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Polymorphosis in a brachionid rotifer, *Brachionus quadridentatus* Hermann from Morar channel, Gwalior (India)

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Abstract. Five polymorphic forms, including a new one, of the brachionid rotifer—*Brachionus quadridentatus*, are described from the Morar channel in Gwalior. These are the nominate form *quadridentatus*, form *cluniorbicularis*, form *rhenanus*, form *brevispina* and form *monospina* nov. The variation in different morphological forms is due to the emergence, development and elongation of postero-lateral and postero-median spines, and changes in the size of lorica. The present communication forms the first report of polymorphosis in *B. quadridentatus* from India.

Keywords. Rotifera; *Brachionus quadridentatus*; polymorphosis; morphometry.

1. Introduction

Seasonal on cyclic variations in morphology have been described in several animals viz dinoflagellates, rotifers, cladocera, protozoa and copepods inhabiting aquatic systems. This phenomenon of form variation was referred as cyclomorphosis by Lauterborn (1904). Hutchinson (1967) reviewed the occurrence of this phenomenon in all groups of zooplanktonic animals in much greater detail. Wesenberg-Lund (1900), Kratzschmar (1908), Hermann (1920), Woltereck (1928), Pejler (1957), Gallagher (1957), Butchner *et al* (1957), Nayar (1965), Arora (1966), Fukusho and Iwamoto (1981), Saksena and Sharma (1981, 1984) and Sharma and Saksena (1984) have described form variation in certain rotifers. Recently, Pejler (1980) has reviewed the subject of form variation in the rotitorian genus *Keratella* and discussed factors responsible for the variations. In the present paper, an attempt has been made to describe polymorphic forms of a brachionid rotifer, *Brachionus quadridentatus* (Hermann) collected from Morar sewage channel in Gwalior and forms first such report on this species of rotifera from India.

2. Materials and methods

Zooplankton samples were collected from Morar sewage channel, a free flowing water body running through Morar, a sub-city of Gwalior. Besides collecting sewage from various localities throughout its course in Morar, channel receives sewage water from Ramaua reservoir. The plankton samples were collected by filtering water through Birge conical bolting nylone net (No. 20) and were fixed with 5% formaldehyde. The figures were drawn with the help of Camera-lucida and measurements were taken with ocular disc duly calibrated with stage micrometer. The morphometric data of different forms of *B. quadridentatus* are presented in tables 1 and 2.

Table 1. Morphometric data of various forms of *B. quadridentatus* (mm)

Specifications	Form I	Form II	Form III	Form IV	Form V
Total length	0·20	0·19	0·21	0·23	0·34
Length of lorica	0·17	0·12	0·135	0·15	0·16
Width of lorica	0·18	0·16	0·185	0·19	0·20
Length of antero-median spine	0·03	0·02	0·03	0·035	0·05
Length of antero-intermediate spine	0·01	0·005	0·01	0·01	0·02
Length of antero-lateral spine	0·02	0·02	0·02	0·02	0·03
Length of postero-lateral spine	—	0·005	0·02 (Right only)	0·04	0·09

Table 2. Showing relative data of lorica and spines of various forms of *B. quadridentatus*.

Specifications	Form I	Form II	Form III	Form IV	Form V
Total length/length of lorica	1·18	1·58	1·56	1·53	2·13
Length of lorica/width of lorica	0·94	0·75	0·73	0·79	0·80
Length of postero-lateral spine/ length of lorica	—	0·04	0·15	0·27	0·56
Length of antero-median spine/ Length of postero-lateral spine	—	4·00	1·50	0·88	0·56
Length of antero-median spine/ length of lorica	0·18	0·17	0·22	0·23	0·31

3. Observations

In all 5 distinct polymorphic forms of *B. quadridentatus* were recognised (figure 1). For the sake of convenience in description, these forms are referred as I, II, III, IV and V and are described as under:

3.1 *Form* I—*B. quadridentatus* f. *cluniorbicularis* Skorikov, 1894

There are 6 occipital spines of which median spines are longer and curved a little outwardly. Lorica is broader than long. This form is characterised by the absence of postero-lateral spines and rounded posterior corners (figure 1A).

3.2 *Form* II—*B. quadridentatus* f. *rhenanus* Lauterborn, 1893

In this form the lateral and median occipital spines are almost equal in length. Intermediate spines are short. Two pairs of posterior spines are present. Postero-lateral spines are in the form of small buds only. The postero-median spines are thus longer than the postero-lateral spines (figure 1B).

