (1922) and Herald (1953) distinguish *YoZIA* from the monotypic *Trachyrhamphus* on the basis of the following: orbits prominent or not; snout ridge entire or serrate; snout long or short. These are not diagnostic generic characters and the presence of elongate dermal processes in young *YoZIA* may prove useful in determining the relationship of these nominal genera. Comparable brood-pouch young (postlarvae) of *Trachyrhamphus* are not available at this time. However, larval specimens have a short brush-like caudal fin and there appears to be a single knob-like dorsal protrusion a short distance in advance of the caudal-fin base. Other studies in progress by the senior author may eventually show these

genera to be synonymous or that some nominal species of *Yozia* should be referred to *Trachyrhamphus*.

The function of the elongate processes described here is unknown but some discussion seems warranted. Dermal appendages are not uncommon in syngnathine pipefishes, but they are usually minute projections (Dawson, 1978: fig. 2) or in the form of simple or ornamented flaps (Dawson, 1977b: fig. 9). These are assumed to aid in camouflage, but some tactile function cannot yet be discounted for the minute flaps on some species of *Micrognathus* Duncker and the dendritic appendages on the snout of *Halicampus macrorhynchus* Bamber (Dawson and Randall, 1975). Elongate processes described here could not seemingly aid in concealment within the planktonic environment and they would certainly be detrimental in association with floating algae, a favored habitat of some juvenile pipefishes. A tactile function for appendages of this type would appear ineffective and unlikely. The long appendages of the two larger *Yozia intermedia* (Figs. 4, 5) are somewhat buoyant in preservative. It appears most likely that their life configuration approaches that shown in Fig. 5 (lower), and that they serve as floatation processes for the essentially passive planktonic fish. This would be an energy conservative function materially contributing to survival during an extended planktonic existence. If not buoyant in life, these processes would act as drogues and require excessive energy output for effective tail movement or forward progress relative to the surrounding water mass. We assume that dorsal appendages illustrated for brood-pouch young of *Y. bicoarctata* and *Y. tigris* (Figs. 1, 2) are similarly elongate in planktonic juveniles and also function as buoyant processes.

Factors resulting in eventual loss of these appendages are unknown, but adults of these species are demersal and are most often taken in bottom trawls in moderate depths (to ca. 80 m). *Yozia bicoarctata* and *Y. intermedia* range from the Red Sea eastward to at least Japan, whereas *Y. tigris* is an Australian endemic apparently known only from Queensland, New South Wales and Western Australia

(Munro, 1958). More numerous floatation processes, in combination with favorable oceanic currents, may have contributed to the extended range of *Y. bicoarctata* and *Y. intermedia*.

Microstructure of these unusual appendages is presently under study by Dr. H. D. Howse (GCRL).

#### Acknowledgements

We thank Naohiro Nakata and Isamu Mitani of the Kanagawa Prefecture Fisheries Experimental Station for making their Sagami Bay material available for study and for donating a specimen to the GCRL collections. Drawings are by Mrs. Nancy Gordon. This study was in part supported by National Science Foundation Grant BMS 75-19502; C. E. Dawson, principal investigator.

#### Literature cited

- Dawson, C. E. 1977a. Review of the pipefish genus *Corythoichthys* with description of three new species. *Copeia*, 1977 (2): 295~338, figs. 1~21.
- Dawson, C. E. 1977b. Synopsis of syngnathine pipefishes usually referred to the genus *Ichthyocampus* Kaup, with description of new genera and species. *Bull. Mar. Sci. (Univ. Miami)*, 27 (4): 595~650, figs. 1~19.
- Dawson, C. E. 1978. *Micrognathus vittatus* (Kaup), a junior synonym of *M. crinitus* (Jenyns), with description of the insular pipefish, *M. tectus*, new sp. *Copeia*, 1978 (1): 13~16, figs. 1~2.
- Dawson, C. E. and G. R. Allen. 1978. Synopsis of the "finless" pipefish genera (*Penetopteryx*, *Apterygocampus* and *Enchelyocampus*, gen. nov.). *Rec. Western Aust. Mus.*, 6 (4): 391~411, figs. 1~7.
- Dawson, C. E. and J. E. Randall. 1975. Notes on Indo-Pacific pipefishes (Pisces: Syngnathidae) with description of two new species. *Proc. Biol. Soc. Wash.*, 88 (25): 263~280, figs. 1~9.
- Duncker, G. 1915. Revision der Syngnathidae. *Mitteil. Naturh. Mus. Hamburg*, 32: 9~120, pl. 32, figs. 1~10.
- Herald, E. S. 1953. Family Syngnathidae: Pipefishes. In L. P. Schultz et al. *Fishes of the Marshall and Marianas Islands*. *Bull. U. S. Nat. Mus.*, 202 (1): 231~278, figs. 36~44.
- Hubbs, C. L. 1943. Terminology of early stages of fishes. *Copeia*, 1943 (4): 260.
- Kaup, J. J. 1856. Catalogue of lophobranchiate fish in the collection of the British Museum.

- Taylor and Francis, London, 76 pp., 4 pls.  
Munro, I.S.R. 1958. Family Syngnathidae. Handbook Austr. Fishes 20: 82~84. In Aust. Fish. Newsletter, 17 (2): 18~20, figs. 568~586.  
Poll, M. 1953. Poissons. III. Téléostéens malacoptyrygiens. Res. Sci. Océanogr. Belge Côt. Afr. l'Atl. Sud. (1948~1949), 4 (2): 1~258, figs. 1~104.  
Smith, J.L.B. 1963. Fishes of the family Syngnathidae from the Red Sea and western Indian Ocean. Ichthyol. Bull. Rhodes Univ., 27: 515~543, pls. 75~82, figs. 1~19.  
Weber, M. and L.F. de Beaufort. 1922. The fishes of the Indo-Australian Archipelago. IV. E. J. Brill, Leiden, XIII+410 pp., 103 figs.

(CED: Gulf Coast Research Laboratory Museum, Ocean Springs, MS. 39564, U.S.A.; FY and CI: Laboratory of Ichthyology, Tokyo University of Fisheries, Tokyo 108, JAPAN)

ワカヨウジ属3種に見られる糸状物とワカヨウジ属とヒフキヨウジ属の比較

C. E. Dawson・安田富士郎・令井 千文

インド太平洋産ヨウジウオ類のワカヨウジ *YoZIA bicoarctata*, *Y. tigris* 及びイトヒキヨウジ (新称) *Y. intermedia* を記載し, これら3種の近似種であるヒフキヨウジ *Trachyrhamphus serratus* と比較論議した。なお, ワカヨウジ属3種には背部に糸状物があるが, これは幼期の浮遊機構に役立つものと思われる。

(Dawson: Gulf Coast Research Laboratory Museum, Ocean Springs, MS. 39564, U.S.A.; 安田・令井: 108 東京都港区港南 4-5-7 東京水産大学魚類学教室)