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A review on *Mystus cavasius*, a popular food fish of Indian subcontinent

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Abstract

Mystus cavasius is a freshwater catfish which is a very popular food fish of Indian subcontinent and has high market price. Recently it has also made its mark as ornamental fish and has been exported with good market price from India. Fishery of this particular fish species till date is capture based; but to explore its fishery captive culture is needed and in this purpose detail information on its biology and fishery is required. Earlier few works have been conducted on morphology, biology and fishery & culture of this fish species; but consolidated information is not available on these aspects. So with this view the current review work has been conducted to sum up all available information along with notes down the lacunae of information which will be beneficial for the exploration of its fishery.

Keywords: Morphology, Biology, Review, *Mystus cavasius*

1. Introduction

Mystus cavasius (Hamilton-Buchanan, 1822) is a catfish under family Bagridae of order Siluriformes. It is commonly known as Gangetic *Mystus* which has been reported to be distributed in India, Bangladesh, Pakistan, Nepal, Sri Lanka, Thailand and Myanmar [1-5]. The fish is usually found in fresh water and is mostly available in rivers (both fast flowing and slow flowing), canals, beels, ponds, ditches and inundated fields [6, 7]; also has been reported from tidal rivers and lakes [2]. It has high market demand as food fish with high market price [2, 4, 8, 9] due to good protein content in its flesh [7, 8, 10]. It has also made its entry in the ornamental fish market and recently has been documented to be exported as indigenous ornamental fish from India [11].

Few works on different aspects of its biology, morphology, fishery and culture have been conducted earlier but no such consolidated review report is available on these aspects. So with this view this review report has been prepared to sum up all the available information along with notes down the lacunae of information in some area which will be good enough to explore the fishery of this fish species in near future.

2. Morphological characters

Day [1], Talwar & Jhingran [2] and Chakrabarty & Ng [5] have documented the morphological characters of *Mystus cavasius* which has been summarized here:

Body elongate and moderately compressed; dorsal profile rising evenly, but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle; ventral profile slightly convex to anal-fin base, then sloping slightly dorsally to end of caudal peduncle. Skin smooth. Lateral line complete and midlateral in position. Depth of the body 4 to 4.5 times in standard length. Head conical; occipital process narrow, 3.5 to 4 times as long as broad, extends to the basal bone of dorsal fin; upper surface of the head slightly roughened, its median longitudinal groove on head extends to the base of occipital process, which last is narrow and three or four times as long as wide at its base, and with a shallow groove along its last half or two-thirds; no interspace between its posterior extremity and the basal bone of the dorsal fin. Mouth terminal, fleshy upper lip extending anteriorly beyond upper jaw. Snout rather obtuse, upper jaw a little the longer; width of the gape equals 2/5 of the length of the head, the cleft extends half way to below the orbit. Eye diameter 3.2 to 4 times in head, about 1.2 times in interorbital width. Gill openings wide, extending from exposed surface of post-temporal to beyond isthmus at line through mouth corners. *Teeth*: On the palate in an uninterrupted crescentic band; oral teeth small and

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villiform, in irregular rows on all tooth-bearing surfaces, pre-maxillary tooth band rounded, of equal width throughout; dentary tooth band much narrower than pre-maxillary tooth band at symphysis, tapering laterally; vomerine tooth band unpaired, continuous across midline, smoothly arched along anterior margin, tapering laterally to point extending posteriorly well past level of pre-maxillary band, band width narrower than pre-maxillary band at midline, widening laterally and then tapering to a sharp point posterolaterally. **Barbels:** Barbels four pairs; the maxillary barbels long and slender, extend to beyond the base of the caudal fin in adult but in young specimens do not extend beyond anal fin; the nasal barbels nearly or quite as long as the head; internal mandibular barbels origin close to midline, thicker and longer than nasal barbel and extend to base of posterior most pectoral fin ray, the external mandibular barbels originating posterolateral of inner mandibular barbel extend almost to the base of the ventral. **Fins:** dorsal fin with spine and spinelet, origin of dorsal fin anterior to mid-body, about two-fifths of body. Dorsal fin margin straight or slightly concave, with first two fin rays longer than others, the fin is rather higher than the body and pointed, dorsal spine long, straight and weak, feebly serrated, and nearly or quite as long as the head excluding the snout; the adipose dorsal commences just behind the rayed one, the length of its base is three times as long, and deeply incised posterior portion, spanning almost all of post-dorsal distance. Pectoral spine as long as, but stronger than, the dorsal, sharply pointed at tip, smooth externally, denticulated internally, pectoral fin margin straight anteriorly, convex posteriorly. Ventral arises just posterior to the vertical from the last dorsal ray. Anal fin origin located at approximately the middle third of adipose fin and its posterior margin is curved. Caudal fin deeply forked, pointed, upper lobe the longer. **Color:** grayish becoming yellowish along the abdomen and cheeks with a more or less well defined mid-lateral longitudinal stripe; often also a less well defined or more diffuse longitudinal stripe ventral to the mid-lateral stripe. Maxillary barbels, dorsal and caudal fin dusky, paired fins and anal fin dull white. There is usually a black spot covering the basal bone of the dorsal fin. Occasionally there is a bluish band along the lateral line.

