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FREQUENCY, ABUNDANCE AND DISTRIBUTION OF LICHEN IN NATIONAL BOTANICAL GARDEN, MIRPUR, DHAKA, BANGLADESH

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Key words: Lichen, Distribution, National Botanical Garden

Abstract

An investigation was carried out to study lichen flora of National Botanical Garden, Dhaka, during the tenure of May 2018 to April 2019. Seven genera of lichens namely *Chrysothrix, Cladonia, Cryptothecia, Herpothallon*, *Parmelia, Pertusaria* and *Usnea* were recorded from 15 blocks of the Garden. Lichens were abundantly grown and their number increased from June to October, whereas from November to April the number of lichens gradually decreased. The maximum frequency percentage (36.52) of the association found in *Parmelia* while minimum frequency percentage was recorded 2.48 in *Usnea*. Among three different heights, the highest number of lichens was recorded within 2 to 4 feet. Most exclusively, *Parmelia* was found in all the studied blocks, whereas other identified lichens were observed randomly. The present investigation will be helpful to enrich the knowledge on lichen biota of Bangladesh.

Introduction

Among the terrestrial autotrophs of the world, lichens exhibit intriguing morphological variation in miniature. In color they exhibit a fantastic array of orange, yellow, red, green, gray, brown, and black[1,2]. Lichens vary in size from less than a mm^2 to long, pendulous forms that hang over 2m from tree branches. Linear growth varies from imperceptible to many millimeters in a year. Lichens occur commonly as epiphytes on trees and other plants, and in some ecosystems epiphytic lichen biomass may exceed several hundred kg/ha[3]. In addition, they frequently colonize bare soil, where they are an important component of cryptogamic soil crusts in arid and semi-arid landscapes[4,5]. Furthermore, lichens occur almost ubiquitously on rocks with the most obvious ones occurring as epiliths, either growing over the surface or embedded within the upper few millimeters. A few lichens even occur endolithically within the upper few millimeters of the rock, such as occurs in Antarctica[6]. In the tropics and subtropics, some rapidly growing lichens even colonize the surface of leaves as epiphylls[7,8]. Lichens occur in most terrestrial ecosystems of the world, but their biomass contribution varies from insignificant to being a major component of the whole ecosystem[9]. Lichens act as a pollution indicator of the city. Due to over population and industrial revolution, toxicity

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and pollution increases day by day in Dhaka city. In addition, National Botanical Garden situated almost center of the city. Very few works have been done on the lichen flora[10,11] in Bangladesh. There is no evidence is available on lichen flora in National Botanical Garden, Dhaka. So, the present research work was undertaken to find out the frequency, distribution and abundance of lichen flora in National Botanical Garden, Dhaka, Bangladesh.

Materials and Methods

Lichen samples were documented from the National Botanical Garden, Mirpur, Dhaka. Bangladesh with an area of around 84 hectares. It is situated 23.81660° North and 90.34875° East and divided into 57 sections and is managed by Forest Department under the Ministry of Environment and Forests, Government of the People's Republic of Bangladesh (Fig. 1). Lichens were found and collected from fifteen blocks within fifty-seven blocks. Twenty-four observations were made with the interval of 15 days. Lichens were documented during the tenure of May 2018 to April 2019. Three different height

