On the occurrence of *Audouinella chalybea* (Roth) Bory, 1823, a rare freshwater red algae (Florideophyceae: Acrochaetiales: Audouinellaceae) from eastern Himalaya, India

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**Abstract:** *Audouinella chalybea* (Roth) Bory has been recorded from Phamrong falls of Sikkim Himalaya. Well developed plants of the alga were found attached to the stones and pebbles in the running outlets of the falls. The plants were found anchored to the substratum by spine like base attachment cells. Such structure has not been recorded in earlier studies. Both monosporangia and tetrasporangia have been recorded in our plants. This is the first report of the species from eastern Himalaya and appears to be the second report from India.

**Keywords:** Himalayan hill alga, new report, Phamrong falls, Rhodophyta, Sikkim.

The genus *Audouinella* Bory is one of the infrequently recorded freshwater red alga known from running waters throughout the globe (Desikachary et al. 1990; Kumano 2002; John et al. 2011; Wehr et al. 2015). The thallus of this alga is tufty in appearance mostly up to 50 mm in height. Although blue coloured species are included in genus *Audouinella* Bory, many authorities doubts it to be “chantransia stage” of Batrachospermales as no carposporangia or gametangia have been observed (Necchi et al. 1993a,b; Necchi & Zucchi 1997; Pueschel et al. 2000; Sheath & Sherwood 2011). On the other hand Desikachary et al. (1990) have considered all freshwater species as *Audouinella* Bory while marine species as *Acrochaetium* Nageli.

The genus in India is represented by 12 species (Ganesan et al. 2018; Koley et al. 2020). During systematic investigations on the freshwater red algae of eastern Himalaya the authors recorded a good population of *Audouinella chalybea* (Roth) Bory from Sikkim Himalaya.

**MATERIAL AND METHODS**

The specimens were collected from Phamrong falls of Sikkim. The alga was found growing on rocks under running water along with mosses & blue green algae in the month of April. The pH recorded at the time of collection was acidic (around 4.5–5) & temperature 19°C. The samples were preserved in 4% formalin solution. GWF solution (Glycerine:Water:Formalin::1:1:1) (Bando 1988) was used as mountant for the study. Preliminary observations were made under Olympus GB Microscope & Photomicrographic images were taken using Zeiss Axioscope A1 microscope attached with Axiocam 504 model digital camera.

**Systematic description**

*Audouinella chalybea* (Roth) Bory, 1823

(Kumano 2002, p. 51, pl. 26, figs. 5–6)
Occurrence of Audouinella chalybea from eastern Himalaya, India

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Image 1. Audouinella chalybea: A & B—Part of thallus showing apical rounded cell | C—Arrow showing basal cell of the thallus | D—Branching pattern: Enlarged view | E—Part of thallus showing both types of sporangia (tetrasporangia arrow marked) | F & G—Part of thallus showing sporangia | H—Part of thallus showing both monosporangia (single arrow) & tetrasporangia (double arrow). © Jai Prakash Keshri.
Thallus found growing on pebbles in running water of stream adhered to substratum possibly be spine like hyaline basal cell 107.75 µm long & 7.67–8.18 µm broad (Image 1C); penicillate forming bushy growth up to 3 mm in height, bluish-green in colour; well branched, branching unilateral & alternate both, up to 3rd order, mostly approaching height of the main axis; main axis distinct, cells of the main axis 7–13 µm in diameter, 28–80 µm long (4–7 times longer than broad); terminal cells rounded never acuminated; cells uninucleate with parietal chloroplast, dissected in mature cells as spiral ribbons; cell wall thin 1.03–1.30 µm; monosporangia abundant mostly unilaterally inserted towards the main axis on secondary and tertiary branched, globular to ellipsoid 10.05–12.43 µm in diameter and 15.75–16.35 µm long; tetradsaropangia 13.37–15.19 µm in diameter and 16.21–21.24 µm long growing mostly at the tip of branches.

**Discussion**

Our specimen possesses notable characteristics of the species that was not mentioned in the plants described by Misra & Dey (1959). They have not observed the tetradsaropangia. Moreover, occurrence of spine like hyaline basal cell is a new observation. This species was reported only once by Misra & Dey (1959) from Uttar Prades. Numerous sporangia were shown in the plant but no mention of tetradsaropangia or other characteristics have been clearly spelt. Although the species is widely distributed recorded but has been recorded mostly from warm temperate regions (Hu & Wei 2006; Eloranta & Kwandrans 2007; Eloranta et al. 2011; Ganesan et al. 2018; Guiry & Guiry 2022), it is surprising that no subsequent report of the species have been made from India. We have found well developed plants of the alga. The needle like basal attachment region recorded in present investigation has not been found in any other relevant literature. Therefore the possibility of the plant to be ‘Chantransia Stage’ comes under question mark because it should have a thalloid structure. Tetradsaropangia were also found common. It may be the plant represents the diploid (sporophyte) phase of the plant. It is possible that the plants are maintaining its life cycle only in one stage in Himalayan streams due to scarcity of opportunities of sexual reproduction. Study of the ploidy level of the plant and detail investigations may put new light in the understanding the taxonomic identity of the taxon.

The authors feel that plenty of freshwater red algae including this species may be obtained from several localities of Indian region specifically from Himalayan streams & rivers.

**Conclusion**

The authors experienced that Himalayan streams and hills are rich in freshwater algal diversity but they are never abundant on their sites. Only experienced phycologists may locate the plants. So it appears that our knowledge of freshwater red algae is poor possibly due to lack of proper exploration and not due to the scarcity of occurrence. This is because few good papers have come up in last two decades.

**References**


Erratum


There is a mix up in the affiliations for authors two and three.

Correct affiliations are:

Dimpi A. Patel¹, Chinnasamy Ramesh², Sunetro Ghosal³ & Pankaj Raina⁴

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