Short communications

Pakistan J. Zool., vol. 42(3), pp. 345-348, 2010.

Feeding Behavior of a Carp, *Cirrhinus reba* (Hamilton) from Fishponds of District Jacobabad, Sindh, Pakistan

Punhal Khan Lashari, Naeem Tariq Narejo* and Muhammad Younis Laghari
Department of Fresh Water Biology and Fisheries, University of Sindh, Jamshoro, Sindh, Pakistan
*Corresponding author: dr_ntnarejo@yahoo.com

Abstract.- *Cirrhinus reba* was observed as an omnivore with higher feeding preference for plant foods. The plant food items recorded in the gut content were Cyanophyceae, Chlorophyceae, Bacillariophyceae and aquatic higher plants. Animal foods were found to be less preferred food items of this fish. It was also found to be a bottom feeder with respect to dial patterns of feeding. The fish was observed to be a continuous feeder with greatly reduced feeding activity at night. Two feeding peaks of this fish were recorded, the major of which was recorded at dusk, while the minor one at noon. The fish did not show any tendency to change its food item with the change in hour.

Key words: Dial pattern of feeding, food habit, *Cirrhinus reba*, fishponds.

The food is the most important and vital need for optimum production of the fish. So, the proper knowledge about food and feeding habit and electivity is a pre-requisite for successful raising of fish (Alam *et al*., 2002). According to Hynes (1950) food composition in aquatic habitat varies throughout the year and each important food item tends to have a maximum importance at a certain season. The knowledge of food and feeding habit helps to select such species, which produce maximum yield utilizing all available potential food of the water bodies without competition (Dewan *et al*., 1985). There are few published reports on the food and feeding habits of fishes in our country such as Javed (1971), Sahndhu and Lone (2003), Narejo *et al*. (2005) and Narejo (2006). There is no published report available on the food and feeding habit of *Cirrhinus reba* from Pakistan. This study shows food and feeding habit of this important fish in respect to its dial patterns of feeding.

Materials and methods

Experimental fishes were collected from fishponds of District Jacobabad, Sindh with the help of cast net having mesh size 12 mm. To study food and feeding habit a total of 208 fishes measuring 85-160 mm in standard length were collected once in every month starting from July 2005 to June 2006. But to determine the dial patterns of feeding 124 fishes ranging from 90-155 mm standard length were sampled once in the months of August, September, March and April 2006. The collections were made at every three hours beginning at 0600 hour and sampling was continued for 24 hour during each collection trip. Immediately after collection the fishes were preserved in 10% formalin to check further digestion of food. The gut contents of the fish were examined both by points method and percentage of frequency of occurrence method as suggested by Mian and Dewan (1977). For identification of food organisms taken by the fish Ward and Whipple (1959) and Prescott (1962, 1964) were consulted.

Results and discussion

Feeding behavior of C. reba

Table I shows the analysis of stomach contents of 208 fishes. A total of 34 genera of plankton belonging to the different food groups along with aquatic higher plants, debris and others were encountered.

All these above food items were considered into 9 chief food groups debris (sand and mud, rotten plants and animals) was the most dominant food item both by percentage and total points (50.78) and percentage of occurrence (100%). Higher plants occupied the position next to debris both by percentage of occurrence and percentage of total points. Considerable amount of Cyanophyceae and Chlorophyceae were also recorded in the gut contents of the fish. Bacillariophyceae occupied the lowest position among plant foods. Animal food

0030-9923/2010/0003-0345 $ 8.00/0

Table I.- **Composition of diet of *Cirrhinus reba* (Hamilton) from fishponds of District Jacobabad, Sindh, based on percentage of occurrence and percentage of total points.**