3. Maximum length

Day^[1] has reported maximum length of 18 inches (45 cm) for *Mystus cavasius*; while Talwar and Jhingran^[2] have documented a closer value of 40 cm for this fish species. Maximum length of 22.5 cm, 24.9 cm, 26.5 cm and 27.4 cm have been documented by Bhatt^[12], Muralidharan *et al.*^[13], Krishna Rao^[14] and Sani *et al.*^[15] respectively. Hossain *et al.*^[16] have reported just a length of 11.29 cm as the maximum length for *Mystus cavasius* in their studied specimens at Jamuna river, Bangladesh.

4. Growth pattern

Krishna Rao^[14] has reported isometric growth pattern for *Mystus cavasius* in his study. Muralidharan *et al.*^[13] and Hossain *et al.*^[16] have documented positive allometric growth for *Mystus cavasius* from Cauvery River, southern India and Jamuna river, Bangladesh respectively while Venkateshwarlu *et al.*^[20] and Sani *et al.*^[15] have reported negative allometric growth in Bhadra reservoir, Karnataka and Betwa river respectively.

5. Food and feeding habit

Bhatt^[12] has documented it as omnivorous and predatory fish with wide range of food preference; he has reported presence of insect larvae & nymph, insects, molluscs, fish larvae, fish & fish scales, chironomid larvae, algae, higher aquatic plants etc in the gut content of *Mystus cavasius*. High feeding activity has been documented during monsoon, post-monsoon and winter months while poor feeding activity has been reported during summer months. Rise in temperature and prevailing draught conditions has been reported to be responsible for the fall in the feeding intensity in summer months. No effect of gonad maturation on feeding intensity has been reported as even during the months when gonads attain peak maturity high intake of food has been documented.

Chaturvedi and Saksena^[17] have reported it as eury-omnivorous fish as it feeds on wide range of diet including phytoplankton (bacillariophyceae has been reported as the most preferred food item followed by cyanophyceae, chlorophyceae and euglenophyceae), zooplankton (rotifer, cladocera, protozoa and copepod), insects, insect larvae and their parts, roundworms and mollusca. They have documented maximum percentage of plant material (57.48%) in the diet followed by insect larvae (15.64%), zooplankton (10.09%), insect parts (9.02%), mollusca (4.16%) and round worms (1.06%). However, on the basis of the biomass of the food items accounted in the gut of this fish during their study, they have reported inclination of *Mystus cavasius* towards the carnivorous feeding habit. High feeding activity has been reported during winter months with high availability of food items and low feeding activity has been reported in summer months with lowest in June due to depletion of food material with prevailing high temperature condition. The high occurrence of empty stomachs has been reported during the pre-spawning months and improved feeding activity after spawning has also been reported. Seasonal variation in the number of different food items in the gut content has been documented due to abundance and deficiency of particular food items in different months; variations in physicochemical parameters of the habitat have been reported to be responsible for such kind of differences.

Krishna Rao^[14] has reported it as an insectivorous predator; it's a bottom feeding carnivore and its basic region of feeding is the littoral zone. The food items which have been documented in the stomachs are mainly insects and their larvae, molluscs and ostracods in the order of importance. Low feeding activity during spawning season has been reported by him.

