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A record of anopthalmia in *Mystus tengara* (Hamilton, 1822) from Assam

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Abstract: An abnormal case of anopthalmia in a striped catfish *Mystus tengara* (66.8 mm in standard length) from Assam is reported in this communication. Thirty eight morphological characters of the abnormal specimen were also studied and compared with normal specimens to observe variation in the morpho-meristic traits, if any. In the abnormal specimen, the proportionate height of the dorsal fin (31.1 mm) and nasal barbel length (75.9 mm) was found to be higher compared to that of the normal specimens (21.6 – 26.5 mm and 47.9 – 72.5 mm, respectively). While the body depth of anus was higher in case of normal specimens (19.1 – 29.2 mm) compared to abnormal specimen (14.5 mm). However, no marked variation was observed in meristic characters. This anomaly does not seem to have affected morphological aspects. Factors like weed infestation, pesticide and herbicide application adversely affecting the habitat is believed to be the cause of such deformity. The abnormality does not seem to have affected the overall growth of the fish.

Keywords: Anopthalmia, Environmental stress, Morphological anomalies, *Mystus tengara*

INTRODUCTION

Abnormal phenotypes, while rare, can be observed in many populations of fish (Tave and Handwerker, 1998). Morphological anomalies in fishes can be attributed to various factors like nutritional deficiency (Cahu *et al.*, 2003), temperature variations (Gluth and Hanke, 1983), low dissolved oxygen (Turner and Farley, 1971; Anon, 1996), high carbon dioxide concentration in water (Martens *et al.*, 2006), pollutants like chlorinated hydrocarbons, organophosphates, pesticides, heavy metals (Weis and Weis, 1989; Lin Sun *et al.*, 2009), parasitic infection (Cunningham *et al.*, 2005), developmental error and injury (Devadoss, 1983; Dutta and Kumar, 1991; Gupta *et al.*, 2000 and Subba, 2008).

Anopthalmia (the congenital absence of one or both eyes) in fish have been reported by many authors. A compiled bibliography of 1499 papers on fish anomalies was given by Dawson (1964, 1966, 1971) and Dawson and Heal (1976), of which 63 papers described eye abnormalities (Tave and Handwerker, 1998). Since then, many reports have been published on morphological anomalies in fishes (Kruitwagen *et al.*, 2006; Tave *et al.*, 2011; Saha and Saha, 2013).

Species of the genus *Mystus* are small to medium sized catfishes, inhabiting streams, lakes, and rivers of southern and southeastern Asia. Jayaram and Sanyal (2003) and Ferraris (2007) listed 44 and 33 species of *Mystus*, respectively. Among them, *Mystus tengara* (Hamilton, 1822) is known to have a fairly wide distribution in the Ganges and Brahmaputra river basins in northern and northeastern India. The species does not face any major threats and is therefore assessed as least concern (Ng, 2010).

Reports on abnormality of catfish are scanty and those available are mostly related to skeletal deformity (Sarkar and Kapoor, 1956; BabuRao and Siva Reddy, 1984; Jesu *et al.*, 2004; Teji and John Thomas, 2006; Nagarajan, 2012). However, an unusual specimen of *M. tengara* was collected from a rivulet of Brahmaputra River, Assam. The present communication is an attempt to report the case of anophthalmia in *M. tengara.*

MATERIALS AND METHODS

The deformed specimen of *M. tengara* (lacking right eye) was collected on 5th December, 2013 from a rivulet of Brahmaputra river near Folimari village Part - I in the vicinity of Dhubri town (District: Dhubri), Assam, India, during routine collection of samples for taxonomic evaluation of the genus *Mystus*. The specimen measuring 66.8 mm in standard length is preserved in the museum at CIFE, Mumbai, India (CIFE/FRM/MUS/Mt-48).

Sixteen normal specimens of the same species were also collected from the same site on the same day for observation of morphological features (Fig 1). Thirty eight morphological characters (30 morphometric and 8 meristic) were recorded for comparison. For the normal specimen the data are given in range. Gillrakers

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count on the first left branchial arch was taken only for the normal specimen. Methods for counting gillrakers follow Roberts (1992). Measurements were made point to point with a digital dial Vernier caliper to the nearest 0.1 mm. Subunits of the head are presented as proportions of head length (HL). Head length and measurements of body parts are given as proportions of standard length (SL). The inter-orbital distance of the abnormal specimen could not be measured for obvious reason and the gillraker count was also not taken to avoid damage to the specimen. Counts and measurements were taken by following Ng and Dodson (1999). Identification of the species was done following the key described by Jayaram (2006) and Darshan *et al.* (2013).