	No. of fish in which detected	Occurrence (%)	Average points/fish[8]	Total points (%)
Cyanophyceae[1]	170	89.01	3.33	13.67
Chlorophyceae[2]	167	87.73	2.71	11.12
Bacillariophyceae[3]	94	49.22	0.51	2.09
Higher plants	175	91.62	4.05	16.64
Rotifers[4]	63	33.0	0.13	0.52
Cladocerans[5]	7	3.66	0.01	0.03
Copepods[6]	26	13.61	0.03	0.14
Others[7]	168	87.96	1.22	5.01
Debris	191	100.0	12.38	50.78

[1]Cyanophyceae: *Chroococus, Aphanocapsa, Microcystis, Merismopedia, Dactylococopsis, Coelosphaerium, Lyngbya, Anabaena* and *Nostoc*.
[2]Chlorophyceae: *Volvox, Ulothrix, Stichococcous, Chaetophora, Radiotillum, Microspora, Stigeoclonium, Protococcus, Oedogonium, Pediastrum, Rhizoclonium, Ankistrodesmus, Sclenastrum, Kirchnorilla, Mougeotiopsis, Trachelomonas* and *Euglena*.
[3]Bacillariophyceae: *Cyclotella* and *Naviculla*.
[4]Rotiferes: *Brachionus* and *Keratella*.
[5]Cladocerans: *Daphnia* and *Bosmina*.
[6]Copepods: *Cyclops* and *Diaptomus*.
[7]Others: Semidigested unidentified parts of plants and animals.
[8]Allocating points to each food item, also take into account the size of fish and fullness of stomach known as points per/fish
For example: Full stomach, 20 points; Half stomach, 10 points; Quarter stomach, 05 points as suggested by Hynes (1950).

Table II.- **Time of day and feeding based on the average index of fullness and average points per fish of *Cirrhinus reba* (Hamilton) from fishponds District Jacobabad, Sindh.**

Hour	No. of fish	Length range (mm)	Percentage of empty stomachs	Average index of fullness	Average of total point
0600	12	112 – 155	16.67	1.0	6.0
0900	18	115 – 154	------	1.39	13.0
1200	19	108 – 155	5.26	1.74	23.42
1500	14	105 – 150	14.29	1.0	16.57
1800	18	110 – 150	------	1.94	35.50
2100	19	90 – 150	21.05	0.95	9.68
2400	14	105 – 141	28.57	0.71	4.50
0300	10	112 – 150	30.0	0.70	7.0

items constituted very small amount of gut contents of this fish (Table I). Among animal food, rotifers occupied the highest position with respect to percentage of occurrence and percentage of total points.

From the above observations it can be concluded that the fish (*C. reba*) was found to be an omnivore, which prefers to feed on debris and plant foods. Animal food was less preferred by this fish. The present findings agreed with the findings of Alikunhi (1957), which reported that the adult fish subsists largely on planktonic algae. Considerable quantities of debris, sand and mud in the gut contents of the fishes were also recorded by him. Jhingran (1975) and Dewan *et al*. (1985) also reported that *C. reba* feeds largely on planktonic organisms, detritus, mud and decaying leaves. Considerable amount of debris recorded from the gut contents of the fish during the present study clearly indicated that the fish is a bottom feeder. Menon and Chacko (1955) and Dewan *et al*. (1985) also regarded *C. reba* as a bottom feeder, which confirmed the present findings.

Table III.- Dial patterns of feeding based on percentage of frequency of occurrence and average points per fish of *Cirrhinus reba* (Hamilton) from Fishponds of district Jacobabad, Sindh.

