



## Bryoflora of Bhubaneswar and its adjoining areas

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### ABSTRACT

Thirty six species of bryophytes under 18 families and 20 genera were reported from different localities of Bhubaneswar and its adjoining areas which, encompass 26 species of mosses under 10 families and 13 genera, 8 species of liverworts under 5 families and 5 genera and 2 species of hornworts under 2 families and 2 genera during a study conducted for the period from January to September, 2016. In terms of species richness, the botanical garden of Regional Plant Resource Centre was found to be the most diverse as compared to Khandagiri and Udayagiri hill and Chandaka-Dampara wildlife sanctuary. Pottiaceae, Fissidentaceae, Bryaceae, Funariaceae and Ricciaceae were the dominant families in the study area. Three mosses such as *Archidium birmannicum* Mitt. ex Dixon, *Eurhynchium hians* (Hedw.) Sande Lac. and *Barbula indica* (Hook.) Spreng. were new distributional record for bryoflora of Odisha while *Physcomitrium pyriforme* (Hedwig) Hampe, *Ectropothecium cyperoides* (Hook. ex Harv.) A. Jaeger, *Dicranella macrospora* Gangulee, *Bryum junghugianum* Madhusoodanan and *Eurhynchium striatulum* (Spruce) Schimp. were new record for Eastern Ghats of India. The present study provides base line information on bryophytes for future bryological studies and bryomonitoring in Bhubaneswar.

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### 1. Introduction

Bryophytes are the second largest group of plants after angiosperms with about 25,000 species worldwide (Buck and Goffinet, 2000). So far, 2489 taxa of bryophytes recorded from India, comprising 1786 species in 355 genera of mosses, 675 species in 121 genera of liverworts and 25 species in six genera of hornworts (Dandotiya *et al.*, 2011). In India they are distributed in Eastern and Western Himalayas, South India and Central India (Nath and Asthana, 2005). The state of Odisha is an abode for around 3000 species of plants which includes 138 species of Orchids, 170 species of pteridophytes, 10 species of gymnosperms, 71 species of mangroves and their associates and 7 species of sea grasses (Dash *et al.*, 2015). Apart from angiosperms, gymnosperms and pteridophytes, lower group of plants like algae, bryophytes and lichens also contribute substantially to the floral richness of the state. But the studies on cryptogams in general, and bryophytes in particular, are

insufficient as compared to other groups of plants. Bryophytes of Odisha were documented by Dash *et al.* (2007), Dash and Saxena (2009), Dash *et al.* (2009), Dash and Saxena (2011) and Alam *et al.* (2013) from time to time and reported several species from some of the biodiversity rich sites of Odisha. Recently, Mishra *et al.* (2016) reported 149 species of Bryophytes from 12 district of Odisha with many new records for the state.

Bhubaneswar and its adjoining areas are surrounded by some biodiversity rich sites like Khandagiri and Udaygiri hills, Chandaka-Dumpara wildlife sanctuary, Botanical Garden of Regional Plant Resource Centre Campus, Botanical Garden of Nandankan, Sikharchandi hill and Dhauligiri hill where both wild and introduced plants are protected and conserved with an amalgamation of in-situ and ex-situ methods. Many researchers studied plant diversity in Bhubaneswar and its adjoining areas like Saxena and Brahmam (1996), Choudhury and Patnaik (1982), Biswal

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and Thatoi (2005) (Chandaka), Panda and Panda (2012) (Nandankanan zoological Park), Panda *et al.* (2014) (Regional Plant Resource Centre) etc. However the bryophytes have not received any attention from none of the researchers so far. We for the first time conduct a detailed survey and documentation on bryophytes of Bhubaneswar and its adjoining areas.

## 2. Materials and Methods

Field survey was conducted in Khandagiri and Udaygiri hills (KUH), Chandaka-Dumpara wildlife sanctuary (CDWLS), Botanical Garden of Regional Plant Resource Centre Campus (BGRPRC), Botanical Garden of Nandankanan Zoological Park (BGNZP), Sikharchandi hill (SCH) and Dhauligiri hill (DGH) located in Bhubaneswar for the period from January to September, 2016. Bryophyte samples like corticolous (growing on tree bark), rupicolous (on rocks), saxicolous (on stones and pebbles), lignicolous (fallen logs) and terricolous (on roadside cuts/on soil) forms were collected in the polythene bags and brought to the laboratory, washed and dried. Collected samples are kept in standard Herbarium packets in dried forms and were deposited in the newly created herbarium of Odisha Biodiversity Board (OBB), Bhubaneswar. Internal structures were studied and photographed with elaborate details using compound microscope. Whole plant photographs were taken to illustrate habit using digital camera (Nikon D-3300 with macro lens of 90mm). Identification of the specimens was done referring the literatures of Chopra and Kumar (1988), Kashyap (1929), Kashyap and Chopra (1932), Gangulee (1969 – 1980) and Singh (2014).