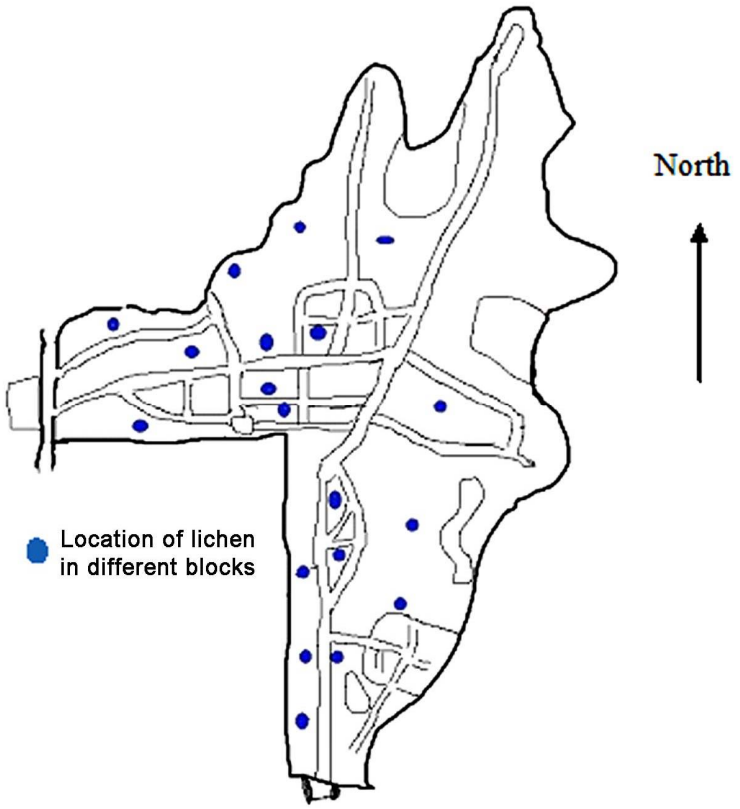

Fig. 1. Distribution of lichen in National Botanical Garden, Mirpur, Dhaka.

ranges were selected during sampling[12]. They were 0-2 ft, 2-4 ft and 4 ft-above. Collection of Lichen was followed by the method described by May[13]. Howbeit, a hand lens (10x) is used to examine the structure of the thallus. A sharp flat edged chisel (1 to 2 inch) and a hammer (1 to 2 kg), polythene packet, rubber bands, GPS machine, herbarium press, meter scale etc are the tools required for the collection. Lichens were collected along with their substratum. Only lichen that are loosely attached to substratum are scraped out and collected. Collected materials are used for detailed microscopic and further study. Nikon D3200 DSLR camera was used for spot photography. During sampling photographs of lichens were taken through DSLR camera (Nikon D3200). Morphological identification was done according to McFarlin and Melinda[14], Albert[15] and Thomus[16].

The frequency distributions of lichen species were calculated based on presence/absence data per tree and per block. Standard error of mean (SEm) was calculated by using Microsoft Office Excel.

Results and Discussion

Seven genera of lichen were recorded in National Botanical Garden Mirpur, Dhaka, during the tenure of May 2018 to April 2019. The identified lichen genera were *Chrysothrix*, *Cladonia*, *Cryptothecia*, *Herpothallon*, *Parmelia*, *Pertusuria* and *Usnea*. Out of 57 blocks, lichens were recorded from 15 blocks *viz*., 1, 2, 4, 6, 7, 9, 11, 13, 16, 39, 48, 51, 52, 53, and 56 blocks of the Garden. During the tenure of research it was noticed that lichens were not found on *Eucalyptus oblique* plant.

From these observations overall percentage of occurrence is presented in Table 1 and Fig. 2. Frequency percentage of occurrence of *Parmelia* was the highest (36.52) followed by *Cryptothecia* (20.21), *Herpothallon* (15.60), *Cladonia* (14.18), *Chrysothrix* (8.16), *Pertusaria* (2.84) and *Usnea* (2.48). A total of 282 lichen individuals were recorded from National Botanical Garden. Among them *Parmelia* was 103, *Cryptothecia* was 57, *Herpothallon* was 44, *Cladonia* was 40, *Chrysothrix* was 23, *Usnea* was 7 and *Pertusaria* was 8. Similar result was also found by Gamache and Payette[12].

Fig. 3 showed the number of recorded seven lichen genera during the tenure of May 2018 to April 2019. Lichens were grown abundantly from May to October. On the other hand, the number of lichens gradually decreased from November to April. Out of seven lichens, *Parmelia* was recorded from all the studied months whereas *Usnea* only found in the month of April, May and June. Maximum number of *Parmelia* species was found in the month of August. Most exclusively only two types of lichen genera for each month were found from November to February in the selected Botanical Garden.

Fig. 3 also represents the abundance of lichen at different heights of the plant. Out of three different height ranges, the highest number of lichens were recorded from 2-4 ft ranges area of the plant. In case of *Chrysothrix,* about 30% grown under 2 ft, 39% between 2-4 ft and 22% above 4 ft. In case of *Cladonia*, about 30% grown under 2 ft, 43% between 2-

4 ft and 27% above 4 ft. For *Cryptothecia*, about 39 % grown under 2 ft, 28% between 2-4 ft and 33% above 4 ft. For *Herpothallon*, about 34 % grown under 2 ft, 39% between 2-4 ft and 27% above 4 ft. For *Parmelia*, about 31% grown under 2 ft, 44% between 2-4 ft and 25 % above 4 ft. Regarding *Pertusaria*, about 25 % grown under 2 ft, 61% between 2-4 feet and 13 % above 4 ft. Finally, *Usnea*, about 44% of individual grown under 2 ft, 28% between 2-4 feet and 28% above 4 ft. Similar result was also found by Gamache and Payette[12].

