



## Tuber formation in *Conocephalum conicum* (L.) Underw.

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### ABSTRACT

The present study deals with tubers in *Conocephalum conicum*, an asexual reproduction type. Asexual modes of reproduction in this taxon need to be studied since the genus is facing problems in sexual reproduction. The finding of tubers in *C. conicum* is first record from India.

**Keywords:** Threatened, tubers, dioecious, perennate, dormancy.

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### INTRODUCTION

Bryophytes called as liliptians of plant kingdom aren't just small tracheophytes but the most diverse group of land plants with more than 20,000 species worldwide. Sexual reproduction in bryophytes is invariably of oogamous type in which a motile biflagellate antherozoid enters the flask shaped archegonium and fertilizes the egg concealed in its venter to produce a zygote. Due to the flagellate nature of sperms, a film of water is essential for transfer of sperm to egg. Necessity of water for fertilization coupled with short durability of sporophytes and geographical/seasonal isolation of male and female thalli (in dioecious taxa) poses severe limitation for these plants in completing their sexual lifecycle. To cope up with these limitations, these plants have developed a number of asexual modes of reproduction including fragmentation, adventitious branching, tubers, gemmae, stolons, innovations, persistent apices etc. Asexual reproduction plays a significant role in bryophyte dynamics (Laaka-Lindberg *et al.* 2003). Nearly 40 % of leafy hepatics are estimated to reproduce asexually (Wyatt 1982).

Tubers are referred to as extensions which are positively geotropic and rich in lipid droplets and starch grains. They function as perennating organs during

unfavourable conditions and germinate rapidly to produce new plants. They thus act as a diaspore bank that helps in recolonisation of disturbed grounds (During *et al.* 1987). Tubers are frequently reported to occur in all the three groups of bryophytes i.e. hepatics such as *Riccia discolor*, *Aitchisoniella himalayensis*, *Stephensiella brevipedunculata* and *Sewardiella tuberifera* (Udar & Srivastava 1983); hornworts-*Anthoceros* species (Schuster 1984) and mosses – *Funaria hygrometrica* (El-Saadawi & Zanaty 1990), *Bryum bicolor* (Risse 1993), *Pottia bryoides* (Arts 1987), *Pleuridium nervosum* (Arts 1998).

### MATERIALS & METHODS

Noori Chhamb is an important historical and tourist destination situated at an altitude of 2120m near Behrangalla in Surankote tehsil about 45 kms from Poonch town. Area with annual temperature range from -2°C to 40°C harbours a very rich bryoflora and is thus frequently visited by the author for research purposes. Thin vertical hand sections of a few thalli from the population collected were cut mounted in glycerine and photomicrography was done using photomicrographic unit. Data regarding temperature was collected from meteorological department, Srinagar.

## RESULTS & DISCUSSION

*Conocephalum conicum* commonly known as snakewort is reported from Eastern (Chopra 1938 and Pande & Bharadwaj 1949) and Western Himalayas (Kashyap 1929, Parihar *et al.* 1994). From J&K state, *C. conicum* is reported from all the three regions- Jammu (Tanwir 2005, Iqbal *et al.* 2011), Kashmir (Koul & Dhar 1968) and Ladakh (Dolma & Langer 2012). Pant (1983) reported this taxon as threatened from the Western Himalayas. She raised her voice to conserve this taxon.

*C. conicum* reproduces asexually by bulbils (Cavers 1903), tubers (Kitagawa 1982, Paton 1993) and regeneration from thallus fragments and ventral innovations (Iqbal *et al.* 2011). Karsten in 1887 reported the presence of tuber like bodies on the thalli of *C. conicum* which appeared in complete darkness. Ainsworth (1965) presented illustrations of bulbils and described their production over laminal part of the thallus. Several other workers also have observed the presence of tubers in the species (Macvicar 1912, Kitagawa 1982). Paton (1999) was of the view that tubers develop on the lower surface of the senescent thalli. Similar observations were recorded in the present study in a population collected from Noori Chamb (District-Poonch, J&K) during first week of October, 2013. A number of thalli of this population had ventral tubers in the midrib and wing region (Figs. 1A & 1 B). Tubers were chlorophyllous, circular, densely packed with starch grains, bounded by dark coloured single layered wall (Fig. 1 C). Number of tubers ranged from 2-3 per thallus. This finding appears to be first on the occurrence of tubers in *C. conicum* from India.

Tendency towards asexual and sexual reproduction can be influenced by genetic and environmental factors. During (2007) suggested that dioecious taxa among the bryophytes of Netherlands produced asexual propagules more commonly than monoecious ones. *C. conicum* is also dioecious and is known to propagate asexually by a number of means. When conditions are stable either asexual or sexual reproduction dominates leading to the loss of other, but unstable and unfavourable conditions can favour one reproductive system in some years and other reproductive system in some other years (Bengtsson & Ceptites 2000). In the population under

