Reprints
A new Balladyna species from Kerala, India
V.B. Hosagoudar, Jacob Thomas, S.S. Shaji and P.P. Rajeshkumar

Abstract: A new species, Balladyna salaciae, infected the leaves of Salacia oblonga, collected from Silent Valley National Park of Palghat district in Kerala state has been described and illustrated in detail.

Keywords: Balladyna, new species, Salacia, Kerala, India

Introduction

During a survey of the foliicolous fungi in the Western Ghats region of Kerala state, a black mildew fungus was collected on the leaves of Salacia oblonga (Hippocrataceae) from the Silent Valley National Park of Palghat district in Kerala State. Microscopic examination of the fungus revealed the presence of unicellular appressoria, mycelial setae, globose ostiolate perithecia, having successively maturing asci with uniseptate brown ascospores. These are the characteristics of the genus Balladyna.

Taxonomy

Balladyna salaciae sp. nov. (Fig.1)

Coloniae hypophyllae, dense, crustose, ad 4 mm diam., confluentes. Hyphae straights to undulate, regularly acute or laxely ramose, arte reticulatae et formans rete mycelialis, cellularae 19-36 x 6-7 µm. Appressoria numerosa, alternata vel unilateralis, unicellularis, antrorsa vel retrorsa, recta vel curvula, integra vel leniter angularis, clavata, recta vel variae curvula, 12-19 x 7-10 µm. Setae myceliales numerosae, dispersae, simplices, rectae, flexuose, ad apicem acute vel obtuse, ad 140 µm longae. Perithecia dispersa, moderatim numerosa, stipitata ad initio, subsessilia ad maturitatem, ovata, globosa, ostiolata, 100-150 x 60-80 µm; asci pauci, globosi vel ovati, paraphyses hyalinus ascis interspersae, 4-6 spori, bitunicati, 60 µm in diam., wall thick; ascospores conglobatae, oblongae, brown, uniseptatae, 28-36 x 14-17 µm, wall smooth.

Materials examined: On the leaves of Salacia oblonga Wallich ex Wight & Arn. (Hippocrataceae), Silent Valley National Park, Palghat, Kerala, India, June 17, 2007 Jacob Thomas & al  HCIO 48257 (type), TBGT 2996 (isotype).

The genus Balladyna belongs to the obligate biotrophs of the group ‘Black mildews’ and their host range is restricted to the members of the corresponding host family. This genus represents 15 species infected the members of the family Rubiaceae, Annonaceae, Strychnaceae and Verbenaceae (Hosagoudar, 2004). Since there is no report of the genus Balladyna on the members of the family Hippocrataceae, it is described here as a new species.

References

GLOMUS TAIWANENSIS, A NEW RECORD TO KERALA STATE

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SUMMARY

The study of the mycorrhizal association in different forest types in Silent Valley National Park has been initiated. Three field tours conducted to the study area resulted in recording several mycorrhizal spores belonging to the genera: Acaulospora, Gigaspora, Scutellospora, Glomus and Sclerocystis. Of these, Glomus taiwanensis is recorded here for the first time from the soil of Kerala state.

Key words: Mycorrhiza, Glomus taiwanensis, Silent Valley National Park

Introduction

Fungi are ubiquitous in nature and are the second largest biota after the insects. The fungal wealth above the ground has got attention of the Mycologists but inside the soil has attracted attention during the recent past. Soil is the store house for both pathogenic and saprophytic microbes. The third group is symbiotic microbes which influence the productivity, growth and yield of the plants. In this symbiotic association, mycorrhiza plays an important role by associating the fungal hyphae with the root of the plants. In this association, fungi receive carbohydrates from the plants while the plants receive mobilized phosphorous and other nutrients from the soil through Arbuscular mycorrhizal fungal hyphae. These fungi form vesicles, arbuscules and the hyphae inside the cortex of the root hairs which bear spores both inside and outside and sporocarp out side the roots.

Western Ghats of India are rich in biodiversity and sheltered for many endangered and endemic macro biota. Estimation of microbiodiversity of this area remains as an unopened book. Due to the highly enriched species diversity and vast landscape, the whole area of Western Ghats cannot be considered for the microbial estimation at a time. As part of the microbial diversity of Western Ghats, an attempt has been made here to survey the Mycorrhizal fungal flora of the Silent Valley National Park, the most important Tropical Rain Forest of Western Ghats.

Three field collection trips were conducted to the study area, collected the soil samples of required quantity from grasslands, evergreen forests, reverine areas, followed the standard procedure in the isolation of spores (Gerdmann & Nicolson, 1963). During this study, several mycorrhizal spores belonging to the genera Acaulospora, Gigaspora, Scutellospora,
Glomus and Sclerocystis have been isolated. To our interest, we could isolate the sporocarp bearing mycorrhizal fungus and review of the literature revealed that it is hitherto unrecorded fungus from the state of Kerala. Hence, the report.


