



First record of *Matsubaraea fusiformis* (Perciformes: Percophidae) in the waters of western Taiwan: A taxonomic description

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Abstract

Herein, we present a new record of *Matsubaraea fusiformis* in western Taiwan waters; the discovery was based on its morphological characters. Five *M. fusiformis* samples were collected (August 2022) from the offshore waters (depth: 35.3–49.6 m) of Changhua County, western Taiwan, by using commercial bottom trawlers. A total of 5 genera and 10 species of the family Percophidae have been found in the waters of southwestern and northeastern Taiwan, primarily in the sandy deep-sea regions. This paper presents the first record of *M. fusiformis* in Taiwan. The findings also reveal that *M. fusiformis* is predominantly found in shallow waters.

Key words: Changhua County of Taiwan, sandy dweller fish species, commercial bottom trawling net

Introduction

Taiwan is located in the western North Pacific Ocean. The hydrological environment is highly complex and is affected by the interactions of diverse water masses across seasons (Jan *et al.* 2002). The coastal waters (average depth: <60 m) of western Taiwan, where located in Taiwan Strait, feature shallow sandy seabeds and coastal sand dunes (Lin 1996; Jan *et al.* 2002; Chen *et al.* 2022). Such shallow and soft-bottom habitats are inhabited by various marine sand-dwelling and demersal organisms, particularly sandy dweller fish species (Chen *et al.* 2021; Chen *et al.* 2022). The average temperature of water in this area ranges from approximately 17°C in winter to approximately 30°C in summer (Fan *et al.* 2002; Chen *et al.* 2021). The nutrient-rich waters in this area result from upwelling and the passage of diverse water masses, which lead to high primary productivity (Hsieh *et al.* 2016). Furthermore, this area is a key fishing ground for trawling and gill netting in Taiwan (Kuo & Shao 1999).

Matsubaraea fusiformis (Fowler 1943) is a species belonging to the family Percophidae; this species is found in the Western Pacific Region, which includes countries such as Japan, the Philippines, Thailand, Vietnam, and Australia (Matsuura 1991; Noichi *et al.* 1991; Johnson 1999; Nguyen & Nguyen 2006; Nakabo 2013; Nakabo 2018; Ogata & Murase 2020). Limited information is available regarding this species. Moreover, the population of this species may be underestimated because very few samples are collected during general fish surveys or fishing catch assessments.

In the present study, we sampled *M. fusiformis* from the offshore waters of Changhua County, western Taiwan. The samples were collected using a commercial trawling net during a study of the composition of local fish communities. The aim of this paper is to present the first record of *M. fusiformis* in Taiwan. Herein, we present the sampling conditions (date, time, location, water depth, and environment) and morphological characteristics of *M. fusiformis*.

Materials and methods

Sampling

All specimens were caught using a commercial bottom trawling net from the vessel JINN FA TSAIR on August 10, 2022 (between 2 and 4 AM). Trawling was conducted approximately 60 km west of the coastal waters of Changhua County (Figure 1; speed: 3.6–3.9 knots). The trawling distance was 5 km, and the trawling direction was from southwest to northeast. The vertical and horizontal openings of the net were approximately 15 m and 3.5 m in terms of height, respectively. The cod-end mesh size of the bottom trawl net was 0.8 cm. The sampling depth was recorded using an echosounder. Using a conductivity-temperature-depth profiler, the water temperature was measured from the sea surface to a certain depth near the sea bed.

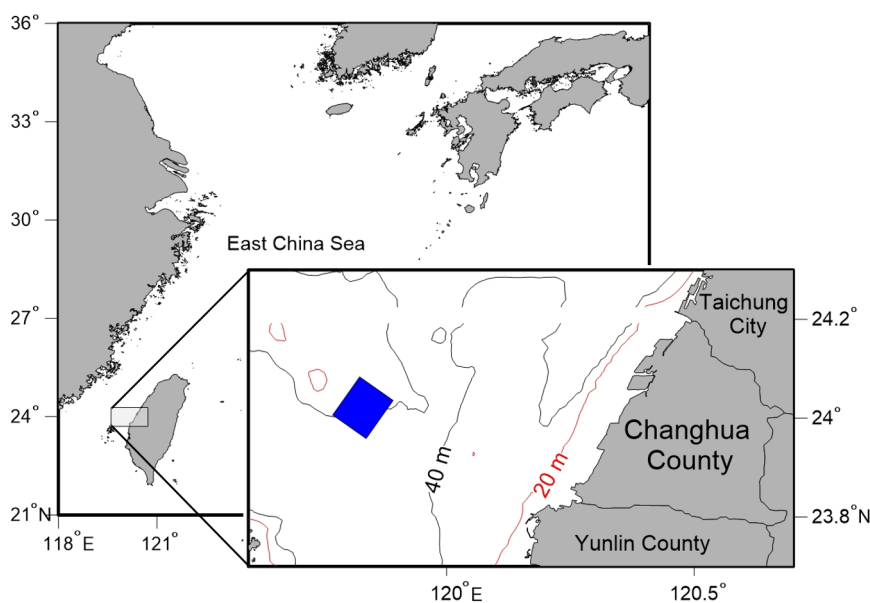


FIGURE 1. Sampling location (blue square) of *Matsubaraea fusiformis*.

