The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 20(3): 14-21, 2025 www.thebioscan.com

"ENUMERATION OF LICHEN BIOTA FROM DAVANGERE DISTRICT OF KARNATAKA"

SHWETHA ULLEGADDI[1], VINAYAKA K.S[2], SANJEEVA NAYAKA[3], ANKITHA S[1], DEEPAK GOWDA H S[1], MADHU KUMAR DJ[4], SHWETA G M[1] AND MANASA D.J[1]*

[1]Department of PG Studies in Botany, Davangere University, Davangere, Karnataka, 577007

[2]Plant Biology Lab., Department of Botany, Sri Venkataramana Swamy College, Vidyagiri, Bantwal-574211, Dakshina Kannada, Karnataka.

[3]Lichenology Lab.oratory, CSIR-National Botanical Research Institute, Rana Pratap Marg, Lucknow, Uttar Pradesh

[4]Department of Chemistry, Ambli Dodda Bharamappa First Grade College, Harapanahalli (T), Vijayanagara

Corresponding mail: manasadj310@gmail.com

DOI: 10.63001/tbs.2025.v20.i03.pp14-21

KEYWORDS
Foliose lichen, Diversity, Pyxine, Physcia.

Received on:

10-05-2025

Accepted on:

12-06-2025

Published on:

03-07-2025

ABSTRACT

Lichens, which are symbiotic relationships association between cyanobacteria or algae and fungi and are considered as bio-indicators of the environment health. Lichen diversity is still poorly understood in many regions of India, including Karnataka's Davanagere district, despite its ecological importance. The aim of this study is to record the diversity of lichens found in Davanagere district with distinct habitats. We identified 26 lichen species from 16 genera and 8 families through methodical field surveys carried out in forest, semi-forested, agriculture, urban and rural areas. Crustose and fruticose lichens were the next most common growth forms, after foliose lichens. *Dirinaria, Graphis, Lecanora, Parmotrema, Physcia, Pyxine and Ramalina* are the most commonly available genera. The results establish a baseline for upcoming ecological and environmental monitoring research and offer fresh perspectives on the lichen biota of central Karnataka.

INTRODUCTION

A symbiotic association between cyanobacteria or algae (photobiont) and fungi (mycobiont) results in the composite organisms known as lichens. This group of organism have attracted considerable attention because they perceived a significant position in the ladder of evolution for the land plants. During association, the phycobiont and mycobiont lose their original identity, and the resulting entity (lichen) behaves as a single organism, both morphologically and physiologically (Hale, 1983). Generally, lichens are often abundant in habitats with an alternation of humid and xeric phases or in extreme environments of high altitude or latitude (Kappen, 1973). They inhabit a variety of substrates, such as soil, rocks, tree bark and manmade artifacts. Due to their extreme sensitivity to environmental changes,
lichens are frequently employed in ecological health and air quality biomonitoring. Within the Western Ghats, Karnataka is renowned for its abundant biodiversity. There are about 1700 species of lichens reported from Western Ghats among them 706 species belonging to 42 families were reported from Karnataka (Sinha *et. al.*, 2025). However, there are many areas within Karnataka re unexplored or under-explored for lichens and Davengere is one such area. The working plan 2018-2019 to 2027-2028 of Davangere Forest Division indicates that the district has excellent biodiversity consisting of angiosperm plants of Non Timber Forest Produce and medicinal importance. Some of the important tree species in the district are *Anogeissus latifolia, Azhadirachta indica, Chloroxylon swietenea, Emblica officinalis, Terminalia* spp, *Tamarindus indica* while sandal, "The pride of Karnataka" grows naturally in the division. The spotted, sambar, wild boars, jackals, blackbucks, cobra, viper, krait are some of the faunal elements. Rangayyanadurga Four Horned Antelope, a vulnerable species found this area and a wildlife sanctuary is established for its conservation. The forest working plan does not mention the occurrence of any cryptogams (except mushrooms) in the district. Rajeshwari et al. (2020) reported six species of *Usnea* from Karnataka and Davangere was one of the study sites. Although, there are some lichen collections from the district by few researchers, but an exclusive checklist of lichens for Davangere is not yet available. In order to fill this gap, this study surveys and catalogues lichen species in the Davangere district's various habitats.

