

Macrolichens Cover And Their Distribution Pattern On Two Common Phorophytes (*Quercus Semecarpifolia* And *Rhododendron Arboreum*) In A Temperate Forest Of Rudraprayag District Grahwal (Uttrarkhand), India

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ABSTRACT: Macrolichens cover and their distribution pattern on two common *Quercus semecarpifolia* and *Rhododendron arboreum* trees from the moist temperate forest (Chopta) of Garhwal Himalaya. Out of three d. b. h. classes trees (diameter at breast height), d. b. h. between 0.1-0.30 m, has found maximum cover of macro-lichens at southeast aspect. [Nature and Science. 2009;7(3):13-16]. (ISSN: 1545-0740).

Key Words- Lichen cover, Macrlichens, Garhwal Himalaya

INTRODUCTION

Lichens are most successful symbiotic organisms in nature, dominating 8% or more of the earth's terrestrial area (Ahmadjian 1995) and are amongst the most significant indicators of air pollution and ecosystem health (Richardson 1992, Wolseley et al 1995, Upreti 1995). They are very sensitive to microclimatic changes. Therefore any natural manmade disturbances are bound to affect lichen populations (Negi, 1996). Lichens are able to grow in diverse climatic conditions and on equally diverse substrata. They are widely distributed in almost all the phytogeographical regions of the world. Requisite moisture and light, unpolluted air and undisturbed substratum often favor optimum growth and abundance of lichens (Awasthi, 2000).

To assess the micro-lichen distribution pattern and cover on different tree species, the host tree species were identified through a survey and presence or absence of occurrence of macro-lichens on different tree species in an open canopied forest (ocf) and a closed canopied forest (ccf) were recorded. A total of eight tree species viz. *Rhododendron arboreum*, *R. anthopogon*, *Quercus semecarpifolia*, *Taxus baccata*, *Ilex dipyrena*, *Abies pindrow*, *Asculus indica*, and *Acer sp* were identified in both the forest between 2500m to 3500m altitudes. Due to variation of the aspects and vegetation type on the southeast aspect (ocf site) only two species viz. *Quercus semecarpifolia* and *Rhododendron arboreum* were present there. *Rhododendron arboreum* was less dominant than the *Quercus semecarpifolia*. Thus comparison of macro-lichen species distribution and cover on different parts viz. trunk, branch and twigs of these two tree species were performed.

The present paper, enumerates the cover of some macro-lichens 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.

METERIALS AND METHODS

Site

Chopta forest is situated between 2500m to 3500m altitudes along with Akashkamini valley of district Rudraprayag (Garhwal) India. A stratified random sampling method was employed. For the assessment of the macro-lichen species distribution pattern and cover on tree parts, the selected host tree species viz. *Quercus semecarpifolia* and *Rhododendron arboreum* were stratified into different parts or locations of tree parts, due to suitability of the work, on northwest aspect and south east aspect of the forest. The studied parts of the host tree are as trunk, branch, and twigs.

Sampling of host trees

The trees were categorized into three d. b. h. (diameter at breast height) classes viz. 0.1-0.30m, 0.31-0.60m and 0.61-0.90m. Five trees of each species on both the site of the forest of each d. b. h. class were selected randomly between 2500m to 3500m altitudes, and laid five quadrats (10cm²) randomly on each selected tree trunk and in each quadrat, number of individuals of small, medium and large macro-lichens were counted in each sample quadrat and noted properly. The d. b. h of the trunk was also recorded. Similarly three branches of each selected tree species randomly selected and placed randomly five quadrats

(5cm²) on each branch and count and noted the number of individuals of small, medium and thallus in each quadrat sample.

The summing of individuals of each small, medium and large macro-lichen taxa in total number of quadrats studied on total sample trees trunk (five trunks) and multiplied by calculated mean size of small, medium and large size of each selected macro-lichen and the calculated value is divided by total number of quadrats studied. The calculated mean cover represented by square centimeter size of the lichen on the tree part.

Formula (Kumar, 2008)-

$$C = T \times A / N$$

Where 'C' is the size wise cover (cm²) of a macro-lichen.

