



International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2019; 7(2): 42-45

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www.fisheriesjournal.com

Received: 17-01-2019

Accepted: 20-02-2019

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Comparative analysis of animal based feed preferences in selected Aquarium fishes

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Abstract

Ornamental fishes are always an attractive add to your decoration design. In an aquatic ecosystem, the live food organisms constitute the most valuable resources for aquaculture. This outstanding achievement in animal based feed has resulted in increased survival, higher growth rate and greater resistance to stress. The study of the comparative feeding preferences of ornamental fishes *Trichogaster trichopterus* (Gourami), *Puntius conchoni* (Rosybarb), *Cyrtocara moorii* (Blue Dolphin cichlid), *Poecilia sphenops* (Blackmolly), *Paracheirodon innesi* (Neon tetra) towards Mosquito larva, Bloodworms and Earthworm has revealed that fishes were fed three feeds and they preferred bloodworm and mosquito larvae. Fish primarily detect food in the aquarium through olfaction (smell) and sight rather than appearance, feel, and taste of the live foods. The *Puntius conchoni* fish consumed mosquito larvae then earthworm (34.8±7.0 mg and 29.4±4.23 mg) and *Trichogaster trichopterus* feed more bloodworm (41.25±4.03mg) in short time duration. The selected fishes are indeed suitable feed on mosquito larvae that can be used from wild in the context of mosquito management and inexpensive resources of this larvae can be used for aquarium fish production as alternative potential feed to reduce the feed cost.

Keywords: Ornamental fishes, animal based feeds, feeding preferences, mosquito larvae

Introduction

Ornamental fishes are attractive colourful fishes of various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy. Ornamental fish is one of the important items among the various types of commercially important fishes marketed nationally and internationally. Generally, all basic nutritional requirements are met in commercial diets based on fish meal as the main protein, and fish oil as a source of essential fatty acids and sterols. However, as a result of increasing aquaculture, both at regional and national scales, and the increasing susceptibility of ocean fisheries to natural events, the search for alternative diets that are able to sustain fish production and are economically and ecologically viable has become necessary. Development of a suitable live feed for aquarium fishes requires the information about the nutritional requirements, which is scarcely available. Thus it is high time to draw the attention of aquaculture researchers to turn their efforts to this sector so as to generate relevant information for further development of suitable aquarium fish feed in the country. The information provided in this article gives an insight about the nutrition of aquarium fishes.

The ornamental fishes were herbivores, carnivores and omnivores and they are selected based on their body colour, body shape. The selected feeds were Mosquito larvae (*Anopheles* spp.), Bloodworm and Earthworm which contribute a good nutritious foods for ornamental fishes as *Trichogaster trichopterus* (Gourami), *Puntius conchoni* (Rosybarb), *Cyrtocara moorii* (Blue Dolphin cichlid), *Poecilia sphenops* (Blackmolly), *Paracheirodon innesi* (Neon tetra). The animal based feeds contain all nutrients such as protein, carbohydrates, lipids, vitamins and minerals (New, 1998). Providing appropriate live food at proper time play a major role in achieving maximum growth and survival of the young ones. To achieve maximum production and profitability, the nutritional components of natural foods must be identified and quantified.

Nutritional value of live food organisms can improve the breeding and health of fishes. In this current study, Earthworm species *Eudrilus eugeniae* and Mosquito species *Anopheles* larvae and the blood worm are given as feed to the cultured fish and the fish preference has been analysed. Mosquito larvae and Earthworms contribute a good nutritious food for ornamental

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fishes. Mosquito larvae are excellent source of protein (De La Noue and Choubert, 1985) [10]. Earthworms are also good source of nutrients (Hilton, 1983) [7] they commonly found in soil, feeding on live and dead organic matter. *Anopheles* mosquito larvae has short siphon, head is longer than broad and has palmate hairs on the sides of abdomen. This mosquito larvae are known vector for transmission of diseases in worldwide, including the pathogens which are responsible for equine infectious malaria (Homski *et al.*, 1994; Walker, 2002) [8, 19]. In this study, the common ornamental fishes is used in experiments designed to assess the feeding of third instars of *Anopheles* spp. and the result indicate that fishes were feed on mosquito larvae. The selected fishes were prefer all given live feeds. The water characteristics like physico-chemical parameters are influencing fishes feeding habitats in aquarium water (Janardan and Goswami, 2012) [9]. This studies the emphasis on Physico-chemical parameters, proximate composition of animal based feeds, and feed preference based on quantity of feed consumption of fishes.