Hour of capture	Items	Cyano-phyceae	Chloro phyceae	Bacillario phyceae	Higher plants	Rotifers	Copepods	Cladocerans	Others	Debris
0600	Occ	7	8	4	8	2	1	--	9	10
n = 12	% Occ	70	80	40	80	20	10	--	90	100
P = 72	Av. PPF	0.70	0.81	0.23	0.45	0.02	0.02	--	0.60	3.17
0900	Occ	165	16	12	18	5	--	1	15	18
n = 18	% Occ	88.89	88.89	66.67	100	27.77	--	5.56	88.33	00
P = 234	Av. PPF	1.68	1.95	0.59	1.70	0.04	--	0.01	1.0	6.03
1200	Occ	17	17	13	17	4	4	2	17	18
n = 19	% Occ	94.44	94.44	72.22	94.44	22.22	22.22	11.12	94.44	100
P = 445	Av. PPF	3.60	3.83	0.77	2.49	0.05	0.04	0.01	1.96	10.67
1500	Occ	9	9	9	9	4	1	--	7	11
n = 14	% Occ	81.81	81.81	81.81	81.81	36.36	9.09	--	63.63	100
P = 232	Av. PPF	2.93	1.94	0.64	2.50	0.04	0.03	--	0.58	7.89
1800	Occ	18	18	8	17	7	--	--	18	18
n = 18	% Occ	100	100	44.44	94.44	38.88	--	--	100	100
P = 639	Av. PPF	5.58	4.26	0.86	3.49	0.18	--	--	2.16	18.97
2100	Occ	13	14	2	15	1	1	--	13	15
n = 19	% Occ	86.67	93.33	13.33	100	6.67	6.67	--	86.67	100
P = 184	Av. PPF	0.84	0.68	0.03	1.27	0.08	0.03	--	0.73	6.02
2400	Occ	5	4	3	6	--	--	--	7	10
n = 14	% Occ	50	40	30	60	--	--	--	70	100
P = 63	Av. PPF	0.21	0.11	0.01	0.51	--	--	--	0.41	3.25
0300	Occ	7	6	1	7	--	--	--	7	7
n = 10	% Occ	100	85.71	14.29	100	--	--	--	100	100
P = 70	Av. PPF	0.43	0.28	0.01	1.16	--	--	--	0.49	4.63

n, number of fish examined; p, number. of total points; Occ, occurrence; Ave. P.P.F, average points per fish.

Dial patterns of feeding in C. reba

The results of the study on time of day and feeding based on percentage of empty stomach, average index of fullness and average point per fish are presented in the Table II. The highest percentage of empty stomach was recorded at 0300 hour and no stomach was recoded empty at 0900 hour and 1800 hour. The values of average index of fullness and average points per fish showed almost similar trend of variations. The highest values of average index of fullness and average points per fish were recorded at 1800 hour and very low values of the same were recorded during night (Table II). The findings of empty stomach, average index of fullness and average points per fish indicated that the fish is a continuous feeder with higher feeding activity at day time and very low feeding activity at night. The fish showed two feeding peaks, the major one at dusk and the minor one at noon. Two feeding peaks, the major peak just before dawn and minor one shortly after dusk were also recorded by various workers in different fish species like Darnell and Meirotto (1962) in black bullheads, Javed (1971) in *Heteropneustes fossilis* and *Puntius sophore* and Dewan *et al*. (1985) in *Cirrhinus reba*.

The results of the studies on the time of day and feeding based on different food items was determined by percentage of occurrence categories are presented in Table III. Amongst all the food groups debris were found to be the most dominant food item in the gut contents of the fish collected throughout 24 hour period. Next to debris, Cyanophyceae, Chlorophyceae and higher plants were found to be important food items for the fish. The fish did not feed a any animal food during 0000 hour to 0300 hour. But during rest of the period it was found to feed at least any one of the food group in small quantity. However, all the major food items showed almost similar trend of variations with maximum values at day time (Table III). Similar findings were also reported by Dewan *et al*. (1985) in *C. reba*.

The above findings indicated that the fish had maximum feeding intensity just before noon to dusk. No tendency to change food items with the change in hour was recorded in this fish. The patterns of taking all the food groups were same throughout 24 hour period.

References

Alam, M. T., Rahmatullah, S. M., Alam, M.S. and Rahman, M. F., 2002. *Univ. J. Zool. Rajshahi Univ*., **21**: 41-44.