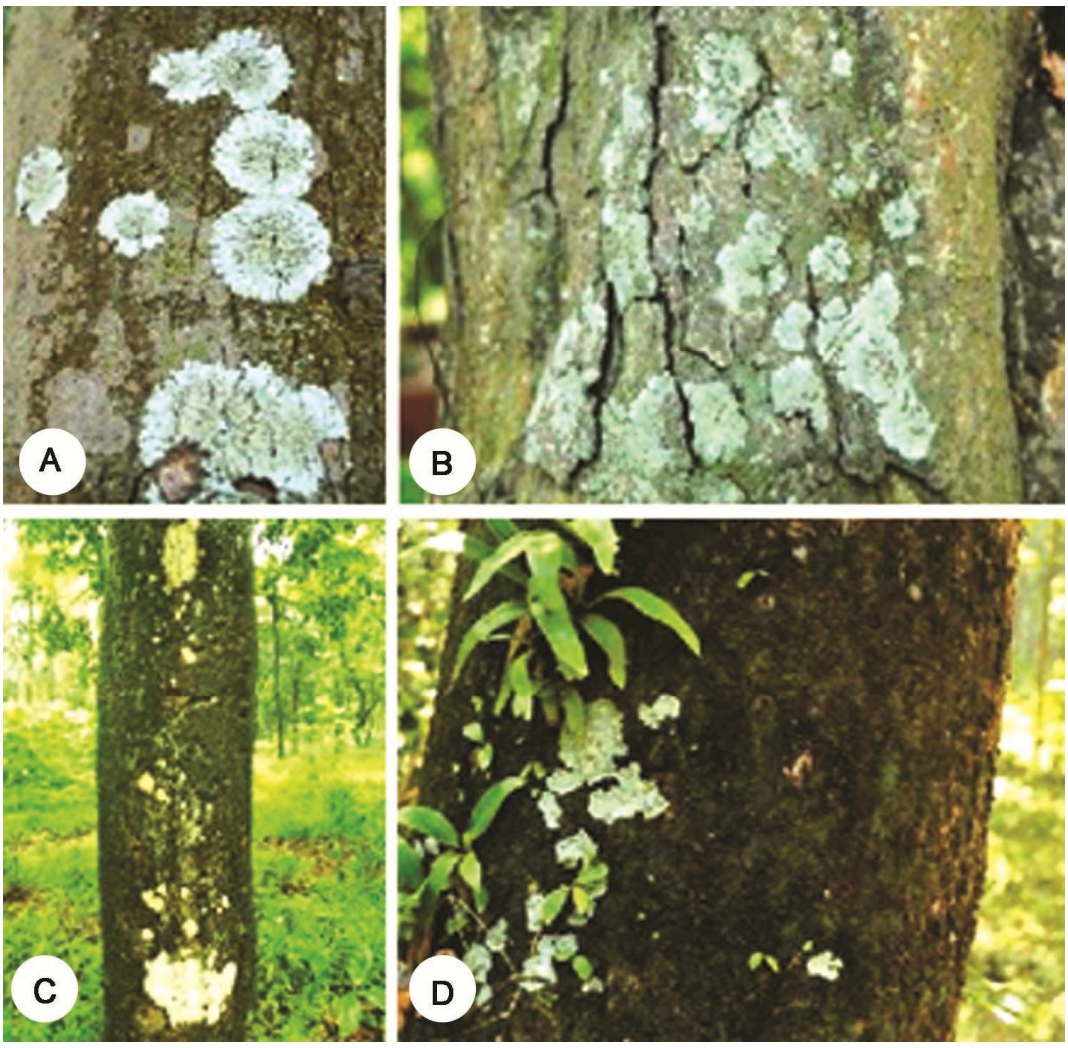

Fig. 2. Frequently occurred lichens on different habitats and heights; A = *Parmelia,* B = *Cladonia,* C = *Pertusaria,* D = *Chrysothrix.*

Table 1. Frequency percentage of occurrence of lichens at National Botanical Garden.