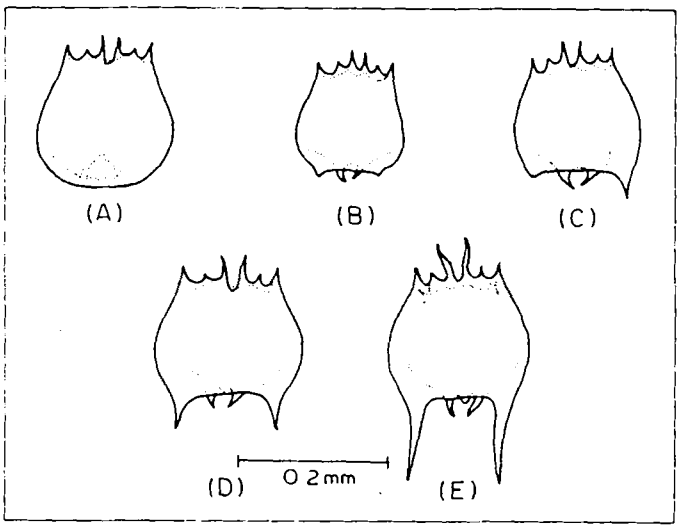

Figure 1. Different forms of *B. quadridentatus*. **A.** Form I—*cluniorbicularis*. **B.** Form II—*rhenanus*. **C.** Form III—*monospina*. **D.** Form IV—*brevispina*. **E.** Form V—*quadridentatus*.

3.3 *Form* III—*B. quadridentatus* f. *monospina* nov.

In this form due to the increase in the width of lorica the ratio between its length and width becomes less. Only right postero-lateral spine of moderate length is developed. This form is being reported for the first time (figure 1C).

3.4 *Form* IV—*B. quadridentatus* f. *brevispina* Ehrenberg, 1832

This is characterised by the presence of postero-lateral spines of moderate length on both the sides, as well as postero-median spines. Lorica is wider (figure 1D).

3.5 *Form* V—*B. quadridentatus* f. *quadridentatus* Hermann, 1783

This is the nominate form of *B. quadridentatus* having well developed anterior and posterior spines. Antero-median spines are larger than antero-lateral spines. Length of postero-lateral spines increases with the increase in the size of lorica (figure 1E).

The variations in different forms of *B. quadridentatus* are due to initial appearance and subsequent development and elongation of postero-lateral and postero-median spines. The variations are also in the antero-median spines, whose length increases gradually from forms I–V. With the increase in the width of lorica, the relative length of lorica decreases. Morphometric data of different morphological forms are given in tables 1 and 2.

Following are the prominent morphometric changes in lorica and various spines in

various forms of *B. quadridentatus*:

(i) Total length of lorica increases from forms I–V (i.e., 0·20–0·34 mm).
(ii) Width of lorica also increases gradually from 0·18–0·20 mm from forms I–V.
(iii) Length of antero-lateral and antero-median spines increases gradually and reaches its maximum in form V.
(iv) The retro between length of antero-median spines and postero-lateral spines decreases from forms II–V.
(v) The length of antero-median spine/length of lorica increases from 0·18 mm in form I to 0·31 mm in form V.

4. Discussion

The phenomenon of morphological form variation is generally exhibited by those organisms which reproduce asexually or parthenogenetically for a longer period. Among rotifers, species of *Asplanchna, Keratella* and *Brachionus* have been reported to show form variation during their life histories (Hutchinson 1967; Koste 1978; Pejler 1980).

In *B. quadridentatus*, Kofoid (1908) had recorded many morphological forms from Illinois river, while other workers have described only 4 morphological forms (Luntz 1928; Ahlstrom 1940). These are f. *cluniorbicularis*, f. *rhenanus*, f. *brevispina* and f. *quadridentatus*. In our sample collected from Morar channel, Gwalior, besides 4 forms described earlier, a new form, viz., *monospina* has been added. *B. quadridentatus* f. *monospina* is characterised by the presence of only one i.e., right postero-lateral spine of moderate length. Sachse (1911) in his study, indicated that there is a gradual decrease in body length as the length of spines increases. Ahlstrom (1940), has, however, observed the opposite relationship. He found that the length of postero-lateral spines is directly proportional to the length of the specimens. Our observations regarding the length of postero-lateral spines are in confirmity with those of Ahlstrom (1940).

Regarding the factors influencing form variation in rotifers, it may be mentioned that it may occur due to seasonal indices, i.e., change in food, change in environmental factors such as climate and nutrients and as a defence mechanism against predators. Jennings (1900) observed short- and long spined-forms of *B. quadridentatus* from different water bodies and has correlated the shortness of spines in this species with the high electrolyte concentration of water. Kofoid (1908) reported different forms of *B. quadridentatus* in Illinois river, from June–September. He observed that f. *cluniorbicularis* with a rounded posterior margin was present only in summer and f. *rhenanus* was observed in August–September, while Sachse (1911) reported f. *cluniorbicularis* in the spring and f. *quadridentatus* in autumn. He concluded that the form variation in this species is not so regular with the seasons as in the case of *B. calyciflorus*. Form *rhenanus* from Berlin Dahlem was observed in spring and typical long-spined form *quadridentatus* from the same region in summer (Luntz 1928). In our study all 5 forms of *B. quadridentatus* were recorded in the month of June but only the nominate form e.g. *B. quadridentatus* during the months of July, August, suggesting that high temperature may probably trigger polymorphosis in this population. However, this needs to be confirmed.

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