Materials and methods

The current study was designed to unveil the assessment of feeding behaviours in aquarium fishes versus animal based feeds. The animal based feeds are a convenient and often essential food source for ornamental fish. The study extends further to the control of mosquito larvae.

1. Selection of ornamental fishes

Five different exotic ornamental fishes were collected from five different families- *Trichogaster trichopterus* (Gourami-Osphronemidae family), *Puntius conchoni* (Rosybarb-Cyprinidae family), *Cyrtocara moorii* (Blue Dolphin cichlid-Cichlidae family), *Poecilia sphenops* (Blackmolly- Poeciliidae family) and *Paracheirodon innesi* (Neon tetra- Characidae family).

2. Maintenance of ornamental fishes

Glass tank filled with 12L of water was used to culture the fishes. To supply oxygen to the tanks, air pumps and air stones were used. Six fishes from each species was introduced to the tanks. Feeds were given to all the tanks.

3. Measured the length and weight of fishes

Selected fishes were weighed and their length was measured.

4. Collection of animal based feeds

4.1. Mosquito larvae

Third instar of *Anopheles* larvae were collected from dirty murky water and stored for future use.

4.2. Earthworm and Bloodworms

Eudrilus eugeniae (earthworm) and *Glycera dibranchiate* (bloodworm) were collected to this experiment.

5. Introduction of animal based feeds in to aquarium tanks

Animal based feed of each species about 50mg of weight were introduced into tanks, each feeds weighed individually to make 50 mg, each feed weight of mosquito larvae (1.3mg), Bloodworm (4.5mg), and Earthworm (8.4mg) were observed.

6. Physico-chemical parameters

Physico- chemical parameters that included Temperature, pH, Dissolved oxygen (Winkler, 1888) [20], Salinity (Baseggio, 1974) [4] and Ammonia (APHA, 1998) [1] was measured.

7. Statistical analysis of data

All the collected data were statistically analysed.

Results

The present study emphasis on the feeding behaviour and preference in aquarium fishes versus animal based feeds like Bloodworm, Mosquito larvae and Earthworm. A total of 5 fish species were selected. *Cyrtocara moorii* have length (6.98±0.06cm) and weight (4.19±0.005g) larger than that of other selected fishes. Fish size and numbers were more similar at the end of the experiment. The Earthworm feed have large size as length (13.02 ±0.03mm) and weight (8.4 ±0.002mg) shown in table2.

Table 1: Length and weight of aquarium fishes

Fish species	Length(cm)	Weight(g)
<i>Trichogaster trichopterus</i>	5.43±0.07	2.95± 0.007
<i>Puntius conchoni</i>	3.73±0.07	1.49±0.005
<i>Poecilia sphenops</i>	3.20±0.05	1.07±0.005
<i>Cyrtocara moorii</i>	6.98±0.06	4.19±0.005
<i>Paracheirodon innesi</i>	2.53±0.04	0.17±0.008

*Mean± SD value

Table 2: Weights and lengths of selected live feeds

Animal based feeds	Length(mm)	Wet weight(mg)
<i>Anopheles</i> spp.	7.01 ±0.02	1.3 ±0.002
<i>Glycera dibranchiate</i>	10.21 ±0.01	4.5 ±0.001
<i>Eudrilus eugeniae</i>	13.02 ±0.03	8.4 ±0.002

*Mean± SD value

Given the importance of water physicochemical parameters, including pH, Temperature, Salinity, Dissolved oxygen, Ammonia and its effect on feeding all the time, they were maintained under controlled environment (Table 3). Results of water quality parameters, no significant difference was found during the feeding time. Biochemical parameter of live feeds were essential for fish growths and it has difference. In that context the result shows that more protein (56.13±00.30) in Earthworm, similarly the bloodworms has more lipids (55.40± 0.02) and Carbohydrate (18.01± 0.05) in which live feeds were used as a feed for experimental studies.