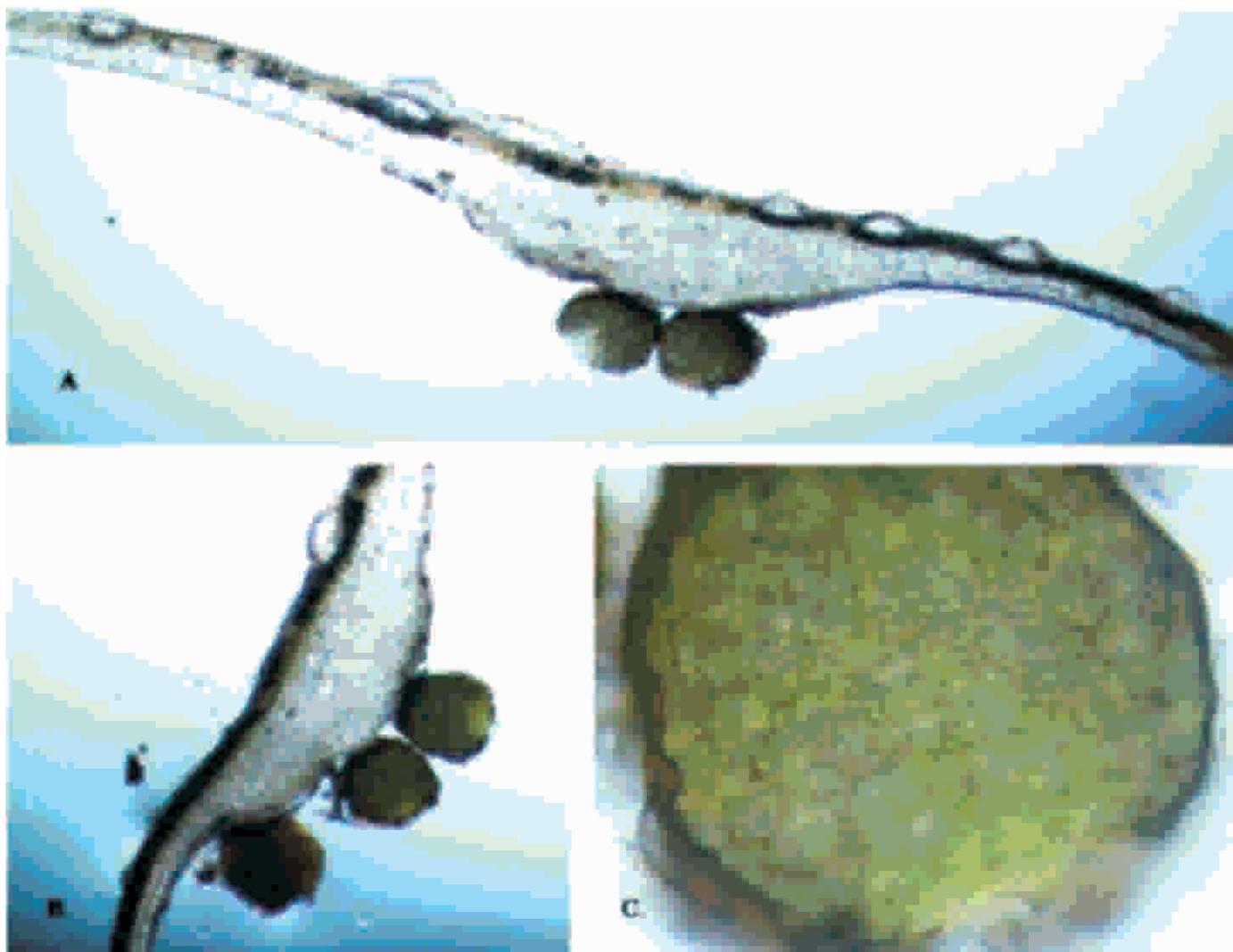
study, sporophyte formation has been recorded during last week of August, 2012 whereas tuber formation was recorded in the first week of October 2013 (Table 1). August and September have frequent showers and temperature is also suitable thereby favouring successful sexual reproduction but month of October is followed by November-January which are the coldest months of the year and snowfall also occurs during these months. In order to cope up with chilling winters and snowfall, the thallus produces ventral tubers even before the winters have arrived. Being below the soil, they are unaffected by the freezing conditions. With the onset of favourable conditions, the growth is resumed and tubers develop into new thalli. They help the plants to tide over the periods of drought and extremes of temperature.

**Table 1 — Collections done from Noori Chhamb during various seasons with data regarding temperature.**

Date of collection	Stage	Temperature (°C)	
		Maximum	Minimum
19-03-2012	Vegetative	24.6	7.8
25-08-2012	♀(with spores and elaters)	31.5	21.5
25-12-2012	Vegetative	23.1	1.5
05-05-2013	Vegetative	32.8	15.3
06-10-2013	Tubers	28.6	10.8

Asexual reproduction is a significant adaptation to adverse environmental conditions where the cost of sexual reproduction to a species is disadvantageous (Green & Noakes 1995). When extreme winters are approaching and survival of species is under threat, species adopts means of reproduction other than sexual so that survival is ensured with less investment of resources. Decline in sexual reproduction reported in the species (Iqbal *et al.* 2011, Bhagat *et al.* 2012) also strengthens the fact that the species is shifting to other modes of reproduction to safeguard its existence. Further investigations and collections are required to arrive at any final conclusion.

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**Fig. A**— V. S. of thallus of *Conocephalum conicum* showing tubers in the midrib region. **Fig. B**— V. S. of thallus of *C. conicum* showing tubers at different positions. **Fig. C**— A magnified view of V. S. of tuber (40X)

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