The carnivorous feeding habit has been reported by Rahman *et al.*^[4]; mainly insect larvae and small fishes have been reported from its gut content. Tripathi^[3] has reported the presence of insects and fish fry in its gut. On the other hand, Govind^[18] has documented predominance of molluscs over insects in the gut content of the specimens from Thungabhadra reservoir.

6. Reproductive biology

6.1. Sexual dimorphism

Bhatt^[12] has reported that sexes of *Mystus cavasius* can be identified externally by the presence of genital papilla; which is present only in males. The papilla becomes very prominent during the breeding season.

6.2. Sex ratio

Bhatt^[12] has reported female dominance over male in *Mystus*

cavasius population; later Roy and Hossain [7], Krishna Rao [14] and Santoshsing and Gupta [19] have also supported this observation.

6.3. Length and age at first maturity

Bhatt [12] has reported 10 cm as length at first maturity for both the sexes of *Mystus cavasius*. Early maturation of females than males has also been reported by him; males have been reported to remain in ripe condition for a longer period. Santoshsing and Gupta [19] have reported 9.5 cm and 8.2 cm as lengths at first maturity for female and male of this fish species respectively.

Bhatt [12] has reported *Mystus cavasius* to get sexually mature at the age of 1 year which later has been supported by Hossen *et al.* [9].

6.4. Fecundity

Bhatt *et al.* [21] have documented fecundity range of 3,314-63,135 for *Mystus cavasius*; they have reported a linear relationship of fecundity with body weight and gonad weight while a parabolic relationship with total length. Roy and Hossain [7] have reported fecundity of *Mystus cavasius* to be ranged from 4,026-25,960 with a mean value of 12,432.38±3,401.92; they have reported a linear relationship of fecundity with body weight, total length, standard length, gonad length and gonad weight. Krishna Rao [14] has documented fecundity range of 2,550-71,324 for *Mystus cavasius*; he has also reported a significant positive correlation of fecundity with body weight and total length. Chaturvedi and Saksena [22] have reported fecundity range of 6,442.68±1,293.38-18,707.95±1,355.59 with mean fecundity of 13,936.44±2,768.927 for *Mystus cavasius* from Chambal river, Madhya Pradesh. They have reported a positive correlation of fecundity with gonad weight and body weight. A positive correlation of fecundity with water temperature and photo period has also been documented by them. Faruq [23] and Islam & Azadi [24] have documented fecundity range of 12,262-20,626 and 13,425-39,404 respectively from Bangladesh.

6.5. Gonadal maturity stages

Bhatt [12] has documented five stages of gonadal maturity namely immature, maturing, mature, ripe and spent in *Mystus cavasius*.

6.6. Breeding periodicity

Qasim and Qayyum [25] have reported June to September as breeding season with July and August as spawning months for *Mystus cavasius* at Aligarh while Bhatt [12] has documented August to September as the spawning months in the same region. Rao *et al.* [26] have reported August-September as a period of intense breeding for *Mystus cavasius* at Mehadrigedda stream of Visakhapatnam. Krishna Rao [14] has reported June-July as spawning months for this fish species at Hemavathi reservoir, Karnataka. Santoshsing and Gupta [19] have documented late July to October as breeding season with August and September as spawning months at Marathwada, Maharashtra. Ashashree *et al.* [10] have documented February to July as its breeding season in Bhadra reservoir, Karnataka. Chaturvedi and Saksena [22] have studied the breeding periodicity of *Mystus cavasius* in Chambal river, Madhya Pradesh and have documented July and September as its spawning months; post-spawning phase, preparatory phase,

maturing phase and pre-spawning phase have been reported to be available during October-November, December-February, March-April and May-June respectively. They have reported a positive correlation of Gonado Somatic Index (GSI) with gonad weight; positive correlation of GSI with water temperature and photoperiod has also been documented by them. Maya *et al.* [27] have documented July as the peak breeding season for *Mystus cavasius* at Mymensingh region of Bangladesh.

Qasim and Qayyum [25] have later reported single spawning nature of *Mystus cavasius* which later has been supported by Bhatt [12], Krishna Rao [14] and Santoshsing & Gupta [19].

Santoshsing and Gupta [19] have reported temperature and photoperiod as important stimulus for gonad development in *Mystus cavasius*; role of monsoon flood as a primary stimulus has also been documented by them.