## 3. Result and discussion

In the present investigation, a total of 36 species of bryophytes under 17 families and 20 genera were reported from Bhubaneswar and its adjoining regions. This comprised 26 species of mosses under 10 families and 13 genera, 8 liverworts under 5 families and 5 genera and 2 hornworts under 2 families and 2 genera (Table 1).

Among mosses, genus *Fissidens* showed maximum diversity with 4 species followed by *Bryum* with 4 species and *Philonotis* with 2 species. In liverworts, *Riccia* with 3 species and *Marchantia* with 2 species were the dominant genera. Only two hornworts viz. *Anthoceros angustus*, and *Phaeoceros laevis*, were collected from the study sites. Out of 36 species, 24 species were collected from BGRPRC followed by 16 species from BGNZP, 13 species from KUH and 9 species from CDWLS. DGH and SCH contributed lesser number of species in comparison to other study sites, which may be attributed to the altered habitat conditions of the hills due to anthropogenic interventions. Termite mounts

in the botanical garden of RPRC provides amicable environment for several species of *Fissidens* and three species of *Philonotis* to grow luxuriantly. Each species was studied in detail with its habitat type and substratum and the bryoflora of Bhubaneswar was categorised into terricolous, corticolous, saxicolous, rupicolous and lignicolous forms following their corresponding habitats. In total 25 terricolous, 14 rupicolous, 4 corticolous, 4 saxicolous and 2 lignicolous forms were reported in this study.

Three species of mosses viz., *Archidium birmannicum* Mitt. ex Dixon, *Eurhynchium hians* (Hedw.) Sande Lac., *Barbula indica* (Hook.) Spreng. (Fig1.1) were recorded for the first time from Odisha while 5 mosses viz., *Physcomitrium pyriforme* (Hedwig) Hampe (Fig1.3), *Ectropothecium cyperoides* (Hook. ex Harv.) A. Jaeger (Fig1.4), *Dicranella macrospora* Gangulee (Fig1.5), *Bryum junghugianum* Madhusoodanan (Fig1.2) and *Eurhynchium striatulum* (Spruce) Schimp. were recorded for the first time from Eastern Ghats of India. A thorough survey of literature (Chopra, 1975; Gangulee, 1969-80; Srinivasan 1974; Udar, 1976; Srivastava and Udar, 1979; Ellis, 1992; Sharma and



Figure 1: Bryoflora of Bhubaneswar and its adjoining areas: 1. *Barbula indica* (Hook.) Spreng. 2. *Bryum junghugianum* Madhusoodanan 3. *Physcomitrium pyriforme* (Hedwig) Hampe, 4. *Ectropothecium cyperoides* (Hook. ex Harv.) A. Jaeger, 5. *Dicranella macrospora* Gangulee

Table 1

Checklist of bryophytes of Bhubaneswar and its adjoining areas.

