

Estimation of dry Mass of epiphytic lichens in a temperate forest of Garhwal Himalaya, India

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ABSTRACT: The dry mass of epiphytic lichens of two common *Quercus semecarpifolia* and *Rhododendron arboreum* tree from the moist temperate forest of Chopta-Tunganath region of Garhwal Himalaya District Rudraprayag has been discussed. Out of three d. b. h. classes' trees (diameter at breast height), d. b. h. 1-30cm and 30-60cm has found maximum mass of epiphytic lichens. [Nature and Science. 2008;6(4):71-75]. ISSN: 1545-0740.

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INTRODUCTION

According to the concept of Esseen & Renhorn (1998), high biomass of epiphytic lichens is a characteristic feature of many old- growth forest ecosystems in temperate and boreal areas. Various workers like Pike (1978), Boucher & Nash (1990), Knops et al. (1991, 1996) and Esseen et al. (1996) epiphytic lichens are abundant, they may play an important role in the nutrient cycling in forest ecosystem. In the temperate regions of the Garhwal Himalaya lichen collection is a common practice among the villagers and the trivial to collect the lichens together with tree twigs, as oak trees especially *Quercus semecarpifolia* (Kharsu oak). The precipitation peculiar to the high altitudes raise the atmospheric humidity; the frequency of clouds in summer as well as the snow amount in winter are water reservoirs favouring the development of lichen flora. As a result, this superior band of wood vegetation includes the great number of lichen species. The great richness of *Usnea* and fewer *Ramalina* genera represented by aerophile species.

The present paper, enumerates the dry mass of major epiphytic lichens was only for five major lichen taxa of the Chopta area of the Garhwal Himalaya viz. *Usnea*, *Everniastrum*, *Parmotrema*, *Cetrariopsis* and *Ramalina*. Because these five lichen taxa are commercially exploiting in some high altitude area of Uttarakhand state. In order to collect lichens from the trees it is not allowed because of the lichens are very slow grower plants, these are pioneer plants in all the epiphytes, if the lichens are extracted from any plant species, the other epiphytes like orchids, mosses and angiosperms can be effected and unable to re-sprout. Kumar (2008) study showed only the ground or fallen lichen collection should be possible.

In order to improve the socio-economic standard of the people of Uttarakhand, it may also be necessary to increase and improve the botanical resources of the area. Depletion of lichen population is a matter of concern from conservation standpoint because of several reasons; being unique symbiotic

organisms they contribute to biodiversity; they are ecologically important as food, shelter and nesting materials for a variety of wild animals (Mc Cune and Geiser 1997).

MATERIALS AND METHODS

The Chopta region lies between and 30° 30'-30° 42' N latitude and 79°-79° 30' E longitude in the Garhwal Himalaya is dominated by *Quercus semecarpifolia* trees associated with *Rhododendron* spp, *Taxus baccata*, *Abies pindrow*, *Aser* spp. and *Cotoneaster* shrub. The dry mass estimation of major lichens from the area on *Quercus semecarpifolia* and *Rhododendron arboreum* trees made between 2500m - 3500m above mean sea level. We have identified two purely *Q. semecarpifolia* forest at southeast aspect (open canopied forest) and northwest aspect (closed canopied forest) of the study area. At presents lichen exploitation has band in the study area due to the area comes under the Kedarnath Wild Life Sanctuary area (KWLS). The study has been carried out during June to September 2006. To assessing the mass of major epiphytic lichens vegetation on three dbh classes trees, we have developed a appropriate methodology. Before collecting the epiphytic lichen mass, we have provided a reconnaissance survey to collecting the information on traditional method of lichen harvesting from some high altitude villages of district Chamoli.