Genus	Number of individuals	Percent of occurrence (± SEm)
Chrysothrix sp.	23	8.16 ± 0.70
Cladonia sp.	40	14.18 ± 1.08
Cryptothecia sp.	57	20.21 ± 0.67
Herpothallon sp.	44	15.60 ± 0.75
Parmelia sp.	103	36.52 ± 1.15
Pertusaria sp.	8	2.84 ± 0.31
Usnea sp.	7	2.48 ± 0.37

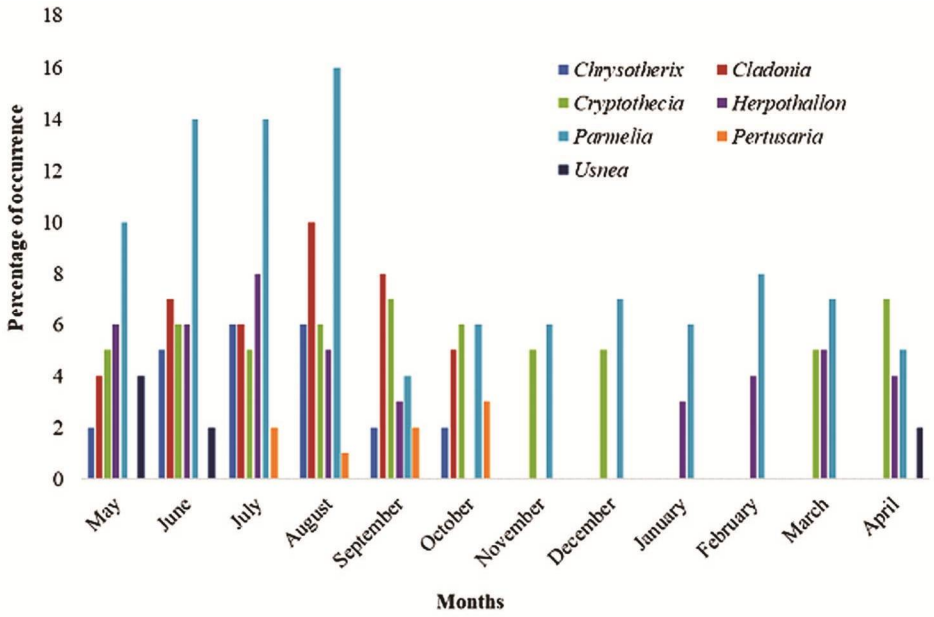

Fig. 4. Percentage of occurrence of lichens during May 2018-April 2019.

Month wise occurrence of lichens in the selected 15 blocks is presented in Table 2. During May-June 2018, *Usnea* was recorded exclusively in block 51 only. *Parmelia* was recorded in all blocks over the studied period. *Cryptothecia* was recorded in block no 13 and 16, whereas *Herpothallon* in 9 and 16; *Cladonia* in 39, 48 and 51; *Chrysothrix* in 4 and finally *Pertusaria* in block 51 and 52. During July–August 2018, *Usnea* was not found in any of the studied blocks. *Parmelia* was recorded in all blocks, followed by *Crytothecia* in 13 and 16 blocks, *Herpothallon* in 9 and 16 blocks, *Cladonia* in 39, 48 and 51 blocks,

Table 2. Occurrence of lichens in 15 blocks among 57 blocks.

Blocks	May-June 2018							July-August 2018							September-October 2018						
	Lichen genera							Lichen genera							Lichen genera						
	Ch	Cl	Cr	He	Pa	Pe	Us	Ch	Cl	Cr	He	Pa	Pe	Us	Ch	Cl	Cr	He	Pa	Pe	Us
1	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
2	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
4	+	-	-	-	+	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-
6	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
7	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
9	-	-	-	+	+	-	-	-	-	-	+	+	-	-	-	-	-	+	+	-	-
11	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
13	-	-	+	-	+	-	-	-	-	+	-	+	-	-	-	-	+	-	+	-	-
16	-	-	+	+	+	-	-	-	-	+	+	+	-	-	-	-	+	+	+	-	-
39	-	+	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	+	-	-
48	-	+	-	-	+	-	-	-	+	-	-	+	-	-	-	+	-	-	+	-	-
51	-	+	-	-	+	+	+	-	+	-	-	+	+	-	-	+	-	-	+	-	-
52	-	-	-	-	+	+	-	-	-	-	-	+	+	-	-	-	-	-	+	+	-
53	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
56	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-

(Right side of the table)