Alikunhi, K.H., 1957. *Fish culture in India*. Fm. Bull. Indian. Coun. Agric. Res., 2: 144 pp.

Darnell, R. M. and Meirotto, R. R., 1962. *Trans. Am. Fish. Soc*., **91**: 313-320.

Dewan, S., Miah, M. J. U. and Mazumdar, K., 1985. *Bangladesh J. Aquacult.*, **6-7**: 39-44.

Javed, M. Y., 1971. *The Nucleus*. **8**: 131-144.

Jhingran, V.,G., 1975. *Fish and fisheries of India*. 1st. Ed. Hindustan Publishing Corporation (India) Delhi, 110007, 954 pp.

Hynes, H.B.N., 1950. *J. Anim. Ecol*., **19**: 36-58.

Menon, M. D. and Chacko, P. I., 1955. *Proc. Indo-Pecif. Fish. Coun*., **6**: 182-186.

Mian, J.U. and Dewan, S., 1977. *Bangladesh J. agric. Sci*., **4**: 81-88.

Narejo, N.T., 2006. *Pakistan J. Zool*., **38**: 93-98.

Narejo, N. T., Laghari, S. M. and Jafri, S. I. H., 2005. *Pakistan J. Zool*., **37**: 265-267.

Prescott, G.W., 1952. *Algae of the Eastern Great Lakes Area*. Wm. C. Brown. Co. Pub. Dubuque, Iowa, pp. 946.

Prescott, G.W., 1964. *How to know the freshwater Algae*. Wm. C. Brown. Co. Pub. Dubuque, Iowa, pp. 272.

Sandhu, A. A. and Lone, K.P., 2003. *Pakistan J. Zool.*, **35**: 353-356.

Ward, H. B. and Whipple, G. C., 1959. *Fresh water biology*. John Wiley and Sons Inc., New York, pp. 1248.

(Received 22 October 2007, revised 29 July 2009)

Pakistan J. Zool., vol. 42(3), pp. 348-350, 2010.

Meloidogyne incognita Infecting Dahlia

Safdar Ali Anwar* and Nizar Javed
HEC-Foreign Professor and Associate professor, Respectively, Department of Plant Pathology, University of Agriculture, Faisalabad.
*Corresponding author: anwar.safdar@yahoo.com

Abstract.- This investigation was conduct to identify root knot nematode inducing galls on roots of dahlia plants and its effects on the plant growth grown in naturally infested soil. *Meloidogyne incognita* was identified by comparing the shape of perineal patterns of adult female and morphology of adult males isolated from galled roots of dahlia plants. The nematode infected plants had arrested root system with shortened shoot length and reduced stem diameter.

Keywords: Dahlia, *Meloidogyne incognita,* root and shoot symptoms.

Dahlia is a genus of bushy, summer- and autumn-flowering, tuberous perennials belongs to family Asteraceae. They are originally from Mexico, where they are the national flower. Dahlias are popular additions to many gardens because of their versatility. They do well in gardens as bedding plants and as specimen plants in containers. Dahlias also make excellent cut flowers. Their flowers display a variety of sizes, shapes, and colors but pest infestation reduces their aesthetic quality and marketability.

Dahlia flowers are produced by directly growing in the ground or containers filled with compost. The roots are exposed to soil-borne pests particularly to nematodes (Stockes, 1977). Our survey indicated that the decline of ornamentals might be due to plant parasitic nematodes, particularly root knot nematodes (Personal observations). Nematodes infected ornamentals had restricted and distorted root system, which results in poor growth, less vigor, chlorosis and necrosis of foliage, and with heavy nematode infection even death of the plant (Hassis *et al.*, 1961). Nematode infested plants are more susceptible to fungal and bacterial pathogens (Anwar and Khan, 1973; Golden and Van Gundy, 1975).