'T' is the total number of individuals of each small, medium & large size macro-lichen taxa in all quadrats studied on total number of sample trunk for each dbh class.

'A' is the calculated size of macro-lichen taxa.

'N' is the total number of quadrats studied on total sampled trunk of each dbh class.

Similarly for branch the lichen species cover (size wise) were calculated by the following formula (Kumar, 2008)-

$$C = B \times A / N$$

Where 'C' is the size wise cover (cm²) of macro-lichen taxa.

'B' is the total number of individuals of each small, medium & large size macro-lichen taxa in all quadrats studied on total number of branches for each dbh class tree.

'A' is the calculated mean size of that lichen taxa.

'N' is the total number of quadrats studied on total sampled branches of each d. b. h. class tree.

To estimate the lichen cover on twigs, a scale with ten centimeter marking at 1cm distance was used on five randomly selected twigs of each d. b. h. class tree, and the sum of total lichen cover on all sampled twigs of each d. b. h. class trees, was divided by total number of twigs sampled on that d. b. h. class trees (Table 1).

Table 1: Calculated mean size (cm²) of each major lichen taxa.

Major lichen species	Calculated mean size of major macro-lichen thallus (cm ²)		
	Small	Medium	Large
<i>Everniastrum</i>	1.7	3.12	6.48
<i>Parmotrema</i>	1.74	3.08	5.0
<i>Usnea</i>	1.9	3.74	6.0
<i>Ramalina</i>	1.56	3.02	4.88
<i>Cetrariopsis</i>	1.74	3.1	5.94

RESULTS

The macro-lichen cover analysis on the tree parts at two different study sites are given in table 2, 3, and 4. In both the aspects young saplings of *Quercus semecarpifolia* (dbh between 0.01-0.30m) provides maximum lichen cover, and *Rhododendron arboreum* recorded minimum cover of macro-lichens.

Table 2: Lichen cover (cm²) on trunk of two phorophytes at southeast aspect (ocf).

Phorophyte (Trunk)	Trunk dbh (m)	Available mean surface area (m ²) for covering/growth of lichens	Lichen cover (cm ² /10cm ²)
<i>Q. semecarpifolia</i>	0.1-0.30	0.33	7.46
	0.31-0.60	0.9	4.13
	0.61-0.90	8.4	3.2
<i>R. arboreum</i>	0.1-0.30	0.17	4.24
	0.31-0.60	1.31	2.31
	0.61-0.90	5.42	1.39

Table 3: Lichen cover (cm²) on trunk of two phorophytes at northwest aspect (ccf).

Phorophyte (Trunk)	Trunk dbh (m)	Available mean surface area (m ²) for covering/growth of lichens	Lichen cover (cm ² /10cm ²)
<i>Q. semecarpifolia</i>	0.1-0.30	0.35	9.46
	0.31-0.60	0.95	1.43
	0.61-0.90	8.02	2.37
<i>R. arboreum</i>	0.1-0.30	0.12	0.61
	0.31-0.60	0.96	0.53
	0.61-0.90	4.36	0.85

Table 4: Lichen cover (cm²) on branch of the phorophytes.

Forest	Branch	Lichen taxa	Lichen cover (cm ² /5cm ²)	Available mean surface area of the branch for growth of lichen taxa (m ²)
OCF	<i>Q. semecarpifolia</i>	<i>Everniastrum</i>	2.21	0.08
		<i>Parmotrema</i>	0.69	
		<i>Usnea</i>	1.62	
		<i>Ramalina</i>	0.17	
		<i>Cetrariopsis</i>	0.24	
		Total cover	4.93	
<i>R. arboreum</i>		<i>Everniastrum</i>	0.92	0.03
		<i>Parmotrema</i>	0.35	
		<i>Usnea</i>	0.42	
		Total cover	1.69	
CCF	<i>Q. semecarpifolia</i>	<i>Everniastrum</i>	3.28	0.08
		<i>Parmotrema</i>	0.34	
		<i>Usnea</i>	0.62	
		<i>Ramalina</i>	0.16	
		<i>Cetrariopsis</i>	0.07	
		Total cover	4.46	
<i>R. arboreum</i>		<i>Everniastrum</i>	0.08	0.03
		<i>Parmotrema</i>	0.29	
		Total cover	0.37	

