The present communication is an exclusive contribution of some fresh water red algal species from the central, north and north eastern parts of India. A total of four taxa have been reported from four different states, Uttar Pradesh, Madhya Pradesh, Assam, and Sikkim of India. *Batrachospermum longiarticulatum* Necchi from Sikkim and Assam of north east India, *Batrachospermum moniliforme* Roth and *Compsopogon coeruleus* (Balbis) Montagne from Madhya Pradesh of Central India and *Thorea siamensis* Kumano and Traichaiyaporn from Uttar Pradesh, north India. All taxa were recorded for the first time from the above mentioned new localities of India. Genus *Thorea siamensis* Kumano and Traichaiyaporn was reported for the first time from Indian sub-continent.

**Keywords:** Red algae, *Batrachospermum*, *Compsopogon*, *Thorea*, India.

Freshwater red algae exhibit smaller range than marine species and they are about 3% of the total number of Rhodophyceae. These algae comprise a heterogeneous assemblage of morphological structure consisting of about 28 genera with 150 species belonging to eleven orders (Sheath 2003). Fresh water red algae are characteristic group of microalgae with a world-wide distribution. Most of the fresh water red algae are lotic forms that occur in shady and slow-fast running waters of streams, and grow on surface of open rocks or submerged rocks even on the root surface of large aquatic plants. Few species are lentic forms found in lakes and ponds (Sheath *et al.* 1992).

The main contribution to our knowledge about red algae of India made by Bruehl and Biswas (1923), Krishnamurthy (1957), Misra and Day (1959), Das (1963), Vasudeva (1962), Patel and Francis (1968, 1969), Pandey *et al.* (1976), Chaturvedi *et al.* (1978), Pandey and Chaturvedi (1979), Balakrishnan and Chaugule (1980), Sankaran (1984), Desikachary *et al.* (1990), Baluswami and Babu (1999), Gupta (2005), John and Francis (2007), Ratha *et al.* (2007), Ratha and Adhikary (2009), Bhosale *et al.* (2012) from different parts of India but these were scanty reports. There are still several unexplored localities at different parts of India which need thorough and extensive explorations for red algal floristic, diversity and distribution studies. Though there are numerous water bodies including rivers, ponds, puddles, lakes, streams and mountain streams etc., there were no thorough investigations at central, north and north eastern parts of Indian states especially Madhya Pradesh, Uttar Pradesh, Assam, and Sikkim. During our fresh water algal exploratory studies of the above mentioned states authors came across with some red algal species, which were collected and are described here. The present communication is a contribution of few fresh water red algal species existence from certain parts of Indian sub-continent and addition to already reported red algal species.

**MATERIALS AND METHODS**

A total of five fresh water red algal samples were collected from five different localities central, north and north eastern states Madhya Pradesh, Uttar Pradesh, Assam, and Sikkim of India (Plate-1) The samples were collected from shady slow flowing streams, canals and rivers during July 1999 to March 2014. All the samples were preserved in 4% formaldehyde and deposited at Herbarium of National Botanical Research Institute, Lucknow. For the morphological studies, the fresh samples were examined using Leica DM 500 light microscope attached with Leica EC3 Camera with computerized image analysis system.

Taxa were identified by using the standard publications of Fritsch (1945), Gupta (2005), Ratha and Adhikary (2009).
RESULTS

Samples of *Batrachospermum* species were collected from three localities, first one was from slow flowing, shady stream near Gangtok in Sikkim, second sample was from slow flowing shady canal, near Silchar, South Assam and the third sample from slow flowing, shady stream of Kerwa dam, in Bhopal, Madhya Pradesh. Samples of *Compsopogon* species collected from shady fast flowing stream, near B-fall, at Pachmarhi, Madhya Pradesh and Sai river, Lucknow, Uttar Pradesh. *Thorea* was collected from slow flowing water of Sai river, Lucknow, Uttar Pradesh.

Systematic enumeration of taxa

1. **Compsopogon coeruleus** (Balbis) Montagne (Plate-2, Figs. 7-10 and 14)

    Order: Compsopogonales  
    Family: Compsopogonaceae  
    Genus: *Compsopogon* Montagne in Bory de St. Vincent and Durieux,  

    **Thallus:** bluish-violet, coarse, erect; filaments profusely branched, 5-8 cm long; branches making an angle of 30-60° with subtending axis; main axis multiseriate, 172-180 µm broad, constituted by central cells, surrounded by corticating cells; central cells 26-45 µm long, 45-68 µm broad; corticating cells unilayered except in main axis, 15-25 µm long 11-24 µm broad; uniseriate branches, 42-48 µm broad. Cells of branches 6-22 µm long, 18-48 µm broad, lateral wall uniseriate thick and double layered, inner layer rigid and outer layer gelatinized; terminal cells of uniseriate branches with rounded apices.
CONTRIBUTION TO THE KNOWLEDGE OF FRESH WATER RED ALGAE.....

