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Biology of the ornamental cyprinid fish *Danio dangila* (Hamilton, 1822) from the North-eastern hill region of India

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ABSTRACT

The moustache danio *Danio dangila* (Hamilton, 1822) is one of the most popular native ornamental fishes of the North-eastern hill region of India. The species needs immediate attention owing to its reduced abundance in the wild. The length-weight relationship of *D. dangila* indicated an isometric growth in general and was found to follow the cube law. The L-W relationships derived for the species were: $\log W = -5.009 + 3.00 \log L$ (male and female combined); $\log W = -5.542 + 3.31 \log L$ (male) and $\log W = -5.462 + 3.26 \log L$ (female). The 41-50 mm size group was found to be predominant (44.25%) in the wild. The fish predominantly feeds on phytoplankton (97.12%), with Myxophyceae forming 68%, followed by Zygnemophyceae 25%, Ulvophyceae 3%, Zygnetophyceae 2%, Cryptophyceae 1% and Bacillariophyceae 1%. The major zooplankton group in the diet was Rotifera. Nematodes and other similar worms also formed a part of their diet. The sex ratio (female: male) estimated was 1:1.77. The gonadosomatic index (GSI) for gravid females ranged from 2.55 to 24.12 with an average value of 7.65. The minimum and maximum fecundity were 400 and 2000 in females having a length of 52 and 64 mm and weight of 2.52 and 3.15 g respectively.

Keywords: *Danio dangila*, Fecundity, Feeding, Length-weight relationship, North-eastern hill region

The genus *Danio* comprises many species of danionins familiar to aquarists and among them, the moustache danio *Danio dangila* (Hamilton, 1822) is one of the most popular ornamental fish, both locally and globally (Vinod *et al.*, 2001). This species is characterised by an olive colouration dorsally with silvery sides and several narrow blue lines, which are discontinuous anteriorly forming a beautiful network in the first half of the body (Fig. 1). The anal fin has two to three blue stripes and there is a dusky spot at the upper angle of the gill opening.

D. dangila is an active swimmer and generally move on the surface. Their bright silvery appearance and

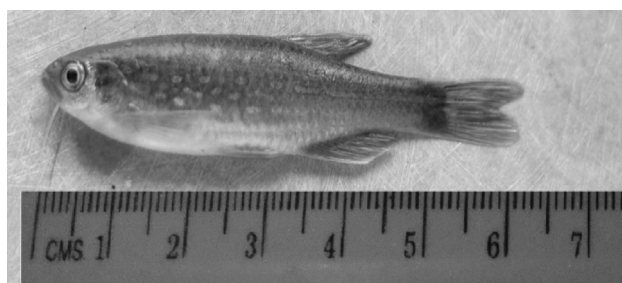


Fig. 1. The moustache danio *Danio dangila*

bands are unique features attracting hobbyists and the species fetches ₹12/- and US\$ 1.50 per pair in the local and international markets respectively. Both sexes of this fish have almost the same colouration and have equal acceptance in the ornamental fish trade. They are hardy and compatible with other species in a community aquarium tank. This species is distributed in India, Bangladesh, Nepal, Bhutan and Myanmar (Talwar and Jhingran, 1991). The name “danio” comes from the Bengali name *dhani*, meaning “rice field”. They commonly inhabit paddy fields, ponds and small streams and are found to be distributed in all the North-eastern states of India (Sen, 2000; Mahapatra *et al.*, 2004). West Bengal and North-eastern states are the main contributors to the wild caught fishes exported from the country (Mahapatra *et al.*, 2006). Although the demand for this fish is high in the ornamental fish trade, presently the requirement is being fulfilled only from the natural collection (Mahapatra *et al.*, 2001). This fish is assessed as “Least Concern (Lc)” in the IUCN Red List and has a wide distribution (Vishwanath, 2010). But recently, the overexploitation of this species from the wild resulted in depletion of the natural stocks. This calls for an urgent need to breed this fish in captivity to meet

the growing demand and also as a formal step towards conservation (Mahapatra *et al.*, 2004; Mandal *et al.*, 2007; Dey *et al.*, 2014). The present study was undertaken to understand the biology of this species which is very much essential for captive breeding under controlled conditions.

Monthly samples of *D. dangila* were collected during April 2000 to December 2004 from streams and paddy fields of Meghalaya, North-eastern India. The fishes were collected from terraced paddy fields using a bamboo trap locally called “roh” (Fig. 2a) and from streams and swampy areas using a bamboo-made gear locally known as “chekke” (Fig. 2b). Operation of these traditional gears can be regarded as an eco-friendly method of fish collection, as these gears do not cause destruction to the habitat and the fishes collected are also not injured.

