

Studies on the Associates of *Conocephalum conicum* L. (Dumort.) and *Dumortiera hirsuta* Sw. (Nees)

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ABSTRACT

Paper includes information on association of 46 populations of *Conocephalum conicum* L. (Dumort.) and 25 of *Dumortiera hirsuta* Sw. (Nees) with diverse organisms, including fungi, bryophytes, pteridophytes, gymnosperms, angiosperms and an insect.

Keywords: Liverworts, Association, *Conocephalum conicum*, *Dumortiera hirsuta*

1. Introduction

Bryophytes are known to grow in close association with organisms as diverse as algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms among plants and protozoa, rotifers, nematodes, earthworms, molluscs, insects and spiders among animals. Direct interaction of bryophytes includes providing food, shelter and nesting material for small mammals and invertebrates. Indirectly, they serve as a matrix for a variety of interaction between organisms [1].

2. Material and Method

Plants of *Conocephalum conicum* and *Dumortiera hirsuta* were collected along with their associates growing in diverse habitats, from different sites of tehsil Bhaderwah of district Doda of Jammu (India) region growing at altitude between 1230 - 2600 m, the district falls between 32 degree-53' and 34 degree 21' North latitude and 75 degree-1' and 76 degree-47' East longitude. Periodical explorations were undertaken and field photography was done for the populations growing in natural habitats.

3. Observations and Discussion

A total of 12 plants and one insect species have presently been found associated with the two liverwort taxa. Among these, the most frequent association existed between *Conocephalum conicum* and *Dumortiera hirsuta* themselves.

A number of algal taxa are reported to grow in association with bryophytes. In the terrestrial habitat, cyanobacteria, especially *Nostoc*, are common, and green algae frequent. *Nostoc* is endophytic in some hepatics, for example *Blasia* (Metzgeriales), and in Anthocerotales, with which there is an obligate relationship. Since *Nostoc* is a nitrogen fixer, its advantage to the bryophytes is apparent. *Frullania tamarisci* is also reported as phorophyte for *Stigonema* cf. *minutum* [2]. Observations on plant association of liverworts with other plant taxa were also earlier made by Fardos [3] for *Reboulia hemispherica* and reported its occurrence in association with one algal taxon *Lyngbya*. Similarly, Kapoor [4] observed filaments of *Anabaena* sp. and *Vaucheria* sp. growing on the dorsal surface of thalli of *Riccia*.

Bryophytes are also known to harbor the mycelia of zygomycetous and other fungi. Both hepatic taxa presently studied have been observed to grow in association with *Glomus* sp. (Figure 1(a)). Fungal hyphae were found associated with the smooth walled as well as tuberculated rhizoids. Their frequency, however, was far more in smooth walled one.

Conocephalum conicum has earlier been reported to grow mixed with mosses, such as *Thuidium delicatulum* and *Mirella careyana* [5,6]. Association of *Conocephalum conicum* with *Marchantia* sp., *Preissia quadrata*, *Reboulia hemispherica* and occasionally with *Riccardia pinguis*, *Pellia fabbronia*, *Mannia rupestris* and *Clevea hyalina* has also been reported [7]. Report on the colonization of

a typical liverwort dominated community consisting of *Conocephalum conicum*, *Dumortiera hirsuta*, *Pellia endivaefolia*, *Chiloscyphus polyanthus*, *Phaeoceros himalayensis* and *Eurhynchium striatum* is also known [8]. The association of *Conocephalum conicum* with *Dumortiera hirsuta*, *Wiesnerella denudata*, *Marchantia subintegra*, *Marchantia nepalensis*, *Pellia endivaefolia* and mosses is also well observed [9]. Observations on plant association of liverworts with other taxa were also earlier

made [3] for *Reboulia hemispherica* and also reported it to occur in association with hepatics, (*Plagiochasma appendiculatum*, *Marchantia polymorpha*, *Marchantia palmata*, *Asterella angusta*, *Chiloscyphus himalayensis*), mosses (*Rhodobryum roseum* and *Fissidens* sp.) ferns (*Asplenium dalhousiae* and *Adiantum capillus venaris*), gymnosperm (*Cedrus deodara*) and angiosperms (*Cynodon dactylon*, *Fragaria indica*, *Mazus pulmilus*, *Stellaria media* and *Oxalis* sp.).



Figure 1. Association of *Conocephalum conicum* with (a) *Glomus*. sp.; (b) *Dumortiera hirsuta*; (c) *Marchantia palmate*; (d) *Chiloscyphus kashyapii*; (e) *Dryopteris radactopinnata*; (f) *Athyrium attenatum* and *Woodwardia unigemmata*; (g) *Cedrus deodara*; (h) *Cirsium arvensis*; (i) *Pilea umbrosa*; (j) *Salix alba*; (k) *Conopogon* sp.