7. Fishery and culture

A numbers of different kinds of net have been reported to be used for its fishing. Set-bag net (locally known as dur jal), seine net (locally known as moshari ber jal) and lift net (locally known as veshal jal and khora jal) have been reported to be used for fishing of *Mystus cavasius* in the Shitalakshya river at Siddirgonj area, Narayangonj, Bangladesh during pre-monsoon period [28]. Chaturvedi and Saksena [22] have documented the use of cast net for its collection in their study in Chambal river, Madhya Pradesh. Siddiq *et al.* [29] have documented the use of punti jal (a kind of gill net), dharma jal (a kind of lift net) and thela jal (a kind of drag net) in Meghna river estuary, Chandpur region, Bangladesh. Use of gill net has been reported from Hemavathi reservoir, Karnataka for its fishery by Krishna Rao [14].

Except few scattered works, not much information is available on the culture of *Mystus cavasius*; maximum works so far have been done in Bangladesh. Rahman *et al.* [30] have conducted an experiment to ascertain the best stocking density of *Mystus cavasius* fry in nursery pond to get maximum production and benefit; they have documented that a stocking density of 2,00,000 fry/ha is the best one to get highest growth, production and net benefits comparing stocking density of 2,50,000 fry/ha and 3,00,000 fry/ha. Kohinoor *et al.* [31] have experimented to culture *Mystus cavasius* with Indian Major Carps and *Ompok pabda*; and have concluded that it can be cultured effectively in low input carp polyculture management. Kohinoor *et al.* [32] have obtained production of 1,370 to 1,535 kg/ha in six months of culture of *Mystus cavasius* in monoculture management.

Akhteruzzaman *et al.* [33] and Mishra *et al.* [34] have earlier tried to induce breed *Mystus cavasius*; apart from these no further development has so far been reported.

8. Conclusion

Food and feeding habit of *Mystus cavasius* has already been studied in details; though high contradiction is there regarding its feeding habit; Bhatt [12] and Chaturvedi & Saksena [17] have reported it as omnivorous fish while Govind [18], Tripathi [3], Rahman *et al.* [4] and Krishna Rao [14] have documented its carnivorous feeding habit. This variation of food habit may be due to difference in availability of food items with changing study sites; though firm conclusion on its feeding habit is really needed. Study on mouth morphology and architecture can provide conclusive information on feeding habit; study of the mucosal surface of the alimentary canal is also very

effective to ascertain feeding habit of a fish. On the other hand enzymatic study of the alimentary canal is also very effective to get information on feeding habit of a fish. None of the workers earlier have studied on those aspects which to be done involving different age classes, size classes and sex to get information on age wise, size wise and sex wise variation in food habit or food preference if any. Change in feeding activity has been reported earlier in accordance to food availability, lowest feeding activity has been reported during the summer with increasing water temperature that resulted depletion of food material, they have not found any correlation between breeding season and change of feeding activity; Krishna Rao ^[14] has reported low feeding activity during spawning season. So, detail work is needed to get a clear cut view on change of feeding activity in respect to breeding season if any. On the other hand, female dominance over male and high fecund nature of *Mystus cavasius* has been documented. Single spawning nature has also been reported with effect of photoperiod, temperature and monsoon on gonad development. So, overall there is fair information available on feeding and breeding biology of *Mystus cavasius*; few lacunae which have been highlighted here should be studied in detail to explore and proper management of its fishery in coming days. Not much information is available on its fishery and culture. Till now its fishery is mainly capture based; but captive culture is needed to continue and explore its fishery. *Mystus cavasius* is a hardy fish; can withstand harsh environmental conditions, such as low oxygen, wide range of temperature fluctuations etc ^[33]. So, this can be easily cultured if proper information on its sustainable culture methodology, supplemental diet etc can be collected following proper experimentation. In this regard a new finding must be shared; recently Hossen *et al.* ^[9] have reported from their experimental analysis the higher reproductive performance of *Mystus cavasius* with high fertilization rate and hatching rate of fertilized eggs and the spontaneous spawning in fishes fed with Poly Unsaturated Fatty Acids (PUFAs) treated diet. They have suggested supplementation of PUFAs as nutritional requirements of brood stock which could lead to better spawning performance that would be immensely helpful to repopulate and conserve the fish in their natural aquatic habitats.

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