

FRESHWATER OSTRACODS (CRUSTACEA: OSTRACODA) OF THE PLATEAUS OF THE NORTHERN WESTERN GHATS, INDIA

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Ostracoda, a class of Crustacea, can be found in all types of aquatic habitats. They are also known as “seed-shrimps” because of their tiny seed like appearance that differentiates them from much larger “clam shrimps”, Conchostraca with concentric rings on valves (Smith 2001).

Temporary waters are unique habitats in comparison to permanent lotic and lentic habitats and are characterised by the cyclic process of drying and filling (Williams 2006). Their biodiversity is remarkably high consisting of species with adaptations to withstand draught or frozen periods. Indian temporary freshwater habitats in particular have a high ostracod biodiversity (Deb 1972 & 1983; Victor & Michael 1975; Battish 1977; 1978 & 1981; Victor & Fernando 1979; George et al. 1993; Shinde 2012).

The northern Western Ghats consists of flat table-topped hills which are the result of collective geological

events involving basalt flows (Watve 2013). Such flattable tops are popularly called ‘rocky outcrops’. This part of the Western Ghats has a dry period of about eight months and an approximately four-month period of monsoon with heavy rains (Dahanukar et al. 2004) during which a large number of temporary water bodies are formed. These habitats host an impressive array of freshwater micro- and macroinvertebrate fauna including ostracods.

Studies on Indian Ostracoda commenced in 1859 and from then till now 208 species of non-marine Ostracoda, both extinct and extant have been reported (Battish 2000). When compared to states like Tamil Nadu, Kerala and Punjab, studies on Ostracoda in Maharashtra State are very scarce. Before the study by Shinde (2012), the only investigations on ostracods were those of Deb (1972, 1973). This review specifically reports on the ostracods of the northern Western Ghats including the ‘rocky outcrop’.

Methods: Sampling was carried out in eight different sites present on hilltops including six forts of the northern Western Ghats from 2008–2012 (Fig. 1; Table 1). Three sites were on ‘ferricretes’ type of outcrops and five sites were on ‘basaltic mesa’ where there are hill forts (Watve 2013) (Images 1 a,b). Mapping of the sites was carried out using DIVA-GIS 7.5, while geographic data were obtained using handheld GPS and Google Earth (<http://earth.google.com>).

In our study, qualitative samples for ostracods were collected using a circular plastic frame hand net



ISSN
Online 0974–7907
Print 0974–7893

OPEN ACCESS

DOI: <http://dx.doi.org/10.11609/JoTT.o3610.5667-70> | **ZooBank:** urn:lsid:zoobank.org:pub:FA596A02-0519-471B-AF37-090920D475CB

Editor: Okan Külköylüoğlu, Abant İzzet Baysal University, Bolu, Turkey.

Date of publication: 26 April 2014 (online & print)

Manuscript details: Ms # o3610 | Received 02 May 2013 | Final received 03 April 2014 | Finally accepted 05 April 2014

Citation: Shinde, Y.S., R. Victor & K. Pai (2014). Freshwater ostracods (Crustacea: Ostracoda) of the plateaus of the northern Western Ghats, India. *Journal of Threatened Taxa* 6(4): 5667–5670; <http://dx.doi.org/10.11609/JoTT.o3610.5667-70>

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Funding: UGC-RFSMS fellowship to YSS and UGC-MRP to KP

Competing Interest: The authors declare no competing interests.

Acknowledgements: We would like to thank UGC-RFSMS fellowship (to YSS), UGC-CAS and UGC-MRP (File No. 33-334/2007 (SR)) for providing the funds. We are grateful to the Head of the Department of Zoology, Pune University and Principal, Modern College, Pune, for providing the facilities. Avinash Vanjare, Sameer Padhye, Shriraj Jakhalekar, Mihir Kulkarni and Siddharth Kulkarni are acknowledged for their help during the collections and for providing pictures of the habitats. We would also like to thank Dr. Neelesh Dahanukar for giving us the opportunity for collections at Chalkewadi site along with Dr. Sanjay Molur and Ms. Priyanka Iyer. We are also thankful to two anonymous reviewers for their comments.