RESULTS AND DISCUSSION

The biometric features of the abnormal specimen as well as the normal specimens are presented in table 1.The dorsal fin of abnormal specimen has 7 branched rays and a spine with 3 serrations at the anterior side near the distal tip and 9 serrations at the posterior end. Pectoral fin has 7 branched rays with a stout spine having 14 large posterior serrations. Anal fin posses 3 unbranched and 9 branched rays. Caudal fin is deeply forked, and both upper and lower lobes have 1 unbranched and 7 branched rays.

The dorsal spine of normal specimens have 2-3 anterior serrations and 7-9 posterior serrations, while dorsal fin has 7 branched rays. Pectoral fin is with 7 or 8 branched rays while spine has 10-17 posterior serrations. Pelvic fin is with 1 unbranched and 5 branched rays. The unbranched and branched rays of anal fin ranged between 2-3 and 7-9, respectively. While both lobes of the caudal fin bear 1 unbranched ray, and 6/7 and 7/8 branched rays in the upper and lower lobes, respectively. Gillraker count for the normal specimens ranged between 31 – 40, with 6 – 9 in the upper limb and 22 -32 in the lower limb.

In the abnormal specimen, the side of the missing eye does not show any sign of injury or damage. On the contrary, the place was slightly depressed and covered with scales (Fig 2). The reason for this abnormality could not be ascertained. However, Tave and Handwerker (1998) reported that anophthalmia either can be heritable or can be caused by environmental disturbances. Tave *et al.* (2011) reported gross abnormalities in tilapia pertaining to eye which were non-heritable and possibly produced by pathogen, heat shock or chemicals. Symptom of anopthalmia was also observed in carps when dissolved oxygen concentration decreases to 25 % of the saturation level (Anon, 1996).Weis and Weis (1976) observed occurrence of unilateral and bilateral anopthalmia in fish embryos exposed to insecticides. Similarly, effect of pollutant causing anophthalmia in mudskipper has also been reported by Kruitwagen *et al*. (2006). Although it is difficult to ascertain the factor responsible for this abnormality, environmental stress could be the probable reason, since, the fish collection site is adjacent to paddy fields and there is every possible chance of pesticides or herbicide being leached into the water body, as reported by Weis and Weis (1976). Moreover, since the collection site was heavily infested with aquatic weed; extreme fluctuation in dissolved oxygen and carbon dioxide content is possible. This may be another factor responsible for occurrence of such abnormality which is well supported by the findings of Anon (1996) and Martens *et al.* (2006).

Fowler (1970) and Barlow (1961) reviewed that lower count of some meristic characters in fishes may be due to environmental differences. But, no such meristic variation was observed in this abnormal specimen. All counts of the abnormal specimen were within the range as in the normal specimens. However, some variation was observed in the morphometric features of the abnormal fish such as dorsal fin height, nasal barbel length and body depth at anus. The proportionate height of the dorsal fin of the abnormal specimen was higher (31.1 mm) as compared to that of the healthy specimens (21.6 – 26.5 mm). Similarly, nasal barbel length was also found to be higher in the abnormal

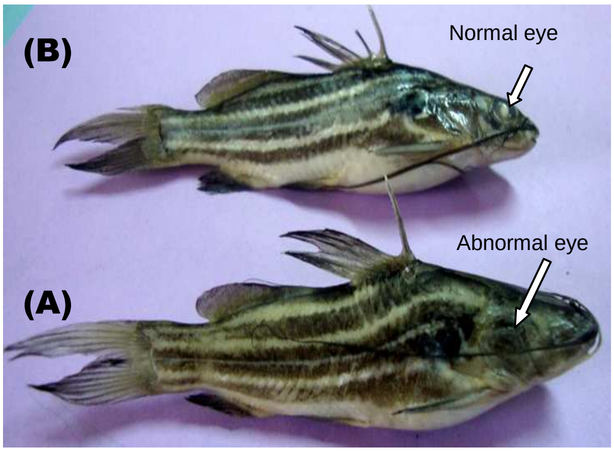

Fig. 1. *Comparison of abnormal specimen (A) with normal specimen (B).*

Fig. 2. *Eye site of abnormal specimen covered with scale.*

Table 1. Biometric data of *Mystus tengara* (in mm).

