# Identification of Lichens in Dikkele Forest Reserve

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## ABSTRACT

**As there was no information found among the published data on lichens in dry or intermediate zone of Sri Lanka a study was carried out to identify the lichens on tree trunks in Dikkele forest reserve. Lichens found on tree trunks in four selected plots of Dikkele Forest Reserve were collected and identified. All the lichens collected were crustose. No foliose species were found on bark of any of the tree trunks. About 14 lichen species belonging to 9 families were identified in selected plots. Of all identified species 22 % were *Thelotrema* species which was the most abundant lichen species in the forest. The second highest (19 %) was belonging to the family Graphidaceae. Presence of large number of bark loving lichens of Thelotremataceae and Graphidaceae family indicates that there is no sign of air quality problems in the forest area. However further studies are necessary to record all the lichens present in the forest.**

**KEYWORDS: Lichens, Identification of Lichens, Symbiosis, Photobiont, Mycobiont.**

## 1. INTRODUCTION

Lichen is a symbiotic organism consists of a fungus and an alga (Honegger, 1991). It covers about 8% of the total land surface of the earth and is the dominant in tundra. It is estimated to be about 30,000 species living worldwide (Nash III, 1996). By nature, lichens are slow growing and drought tolerant for extended periods. Therefore it is found mainly in habitats that are relatively undisturbed for a long time.

Physiologically, lichens are divided in to 3 major types as crustose, foliose and fruticose. Further, squamulose and placodioid are considered as intermediate types. About 46 percent of all known fungi from the fungal kingdom are lichen forming fungi which is about 13,250 species. Of them 98 percent belongs to the Ascomycotina and only 2 percent to the Basidiomycotina (Poelt, 1994). The photobiont can be a member of chlorophyta (about 90 percent of the cases) or cyanobacteria (about 10 percent of cases) (Lange *et al.*, 1989). Most common lichen photobionts are the *Trebouxia* spp. and *Trentepholia* spp. Among the cynobacteria *Nostoc* is the most common (Lange *et al.*, 1989).

Lichens produce a wide variety of compounds known as lichen substances by the fungus and algae. These lichen substances are used in preparation of medicines, dye such as clothing dyes, litmus, oily extracts and to add scents to soaps and perfumes. Recent studies were directed to make use of them as biomonitors of the environmental pollution (Wolseley and Aguirre-Hudson, 1997a).Because they accumulate the chemical compounds within its thallus and die off with the increase of concentration.

Lichens can be distinguished by number of morphological characters. In order to distinguish genera and species their reproductive structures and other thallus characters are widely used in artificial keys (Wolseley P.A, and Aguirre-Hudson 1995). As the fungal partner is specific to the lichen taxon, the classification is based on the sexual characteristics of the fungal partner (Wolseley and Aguirre -Hudson, 1995). However specific key has not yet been developed for Sri Lanka. Therefore keys developed in Thailand and Australia were used to identify lichens in Sri Lanka. Further their secondary metabolites produced by the mycobiont to protect the photobiont from high temperatures or exposure to UV light (Rundel, 1978; Galloway, 1993) can also be used for their identification (Wolseley and Aguirre -Hudson, 1995). Some of the lichens in Sri Lanka have been collected and studied by several lichenologists. G.H.K Thawaits, Director of the Royal Botanical gardens at Peradeniya collected lichens mainly from Sri Lanka as early as 1868. W.A Leighton examined Thawites collection and identified 99 species in 1870. Several lichenologists continued this work and 659 species have been identified and recorded in Sri Lanka. M.E Hale collected lichens from the canopy of *Dipterocarpus* trees in lowland rain forest. However no records were found with regard to lichens in the (Intermediate Zone) Dikkele forest or even from the North western province. Therefore it is decided to study the lichens on tree trunks of the Dikkele forest as an initial step of the research project. Hence this study was to identify the lichen flora on tree trunks of Dikkele forest and to develop a lichen herbarium in the Faculty of Agriculture and Plantation Management.

## 2. MATERIALS AND METHODS

### *Site Description*

The study was carried out in Dikkele forest reserve located in Pannala Secretariat Division in North Western Province (Intermediate zone). It was a forest, planted on an experimental basis first in 1921 and continued planting plot by plot till 1975. The total area of the forest is about 301 ha. Species planted were Mahogany (*Switenia macrophylla*), Jack (*Artocarpus hetarophylus*) and Milla (*Vitex altissima*). However various other local species were established in this forest later. Two such major species are Hora (*Dipterocarpus zelanicus*) and Nadun (*Pericopsis moonina*). The forest can be classified as moist semi evergreen forest.

Geographical co-ordinates of Dikkele forest are approximately 74° 20 N and 80°0 E. Mean annual rainfall ranges from 1850 to 1950 mm per year. Mean annual Temperature ranges from 27 to 29° C and Mean annual Relative Humidity ranges from 74 to 84 % (Data collected from Agricultural Research station at Makandura). The elevation of the Dikkele forest is 71m.

***Study Plots***

Four plots (each 20 ×20 m) were demarcated in the Dikkele Forest Reserve using nylon rope. All the tree trunks larger than 30 cm Girth at Breast Height (GBH) were examined up to 2 m height from the ground level for lichens. All the tree trunks within a plot were numbered and painted for easy identification. A magnifying glass (10 x) was used to observe the lichens on tree trunks. A half of each lichen was removed with sufficient part of the bark from the trees using a chisel and small hammer. Lichens were wrapped with soft tissues and packed them in the pre prepared paper packets. Tree data were collected including species (where possible), girth at breast height and bark type. Tree species were identified from the herbarium in the Department of Plantation Management in Wayamba University.