November-December 2018							January-February 2019							March-April 2019						
Lichen genera							Lichen genera							Lichen genera						
Ch	Cl	Cr	He	Pa	Pe	Us	Ch	Cl	Cr	He	Pa	Pe	Us	Ch	Cl	Cr	He	Pa	Pe	Us
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	+*	+	-	-
-	-	-	+*	+	-	-	-	-	-	+	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	+*	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	+*	+*	+	-	-	-	-	-	+	+	-	-	-	-	-	+*	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
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-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-
-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-

+ indicates present, - indicates absent, * indicates decaying phase. (Ch =*Chrysothrix*, Cl = *Cladonia*, Cr = *Cryptothecia*, He = *Herpothallon*, Pa= *Parmelia*, Pe = *Pertusaria* and Us = *Usnea*).

Chrysothrix in block 4 and *Pertusaria* in 51 and 52 blocks. *Usena* was not found in September-October 2018, while *Parmelia* was found in all the studied blocks. *Cryptothecia* was recorded in block 13 and 16, followed by *Herpothallon* in 9 and 16 blocks, *Cladonia* in 39, 48 and 51 blocks, *Chrysothrix* in block 4 and *Pertusaria* in 53 block. Same as during November-December 2018, *Usnea* was not recorded in any of the blocks. *Parmelia* was found in all blocks. *Cryptothecia* was recorded but in a decaying phase. *Pertusaria* was found in block 52. Regarding January-February 2019, *Chrysothrix*, *Cladonia*, *Cryptothecia* and *Usnea* did not found in the selected blocks. *Parmelia* recorded in every block whereas *Herpothallon* found in blocks 9 and 39 and *Pertusaria* in block 51. During the month of March-April 2019, *Chrysothrix*, *Cladonia*, *Cryptothecia, Usnea* did not found in any selected blocks whereas *Parmleia* was recorded in all blocks. *Herpothallon* found in decaying phase in blocks 7 and 36. *Pertusaria* recorded in block 52 only.

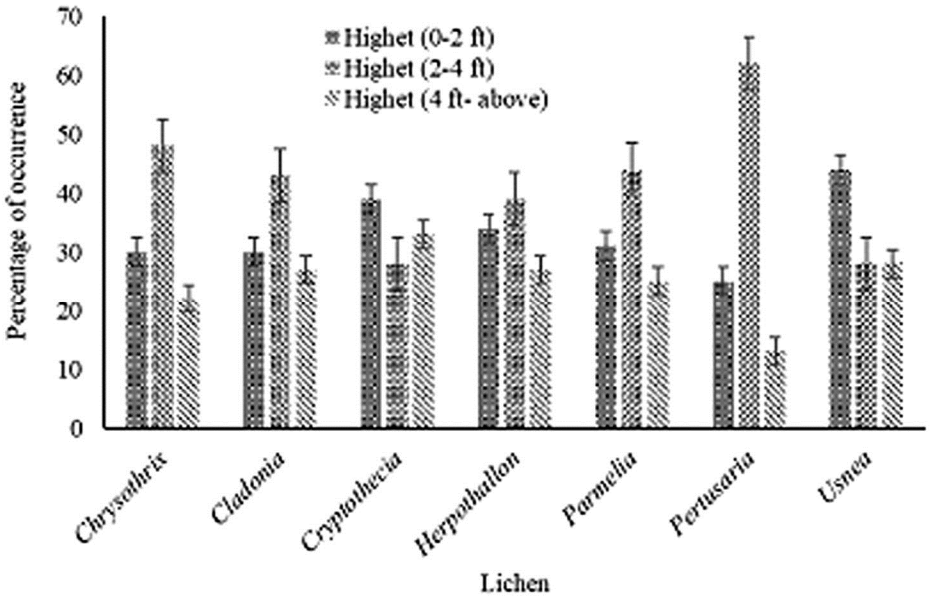

Fig. 5. Percentage of occurrence of lichen on different height of the particular tree.

From these results it is concluded that lichens were abundantly grown and their number increased from June to October, whereas from November to April the number of lichens gradually decreased. The maximum percentage of occurrence of recorded lichen was *Parmelia* (36.52) while minimum percentage of occurrence was *Usnea* (2.48). Among three different heights, the highest number of lichens was recorded within 2 to 4 feet. Most exclusively, *Parmelia* found in all recorded blocks, whereas other identified lichens occurred randomly.

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