Sporocarp globose, brown to dark brown, up to 152 µm in diameter, comprised ca. 190 chlamydospores. Chlamydospores formed radially in single, tightly packed layer around a central plexus of hyphae, clavate to cylindrical, cinnamon brown, 65- 80 µm long, 28-32 µm broad at the upper portion, 9-18 µm broad at the lower portion, wall two layered, external one thin and hyaline, inner layer brown in colour, apical portion of the wall deep golden brown, 9-13 µm thick, 2-3 µm thick laterally. Central portion pale yellow and typically distinct from the wall, stalk pale brown, continuous, 9-21 x 2-5 µm, central plexus up to 72 µm in diameter.

Materials examined: Isolated from the soil of the evergreen forest of Chempotty, Neelikkallu forest, Silent Valley National Park, Palghat, Kerala, June 13, 2007, Shaji & al TBGT (Mycorrhiza slide no. 31), live culture pot no. 31.

This species was reported from Taiwan (Wu & Chen, 1987) and later it was collected from the scrub jungles of Maruthamalai forests in Coimbatore, Tamil Nadu (Muthukumar & Udaiyan, 2002). Now this species is reported here for the first time from the evergreen forests of Kerala state.

ACKNOWLEDGEMENTS

We thank Dr. S. Ganeshan, Director, TBGRI, Palode for the facilities. We are grateful to the Ministry of Environment and Forests, New Delhi for sponsoring this work and Forest Dept., Govt. of Kerala for the permission to carryout the work in the Silent Valley National Park.

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14. OCCURRENCE OF ENDOMYCORRHIZAL FUNGI IN POOCHIPARA FORESTS IN SILENT VALLEY NATIONAL PARK IN KERALA STATE

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The term mycorrhiza was coined by Frank in 1885 for representing fungus root association. About 95% of the vascular plants are harbored with mycorrhizal fungi as symbiont. The root associating micro fungi depend on their host for water and mineral absorption, growth enhancers like hormones and metabolites production and disease resistance. In turn, mycorrhizal fungi are getting carbon source from their host. Based on the nature of infection and hyphal penetration, mycorrhizal fungi are grouped into ectomycorrhizae, endomycorrhizae and ectendomycorrhizae. Silent Valley National Park has four forest sections, Sairandri, Neelikkalau, Poochippara and Walakkad. Due to most diversified flora and fauna, Poochippara section has been selected for endomycorrhizal study. Dominant plants were selected from grass lands, ever green forests and shola forests. Soil samples, approximately 100gm, collected along with feeder roots and diagonal separation was done. Spore count determined by wet sieving and decanting method. Morphologically similar spores were isolated and mass multiplication was done by using Zea mays and Sorghum bicolor as culture pot plants. Healthy spores were isolated from the mass multiplied soil and permanent slides were prepared by using DPX. Percentage of AM fungal colonization in roots were determined. Climatic factors have an influence on distribution and colonization of endomycorrhizal fungi in the study area. The pattern of distribution also varies depending on vegetation type and altitude. The spore count showed maximum in ever green forests and minimum in grass lands except Thoppimala grass lands. It also showed maximum in rainy season and minimum in summer season. The percentage of root colonization also followed the same pattern. Spores isolated are belonging to the genus Glomus, Acaulospora, Gigaspora and Sclerocystis.

15. QUALITY EVALUATION OF CURED VANILLA BEANS OF SOUTH INDIA

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Plants are the natural source of important biomolecules. Vanillin is one such important flavouring molecule used in the Food and beverage industry, Pharmaceutical industry, Cosmetic industry, obtained naturally form the orchid, Vanilla planifolia (Andrews). In Indian subcontinent, vanilla is grown mainly in the southern parts of India (Western Ghats), especially in Karnataka, Kerala and to certain extent in south western parts of Tamil Nadu. Cured vanilla beans were obtained from the major farms/processing centres and subjected to sensory evaluation, colour estimation, estimation of vanillin and other aroma constituents.
Curcuma bhatii (R.M. Sm.) Skornickova & M. Sabu (Zingiberaceae) and its mycorrhizal association

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Curcuma bhatii (R.M. Sm.) Skornickova & M. Sabu (Paracautleya bhatii R.M. Sm.) (Zingiberaceae) is an endemic, threatened plant (Nayar & Sastry 1988). It is the smallest southern Indian Zingiberaceae with a height of 12–15 cm (Sabu 2006) (Image 1a), having short rhizomes. It grows in the crevices of laterite rocks. It is found in a few scattered populations in Udupi District, Karnataka State, which is its type locality. The plant goes under dormancy for about six months by withering its aerial portion. Since, it is difficult to establish it in ex situ, it prompted us to study its microbial association which plays an important role in the nutrition of the plants. This plant was collected from its natural habitat for the mycorrhizal study and the voucher specimen is deposited in TBGRI (Mathew Dan no. 67521).

Methods: The rhizosphere soil sample of the plant was collected for isolation of arbuscular mycorrhizal spore by wet sieving and decanting method (Gerdemann & Nicolson 1963). Root hairs were cut into small pieces (ca. 1cm), decolourised by boiling them in 10% KOH for one hour, cooled to room temperature, washed thoroughly in distilled water, stained with Lactophenol-cotton-blue to study the presence of vesicles and arbuscules (Philips & Hayman 1970).