Materials and Methods

Study area and its ecology

Davanagere district is located in the centre of Karnataka state and covers an area of approximately 5,926 km^2 of which 581 km^2 (9%) is covered with forest. The district has distinct wet and dry seasons and a semi-arid to tropical climate. Scrub and dry deciduous forests make up the majority of the vegetation, which is dotted with urbanization and agricultural land. The sample locations were selected to represent a range of habitats, such as fallow fields, rocky outcrops, roadside trees and city parks.

Table 1: Study locality with GPS coordinates

Site	Locality	Taluk	Latitude and Longitude
1	Benkikere	Channagiri	14.0195° N, 76.0022° E
2	Toluhunase	Davanagere	14.3934° N, 75.9649° E
3	Gangana Katte	Davanagere	14.3552° N, 76.0646° E
4	Kondajji	Harihara	14.5682° N, 75.8716° E
5	Anagodu	Davanagere	14.3932° N, 76.0464° E
6	Nyamathi	Nyamathi	14.1499° N, 75.5655° E
7	Nandigavi	Harihara	14.4708° N, 75.7204° E
8	Devarabelakere	Harihara	14.3981° N, 75.8323° E
9	Dhulehole	Harihara	14.4655° N, 75.7099° E
10	Gurusiddapura	Channagiri	14.6634° N, 76.1965° E
11	Kerebilchi	Channagiri	14.1461° N, 75.9013° E
12	Nallur	Channagiri	14.0872° N, 75.8774° E
13	Chiradoni	Channagiri	14.2141° N, 75.8411° E
14	Kanivebilchi	Channagiri	14.1741° N, 75.8490° E
15	Savalanga	Honnali	14.1008° N, 75.5262° E
16	Doddbathi	Davanagere	14.4860° N, 75.8551° E
17	Bilichodu	Jagalur	14.4940° N, 76.1624° E
18	Gurusiddapura	Jagalur	14.6634° N, 76.1965° E
19	Chinnikatte	Honnalli	14.1246° N, 75.4876° E
20	Ukkadagatri	Harihar	14.4166° N, 75.6368° E
21	Surahonne	Honnalli	14.1435° N, 75.5539° E
22	Guddehalli	Honnalli	14.2015° N, 75.5058° E
23	Kodaganur	Davanagere	14.3352° N, 76.0385° E
24	Davanagere	Davanagere	14.4644° N, 75.9218° E
25	Harihara	Harihara	14.5152° N, 75.8072° E