All samples were frozen on board and subsequently transported to our laboratory. After thawing, the samples were subjected to identification assessments. Then, the samples were photographed, fixed in 70% ethyl alcohol, and deposited at the Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University.

Meristic and morphometric measurements were conducted following a method described by Nakabo (2013). The length was measured (to the nearest 0.01 mm) using a digital caliper (Mitutoyo), and the weight was measured to the nearest 0.0001 g) using an electronic microbalance.

Results

Sampling environment

Five *M. fusiformis* samples were collected from the offshore waters of Changhua County. One sample (sample code: F18T1S1004) was caught between 2 and 3 AM. The trawling route was from 24°0.351'N and 119°47.718'E to 24°2.184'N and 119°49.704'E, the sampling area depth was approximately 35.9–49.6 m, and the water temperature was 28.5°C. The other four samples (sample codes: UN19T3S1012-1–UN19T3S1012-4) were caught between 3:30 and 4:30 AM. The trawling route was from 24°0.279'N and 119°49.610'E to 24°2.328'N and 119°51.329'E, the sampling area depth was approximately 35.3–47.9 m, and the water temperature was 29°C.

Morphological characteristics

Table 1 presents the meristic and morphometric data of the five *M. fusiformis* samples. A fresh sample of *M. fusiformis* (code: UN19T3S1012-1) is depicted in Figure 2. The samples' wet weight ranged from 0.4347 to 1.1649 g. The standard length (SL) and total length were 42.01–55.59 mm and 50.83–65.44 mm, respectively. Of the five samples, three were female fish, one was a male fish, and the remaining one (smallest sample) was unknown.



FIGURE 2. Fresh sample of *Matsubaraea fusiformis* collected from the offshore waters of Changhua County. Sample code: UN19T3S1012-1; standard length: 55.59 mm.

TABLE 1. Meristic and morphometric data of five *Matsubaraea fusiformis* samples collected from the offshore waters of Changhua County.

Sample code	F18T1S004	UN19T3S1012-1	UN19T3S1012-2	UN19T3S1012-3	UN19T3S1012-4
Sex	Female	Female	Male	Female	Unknown
Meristic counts					
Dorsal-fin rays	III-16	III-16	III-17	III-17	II-16
Anal-fin rays	26	26	26	26	26
Pectoral-fin rays	16	16	16	16	16
Pelvic-fin rays	I-5	I-5	I-5	I-5	I-5
Pored lateral-line scales	35	36	36	36	36
Scales above lateral-line	2.5	2.5	2.5	2.5	2.5
Scales below lateral-line	3.5	3.5	3.5	3.5	3.5
Morphometric measurements					
Wet weight	0.9692	1.1649	0.61	0.9178	0.4347
Standard length	52.17	55.59	47.25	51.03	42.01
Total length	61.4	65.44	51.67	59.29	50.83
Body depth	6.78	7.32	5.71	7.02	4.57
Head length	14.83	14.9	12.45	14.51	9.37
Snout length	3.4	3.44	3.07	3.37	2.76
Orbit diameter	2.66	2.76	2.32	2.6	2.26
Predorsal length	21.28	22.84	17.84	21.27	16.04
Dorsal-fin base (I+II)	27.7	31.84	25.86	26.94	23.2
First dorsal-spine length	1.56 (broken)	3.84	4.02	1.83 (broken)	2.3
Second dorsal -spine length	3.21	3.79	3.87	3.01	2.69
Third dorsal -spine length	3.09	2.64	3.6	2.79	-
Preanal length	23.14	24.09	18.58	22.31	17.59
Anal-fin base	27.32	29.51	27.09	27.16	23.63
Pectoral-fin length	10.09	10.39	9.37	9.98	8.69
Caudal-peduncle depth	2.75	2.97	2.73	2.74	1.97
Caudal-peduncle length	1.71	1.99	1.58	1.56	0.79

The length is presented in millimeters (mm), and the weight is presented in grams (g).

Each fish had a cylindrical head and body, two closely spaced eyes, a large mouth, a protruding snout, a gape extending behind the eyes, a lower jaw not protruding beyond the upper jaw, two dorsal fins, and one anal fin. The second dorsal fin exhibited a concave center and crotched-tip rays, except for the first ray. The fin rays were distributed as follows: II–III+16–17. The anal fin rays (total number: 26) had crotched tips. The pectoral fin had 16 rays, and the pelvic fin had I+5 rays. The lateral line scales (2.5 scales above and 3.5 scales below the line) had 35 or 36 pores.