	Abnormal specimen	Normal specimen (n=16)	
		Range	Mean ± SD
Standard length (SL)	66.8	55.8 – 82.4	66.8 ± 8.0
In % of SL			
Pre dorsal length	42.5	36.4 – 42.7	40.6 ± 1.3
Pre pelvic length	52.4	49.9 – 56.4	52.3 ± 2.0
Pre anal length	73.0	70.8 – 76.2	73.3 ± 1.4
Pre pectoral length	24.9	22.8 – 27.3	24.8 ± 1.3
Height of dorsal fin	31.1	21.6 – 26.5	24.4 ± 1.7
Length dorsal fin base	14.8	13.4 – 17.2	15.3 ± 1.1
Dorsal spine length	15.4	12.2 – 16.8	14.9 ± 1.5
Anal fin length	12.2	11.9 – 14.2	13.1 ± 0.8
Anal fin height	21.6	17.5 – 27.4	20.2 ± 2.4
Pelvic fin length	18.8	16.4 – 19.5	17.4 ± 0.9
Pectoral fin length	22.9	19.7 – 23.3	21.2 ± 1.0
Pectoral spine length	21.6	17.5 – 21.7	19.3 ± 1.3
Caudal fin length	28.2	22.5 – 34.9	26.2 ± 3.0
Caudal peduncle length	16.8	15.1 – 19.5	16.9 ± 1.2
Caudal peduncle depth	10.1	9.6 – 12.0	10.4 ± 0.6
Adipose maximum height	5.7	4.3 – 6.2	5.0 ± 0.6
length of adipose fin base	28.4	26.3 – 31.9	29.1 ± 1.4
Post adipose distance	13.7	13.4 – 16.5	14.6 ± 0.9
Dorsal to adipose distance	3.9	3.1 – 7.8	4.7 ± 1.3
Body depth at anus	14.5	19.1 – 29.2	21.8 ± 2.4
Head Length (HL)	29.8	25.6 – 32.0	28.8 ± 1.5
Head Depth	19.0	16.2 – 20.4	18.6 ± 1.1
Head width	19.0	12.3 – 20.3	18.1 ± 1.9
In % of HL			
Snout length	28.3	24.3 – 31.3	27.3 ± 2.0
Eye diameter	27.7	24.1 – 32.6	27.1 ± 2.6
Maxillary barbel length	302.6	218.7 – 339.7	289.3 ± 30.4
Nasal barbel length	75.9	47.9 – 72.5	62.7 ± 8.2
Outer mandibular barbel length	126.9	109.4 – 152.2	126.4 ± 9.8
Inner mandibular barbel length	84.3	70.1 – 95.2	80.2 ± 6.4

specimen (75.9 mm) compared to that of the normal specimens (47.9 – 72.5 mm). While the body depth of anus was higher in case of normal specimens (19.1 - 29.2 mm) compared to abnormal specimen (14.5 mm).

Records on variation in length of barbel are not available. Babu Rao and Siva Reddy (1984) observed some abnormalities in *Mystus vittatus*, which was mostly related to appearance of forked maxillary barbels. Bussing (1966) observed high degree of intra-specific variation in the barbel length among the population of *Pygidium striatum* from Costa Rica. He, however, did not report any valid reason for such variation. Subba (1999) observed deviation of length of dorsal fin height in proportion to standard length in case of African catfish pointing pollution as the reason for abnormalities. Naserizadeh *et al.* (2013), in their observation on morphological differences between healthy and abnormal fishes of Mahisefed (*Rutilus frissikutum*) populations from Caspian sea, found that abnormal fishes had different body component ratios for which they proposed diverse abiotic (diverse pollutants) and biotic (inbreeding) parameters as affecting factors. Deviation of body component ratio in an abnormal species of *Bagarius bagarius* due to developmental error was also reported by Subba (2008).

Generally the number of malformed fish, that survive, decreases with development and few individuals with abnormalities survive until adult stages (Klumpp and Von Westernhagen 1995). Similarly, Nakayama *et al.* (2005) reported that only few medaka embryos that developed anophthalmia following maternal exposure to tributyltin hatched successfully, and none survived for more than a few days. Hence, it is possible that the single anophthalmic *M. tengara* found in the present investigation may have malformed during development.

Conclusion

The abnormality in the fish has not induced any significant change in the gross morphological characters of the fish, while the meristic traits remain the same when compared to that of normal specimens. The absence of eye does not seem to have affected the overall growth of the fish. The possible causes of variation in length of dorsal fin, nasal barbel length and body depth at anus could be validated by conducting further investigation of more population of the species from the locality as well as analysing the soil and water quality of the collection site and adjacent areas. This shall help in undertaking suitable management measures to restore a healthy environment simultaneously conserving the fish germplasm in the long run.

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