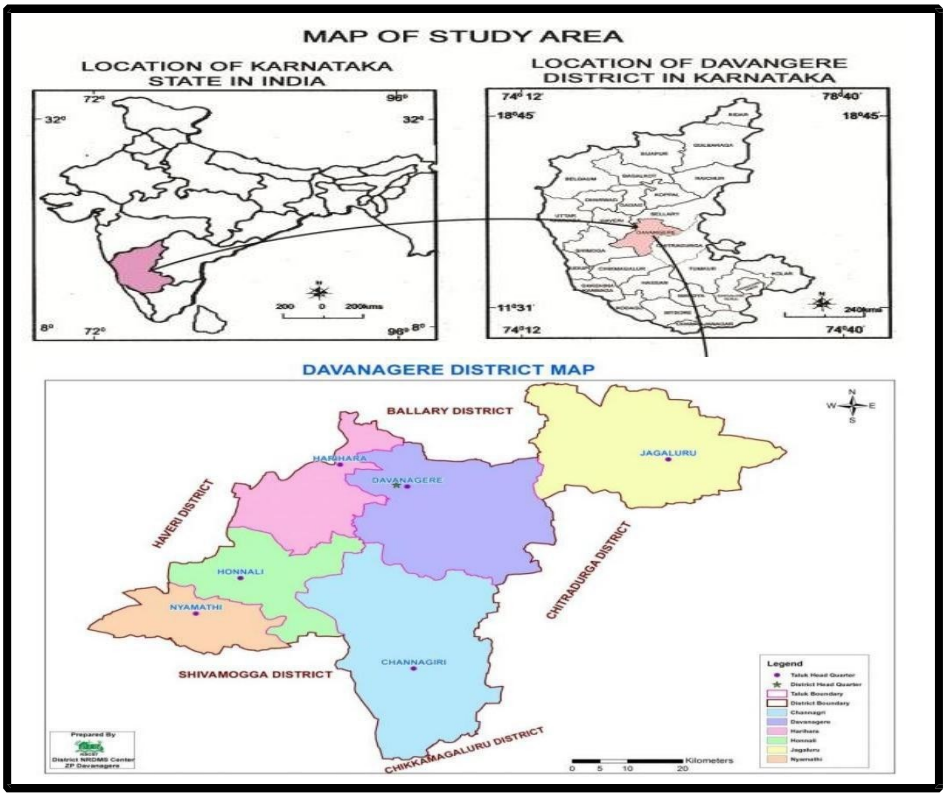

Fig 1: Map of the study area with collection locality

Methodology

A total of 25 localities belong to different habitat types in the study area were surveyed for lichens. Lichens were extracted from soil, rocks and tree bark at each location using non-destructive sampling methods. The representative samples of lichens were collected from various available substrates (Nayaka 2014). The data on locality, altitude, vegetation type and micro habitat were recorded (Table 1). The collected lichen specimens were dried and they were identified on the basis of their morphology, anatomy and chemistry following the recent literature (Awasthi, 1991 and 2007; Orange *et. al.*, 2001; Singh & Sinha, 2010). The colour tests were performed with the routine reagent i.e., K (5% Potassium hydroxide), C (aqueous solution of Calcium hypochlorite) and PD (Paraphenylene diamine). Thin layer chromatography (TLC) in solvent A (180 tolune: 60 dioxine: 8 acetic acid) using techniques of Walker and James (1980) and Orange *et. al.* (2001). The lichen specimens were preserved in the herbarium of Department of studies in Botany, Davanagere University, Davanagere, Karnataka and a set of voucher specimens were submitted to herbarium of CSIR

- National Botanical Research Institute, Lucknow (LWG). The Importance Value was calculated by summing the relative values for species (Species Importance Value) (Uday, 2018).

$$IVI = Rf + Rd + Ra$$

where, Rf=Relative Frequency Rd=Relative Density Ra=Relative Abundance

Result and Discussion

A total of 26 species belonging to 16 genera and 8 families were identified from the study area (Table 2). Among the enumerated lichen biota, 61% of all species observed were foliose lichens, making them the most prevalent type, while 31% were crustose lichens and the remaining 8% were fruticose forms (Fig. 2A). Among the lichen supporting substrates corticolous lichens were more dominant (Fig. 2B).

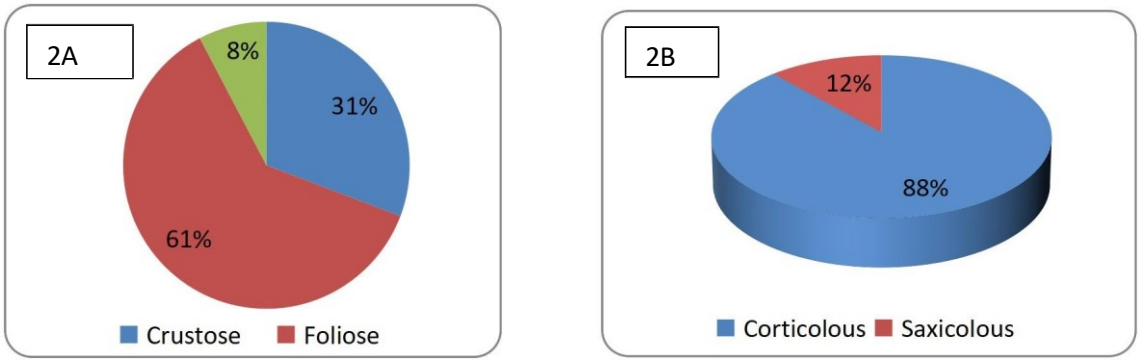

Fig. 2 A & B: Pie-chart showing lichen growth forms diversity and substrate preference

