Bull. Natl. Mus. Nat. Sci., Ser. A, **33**(1), pp. 45–50, March 22, 2007

Kasidoron larvae of *Gibberichthys latifrons* (Osteichthyes, Gibberichthyidae) from Japan

Muneo Okiyama[1], Hiroshi Senou[2] and Takayuki Kawano[3]

[1] Marine Ecology Research Institute, Teikokushoin Bldg, Kanda-Jinbocho, Chiyoda,Tokyo 101–0051
E-mail: bb8m-okym@asahi-net.or.jp
[2] Kanagawa Prefectural Museum of Natural History, Iryuda 499, Odawara, Kanagawa 250–0031
E-mail: senou@nh.kanagawa-museum.jp
[3] Seidenjicho 173, Kohpo Hirono 306, Hamamatu, Shizuoka 435–0035
E-mail: taka3708@f8.dion.ne.jp

Abstract Kasidoron larvae of *Gibberichthys latifrons*, previously known from two Indo-Pacific specimens, are first reported from Japanese waters on the basis of two specimens including an image of a living fish. The third Kasidoron larva, 11.2 mm SL, collected from off Kochi is described in detail. Another larva of about 8.5 mm SL photographed at Zamami, Okinawa is carefully scrutinized, revealing some interesting features peculiar to intact specimen in the field such as the prominent projection on the top of the eyes. These two records represent a northern extension of the range of this species, probably associated with transportation by the Kuroshio Current.
Key words : Kasidoron larva, *Gibberichthys latifrons*, living feature, new Japanese record.

Introduction

The Kasidoron stage, the larval stage of the genus *Gibberichthys*, family Gibberichthyidae, is characterized by a peculiar pelvic appendage called the pelvic 'tree' (de Sylva and Eschmeyer, 1977). Of two species comprising *Gibberichthys*, namely, *G. pumilus* Parr 1933 and *G. latifrons* (Thorp 1969), Kasidoron larvae were chiefly studied on the former (Robins and de Sylva, 1965; Robins, 1966; de Sylva and Eschmeyer, 1977). Available information for the latter has been restricted to only two larvae (7.8 and 21.0 mm SL) from the tropical western Indo-Pacific (Thorp, 1969; de Sylva and Eschmeyer, 1977).

In this paper, Kasidoron larvae of *G. latifrons* are reported for the first time from Japanese waters on the basis of a third specimen collected from off Kochi and the images of a living fish taken in Okinawa. Although swimming behavior of a Kasidoron larva has been observed in a shipboard aquarium for *G. pumilus* (Robins and de Sylva, 1965; de Sylva and Eschmeyer, 1970), their living conditions in the sea have never been reported.

Results

(1) Description of the Kasidoron larva (A) (Fig. 1)

Material. NSMT-PL 255, 11.2 mm SL (slightly twisted), off Kochi, Japan, 31°01′N, 133°31′E, IKPT-net, 300 m of wire out (estimated depth in upper ca 100 m), water temperature 24.8–27.7°C, KT90-13, St. 6-N, 02:57–03:30 hrs, 9 Sept. 1990.

Measurements (in mm). Standard length (SL) 11.2; head length 4.9; body depth ca 7.1; head depth at lower jaw angle ca 4.3; head width ca 5.6; interorbital width 2.3; snout length 1.0; eye diameter 2.0; upper jaw length 2.3; caudal peduncle depth 1.8; length of flattened portion of 3rd pelvic fin ray 5.3 (right). Counts are given in Table 1.

Gross morphology. Body robust, with large head; head length and head width 44% and 50% of SL, respectively. Body deepest (ca 63% of SL)