Name of the species	Family	Distribution	Growth Form	Specimen number
<b>Hornworts</b>				
<i>Anthoceros angustus</i> Steph.	Anthocerotaceae	CDWS, BGNZP	T	BoOH1Aa
<i>Pheoceros laevis</i> (L.) Prosk. subsp. <i>laevis</i>	Notothyladaceae	BGRPRC, KUH	T	BoOH2Pl
<b>Liverworts</b>				
<i>Cyathodium cavernarum</i> Kunze	Cyathodiaceae	All sites	T,R	BoOL1Cc
<i>Aneura pinguis</i> (L.) Dumort.	Aneuraceae	BGRPRC, BGNZP	T	BoOL2Ap
<i>Heteroscyphus argutus</i> (Nees)	Lophocoleaceae	KUH, CDWS	T,S,R	BoOL3Ha
<i>Marchantia linearis</i> Lehm. & Lindenb.	Marchantiaceae	BGRPRC, BGNZP	T	BoOL4Ml
<i>Marchantia palmata</i> Reinw., Nees & Blume	Marchantiaceae	BGRPRC	T	BoOL5Mp
<i>Riccia crystallina</i> L.	Ricciaceae	BGRPRC, BGNZP	T	BoOL6Rc
<i>Riccia discolor</i> Lehm. & Lindenb.	Ricciaceae	BGRPRC	T	BoOL7Rd
<i>Riccia glauca</i> L.	Ricciaceae	BGRPRC, BGNZP	T	BoOL8Rg
<b>MOSESSES</b>				
<i>Archidium birmannicum</i> Mitt. ex Dixon	Archidiaceae	BGRPRC, BGNZP	T	BoOM1Ab
<i>Barbula arcuata</i> Griff.	Pottiaceae	SCH, DGH, BGNZP, CDWLS	R, S	BoOM2Ba
<i>Barbula consanguinea</i> (Thwaites & Mitt.) A. Jaeger.	Pottiaceae	BGRPRC, SCH	R	BoOM3Bc
<i>Barbula javanica</i> Dozy & Molk.	Pottiaceae	All sites	R	BoOM4Bj
<i>Barbula indica</i> (Hook.) Spreng.	Pottiaceae	KUH, BGRPRC	R	BoOM5Bi
<i>Bryum argenteum</i> Hedw.	Bryaceae	BGNZP	R	BoOM6Ba
<i>Bryum junghugianum</i> Madhusoodanan	Bryaceae	BGRPRC	R	BoOM7Bj
<i>Bryum capillare</i> Hedw.	Bryaceae	BGRPRC	R	BoOM8Bc
<i>Bryum coronatum</i> Schwagr.	Bryaceae	All sites	R,C	BoOM9Bc
<i>Dicranella macrospora</i> Gangulee	Dicranaceae	BGRPRC	C	BoOM10Dm
<i>Ectropothecium cyperoides</i> Jaeger	Hypnaceae	BGNZP	C,L	BoOM11Ec
<i>Entodon flavescens</i> (Hook.) A. Jaeger	Entodontaceae	KUH	T,S,C	BoOM12Ef
<i>Entodon plicatus</i> Müll. Hal.	Entodontaceae	KUH	T	BoOM13Ep
<i>Entodontopsis wightii</i> (Mitt.) W.R. Buck & R.R. Ireland	Entodontaceae	KUH	T	BoOM14Ew
<i>Eurhynchium hians</i> (Hedw.) Sande Lac.	Brachytheciaceae	BGNZP	T	BoOM15Eh
<i>Eurhynchium striatulum</i> (Spruce) Schimp.	Brachytheciaceae	BGRPRCBGRPRC	T	BoOM16Es
<i>Fissidens ceylonensis</i> Dozy & Molk.	Fissidentaceae	BGRPRC, KUH	T	BoOM17Fc
<i>Fissidens bryoides</i> Hedw.	Fissidentaceae	BGRPRC	R,L,S	BoOM18Fb
<i>Fissidens sylvaticus</i> Griff.	Fissidentaceae	CDWLS, BGRPRC	T	BoOM19Fs

<i>Fissidens taxifolius</i> Hedw.	Fissidentaceae	BGNZP	T	BoOM20Ft
<i>Funaria hygrometrica</i> Hedw.	Funariaceae	KUH	T	BoOM21Fh
<i>Funaria hygrometrica</i> var. <i>calvescens</i> (Schwagr.) Mont.	Funariaceae	KUH	T	BoOM22Fhvc
<i>Hyophila involuta</i> (Hook.) A. Jaeger	Pottiaceae	All sites	R	BoOM23Hi
<i>Philonotis mollis</i> (Dozy & Molk.) Mitt.	Bartramiaceae	BGRPRC, BGNZP	R,T	BoOM24Pm
<i>Philonotis hastata</i> (Duby) Wijk & Margad.	Bartramiaceae	BGRPRC	R,T	BoOM25Ph
<i>Physcomitrium pyriforme</i> (Hedw.) Hampe	Funariaceae	BGRPRC	T	BoOM26Pp

Srivastava, 1993; Daniels and Daniel, 2003; Nair and Madhusoodanan, 2005; Kumar and Krishnamurthy, 2007; Dash *et al.*, 2007; Dash and Saxena, 2009; Dash *et al.*, 2009; Dash and Saxena, 2011; Alam *et al.*, 2013; Bansal and Nath, 2014; Mishra *et al.*, 2016) revealed that these species are not reported from here earlier and were considered as new distributional records for Odisha and Eastern Ghats, respectively.

Since no systematic data non bryophytes of Bhubaneswar are available till date, the current report can be considered as baseline data that would provide road map for future research towards biomonitoring. Generally the conservation measures are taken for higher group of organisms only. In the case of lower group of plants, less importance is given by the taxonomist as well as the policy makers. The greatest risks to them are poor and deteriorating air quality and loss of critical habitats due to unplanned developmental activities. These issues are mainly societal, and the fate of these special organisms is a factor to consider in the overall conservation process.

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