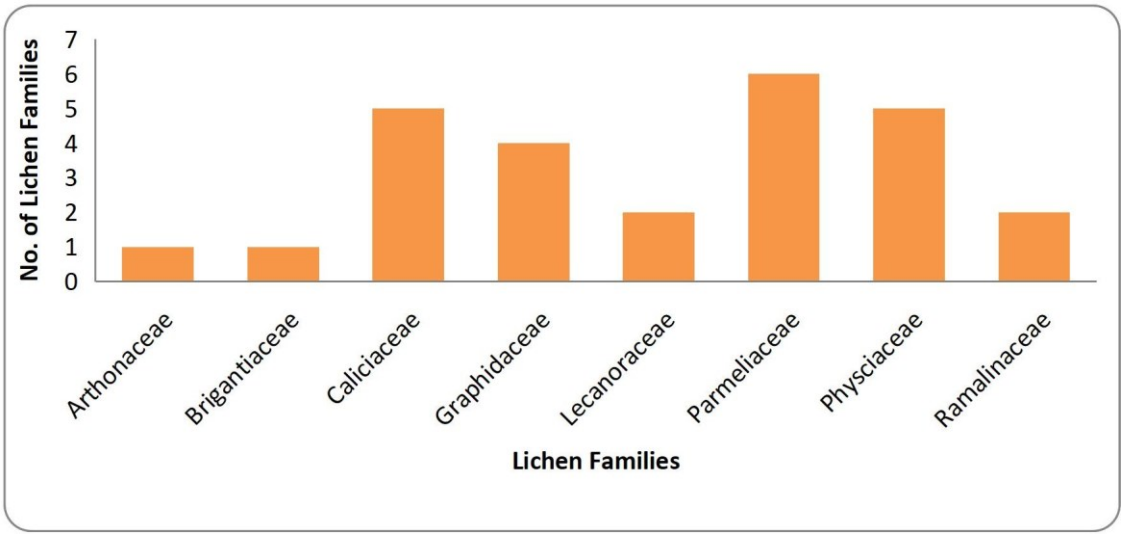

Fig. 3: FIV of lichen species at Davangere district

Pyxine, Parmotrema, Physcia, Dirinaria, Graphis, Lecanora and Ramalina are the most commonly distributed lichen genera in the study area (Fig. 3). Among the reported lichen families Parmeliaceae and Physciaceae were dominated lichen families with Family importance value of 0.24 & 0.19 respectively (Fig. 4). Comparing the lichen distribution, forest areas (41%) having luxuriant growth, but urban areas (7%) representing less distribution (Fig. 5). Most likely as a result of increased pollution and habitat disturbance, urban areas have less diversity. Agricultural rural areas has moderate lichen diversity (31%), this indicates even crop/ horticulture vegetation supports growth of lichen diversity. The richness of lichen flora mainly depends on the heterogeneity, microclimate and higher rainfall (Negi, 2000). Foliose lichens appear to be more tolerant of the semi-arid climate that is common in Davanagere district, based on their comparatively high diversity. The significance of protecting less disturbed habitats is highlighted by the existence of sensitive species there.