A. Traditional Method of Lichen Harvesting

The method has been traditionally followed by lichen collectors of Deval and Tharali block of Chamoli district of Uttarakhand. In these areas lichens collected by the villagers or lichen collectors of Ratgawn, Bursol, Dungari, Man, Kolpuri, Mundoli, Vaan, Kuling, Baak and Ghes village. This area comes under the Badrinath forest division. These areas falls within the Garhwal Himalaya region and the forests are dominated with *Quercus semecarpifolia* (brown oak) and these areas lies between 2000m to 3000m altitudes in west Pinder range of Tharali Tehsil. Brown oak trees of the area harbors luxuriant growth of epiphytic lichens. The collectors collects these plants from the forests and sold it in the local market at Tharali, Deval and Narayanbagar. Some villagers also sold it at Kerabagar and Vaan village of the area.

Villagers of Ratgawn region, approximately 250 collectors collects these plants from the forests in every day in its peak season of collection especially for fallen lichen collection from March to May; there is a major cause of lichen fall due to heavy snow fall in the high altitude areas of the forest. The traditional method of lichen collection is locally called 'Makku Tipan'. Lichen extracts from standing trees through climbing on tree parts (as trunk, branch and twigs) and lichen removed from bark through hands, and for large tree or long branches, a traditional method has followed and used a iron knife tied on a log and then applied it for lichens extraction from the trees. If this kind of technique has not possible, then they cuts the tree parts and after fall down the branch or twigs and extract lichens. Some time the Nepalese are also collects lichens from the forest, they stay there for a month and they harm the trees during the lichen extraction and they also cuts the branches of the trees and extract lichens for sale and wood for fuel or cooking.

B. Sampling of Epiphytic Lichen Thallus

To assessing dry mass of epiphytic lichens, we have collected fifteen (15) individuals of each major lichen taxa from the forest and calculated their dry mass (sun dry mass) for each selected lichen taxa.

C. Sampling of Phorophytes

On the basis of availability of tree species (phorophytes) in both the aspect of the forest, lichen rich habitat and to convenience of the study (as easy to climbing for lichen species counting on tree parts) at both the forest (open canopied as well as closed canopied forests), the trees of *Q. semecarpifolia* and *R. arboreum* categorized into three dbh classes as 1-30cm, 31-60cm and 61-90cm. Three replicates of each dbh class of each phorophyte have randomly selected in both the forests.

D. Counting of Major Epiphytic Lichens on Selected Phorophytes and Estimation of their Dry Mass

We have just counts the number of individuals of each major epiphytic lichen taxa on tree trunk, three randomly selected branches (including lichens on the sub branches and on twigs) of selected trees of each dbh class. The lichen dry mass calculated with the help of following formula-

- i. Lichen dry mass on trunk = Total number of individuals of each major epiphytic lichen on trunk X estimated dry mass of each major lichen taxa.
- ii. Lichen dry mass on a branch = Sum of individuals of each lichen taxa on all randomly selected branches of the tree X estimated dry mass of each lichen taxa / total number of randomly selected branches.
- iii. Lichen dry mass on the total branches of the tree = lichen dry mass on a branch X total number of branches of the selected tree.
- iv. Total dry mass of lichens on the tree (phorophyte) = lichen dry mass on tree trunk + lichen dry mass on all branches of the phorophyte.

RESULTS

The maximum dry mass of epiphytic lichen of *Usnea* species represented by 11mg followed of 6mg *Ramalina* species and 5mg of *Parmotrema* species. Two species of lichens i.e. *Everniastrum* and *Cetrariopsis* have found equal dry mass. The youngest *Q. semecarpifolia* trees dbh 1-30cm provided 329.16(±112.2) g. lichen d.w./tree, at south east aspect, and it was greater about 588.46(±454.93) g. lichen d. w. /tree *Q. semecarpifolia* at north west aspect of the forest The *Q. semecarpifolia* tree dbh 31-60cm recorded 598.56(±317.31) g. lichens d. w. /tree (south east) and 496.86(±349.87) g. lichen d. w. /tree (north west). Similarly for tree dbh 61-90 cm, the lichen dry mass was found on the phorophyte as 753.7(±53.51) g. lichen d. w. /tree at south east and only 189.13(±83.62) g. lichen d. w. at north west aspect of the forest.