Locality: B-fall, Pachmarhi, Madhya Pradesh and Sai river, Lucknow, Uttar Pradesh

Collection No: PCH 20109; Date: 7/10/2010. SAI201103; Date: 12/3/2011

Habitat: Attached on submerged rock surface in fast flowing shady water.


2. Batrachospermum moniliforme Roth (Plate-2, Figs. 1-3)

Order: Batrachospermiales
Family: Batrachospermaceae
Genus: Batrachospermum Roth

Thallus: unialgal, grey-green or violet 5-14 cm long, monoecious, soft- textured, lubricious, profuse branched with beaded appearance; lateral branchlets arise from angular nodal cells and extending half way up and down the internodes, dichotomous with swollen base, cells 18-20µm long, 6-8 µm broad, wall 2 layered, chloroplast laminate, central axis corticated, divisible into nodes and internodes; internodal cells elongated, parallel, non-chlorophyllous, inner cells connected by pit connections, carpogonia rounded yellowish gray, 10-12 µm broad, developed whorls in inner part of branch, carpospores dense, scattered throughout thallus, trichogyne clavate on terminal lateral branches.

Localities: Slow flowing, shady stream at Kerwa dam, Bhopal, Madhya Pradesh

Collection No: PCH 20101; Date: 5/10/2010

Habitat: Attached to rock surface in clear water of a small canal, slow flowing stream.

Distribution in India: Orissa, (Ratha and Adhikary 2009)

4. Thorea siamensis Kumano and Traichaiyaporn, sp. nov (Plate-2, Figs. 11-13)

Order: Batrachospermiales
Family: Thoreaceae
Genus: Thorea Bory de Saint- Vincent

Thallus: rather slender, tufted, highly mucilaginous, 4-12 cm in length, dark green, abundantly branched, multiaxial, consisting of medullar filaments and cortical assimilatory filaments, attached to substrata with discoid holdfasts. Medular portion 200-400 µm in diameter. Assimilatory filaments 170 µm in length, consisting of 11-14 cells, apical cells clavate with rounded apices. Distal portion of assimilatory filaments unbranched or sparsely branched, clavate, gradually tapered from apex.
toward proximal portion. Traichayaporn et al. (2008) have reported for the first time from Thailand.

**Localities:** Sai river, Lucknow, Uttar Pradesh.

**Collection No.:** SAI201102; Date: 12/3/2011

**Habitat:** Attached on rock surface in clear water of a slow flowing river.

**Distribution in India:** So far there were no reports of this species from India. This is the first report from India.

**DISCUSSION**

*Compsopogon* is widely distributed globally, but most common in lowland tropical and subtropical regions (Ratha et al. 2007). *C. coeruleus* was reported earlier from Bareilly, Uttar Pradesh, India by Singh and Pandey (1986). Present one is the second report from India but first report from Lucknow, Uttar Pradesh, India.

*Batrachospermum* is a cosmopolitan genus, normally occur in moderately flowing unpolluted streams. Totally 47 spp. of *Batrachospermum* have been reported globally out of which 14 spp. were reported from India (Ratha and Adhikary 2009). In the present communication two species viz. *Batrachospermum moniliforme* Roth and *B. longiarticulatum* Necchi are reported. *B. longiarticulatum* was earlier recorded from Orissa, India and this is second report from India and first report from north east Indian states of Assam and Sikkim.

*Thorea* commonly occurs in tropical and subtropical regions and in temperate regions with warm waters (Kumano 2002). Though *Thorea* has record of worldwide distribution, but to our knowledge there were absolutely no reports from the Indian sub-continent. *Thorea siamensis* sp. nov. has been reported for the first time from Thailand (Traichayaporn et al. 2008). Ours is the second report in the world and first record from India.

The authors are thankful to the Director, National Botanical Research Institute, Lucknow, for his constant encouragement and laboratory facilities.

**REFERENCES**


Krishnamurthy V 1957  The early stages of development in four species of *Compsopogon* Mont. *Phytomorphology* 7 398-403.


Pandey R.S., Tiwari GL and Pandey DC 1976  Observations on *Compsopogon iyngarii* Krishnamurthy (Rhodophyta). *Hydrobiologia* 49 (3) 239-244.

Pandey UC and Chaturvedi UK 1979  Algae of Rohilkhand division, U.P.,India. *Phykos* 18 37-44


Ratha S K and Adhikary SP 2009  Two type of *Batrachospermum* from Orissa State, Eastern India. *Algae* 24 (2) 61-66.

Sankaran V 1984  *Batrachospermum desikacharyi* sp. nov. (Rhodophyta) from Valparai, Annamalai, Tamil Nadu. *Phykos* 23 163-170.


Vaidya BS 1968  A note on record of *Compsopogon coerules* Mont. from Gujarat *Curr. Sci.* 37 144.

Vasudeva K 1962  The morphology and taxonomy of the genus *Compsopogon montagne* *J Linn Soc (Bot.)* 58 207-222.