DISCUSSION

The lichen cover indicates the tree growth function and also attributes for health and ecosystem function of the area. The corticolous lichens growth on tree bark is a useful indicator of young trees. The lichen cover on different parts of phorophytes at south east aspect (open canopied site) of the forest as young *Quercus semecarpifolia* tree diameter (dbh) between 0.1-0.30m, the lichen cover was 7.46cm²/10cm² and the available mean surface area of the trunk was recorded 0.33m². The trunk diameter between 0.31-0.60m exhibit lichen cover 4.13cm²/10cm², when the available surface area of the trunk was recorded 0.901m². Similarly the trunk diameter between 0.61-0.90m when the available surface area of the trunk was 8.40 m² and 3.20cm²/10cm² lichen cover was recorded.

In the northwest aspect (ccf) of the same forest, the *Q. semecarpifolia* young tree diameter (dbh) between 0.1-0.30m has 9.46cm²/10cm² lichen cover out of 0.35m² available surface area of the trunk. The trunk diameter (dbh) 0.31-0.60m has 1.43cm²/10cm² of lichen cover in 0.95m² surface area of the trunk. Similarly the trunk diameter 0.61-0.91m has lichen cover of 2.37cm²/10cm² out of 8.02m² surface area of the trunk. Both the foliose lichen genera *Everniastrum* and *Parmotrema* covered about 1cm²/10cm² area of the *Q. semecarpifolia* while other lichen genera *Usnea*, *Ramalina* and *Cetrariopsis* exhibit lower lichen cover.

Lichen cover on branch of *Quercus semecarpifolia* was recorded as 4.93cm²/5cm² out of the available surface area of 0.08m² at southeast aspect (ocf). In the north west aspect (ccf) it was recorded 4.46cm²/5cm²

out of available area of 0.08m². In both the aspect the *Everniastrum* play a significant role providing as it constitutes the highest lichen cover (3cm²/5cm²). The other lichen taxa provide a poor representation (<1cm²/5cm² area) for lichen cover on *Quercus semecarpifolia* branch (Table 4).

The *Quercus semecarpifolia* tree at, northwest aspect exhibits the maximum lichen cover represented by more than 70% while southeast aspect has only 40% of lichen cover.

In the open canopied forest the *Rhododendron arboreum* trunk shows maximum lichen cover. The *Rhododendron arboreum* tree trunk in closed canopied site has poor lichen cover (< 1cm²/10cm²) as compare to the open canopied trees (Table 2 and 3).

The *Rhododendron arboreum* trunk dbh between 0.1-0.30m has 4cm²/10cm² of lichen cover. The trunk with 0.31-0.60m dbh has 2.31cm²/10cm² of lichen cover out of the available surface area of 1.31m². The trunk of dbh 0.61-0.91m recorded 1.39cm²/10cm² lichen cover out of 5.42m² available surface area of the trunk. It is interesting to note that the lichen cover was decreasing with increasing diameter of the *R. arboreum* trunk (Table 2 and 3).

Rhododendron arboreum branches in the open canopied forest has 0.92cm²/5cm cover of *Everniastrum* which is quite low in the closed canopied forest (0.08cm²/5cm), while the *Parmotrema* cover in both closed and open canopied forest was more or less similar. The fruticose lichen *Usnea* was not recorded only closed canopied *Rhododendron* forest (Fig. 4.12 and 4.13). The twigs and trunk of *Rhododendron arboreum* in northwest aspect bear 16% of lichen taxa than the southeast aspect, which has only 5% of lichens.

The size of lichen cover may be affected by a number of climatic variations in the study area. The aspect variation, type of vegetation, darkness and disturbances, presence or absence of light, moisture and other climatic conditions play important role in growth and colonization of lichens. It also depends on the age and bark condition of the tree. The bark of the trees in closed canopied forest; provide excellent conditions for growth of other epiphytes viz. mosses, bryophytes, ferns, orchids, and angiosperms. Thus there remains little space for lichens to colonize.

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