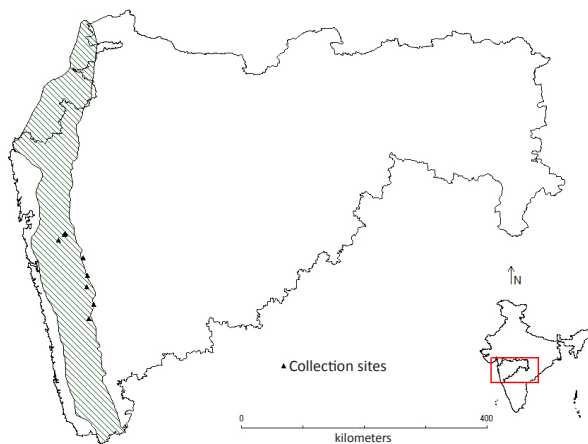


Figure 1. Collection localities in Maharashtra.

(diameter = 15cm, mesh size 150 μ m). The net was swept through disturbed sediments of shallow water bodies and through the aquatic vegetation. Samples were collected in 100ml plastic containers and fixed in the field using 5% formaldehyde. In the laboratory, samples were washed under tap water using the same net and preserved in 70% ethanol. Ostracods were separated under a stereo binocular microscope (Magnus MS24) using micropipettes. Soft part dissections and mounting of dissected appendages were done on a slide containing a drop of polyvinyl lactophenol tinted with lignin pink. Detailed observations were made under a compound microscope (Olympus BX40). Valve details were studied under a JEOL Analytical Scanning Electron Microscope. The ostracod genera were preliminarily identified using Victor & Fernando (1981). For further

confirmation of genus and species identifications we consulted the original papers describing the taxon for the first time and as many redescrptions of the same taxa by other authors. In all, we consulted around 50 publications and citing them all here is beyond the scope of this Note.

Results and Discussion: Our study carried out from 2009–2012 revealed the presence of 17 species of ostracods in various localities (Tables 1, 2). Deb's (1972, 1983) collections were mainly from the Ajinkyatara Fort area and the Tableland of Panchgani; her work reported only six species.

Ostracods from ferricretes were reported by Deb (1972) for the first time with the description of a new species *Stenocypris krishnakantai*; later on this species (Image 2a) was assigned to the genus *Chrissia* (Victor & Fernando 1979). We found this species at the type locality, Ajinkyatara Fort. Other taxa reported by Deb (1983) from the Tableland of Panchgani were *Cypricercus indrani*, *Cypris elongata*, *Eucypris compressa*, *E. indica* as new species and an unknown *Sclerocypris* sp. All these taxa were also found during our study indicating the integrity of habitat conditions favouring their existence.

We also found a species belonging to the genus *Humphcypris* from only one representative sample collected from Chalkewadi Plateau. This is the first report of this genus from Maharashtra and this species, pending further study could probably be new to science.

Many of the species described by Deb (1972, 1983), such as *C. indrani*, *E. compressa*, *E.indica*, *C. elongata*, need taxonomic revision. The descriptions and diagrams provided by the author are no longer adequate to confirm their generic identities and the type specimens.



Image 1. (a) Pool from Visapur Fort, (b) Pool from Tableland (Panchgani)

Table 1. Sites for present collection and from available literature.

	Name of Site	Type of rock	Geographical Location	Altitude (m)
1	Ajinkyatara Fort	Ferricretes	17.67277°N & 73.99543°E	1006
2	Chalakewadi	Ferricretes	17.45972°N & 73.83847°E	1089
3	Korigad Fort	Basaltic mesa	18.62103°N & 73.38639°E	899
4	Lohgad Fort	Basaltic mesa	18.71038°N & 73.47624°E	1002
5	Rohida Fort	Basaltic mesa	18.10339°N & 73.82134°E	1082
6	Sinhagad Fort	Basaltic mesa	18.36544°N & 73.75428°E	1312
7	Tableland	Ferricretes	17.92762°N & 73.80722°E	1326
8	Visapur Fort	Basaltic mesa	18.72152°N & 73.49091°E	1058

Though allegedly deposited in the Zoological Survey of India, Kolkata they are not accessible for study. However, based on the original descriptions and diagrams and by comparing the material collected by us in the type localities, it is possible to assign these species to other genera. Species of the genera *Eucypris* and *Cypricercus* should be assigned to one of the genera in the *Strandesia* group; some species may even require the establishment of a new genus in the subfamily Cypricercinae (Battish 2000; Shinde 2012).