During our regular survey of ornamentals we observed stunted and wilted plants of Dahlia in patches. This prompted our interest to inspect the root system to identify the cause of poor stand of dahlia plantation. The purpose of this study was to determine the species of root knot nematodes associated with dahlia and its effects on the plant growth grown in naturally infested soil.

Materials and methods

The roots of Dahlia plants exhibiting the poor growth were sampled from the lawn of University of Agriculture, Faisalabad. Roots were carefully washed under tap water to remove adhering soil particles and fine entangled grass roots. Roots were stained with Phloxine B (Holbrook *et al*., 1983) and assessed for the presence of egg masses. The root galling and egg mass indices were assessed on 0 to 5 scale, where 0 = no gall, 1 = 1-2, 2 = 3-10, 3 = 11-30, 4 = 31-100, and 5 = >100 galls per root system (Quesenberry *et al*., 1989). Root knot nematodes were identified using perineal patterns of adult females as well as the morphology of male juveniles (Jepson, 1987).

Results

Identification of nematodes

The shape of perineal patterns of adult female and morphology of adult male from gall roots of dahlia plants was readily similar to that of *Meloidogyne incognita* (Hartman and Sasser, 1985).

Root symptoms

Galls of varying sizes on feeder as well as secondary roots were evident. Nematode infected plants had conspicuously reduced root system, especially with sparse development of secondary roots and root hairs (Fig 1AB). The presence of galls and eggmesses suggest the involvement of root knot nematode. The root galling and egg mass indices were 5 on galled roots.

Shoot symptoms

Nematode infected plants were severely stunted and lacked vigor. Nematode infection was

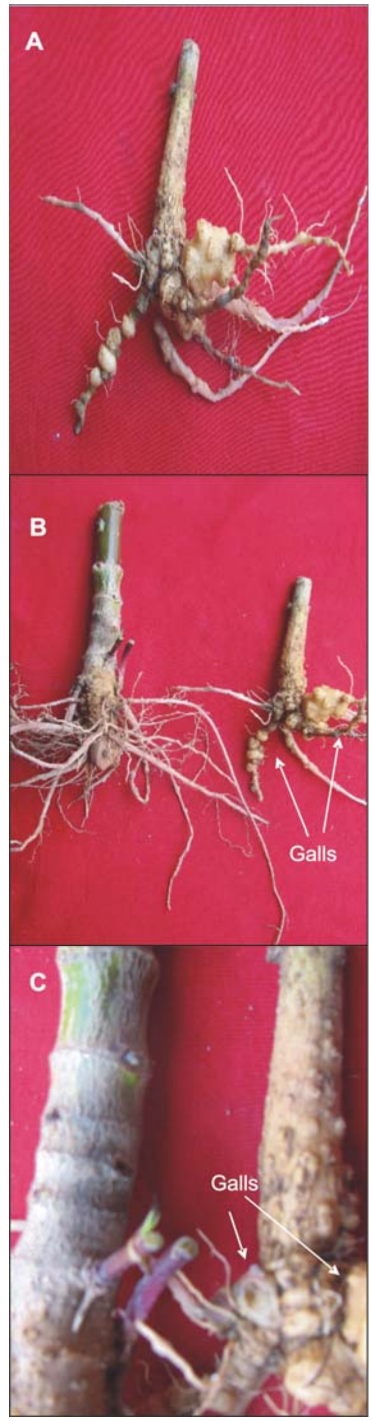

Fig 1. A. Galls on roots of dahlia induced by *Meloidogyne incognita*; B. comparison of galled [right] and health [left] root system of dahlia; C. comparison of stem diameter of nematode infected [right] and healthy [left] plant of dahlia.

able to cause reduction in stem diameter (ca 40%) (Fig. 1C) and size of flowers (ca 50%) compared to that of healthy plants. Such plants exhibited wilting symptoms at flowering. The stem showed vascular brown discoloration, which indicates the fungal infection.