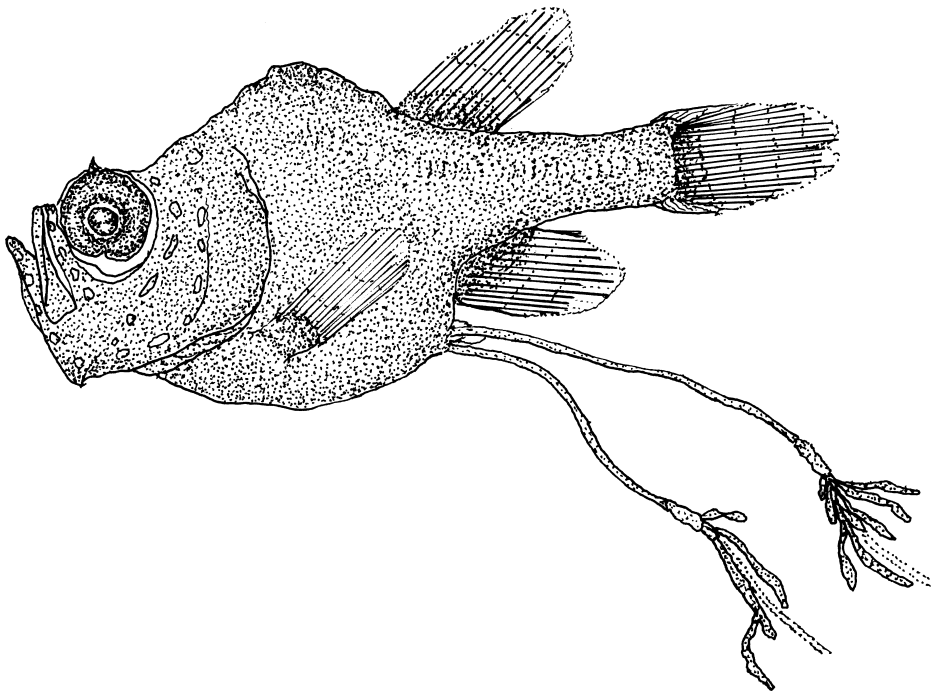

Fig. 1. Kasidoron larva (A) of *Gibberichthys latifrons*, 11.2 mm SL.

Table 1. Measurements and counts of larvae and juvenile of *Gibberichthys latifrons*.

	NSMT-PL 255	BMNH 1967.8.24 1*	NSMT-P 11171	Adults**
Standard L, mm	11.2	21.0	49.0	64–124
Dorsal-fin rays	12	14	ca VI,8	V–VIII, 8–9
Anal-fin rays	13	11	V, 7	IV–V, 7–9
Pectoral-fin rays	13/13	14/13	14/14	12–15
Pelvic-fin rays	6/6	6/6	I,5/I,5	I, 5–6
Caudal-fin rays	7+10+9+5	6+10+9+5	7+10+9+6	VII+10+9+VI–VII
Branchiostegals	9/9	9/9	9/9	9/9
Gill rakers	21/22	19/–	18/17	18–23

* After Thorp (1969).
** After de Sylva and Eschmeyer (1977); Kotlyar (1996, 2002), and Causse (2005).

at level of elevated dorsal keel slightly posterior to head. Abdomen well developed. Tail slender with moderately long caudal peduncle. Anus just anterior to anal-fin origin. Mouth large (upper jaw length ca 47% of HL), directed upward almost vertically. Conical teeth on premaxilla and dentary. Eyes round, very large (diameter ca 50% of HL), with small, membranous projection at top, projecting over head profile. Two nostrils on very short snout. Lateral-line systems, particularly otic, preopercular, suborbital, and mandibular canals, distinct with typical arrangements of large pores; extra small pore illustrated in Thorp (1969, Fig. 3) indistinct. Series of large lateral-line scales developing along body.

Dorsal and anal fins, with short, elevated bases, in nearly opposite positions posterior to center of body; longest rays more than base length. Pectoral fin ventral with moderately long base. Pelvic fin with specialized 3rd ray; proxi-

mal portion of ray 75% of SL, flattened and unornamented, followed by short striated stem and distal ornamented portion mostly missing except for several small leaf-like appendages of similar size. Body surface uniformly black, covered by transparent minute papillae.

Remarks. The present specimen and the larger 21.0 mm larva (Thorp, 1969) have several differences as follows: (1) the anus is located close to the anal-fin origin in the former, whereas it is midway between the pelvic-fin base and the anal-fin origin in the latter; (2) a small projection on the top of eyes is present in the former whereas absent in the latter; (3) flattened proximal portion of the 3rd pelvic ray is 47% of SL in the former, but 41.4% of SL in the latter; and (4) the pelvic appendages are almost lacking in the former whereas massive clusters of leaves are present in the latter. Of these, the first two may be associated with ontogenetic trends and/or preservation effects. The third is apparently due to the delayed growth of the relevant portions around these sizes (de Sylva and Eschmeyer, 1977). Perhaps, mechanical stress during the collection is responsible for the last case, although such variation is also probable in the field as shown by the larva (B) below.