The percentage of mycorrhizal colonization was calculated as:

\[
\text{Percentage of colonization} = \frac{\text{No. of mycorrhizal root segments}}{\text{Total no. of root segments observed}} \times 100
\]

The relative frequency of spores was calculated as:

\[
\text{Relative frequency} = \frac{\text{No. of isolate for each species}}{\text{Total no. of isolates}} \times 100
\]

Fungal spores were identified on the basis of spore morphology (Schenk & Perez 1990).

Result: Root colonization and AM spore count were determined. Curcuma bhatii revealed 95% infection (based on the above formula) and showed about 290 spores per 100g soil. Vesicles and hyphae were present in the roots. The mycorrhizal infection restricted to the epidermis and did not penetrate in to endodermis. Hyphae 2–7 µm broad. Vesicles globose to elongate, 25–50 x 17–20 µm, present in both intercellular and intracellular layer of cortical cells. Spores isolated from the rhizosphere soil belonged to Glomus aggregatum, G. glomerulatum, G. multicaule and Sclerocystis pachycaulis. The spores of Glomus aggregatum and Sclerocystis pachycaulis showed maximum relative frequency (Table 1).

Glomus aggregatum Schenck & Smith, 1982
Mycologia 74 (1): 80, 1982. (Image 1 b,c)

Material examined: 24.vii.2010, spores isolated

Table 1. Relative frequency of spores

<table>
<thead>
<tr>
<th>Species name</th>
<th>Relative frequency</th>
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</thead>
<tbody>
<tr>
<td>Glomus aggregatum</td>
<td>33%</td>
</tr>
<tr>
<td>G. glomerulatum</td>
<td>10%</td>
</tr>
<tr>
<td>G. multicaule</td>
<td>23%</td>
</tr>
<tr>
<td>Sclerocystis pachycaulis</td>
<td>32%</td>
</tr>
</tbody>
</table>

Acknowledgements: We thank Dr. A. Subramoniam, Director, TBGRI, Palode for the facilities and Dr. R. Rejukrishnan for locating its new populations.
from the rhizosphere soil of *Curcuma bhatii* (R.M. Sm.) Skornickova & M. Sabu (Zingiberaceae), Udupi District, Karnataka, coll. P.P. Rajeshkumar, Slide no. TBGT 141.

Chlamydospores formed in loose clusters or in sporocarps without peridium. Sporocarps are of variable size ranging from 800–1000 µm, hyaline to light yellow with a greenish tint in transmitted light. Chlamydospores globose, subglobose, obovate, irregular, 40–50 x 40–50 µm, hyaline to yellow; wall yellow to yellowish-brown, 1–3µm thick, outer wall slightly thicker and lighter in colour than the inner wall. Hyphae at the point of attachment to spore up to 8µm wide. Spore contents continuous with hyphal contents in young spores but get separated from the hyphal content in older spores by the inner spore wall; pore not occluded by hyphal wall thickening. Hyphal attachment straight to recurved sharply at the base of the spores.

*Glomus glomeratum* Sieverding
Mycotaxon 29: 74, 1987 (Image 1d)


Chlamydospores globose, yellowish-brown, up to 64µm in diam. Composite spore wall composed of two wall layers (wall 1 & 2) in one group (group A); wall 1 is yellow to brown, laminate and up to 3µm thick, on the surface of this wall a layer of hyphae is adherent but normally the spore surface is smooth; wall 2 is hyaline, membranous, up to 0.5µm thick and normally adherent to wall 1. Chlamydospores have two attached hyphae, yellow, straight to recurved. The pore of the hyphal attachment 1.6µm in diam. The pore is closed by second wall. Spore content hyaline, oily.

*Glomus multicaule* Gerdemann & Bakshi, 1976


Sporocarps not seen. Chlamydospores dark brown, 167–200 µm in diam., subglobose with four hyphal attachments, attachments generally occur at opposite ends of the spore. Spore wall up to 15µm thick, thickest at the point of hyphal attachments, rounded projections up to 1.6µm thick, regularly distributed over the wall surface.

*Sclerocystis pachycaulis* Wu & Chen, 1985
Taiwania 31: 74, 1986 (Image 1f)


Sporocarp yellowish-brown, globose, 200–280 µm, consisting of terminal chlamydospore arranged on a central plexus of hyphae. Peridium not seen. Chlamydospores yellow to yellowish-brown, ovoid to ellipsoid, 32–40 x 22–27 µm, wall yellowish-brown, up to 3µm thick, with hyaline, separable outer layer, <1µm thick, usually chlamydospore content separated by 1–2 adventur septa below the spore attachment of attached hyphae. Attached hyphae up to 6.5µm with thick wall. Wall thickness of attached hyphae extending down for some distance, usually thicker than the chlamydospore wall.

Discussion
The plants grow on the shallow deep soil on rocks and crevices where the soil appears to be poor in nutrients, a condition which favours mycorrhizal fungi. Soil analysis study may prove this statement. Presence of characteristic mycorrhizal association points out the habitat specificity of this narrowly endemic species.

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