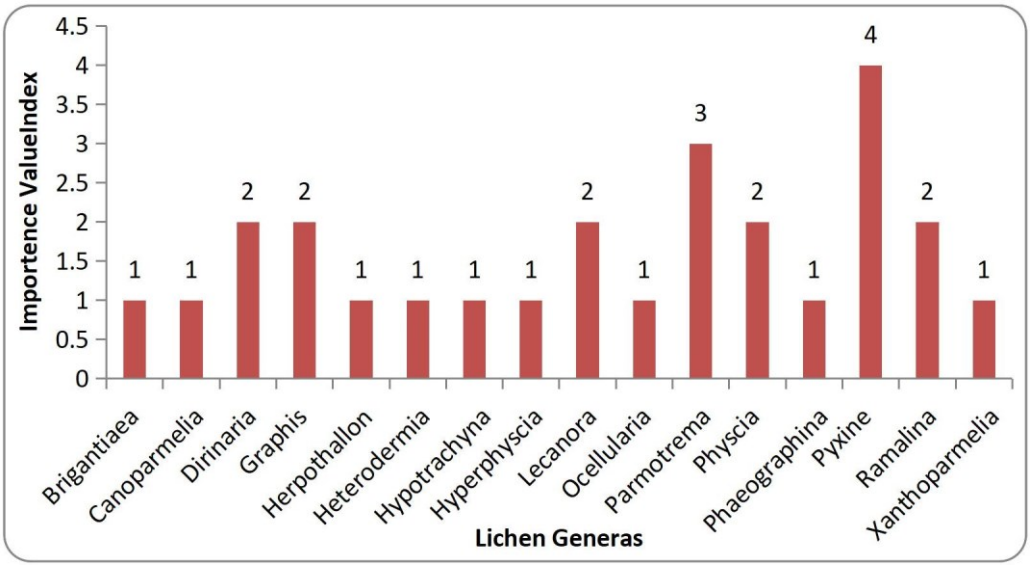

Fig. 4: Graph representing important lichen genera's diversity

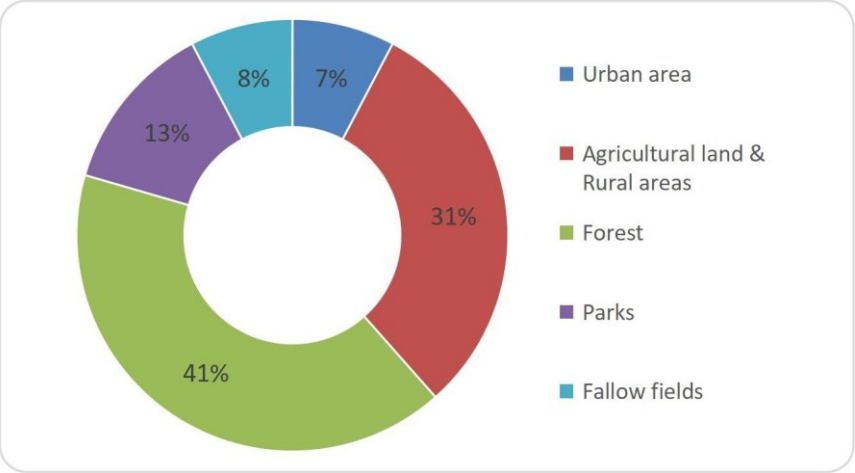

Fig. 5: Pie-chart showing lichen distribution in different habitats

As many as 3236 lichen species across 487 genera and 88 families are reported from India (Sinha *et. al.*, 2025). Singh and Sinha (1997) divided India into eight lichenographic regions. Davangere district which lies in the track of Western Ghats harboured 26 lichen species which is comparatively less. Vinayaka and Krishnamurthy (2017) reported 53 species of lichens belongs to 24 genera and 11 families from the neighbouring district Shivamogga. The lichen diversity in Davanagere is moderate but significant contribution to flora of Karnataka. Some of the important lichens identified in our study, have been shown in Fig.6.

Table 2: Diversity of lichen biota with their growth form and substrate

Sl No	Name of the species	Family	Growth form	Substrate Type
1	*Brigantiaea nigra* D.D. Awasthi	Brigantiaceae	Crustose	Corticolous
2	*Canoparmelia texana* (Tuck.) Elix & Hale	Parmeliaceae	Foliose	Saxicolous
3	*Dirinaria aegialita* (Afzel. ex Ach.) B. J. Moore	Caliciaceae	Foliose	Corticolous
4	*D. applanata* (Fée) D.D. Awasthi	Physciaceae	Foliose	Corticolous
5	*Graphis cincta* (Pers.) Aptroot	Graphidaceae	Crustose	Corticolous
6	*G. scripta* (L.) Ach.	Graphidaceae	Crustose	Corticolous
7	*Herpothallon echinatum* Aptroot, Lücking & Will-Wolf	Arthonaceae	Crustose	Corticolous
8	*Heterodermia diademata* (Taylor) D.D. Awasthi	Physciaceae	Foliose	Saxicolous
9	*Hypotrachyna awasthii* Hale & Patwardhan	Parmeliaceae	Foliose	Corticolous
10	*Hyperphyscia adglutinata* (Florke) H. Mayrhofer & Poelt	Physciaceae	Foliose	Corticolous
11	*Lecanora achroa* Nyl.	Lecanoraceae	Crustose	Corticolous
12	*L. indica* Zahlbr.	Lecanoraceae	Crustose	Corticolous