This Kasidoron larva was collected in upper warm waters less than ca. 100 m (24.8–27.7°C) with many kinds of ichthyoplankton such as *Vinciguerria*, *Cyclothone.*, Myctophidae, *Chlorophthalmus*, Gobiidae, Bothidae, Bramidae, *Naso*, Labridae, *Stemonosudis*, and *Beryx splendens*, among others in this order of abundance.

A new Japanese name, "Makafushigi-uo" (meaning "extremely strange fish"), is proposed for *Gibberichthys latiforns*, since "Fushigi-uo" had be given by Uyeno and Sato (1983) for the Atlantic congener, *G. pumilus*.

(2) Photographs of Kasidoron larva (B) in the sea (Fig. 2)

Material. Image Database of Fishes in the Kanagawa Prefectural Museum of Natural History, KPM-NR 88926-88928 (Fig 2a, b, d). Photographs were taken by the third author during SCUBA diving in the morning (around 10:00), on 6, July 2005, at depths of 4–5 m near the bottom at Furu-Zamami beach, Zamami Islands, Okinawa. Water temperature was 29°C and visibility 20 m; this specimen was returned to the sea after photography.

The larva is estimated to be ca 8.5 mm SL from the image on the palm of diver's right hand (Fig. 2d). Lengths of the 3rd pelvic rays (from the base of the main stalk to the base of last pair of leaves) are estimated as ca 30 mm on the right side, and ca 14 mm on the left side. Large dark leaves are clustered into two sites (one on the left side) along the ray with similar interspace of about 1.3× standard length from the base of the pelvic fin and the first cluster, although there are small, dark leaves and/or keels meandering on the distal half of the basal main stalk. Fig. 2 reveals that each of these large clusters looks like a single associated unit, and the right proximal one comprises smaller and fewer leaves than the other two. Furthermore, it is remarkable that distal unpigmented areas of the left ventral cluster comprising at least six leaves can form a regular pattern during swimming performance (Fig. 2b, c), although its adaptive aspect is unknown.

The small black fish trailing peculiar long pelvic fins, one can recognize it at once as Kasidoron stage of *Gibberichthys*. This larva was readily identified as *G. latifrons* on the basis of its close agreement with known Kasidoron stages (Thorp, 1969; de Sylva and Eschmeyer, 1977), particularly in having longer pelvic tree and the projection on the eyes noted in the description above of the preserved larva, as well as its locality in the western Pacific.

These photographs reveal some interesting features. Firstly, there is a prominent horn-like projection on the large eyes directed more anterior and outward (Figs. 2a, b), which has never been observed. It seems to rotate well in life. As mentioned before, absence of this projection in 21 mm larva of *G. latiforns* (Thorp, 1969) may be due to an ontogenetic effect or perhaps preservation, although *G. pumilus* completely lacks this larval character. Secondly, the pairs of pelvic