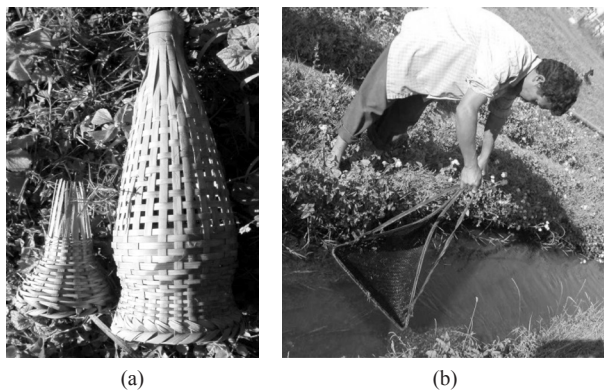


Fig. 2. Gears used locally in Meghalaya for collecting weed fishes including *D. dangila*. (a): Roh, (b): Chekke

A total of 175 specimens were examined for analysing the length-weight relationship. The relationship was established following the formula of Le Cren (1951) by transformation into a straight-line equation, $\log W = \log a + b \log L$. The length-weight (L -W) relationships derived for both the sexes of *D. dangila* separately and for combined sexes are given in Table 1. The length and weight of the fishes ranged from 22.5 to 71 mm and from 0.12 to 3.68 g respectively. Regression model was fitted for length and weight of male, female and combined sexes separately (Table 1). For a fish which maintains its shape throughout its life, the value of regression coefficient will be ‘3’ (Varghese, 1961; Talwar, 1962) and deviation from ‘3’, indicates allometric growth. The length-weight data are presented in the form of scatter diagram (Fig. 3a, b, c) which shows that the relationships are linear. In the present study, r values obtained were 0.982, 0.974 and 0.981 for male, female and combined sexes respectively indicating good fit of the model in all cases. The functional form of relationship between L-W of the species were fitted as: $\log W = -5.009 + 3.00 \log L$ for combined sexes, $\log W = -5.542 + 3.31 \log L$ for male and $\log W = -5.462 + 3.26 \log L$ for female. The ‘b’ value of male (b = 3.315), female (b = 3.259) and combined sexes (b = 3.00) indicated isometric growth for *D. dangila*. In *Brachydanio rerio*, Mahapatra and Lakra (2014) observed negative allometric growth in male, positive allometric growth in female and isometric growth in combined sexes and stated that this species do not strictly follow the cube law.

Table 1. Length-weight relationship of *Danio dangila* among different groups, with their respective value of correlation coefficient (r)

Group	Sample size	Size range	Regression equation	r
Male	20	35.00-62.00 mm, 0.39-2.40 g	$\log W = -5.542 + 3.315 \log L$	0.982
Female	45	34.00-71.00 mm, 0.37-3.68 g	$\log W = -5.0 + 3.259 \log L$	0.974
Combined	175	22.50-71.00 mm, 0.12-3.68 g	$\log W = -5.009 + 3 \log L$	0.981

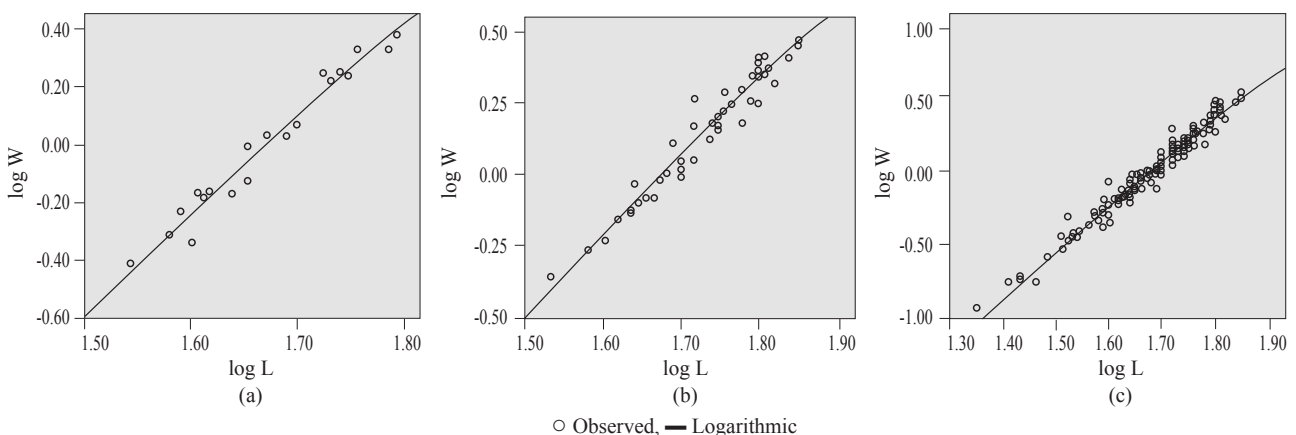


Fig. 3. Length-weight relationship of *D. dangila*. (a): Male, (b): Female, (c): Combined sexes

Distribution in different size

A total of 339 specimens of *D. dangila* were examined for estimating the distribution of different size groups. The variation in the number of fishes recorded in different size groups are presented in Table 2. The size group of 41 to 50 mm was found to be predominant (44.3%) over the other size groups. Larger sized fishes of 61 mm and above were found to be very rare.