Table 3: Physico chemical parameters of water

SI No	Tanks	Parameters				
		pH	Temperature(°C)	Salinity(mg/hr)	Dissolved oxygen(mg/l)	Ammonia(mg/l)
1	Control	7.12±0.05	27.02±0.01	0.01±0.04	4.11±0.32	0.05±0.02
2	<i>Trichogaster trichopterus</i>	7.23±0.02	27.03±0.01	0.02±0.05	4.63±0.12	0.31±0.05
3	<i>Puntius conchoni</i>	7.31±0.03	27.06±0.03	0.02±0.05	4.64±0.19	1.10±0.03
4	<i>Poecilia sphenops</i>	7.30±0.04	26.86±0.05	0.02±0.04	5.37±0.24	0.08±0.02
5	<i>Cyrtocara moorii</i>	7.01±0.02	26.95±0.05	0.03±0.07	4.82±0.15	1.22±0.06
6	<i>Paracheirodon innesi</i>	7.14±0.04	26.83±0.07	0.02±0.04	5.52±0.28	0.06±0.02

*Mean ± SE

Table 4: Biochemical parameters of Livefeeds (%)

Parameters	<i>Anopheles</i> spp.	Bloodworm	Earthworm
Protein	54.78±1.02	55.40±0.02	56.13±00.30
Lipid	06.69±0.53	08.12±0.08	07.22±00.05
Carbohydrates	16.92±0.74	18.01±0.05	14.30±00.21
Ash	10.21±0.01	06.25±0.02	10.31±00.01
Moisture content	11..04±0.31	12.22±0.06	12.04±00.04

* Mean± SD

The fish species showed increasing rate of feed consumption in animal based feeds. *Puntius conchonius* were consumed large quantity of *Anopheles* spp. (34.8±7.00mg) and Earthworm (29.4±4.23mg), and similarly *Trichogaster trichopterus* consumed bloodworm (41.25±4.03mg). The results showed that the feeding rate is influenced by smell and colour of feeds. This designates that the fishes selected the alternative feeds when all the feed types were present at equal densities. The mean quantity of feed consumed by fishes depends on the body size of the fishes (Table.1). The feeding preferences of fishes varied but the trend of feed selection remained same. In terms of feed preference among the three animal based feeds, the *Trichogaster trichopterus*, *Puntius*

conchonius, *Cyrtocara moorii* fish species showed significantly high preference observed in Bloodworm (5minutes) and Earthworm (20minutes). During the experiment, preference of feed was varied and choice of feed consumption are given in following sentence.

Trichogaster trichopterus- Bloodworm > *Anopheles* spp. > Earthworm.

Puntius conchonius- Bloodworm > *Anopheles* spp. > Earthworm.

Poecilia sphenops- *Anopheles* spp. > Bloodworm > Earthworm.

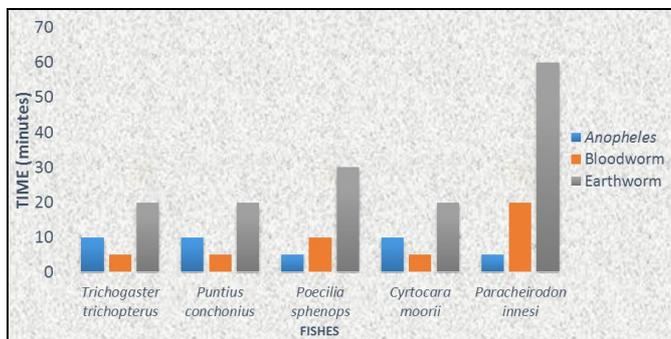
Cyrtocara moorii -Bloodworm > *Anopheles* spp.> Earthworm.

In the present study results shows that the feeding efficiency in relation to fish size and feed size. In general, all fishes were feed on mosquito larvae, consequently the *Puntius conchonius* fish feed on more mosquito larvae than other fishes, that the larvae colour, movement and size may attract fishes for choice of preference (Table 1-5).

Table 5: The feed quantity consumed by Aquarium fishes

Fishes	<i>Anopheles</i> spp.(mg)	Bloodworm(mg)	Earthworm(mg)
<i>Trichogaster trichopterus</i>	28.6±6.50	41.25±4.03	23.8±4.98
<i>Puntius conchonius</i>	34.8±7.00	40.56±3.93	29.4±4.23
<i>Poecilia sphenops</i>	29.0±0.99	25.7±2.12	14.4±2.15
<i>Cyrtocara moorii</i>	26.8±0.95	31.5±1.67	19.6±2.31
<i>Paracheiroidon innesi</i>	9.96±0.96	5.25±1.67	08.4±1.21