13	*Ocellularia upretii* S. Joshi, Divakar, Lumbsch & Lücking	Graphidaceae	Crustose	Corticolous
14	*Parmotrema praesorediosum* (Nyl.) Hale	Parmeliaceae	Foliose	Corticolous
15	*P. tinctorum* (Despr. ex Nyl.) Hale	Parmeliaceae	Foliose	Corticolous
16	*P. cristiferum* (Taylor) Hale	Parmeliaceae	Foliose	Corticolous
17	*Physcia integrata* (Nyl.) Arnold	Physciaceae	Foliose	Corticolous
18	*P. aipolia* (Ehrh. ex Humb.) Fürnr.	Physciaceae	Foliose	Corticolous
19	*Phaeographina caesiopruinosa* (Fée) Müll. Arg.	Graphidaceae	Crustose	Corticolous
20	*Pyxine cocoes* (Sw.) Nyl.	Caliciaceae	Foliose	Corticolous
21	*P. farinosa* Kashiw.	Caliciaceae	Foliose	Corticolous
22	*P. petricola* var. pallida Swinscow & Krog	Caliciaceae	Foliose	Corticolous
23	*P. reticulata* (Vain.) Vain.	Caliciaceae	Foliose	Corticolous
24	*Ramalina nervulosa* (Müll. Arg.) Abbayes	Ramalinaceae	Fruticose	Corticolous
25	*R. conduplicans* Vain.	Ramalinaceae	Fruticose	Corticolous
26	*Xanthoparmelia congensis* (B. Stein) Hale	Parmeliaceae	Foliose	Saxicolous

A greater abundance of lichens was observed on the bark of tree such as *Terminalia paniculata*, *Areca catechu*, *Polyalthia* sp., *Bombax ceiba*, *Cocos nucifera*, *Ziziphus* spp., *Delonix regia*, *Careya arborea*, and *Mangifera indica*. In contrast, lichens were absent on the bark of *Xylia xylocarpa* and *Tectona grandis*. Certain tree species, including *Lagerstroemia microcarpa*, *Eucalyptus* spp., *Terminalia arjuna*, and *Aegle marmelos*, appeared unsuitable for lichen colonization, possibly due to their peeling and unstable bark nature, which may hinder lichen establishment and persistence.

After the Rio Convention on biodiversity in 1992, interest in conservation biology has rapidly increased all over the world, including concern for lower plants (Sonderstrom *et, al.*1992: Pant, 1986). However, most of the countries lack preliminary information on the conservation of lichens. Therefore, it is particularly important to encourage, landscape and environmental specific case studies on lower plants. Further, sharing such information through long term collaborations and networking taxonomists, ecologists and local communities all over world is required (Negi and Gadgil, 1997; Vinayaka, 2016).

Baseline studies are crucial for building a foundational understanding of lichen diversity in regions where such information is scarce or entirely absent. In areas like Davangere, where lichenological records are limited, these surveys serve as the first step in identifying the presence, abundance and distribution of species. Without this basic information, it is difficult to monitor ecological changes, detect species loss or assess environmental health over time. Lichens, being sensitive to environmental disturbances, are important bioindicators, and their baseline documentation allows for future comparisons that can reveal the impacts of urbanization, pollution or climate change. Moreover, such studies help in identifying species with potential ecological, medicinal or industrial value. They also guide conservation efforts by highlighting areas with rich or rare lichen diversity that may need protection. In other words baseline data provide the groundwork for informed ecological management, scientific research and sustainable use of local biodiversity resources.

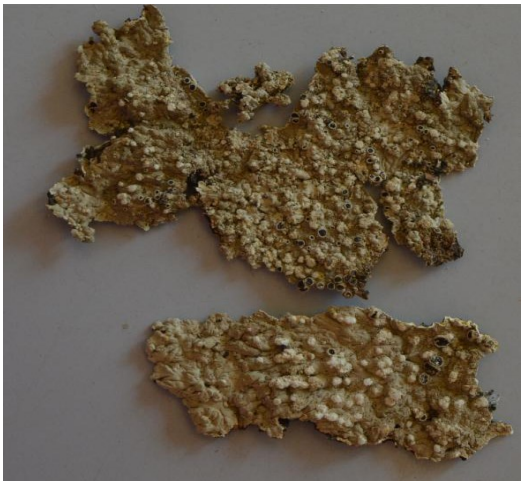

Fig. 6a *Pyxine farinosa*

Fig 6b *Physcia integrata*

Fig 6c *Ramalina nervulosa*

Fig 6d *Dirinaria aegialita*

Fig 6e *Canoparmelia texana*

Fig 6f *Parmotrema praesorediosum*

Fig.6. Some of the important lichens identified in our study

CONCLUSION

This is the first report of occurrence and distribution of lichen from Davanagere district. The recording of 26 species underlines the ecological significance of lichens in this area More long-term monitoring and larger-scale studies are advised to better grasp temporal patterns and the influence of environmental changes on lichen populations.