Discussion

Root knot nematodes, *Meloidogyne* spp. had wide host range including field and vegetable crops, fruit trees and ornamentals. *Meloidogyne incognita* has been found infecting roots of many flowering and bedding plants including snapdragon, *Antirrhinum majus*, lisianthus, *Eustoma grandiflorum*, sunflower, *Helianthus* spp., and gladiolus, *Gladiolus* spp. coleus, *Coleus blumei*, impatiens, *Impatiens* spp., cock's comb, zinnia, *Zinnia elegans* and *Celosia argentea (*McSorley and Frederick, 1994; Jabri *et al*., 1985).). This is the first report on the association of *M. incongnita* with dahlia in The Punjab.

Growing plants maintain a balance between the size of shoot and root system, which ensure a functional equilibrium between the supply of water and nutrients by roots and energy and organic matter by shoot (Brouwer, 1983). Equilibrium between shoot and root system ensures that resources supplied by each can meet the demand by the other. The biotic or abiotic stress on root disturbs this functional equilibrium leading to poor growth of shoot. The extensive galling and root damage induced by nematode infection alter uptake of water and nutrients and interference with the translocation of minerals and photosynthates to foliage (Williamson and Hussey, 1996), which can negatively influence plant growth (Orr and Robison, 1984). The extensive root damage induced by root knot nematode infection might be responsible for poor shoot growth of dahlia.

Plant damage caused by nematodes could not be assessed in this study. Evaluation of germplasm for tolerance to nematode is an important feature of nematode management (Young, 1998). Therefore, tolerance of dahlia cultivars to root-knot nematodes needs to be evaluated to recommend for planting.

Acknowledgements

We would like to express our gratitude and appreciation to Dr. M. V. McKenry, Professor of Nematology, Department of Nematology, University of California, Riverside, Ca 92521, USA for reviewing this manuscript.

This research project # 455 was funded by Higher Education Commission, Islamabad, Pakistan.

References

Anwar, S.A. and Khan, I.U., 1973. *J. Agri. Res.* **11**:94-98.

Brouwer, R., 1983**.** *Netherlands J. Agri. Sci.* **31**: 335–34.

Golden, J.K. and Van Gundy, S.D., 1975. *Phytopathol.*, **65**:265-273.

Hartman, K.M. and Sasser, J.N., 1985. In: *An advanced treatise on* Meloidogyne (eds. K.R. Barker, C.C. Carter and J.N. Sasser), Vol. 2. *Methodology*. North Carolina State University Graphics, Raleigh, NC, USA. pp. 69-77.

Hassis, F.A., Wells, J.C. and Nusbaum, C.J., 1961. *Pl. Dis. Repr.,* **45**:491-496.

Holbrook, C.C., Knauft, D.A. and Dickson, D.W., 1983. *Pl. Dis*., **57**:957-958.

Jabri, M.R., Kahn, A.T., Husain, A.S. and Mahmood, K., 1985. *Pak. J. Nematol.*, **3**:17-21.

Jepson, S.B., 1987**.** *Identification of root-knot nematodes* (Meloidogyne *species*). CAB International, Wallingford, UK.

Mcsorley, R. and Frederick, J.J., 1994. *J. Nematol.*, **26**:773-777.

Orr, C.C. and Robinson, A.F., 1984. *Pl. Dis.* **68**:284-292.

Quesenberry, K.H., Baltensperger, D.D., Dunn, R.A., Wilcox, C.J. and Hardy, S.R., 1989. *Crop Sci*., **29**:62-65.

Stockes, D.E., 1977. *Effects of root knot nematode on ornamental plants*. Nematology Circular N0. 24. Florida Department of Agriculture, Gainesville, Florida.

Williamson, V.M. and Hussey, R.S., 1996. *Pl. Cell,* **8**: 1735-1745.

Young, L.D., 1998. In: *Plant and nematode interactions* (eds. K.R. Barker, G.A. Pederson, and G.L. Windham).

(Received 26 June 2009, revised 2 December 2009)