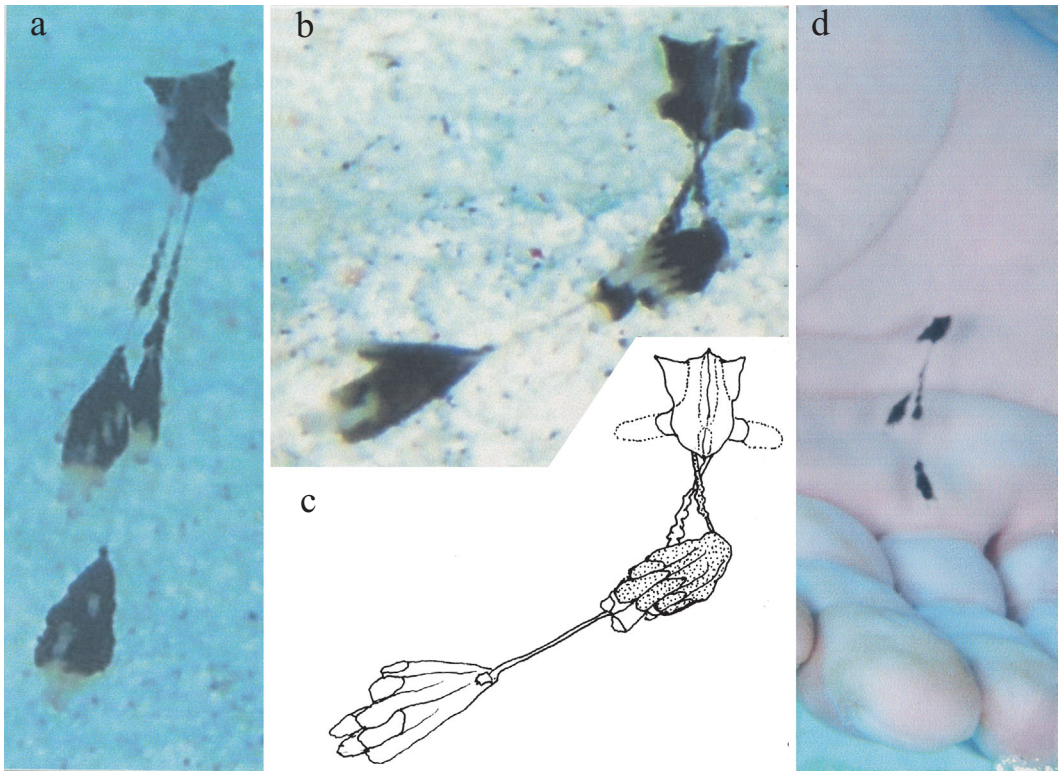

Fig. 2(a–d). Photographs of Kasidoron larva (B) of *Gibberichthys latifrons* in the sea, Zamami Islands, Okinawa. (a) Dorsal view of swimming larva from slightly posterior position; (b) dorsal view of the same from posterior position while larva is turning to the left, (c) line drawing of (b) with left ventral cluster shown by dots, and (d) the same larva in the palm of diver's right hand. (Photo: T. Kawano.)

trees are irregular; that of the right side is longer and has more clusters of leaves than that on the left side. Since both rays have similar structure except for their size, the tip of the left pelvic tree might be lost by accident. It is notable that each cluster of massive leaves resembles the larval body itself in terms of both size and color. It is worthwhile to mention that the third author first mistook this larva as a small piece of drifting algae, suggesting another possible function of these peculiar pelvic appendages as a dummy, other than the well known *Sargassum* and/or siphonophore mimicry (Robins and de Sylva, 1965). Thirdly, the Kasidoron larva seems to spread widely its pectoral fins in controlling the lateral turn or during brief burst swimming.

Remarks. Although only four Kasidoron larvae of *G. latifrons*, have been available, they can be easily distinguishied from larval *G. pumilus* by (1) the distinctly longer 3rd pelvic rays with different structure and composition of the tree, and (2) the presence of a projection on the eye.

(3) Distribution of *G. latifrons* (Fig. 3)

The distribution records of *Gibberichthys latifrons* including the present specimens are shown in Fig. 3. This species has been collected chiefly from the tropical waters ranging from the western Indian Ocean to the central Pacific Ocean, particularly in the southern hemisphere. Its northernmost demersal record was from the South China Sea (86 mm SL; 11°33′2N, 109°48′2E) (Kotlyar, 2002) and the smallest demersal specimen was 64 mm SL available from East Indian Ocean (Kotlyar, 1985). However, among the fish specimens deposited in the Na-