Conocephalum conicum has presently been observed to grow in association with other hepatics, such as *Dumortiera hirsuta*, *Marchantia palmata*, *Pellia endivaefolia* (Figure 1(c)) and *Chiloscyphus kashyapii* (Figure 1(d)); pteridophytes; *Dryopteris radactopinnata*, *Athyrium attenuatum* (Figure 1(e)) and *Woodwardia unigemmata* (Figure 1(f)); on the rotten log of *Cedrus deodara* (gymnperm) (Figure 1(g)) and angiosperms like *Cirrium arvensis* (Figure 1(h)), *Pilea umbrosa* (Figure 1(i)) and *Salix alba* (Figure 1(j)) taxa, and an insect (*Comptonotus* sp.) (Figure 1(k)) belonging to hymenoptera order.

Thalli of *Dumortiera hirsuta* grew found in association with hepatics like *Conocephalum conicum* (Figure 2(a)), *Marchantia palmata*, *Chiloscyphus kashyapii* (Figure 2(a)), *Pellia endivaefolia* (Figure 2(b)) and moss a *Rhodobryum roseum* (Figure 2(c)). Two Pteridophytes namely *Woodwardia unigemmata* and *Dryopteris radactopinnata* (Figure 2(c)) were also found associated with it. Angiosperm associates of *Dumortiera hirsuta* were *Salix alba*, *Urtica dioica* (Figure 2(c)), *Impatiens edg-*

worthi (Figure 2(d)), *Valleriana jatomansi* and *Pilea umbrosa* (Figure 2(e)).

Of the various plant associates recorded presently for the two plant species the best association was among *Conocephalum conicum* and *Dumortiera hirsuta* themselves. The reason behind such a strong association between these two thaloid liverworts is their ability to occupy the same microsites. Microhabitats and habitat structure are the basic requirement for plants to flourish in an ecological niche, which is almost same and cooperative for these thaloid liverworts. Data available for plant associates of the two taxa are summarized in the following Table 1.

The diversity patterns of among the associated organism groups along the investigated geographical gradient come out to be influenced by both climatic and management related factors (habitat fragmentation). There is no uncertainty that an increase in the habitats in the forests will increase diversity. The composition of substratum, microclimatic conditions and the habitat position are key



Figure 2. Plant associates of (a) *Dumortiera hirsute*; (b) *Marchantia palmata*, *Chiloscyphus kashyapii* and *Pellia endivaefolia*; (c) *Rhodobryum roseum*, *Woodwardia unigemmata*, *Dryopteris radactopinnata*, *Salix alba*, *Urtica dioica*; (d) *Imtatiens edgworthi*; (e) *Valleriana jatomansi* and *Pilea umbrosa*.

Table 1. Different associates of *Conocephalum conicum* and *Dumortiera hirsute*.

Sl. No	Associates	<i>Conocephalum conicum</i>	<i>Dumortiera hirsuta</i>
1.	Fungus		
	<i>Glomus</i> sp.	+	+
2.	Bryophytes		
	<i>Conocephalum conicum</i>	-	+
	<i>Dumortiera hirsuta</i>	+	-
	<i>Marchantia palmata</i>	+	+
	<i>Pellia endivaefolia</i>	+	+
	<i>Chiloscyphus kashyapii</i>	+	+
	<i>Wiesenerella denudata</i>	-	+
	<i>Rhodobryum roseum</i>	-	+
3.	Pteridophytes		
	<i>Woodwardia unigemmata</i>	+	+
	<i>Dryopteris radactopinnata</i>	+	+
	<i>Athyrium attenuatum</i>	+	-
4.	Gymnosperm		
	<i>Cedrus deodara</i>	+	-
5.	Angiosperms		
	<i>Salix alba</i>	+	+
	<i>Cirsium arvensis</i>	+	-
	<i>Pilea umbrosa</i>	+	-
	<i>Impatiens edgeworthi</i>	-	+
	<i>Valleriana jatomansi</i>	-	+
	<i>Urtica dioica</i>	-	+
6.	Insect		
	<i>Comptonotus</i> sp.	+	-

Note: Both *Conocephalum conicum* and *Dumortiera hirsuta* have a number of common plant associates among non flowering plant groups (*Glomus* sp., *Marchantia palmata*, *Chiloscyphus kashyapii*, *Pellia endivaefolia*, *Woodwardia unigemmata* and *Dryopteris radactopinnata*) and only one flowering plant species (*Salix alba*) was common between the two indicating that the substratum requirement and habitat preference for these common plants growing in association with one another is same. This clearly indicates that the two hepatics studied presently have similar microhabitat requirements.

variables influencing species composition. It can be concluded that the studied taxa are an important factor in maintaining forest integrity and they are helpful as one conservation endpoint that integrates desirable characteristics such as natural biodiversity, stand structure and continuity. Bryophytes have been proposed as surrogates, because they are important components of forest integrity.

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