***Identification***

Identification of collected species was performed using artificial keys. Some of the collected specimens were identified up to generic level. Some were identified up to species level where possible using morphological characters of lichens that have been used in "artificial field keys of common lichen genera in Thailand" (Wolseley and Aguirre - Hudson, 1995) and a colour key to lichens (Wolseley and Aguirre - Hudson, 1997a). Microscopic observations of free hand sections of thallus and fruiting bodies were also made on lichens in order to follow the keys. Chemical spot tests were carried out to distinguish some species of lichens using freshly prepared Calcium hypochlorite, and 10% aqueous solution of potassium hydroxide. Colour reaction of the thallus was observed by applying a small drop to the cortex on the upper surface and to the medulla after scraping off the cortex to expose the medulla. In addition iodine solution was applied to the hymanium layer of the apothecia to see the colour reaction which was used when following the key. Some lichen species were identified by extensive matching with correctly identified specimens deposited at the National Herbarium, National Botanic Gardens, Peradeniya.

***Preservation***

Lichens were preserved in pockets made out of ordinary photocopying paper. Fragile specimens and rare specimens were mounted on piece of Bristol board before putting them into packets. Information such as the name, family, site, altitude, tree species, recorder's name and date of the collection were labeled on the packets. The completed collection was deposited in the Department of Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila.

## RESULTS AND DISCUSSION

All the lichen species collected from the tree trunks of the 4 selected plots were crustose. Out of all the samples taken from the tree trunks, 14 crustose lichens belonging to 9 families were identified (Table 1). Some of the lichen thallus could not be identified due to lack of information and unavailability of a key specific to Sri Lanka. There were many sterile thallus in most of the tree trunks. They can not be identified due to absence of fruting bodies. No foliose lichen species were found on any of the selected tree trunks of the Dikkele forest reserve probably due to low light intensity on the tree trunks. Foliose lichens are light demanding species (Gajameragedara, 2003). Therefore they were not present in the shady areas of the tree trunks but shade tolerant crustoses were dominant on the tree trunks.

Out of identified lichens *Thelotrema* and *Mirriotrema* species belonging to Thelotremataceae family were 33 %. They were present in all plots. It was the most frequently observed lichen species in the forest, but mainly on Nadun, Mahogany and jack trees. Reason for the presence of high amount of lichens of the Thelotremataceae family in this forest type may be the high Relative Humidity and shade condition maintain by the ever green trees. This has been

**Table 1. Lichen species recorded in all plots of Dikkele forest**

| Family | Species | Life form | Plot Number | | | | Percentage % |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | |
| Bacidaceae | *Bacidia sp* | Crustose | + | | + | | 12.5 |
| Graphidaceae | *Graphis sp* | Crustose | + | | + | + | 11.5 |
| | *Graphina sp* | Crustose | | | + | | 4.8 |
| | *Pheographina sp* | Crustose | | | + | | 1.9 |
| | *Sarchographina sp* | Crustose | + | | | + | 1.0 |
| Lecanoraceae | *Lecanora sp* | Crustose | + | + | + | | 9.6 |
| Lobariaceae | *Pseudopyrenulla sp* | Crustose | + | | | | 4.1 |
| Pyrenulaceae | *Astrothellium sp* | Crustose | + | + | + | + | 12.5 |
| | *Pyrenulla sp* | Crustose | + | | | | 1.9 |
| Pertusariaceae | *Perturasia sp.* | Crustose | | | | + | 1.9 |
| Physiaceae | *Pyxin sp.* | Crustose | | + | | | 0.1 |
| Thelotremataceae | *Thelotrema sp* | Crustose | + | + | + | + | 22.1 |
| | *Mirriotrema sp* | Crustose | + | | + | | 11.5 |
| Trypethiliaceae | *Porina* | Crustose | + | | + | | 5.8 |

+ - Presence of lichens in the plots

discussed by the Sipman and Harris (1989). These taxa contain *Trentepohlia* as the photobiont. Lichens with *Trentepohlia* as photobiont require high moisture level which is supplied by the ever green trees (Wolseley P.A and Aguirre-Hudson, 1997) but susceptible for desiccation and high temperature. The second highest number of lichens was recorded in the family Graphidaceae (19%) in plot number 1, 3, and 4. Hale (1981) recorded that the lichens of Thelotremataceae and Graphidaceae family were abundant in Sri Lanka. *Lecanora* species of Lecanoraceae family found on all plots were 9.6% and found mainly on Mahogany trees. The photobiont *Trebouxia* found in this family is able to tolerate high temperature (Shipman and Harris, 1989). Since *Trebouxia* can tolerate low moisture level Lichens with this photobiont is high in the tropical forest.

Substrate characteristics such as tree species, pH, roughness, moisture retention and age affect the lichen communities inhabiting tree barks (Barkman, 1958) and (James, Hawksworth and Rose, 1977). Splitting of the bark occurred in most of the old trees. Hence lichens were very less or no lichens in most of the Mahogany trees. But they were covered with sterile thallus. Bark loving lichen like *Graphis* species are totally absent or poorly present in polluted areas (Hale, 1981). But in the Dikkele forest it was present in all the plots. Therefore it shows that there is no air quality problem in the Dikkele forest.

## CONCLUSIONS

This study revealed that there were 9 families including 14 crustose lichen species. Of all identified lichens 22 % were *Thelotrema* species. It was the most frequently observed lichen species in the forest. The second highest was in the family Graphidaceae. Presence of large number of lichens in these families confirmed that the air pollution is minimum in this forest area. However further studies are necessary to reveal the relationship between the lichen species and level of air pollution.

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