The average morphometric measurements were as follows: body depth, 4.57–7.32 mm (SL: 10.88%–13.76%); head length, 9.37–14.9 mm (SL: 22.3%–28.43%); snout length, 2.76–3.44 mm (SL: 6.19%–6.6%); orbit diameter, 2.26–2.76 mm (SL: 4.91%–5.38%); predorsal length, 16.04–22.84 mm (SL: 37.76%–41.68%); dorsal fin base (first and second) length, 23.2–31.84 mm (SL: 52.79%–57.28%); first dorsal spine length (measured excluding the samples with a broken dorsal spine), 2.3–3.84 mm (SL: 5.47%–8.51%); second dorsal spine length, 2.69–3.79 mm (SL: 5.9%–8.19%); third dorsal spine length (measured excluding UN19T3S1012-4), 2.64–3.6 mm (SL: 4.75%–7.62%); preanal length, 17.59–24.09 mm (SL: 39.32%–43.72%); anal fin base length, 23.63–29.51 mm (SL: 52.37%–57.33%); pectoral fin length, 8.69–10.39 mm (SL: 18.69%–20.69%); caudal peduncle depth, 1.97–2.97 mm (SL: 4.69%–5.78%); and caudal peduncle length, 0.79–1.99 mm (SL: 1.88%–3.58%). The caudal fin was convex in shape. The tips of the pelvic fins did not reach the anus.

The fresh fish samples were milky white, particularly in the ventral region. A dark-brown netted pattern was observed on the dorsal body and each side (above the lateral line), extending till the caudal peduncle. A brown longitudinal band was observed below the lateral line. Dark-brown spots were noted on the head and the upper and lower jaws. A golden spot was observed at the end of the operculum. The pelvic fins were white. The dorsal, anal, and caudal fins had multiple interlaced brown and white spots. Furthermore, irregular brown spots were noted on the upper side of the pectoral fin rays (but not on the fin membrane). All fin membranes were transparent.

Discussion

The present study documents new records for the offshore water of Changhua County off western Taiwan for *M. fusiformis*. Considering the wide distribution of *M. fusiformis* in the Western Pacific Region, we hypothesized that this species may also be found in other cities in the waters of western Taiwan because of the shallow seabed in this area. In this study, we successfully collected five samples of *M. fusiformis* from the offshore waters of Changhua County. However, despite using the same trawling net deployed at the same depth of water, we could not find this species in any other coastal waters of western Taiwan. Because of the small body size and uneconomical bycatch of *M. fusiformis*, the preservation of this species is challenging. Furthermore, this species can escape trawling nets. All these factors may explain why we could not catch *M. fusiformis* samples again.

We identified the samples solely on the basis of morphological characteristics, without using any other identification methods (e.g., DNA barcoding), because this species exhibits distinct morphological characteristics. We found that the front of the upper lip (both sides of the snout) lacked a prominent spine, the first dorsal fin contained 2 to 3 spines, the dorsal fin had a concave center, and each sample had a cylindrical head. These findings are consistent with the those reported by Nakabo (2013).

Nakabo (2018) and Ogata & Murase (2020) have reported the presence of yellow spots on the dorsal body and each side; however, such spots were barely noted in our study. Although this species is a major predatory zooplankton (Noichi *et al.* 1991), the analysis of our samples' stomach contents revealed no prey items. The literature does not offer much information on the feeding habits of this species. Because our samples were repeatedly stored in ice, frozen, thawed, and subsequently subjected to identification assessments, some fish scales were lost and the first dorsal fin spine was broken. Furthermore, the body color, some blotches on the body, and certain characteristics were somewhat unclear.

A total of 5 genera and 10 species of the family Percophidae have been reported to primarily inhabit the sandy deep-sea waters (100–500 m) of southwestern and northeastern Taiwan (Kao & Shen 1985; Shen *et al.* 1993; Nakabo 2013; Shao, 2024). Our samples were collected from a sea bottom environment that resembled the habitat of other species of the family Percophidae and that of the target species reported in other studies (Shen 1993; Nakabo 2013, 2018; Ogata & Murase 2020; Shao, 2024). However, the habitat of our samples was shallower than that of other species of this family and that of the same species reported in other studies (Kao & Shen 1985; Shen *et al.*

1993; Nakabo 2013; Shao, 2024). The reason for this discrepancy remains to be investigated. Notably, *M. fusiformis* is typically collected from shallow waters (depth <1 m) (Noichi *et al.* 1991; Nakabo 2013; Ogata & Murase 2020). Our result is still shallower than the results of other studies of this species. However, we can't be explained the reason for this difference in our study.

In conclusion, we present the first record of *M. fusiformis* in the coastal shallow waters of western Taiwan. The observed habitat of this species (sandy substrate) is consistent with that reported in other studies. Further studies are warranted to enhance our knowledge on the ecology, reproduction, growth, and population dynamics of *M. fusiformis*. Marine biodiversity must be maintained to preserve local ecological resources and facilitate further research. We suggested that a better understanding of these information about *M. fusiformis* is necessary in the future.

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Author Contributions

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