Lichen mass on the second phorophyte *Rhododendron arboreum* was found very poor as compared to *Q. semecarpifolia*, due to type of bark, shape and size of the tree. In case of *R. arboreum* the highest dry

mass of lichens was recorded on trees dbh 61-90cm dbh was 72.76(\pm 35.67) g. lichen d. w. /tree at north west aspect and it was lesser 21.4 (\pm 13.21) g. lichen d. w. /tree at south east aspect of the forest.

DISCUSSIONS

The lichen mass was situated in the Chopta area on *Quercus semecarpifolia* and *Rhododendron arboreum*, species trees at southeast and northwest aspect. The major lichen taxa exhibited on individual pattern of vertical distribution. The lichen mass depends on tree cover, size & shape of tree, age of tree, and climate of the region. The *Quercus semecarpifolia* is an excellent phorophyte to providing much lichen mass due to dome shaped canopy.

In both the cases the phorophytes *Q. semecarpifolia* and *R. arboreum*, more than 70% mass of major epiphytic lichens was contributed by the canopy twigs and remaining 30% lichen mass contributed by tree branches and trunk or bole at both the aspect of the forest.

The youngest trees of *Q. semecarpifolia* have found as good lichen mass due to the age trees and smoothness in the trunk bark and absence of growth of other epiphytes, and in case of sapling (dbh1-30cm), all the parts of the saplings (including trunk, branches and twigs) were contributed for lichen mass. In case of increasing diameter (dbh>31cm), the twigs also provided good lichen mass as compared to tree branch and trunk or bole.

The Usneaceae family is represented in about more than 60% at southeast aspect and 58.26% lichen dry mass at northwest aspect of the forest. The Parmeliaceae family also represents 26.19% and 25.54% lichen dry mass at southeast and North West aspect. In both the forests Ramaliniaceae family is represents as very poor contribution about 2% in open and 3% in closed canopied forest.

In open canopied forest (southeast aspect) and closed canopied forest (northwest forest) the fruticose lichens provided 46.4% and 26.84% dry mass of lichens, this contribution is grater than dry mass of foliose lichens as 27.94% and 27.36% dry mass of lichens.

According to Degelius (1978) the lichens began to colonize oak twigs in Europe at about five years. Stone (1989) reported that branches of *Quercus garryna* upto twenty year old show growth of many foliose and fruticose lichens. Similar to the studies it was observed that on mature *Quercus semecarpifolia*, *Q. floribunda*, and *Q. leucotrichophora* trees in and around the study area attainment of the climax stage was exhibited by dominance of foliose and fruticose lichens represented by *Ramalina* and *Usnea* species. Dudgeon (1923) mentioned six stages of succession on epiphytic lichens of *Quercus leucotrichophora*. The crustose lichen stage, begining with numerous little patches of crusts as pioneers on the bark of branches that were 3-4 year old, of which two species frequency wise represent about 75% of the total vegetation. Foliose and fruticose lichens appear simultaneously but become somewhat conspicuous, 3-4 years old *Usnea barbata* (= *Usnea complanata*: Mull. Arg.Mot.) was a prominent member. This stage under favourable condition takes about 9-12 years to achieve its full development. The later stage of succession is taken over by mosses, fern and flowering plant. By this time the twig become thick branches. In the present investigation it was observed that on young tree trunk and twigs of *Quercus semecarpifolia*, *Q. floribunda*,

Q. leucotrichophora and *Rhododendron arboreum*, there is dominance of crustose lichens while mature tree twigs bear luxuriant growth of foliose and fruticose lichens. Du Rietz (1945) attempted to correlate certain tree species with dominance of epiphytic lichens and termed them as **Lichen Rich-Bark** species and **Lichen Poor-Bark** species. *Quercus semecarpifolia* is **Lichen Rich-Bark** trees while a *Rhododendron arboreum* tree is **Lichen Poor-Bark** species.

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