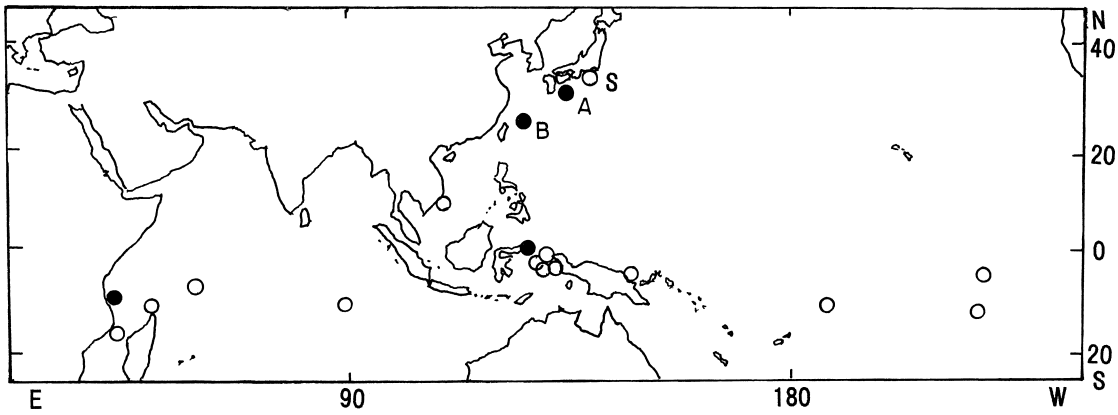

Fig. 3. Distribution of *Gibberichthys latifrons* (after Kotlyar 1985, 1993, 1996, 2002; Causse 2005; present paper). Open circle indicates juvenile and adult; closed circle indicates Kasidoron larva. A, B and S indicate present records.

Fig. 4. Photograph of juvenile *Gibberichthys latiforns* (NSMT-P 11171, 49 mm SL) from Suruga Bay, central Japan.

tional Science Museum was the unpublished smaller juvenile (NSMT-P 11171, 49 mm SL; Fig. 4), which was trawled in May 1967, from more northern waters off Yui, innermost of Suruga Bay (north of 35°N !; indicated by S in Fig. 3), central Japan. Counts of this specimen are given in Table 1.

Since pelagic Kasidoron stage of *G. pumilus* is estimated to terminate at around 20–30 mm SL (de Sylva and Eschmeyer, 1977), this juvenile is likely to have recruited there within a half year before its capture. It is worthwhile to note that Japanese specimens of *G. latifroms* have been restricted to either larvae or early juvenile. Thus, even if its larvae are transported to Japanese waters in association with the prevailing Kuroshio Current, their survival is unlikely in these northern localities. Japanese waters may be the sterile expatriation area (sensu Ekman, 1953) for this species.

Acknowledgements

We are indebted to scientists, captain, and crews on board Tansei-maru Cruise 90-13 in collecting Kasidoron larva (A). J. Paxton kindly criticized the early draft of this paper with many suggestion to improve it. Thanks are also due to

M. Aizawa, A. N. Kotlyar K. Matsuura, T. Otake, K. Shibukawa, and G. Shinohara for giving collection data, literatures, and various support.

References

Causse, R., 2005. New record of *Gibberichthys latifrons* (Gibberichthyidae) from French Polynesia. *Cybium*, **29**: 91–92.

de Sylva, D. P. and W. N. Eschmeyer, 1977. Systematics and biology of the deep-sea fish family Gibberichthyide, a senior synonym of the family Kasidoroidae. *Proceedings of the Calififorniа Academy of Sciences*, 4th series, **41**: 215–231.

Ekman, S., 1953. *Zoogeography of the Sea*. 417 pp. Sidwick and Jackson, London.

Kotlyar, A. N., 1985, New information on the distribution of *Gibberichthys latifrons* (Gibberichthyidae). *Journal of Ichthyology*, **25**: 154–158.

Kotlyar, A. N., 1993. Beryciform fishes of the western part of Indian Ocean (based on the materials from 17th cruise of R/V *Vityaz*). *Trudy Instituta Okeanologii, Akademiia Nauk SSSR*, (128): 179–198. (in Russian)

Kotlyar, A. N., 1996. *Beryciform Fishes of the World Ocean*. pp. 1–368. VNIRO Publishing, Moscow. (in Russian)

Kotlyar, A. N., 2002. New data on beryciform fishes (Beryciformes) from the South China Sea. *Journal of Ichthyology*, **42**: 434–439.

Robins, C. R., and D. P. de Sylva, 1965. The Kasidoroidae, a new family of mirapinniform fishes from the western North Atlantic Ocean. *Bulletin of Marine Science*, **15**: 189–201.

Robins, C. R., 1966. Additional comments on the structure and relationships of the mirapinniform fish family Kasidoroidae. *Bulletin of Marine Science*, **16**: 896–701.

Thorp, C. H., 1969. A new species of mirapinniform fish (family Kasidoroidae) from the western Indian Ocean. *Journal of Natural History*, **3**: 61–70.

Uyeno, T., and Y. Sato, 1983. Gibberichthyidae. *In*: Uyeno, T., K. Matuura, and E. Fujii (eds), *Fishes Trawled off Suriname and French Guiana*. p. 279. Japan Marine Fishery Resource Reseach Center, Tokyo.