Of the 17 species of ostracods recorded here, 13 were found in the pools on the basaltic mesa. *Plesiocypridopsis dispar* (Hartmann, 1964) (Image 2b) was found almost on every plateau made up of basaltic mesa. *Chrissia biswasi* (Deb, 1972) is the largest (giant

ostracod) species found on basaltic mesa. Some of the species which were found commonly on basaltic mesa were not found on ferricretes. *Sclerocypris* sp. is a large taxon found only in the pools formed on ferricretes rock while *P. dispar* is only known from basaltic mesa.

Stenocypris sohni described by Deb (1983) was collected in a water body from Khopoli (Maharashtra); a very similar species was found in Visapur and Korigad water pools on the basaltic mesas (Table 2). We are tentatively referring to this species as *Stenocypris* cf. *sohni* Deb, 1983, pending further study.

The number of species currently known from the northern Western Ghats is likely to be an underestimation. An intensive sampling effort, probably as a part of a larger program for studying freshwater biodiversity is likely to bring more taxa to light. Our study on ostracods indicates that the freshwater habitats on the rocky plateaus of the northern Western Ghats are unique, holding a treasure of diversity, yet to be discovered. Most of these habitats are temporary, characterized by seasonal drying and filling cycles in a regular frequency and their residents are adapted to these environmental conditions with some of them even requiring the drought as a prerequisite for subsequent resurgence (Williams 2006). Even the ephemeral habitats of unpredictable reoccurrence formed during the monsoons are microcosms of interest to investigate phenomena such as dispersal and colonization of micro- and macroinvertebrates. All these habitats are under severe threat from anthropogenic activities and their conservation requires attention.



Image 2. SEM of ostracod species (a) *Chrissia* cf. *krishnakantai* (Deb, 1972) from Ajinkyatara Fort; (scale - 500µm); (b) *Plesiocypridopsis dispar* (Hartmann, 1965) from Visapur (scale - 100µm)

Table 2. Ostracods known from various rocky plateaus.

	Species	Sites																	
		AF		CP		T		KF		LF		RF		SF		VF			
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II		
1	<i>Chrissia biswasi</i> (Deb, 1972)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2	<i>Chrissia formosa</i> (Klie, 1938)	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0
3	<i>Chrissia krishnakantai</i> (Deb, 1972)	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
4	<i>Cypretta fontinalis</i> Hartmann, 1964	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0
5	<i>Cypricercus indrani</i> Deb, 1983	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
6	<i>Cypridopsis dubia</i> Sars, 1903	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	
7	<i>Cypris elongata</i> Deb, 1983	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
8	<i>Cypris protuberata</i> Victor & Michael, 1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
9	<i>Eucypris compressa</i> Deb, 1983	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
10	<i>Eucypris indica</i> Deb, 1983	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
11	<i>Humphcypris</i> sp.	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12	<i>Ilyocypris dentifera</i> Sars, 1903	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	
13	<i>Plesiocypridopsis dispar</i> (Hartmann, 1964)	0	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0
14	<i>Sclerocypris</i> sp.	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
15	<i>Stenocypris derupta</i> Vávra, 1906	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0
16	<i>Stenocypris major</i> (Baird, 1859)	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
17	<i>Stenocypris</i> cf. <i>sohni</i> Deb, 1983	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	
	Total	1	1	1	0	8	6	7	0	4	0	4	0	4	0	4	0	10	0

AF - Ajinkyatara Fort; CF - Chalakewadi Plateau; T - Tableland (Panchgani); KF - Korigad Fort; LF - Lohgad Fort; RF - Rohida Fort; SF - Sinhagad Fort; VF - Visapur Fort. I - present study; II - species given in literature (Deb1972, 1983); 1 - Present; 0 - Absent.

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