Acknowledgement

We were thankful to The Chairman, Department of Botany, Davanagere University for providing the facilities and Director, CSIR - National Botanical Research Institute, Lucknow for their co-operation to carry out the study.

REFERENCES

- Awasthi, D.D. 1991. A key to the microlichens of India, Nepal and Sri Lanka. *Bibliotheca Lichenologica*, 40: 1–337.
- Awasthi, D.D. 2007. *A Compendium of the Macrolichens from India, Nepal and Sri Lanka*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India, pp. 1–580.
- Brunialti, G. and Giordani, P. 2003. Variability of lichen diversity in a climatically heterogeneous area (Ligaria, NW Italy). *Lichenologist*, 35: 55–69.
- Culberson, C.F. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography*, 72: 113–125.
- Hale, M.E. 1983. *Biology of Lichens*. 3rd Edn., Edward Arnold Publishers Ltd., London.
- Kappen, L. 1973. Response to extreme environments. In: Ahmadjian, V. (ed.), *The Lichens: Microclimatic Niches*. Academic Press, New York, pp. 310–380.
- Kumar, M. & Stephen, S. 1997. Lichen flora of Western Ghats: an appraisal. *Journal of Economic and Taxonomic Botany*, 21(1), pp. 27–39.
- Magurran, A.E. 1988. *Ecological Diversity and its Measurement*. Princeton University Press, New Jersey, pp. 1–179.
- Nayaka, S. and Upreti, D.K. 2002. Lichens flora of Sharavathi River Basin, Shimoga district, Karnataka, India, with six new records. *Journal of Economic and Taxonomic Botany*, 26(3): 627–648.
- Negi, H.R. 2000. On the patterns of abundance and diversity of macrolichens of Chopta- Tungnath in the Garhwal Himalaya. *Journal of Bioscience*, 80: 571–589.
- Negi, H.R. and Gadgil, M. 1997. Species diversity and community ecology of mosses: A case study from Garhwal Himalaya. *International Journal of Ecology and Environmental Sciences*, 23: 445–462.
- Orange, A., James, P.W. and White, F.J. 2001. *Micro-*

Chemical Methods for the Identification of Lichens. British Lichen Society, London, UK, pp. 1–30.

- Pant, G. 1986. *Ecology and distribution of lichens in India*. In: Dhar, U. & Kachroo, P. (Eds.), Environment and Forests, Vol. II. Today & Tomorrow's Printers and Publishers, New Delhi, pp. 189–200.
- Singh, K.P. and Sinha, G.P. 2010. *Indian Lichens: An Annotated Checklist*. Botanical Survey of India.
- Sinha, G.P., Nayaka, S. and Mishra, G.K. 2025. A comprehensive checklist of lichens from India-2024. *Cryptogam Biodiversity and Assessment*, 8(2): 1–134.
- Soderstrom, L., Jonsson, B.G., & Rydin, H. 1992. *Biological and ecological characteristics of epiphytic lichen flora and their substratum preferences*. In: Nimis, P.L., Scheidegger, C., & Wolseley, P.A. (Eds..
- Uday Kumar Sen. 2018. Assessment of diversity, population structure, regeneration and conservation status of tree species in a sacred grove of west Midnapore district, West Bengal, India, *International Journal of Botany Studies*, 3(3), pp. 33-42
- Upreti, D.K., Divakar, P.K. and Nayaka, S. 2005. Diversity of lichens in India: A review. *ENVIS Newsletter on Tropical Forest Ecosystems*.
- Vinayaka, K.S. 2016. Diversity and distribution of tropical macrolichens in Shettihalli Wildlife Sanctuary, Western Ghats, Southern India. *Plant Science Today*, 3(2): 211–219.
- Vinayaka, K.S. and Krishnamurthy, Y.L. 2017. Pattern of distribution and substrate specificity of macrolichens in Shimoga district of Southern India. In: *Biodiversity Assessment: Tool for Conservation*. Bhumi Publishing, Kolhapur, pp. 112–129.
- Vinayaka, K.S., Krishnamurthy, Y.L. and Nayaka, S. 2010. Macrolichen flora of Bhadra Wildlife Sanctuary, Karnataka, India. *Annals of Forestry*, 18(1): 81–90.