* Mean± SD

**Fig 1:** Live feed preference of ornamental fishes in short time (*Mean± SD)

Discussion

This study shown for the occurrence of animal based feed preference and behaviours in the selected aquarium fishes. The animal based feeds are *Anopheles* spp., Bloodworm, Earthworm and their mixture in equal quantity were introduced in to aquarium fish tanks with different family. Several behavioural responses have been linked to methods of feeding, feeding habits, frequency of feeding, mechanisms of food detection, and food preferences. Hanna *et al.*, (2015) [6] study on self-selection of a test diet and a control diet by fishes and Volkoff (2006) [18] investigate on Feeding behaviour of fish and its control. Feeding behaviour is a complex behaviour that is closely associated with food intake. Fish have a wide variety of feeding habits and feeding patterns making them good experimental models for the study of the regulation of feeding behaviour. Santhosh *et al.*, (2009) on nutrition, feeding, and Behaviours of Fish and Govind (2013) [5] investigate on feed formulation and feeding

technology for fishes. Several behavioural responses have been linked to methods of feeding, feeding habits, frequency of feeding, mechanisms of food detection, and food preferences has reported by Lall and Tibbetts (2009). David *et al.*, (2017) [2] studied development of a foraging model framework to reliably estimate daily food consumption by young fishes. The foraging model was then applied to evaluate effects of prey type, prey density, water temperature, and fish size on daily feeding rate. From the results it is apparent that large fishes (Table.1) fed enormous quantity of live feeds. The *Trichogaster trichopterus*, *Puntius conchonius* and *Cyrtocara moorii* fishes prefer more bloodworm than mosquito larvae, it prefer less number and quantity of Earthworm. Except one species *Paracheiroidon innesi* fed slowly and less preferred to bloodworm and Earthworm because of its small size which prefer smaller feed as mosquito larvae. Feeding behaviour of *Poecilia sphenops* towards live feeds is an important aspect in the investigatory report of Sumithra *et al.*, (2014) [16].

Certain nutrients or related compounds, such as carbohydrates, amino acids, and lipids, may also affect food intake, the feed contain all the nutrients such as essential proteins, lipids, carbohydrates, vitamins, minerals, amino acids and fatty acids. Yohana *et al.*, (2011) [21] study on nutritional requirements which are indispensable to improve economical and productive potential of freshwater ornamental fishes. The discussion are Nutrition and feeding influence growth and health of fish and their response to physiologic and environmental stressors and pathogens. In the present work, the selected feeds has high nutritive content which make fishes in good health.

Fishes were fed all selected live feeds as Mosquito larvae

(*Anopheles* spp.), Bloodworm and Earthworm. The preferability towards bloodworm indicates the affinity towards their red colour, body fluid and smell. The fishes prefer less to Earthworm because of their large size, body fluid, bad smell, dirty colour and setae are stiff bristles present on the body and the *Anopheles* spp. have lean with less movable body can easily fed by fishes.

Sumithra *et al.*, (2014)^[16] conducted experiment on Influence of Different Type of Feeds on Growth Performance in *Poecilia sphenops* and Oronsaye (2009)^[3] investigate on biological control potentials on mosquito larvae. Walker *et al.*, (1992)^[13] and Rajni Kant., Sharma. (1996) studied feeding behaviour, natural food, and nutritional relationships of larval mosquitoes discussed about nature of *Anopheles* mosquito larvae. All species of fish reduced mosquito emergence. When fish population densities were similar, fish reduced emergence to the similar levels. Cabrera *et al.*, (2017)^[11] study on control of mosquito larvae by poeciliids and Sumithra, *et al.*, (2014)^[17] investigate on bio-control of mosquito larvae through the *Poecilia sphenops* the results showed that the fishes most preferred to mosquito larvae. From the experiment, the *Poecilia sphenops* and *Paracheirodon innesi* prefer first to mosquito larvae and other fishes are prefer to Bloodworm. All the fishes fed more quantity of mosquito larvae so that population of larvae can be controlled by feeding. In this experiments the physico-chemical parameters will not be affect the feeding behaviour because of the short time feeding period.

Conclusion

The present feeding study suggests that the selected animal based feeds are extremely simple and can provide nutritious food for selected fishes. During the experiment, it is observed that the feeding behaviour and preference were varied based on size and colour of live feeds. The fish primarily detect food in the aquatic environment through odour and vision; however, appearance, feel, and taste of the feeds are vital factors in determining whether food will be swallowed or rejected by fishes. The feed consumption ability of the fishes which increases with the body size and mouth width. This foraging study reflected the ornamental fish are indeed capable of effectively regulating the mosquito larvae as *Anopheles* spp. by feeding it taken from wild. Malaria is carried by *Anopheles* spp. and the regulation of the mosquito population depends on the feed selection pattern by the fishes. Physico-chemical parameters were analyzed during experimental studies and could not observed drastic variation due to controlled environment.

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