Table 2. Frequency distribution of different size groups of *Danio dangila* recorded during the study period

Size groups (mm)	No. of fishes	Percentage contribution
<30	12	3.5
31-40	79	23.3
41-50	150	44.3
51-60	65	19.2
61 & above	33	9.7

Gut contents of 50 specimens were analysed for studying the food habits employing percentage occurrence method (Hynes, 1950). Food items were identified up to major taxonomic groups. The moustache danio was observed to feed on both phytoplankton and zooplankton; with a preference to the former. A similar observation was made in *B. rerio* by Mahapatra and Lakra (2014). The mouth of *D. dangila* is terminal and oblique; with two pairs of barbels (maxillary and rostral) and there are four pairs of well-developed gill arches. The important groups of phytoplankton in the diet include diatoms like *Navicula* sp., *Fragilaria* sp., *Asterionella* sp. and desmids like *Cosmarium* sp., *Eaustrium* sp. and *Closterium* sp. Occasionally, zooplankton like *Philodina* sp., *Lecane* sp., *Testudinella* sp., *Lepidella* sp. and *Arcella* sp. were also encountered. Nematodes and similar worms also formed a part of their diet. In the gut, phytoplankton formed 97.12% and the rest were zooplankton. Myxophyceans were observed as the most abundant group with an average of 68% (Fig. 4) and encountered on a regular basis in the gut contents throughout the study period. *Navicula* sp., *Fragilaria* sp. and *Asterionella* sp. were the dominant genera of Myxophyceans recorded. Zygnemophyceae was found to be the second most abundant group contributing an average of 25% forming the dominant genera among them. Ulvophyceae, Zygnetatophyceae, Cryptophyceae and Bacillariophyceae have been found to constitute 3, 2, 1 and 1% respectively. The major zooplankton group was represented by Rotifera which comprised *Lecane* sp., *Lapedella* sp., *Aneuraeopsis* sp., *Asplanchna* sp., *Lepadella* sp. and *Testudinella* sp.

In *D. dangila*, the females were found to be broader while the males were slender in appearance. Females can be distinguished from their male counterparts

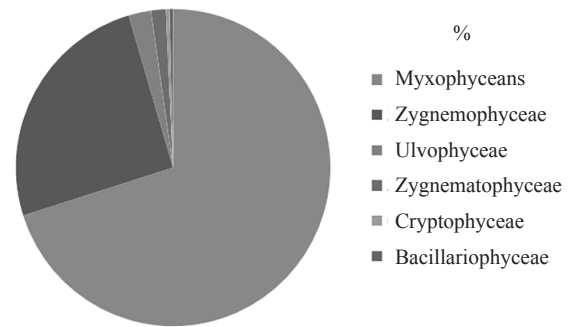


Fig. 4. Composition of phytoplankton in the gut content of *Danio dangila*

during the breeding season from their swollen belly. The minimum length and weight at first maturity was 52 mm and 2.52 g respectively in females. The length at which 50% of the females were mature was considered as the length at first maturity. The attainment of first maturity occurs when male is 5+ months and female is 6+ months old. The sex ratio was studied using Chi-square test (X^2), following the equation of Fisher (1970) and the ratio (female:male) obtained was 1:1.77. The gonadosomatic index (GSI) for females was estimated as the ratio of the weight of gonad to body weight. The GSI for gravid females ranged from 2.55 to 24.12 with an average of 7.65. The fecundity was estimated from 30 specimens by counting the number of mature ova from a known weight of subsamples collected from the anterior, posterior and middle portions of both the ovaries followed by calculating the total number of mature ova in the ovary following Grimes and Huntsman (1980). The minimum number of ova produced was 400 in a female having total length (TL) of 52 mm and weight of 2.69 g while a maximum of 2000 nos. of ova was produced by a female having TL of 71.0 mm weighing 9.75 g. *B. rerio* which shares a similar habitat with *D. dangila* is comparatively smaller in size with a fecundity ranging from 215 (fish having TL of 29 mm and weighing 0.2 g) to 2836 numbers (fish having TL of 49 mm weighing 1.81 g) (Mahapatra and Lakra, 2014). The average fecundity recorded was 882 and the number of mature eggs per gram of body weight (fecundity factor) ranged from 141 to 702 with an average of 306 (Table 3).

Since the population of moustache danio in the wild is declining gradually, it is essential to attempt breeding programmes in captivity for conservation of the species. The information generated on the biology of the species from the present study would definitely help in attempts for artificial propagation of the species in captivity.

Table 3. Fecundity observed from 30 gravid females of *Danio dangila*

	Total length (mm)	Weight (g)	Ovary weight (g)	Fecundity	Fecundity factor (No. of ova per g body wt.)
Average	64.03	3.03	0.27	882	305.85
Maximum	71	9.75	1.85	2000	701.90
Minimum	52	2.69	0.08	400	141.33

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