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LAL BAHADUR SHASTRI GOVERNMENT DEGREE COLLEGE
SARASWATI NAGAR-171206
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A NAAC ACCREDITED 'B^{+}' COLLEGE

Research Activities

The faculty members of the college are actively engaged in research activities and regularly participate in national and international conferences/workshops as well as regularly publish quality research papers in reputed journals of their respective fields. Most of the faculty members hold Ph.D. degree in their respective subjects.

The college also organizes conferences/workshops in collaboration with other colleges, one such conference with the theme "**A New world order: Resilience and Reinvention**" was organized in the month of December 2020. The report of the conference can be found here:

https://www.lbsgcsnagar.edu.in/pdf/International%20Conference.pdf

The Department of Chemistry organized a Two days workshop on instrumentation and Chemistry Practicals in the month of November 2022. Astt. Prof. Raveena Thakur, Instumentation Instructor cum In-charge, Chemistry Department, GGDSD College, Sector - 32 C, Chandigarh, was the invited speaker for this workshop. More than 100 students from various colleges participated in this workshop. The detailed report of the workshop can be found here:

https://www.lbsgcsnagar.edu.in/pdf/Chemistry%20Webinar.pdf

The college has many apparatus which aid in research work such as a UV/Visible Spectrophotometer, a double distillation unit, Autoclave, Microtome, LCD projection Microscope, Microbiological Shaker, tissue homogenizer.

Following are the recent publications of the faculty members in Journals notified on UGC Website:

Bot. Rev. (2018) 84:108–155
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REVIEW

Studies on Ectomycorrhiza: An Appraisal

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Abstract Ectomycorrhizal (ECM) fungi are obligate symbionts of dominant vascular plants, liverworts and hornworts. There are reports of about 20,000 to 25,000 ECM fungi that promote plant growth by facilitating enhanced water and nutrient absorption, and provide tolerance to environmental stresses. These below-ground fungi play a key role in terrestrial ecosystems as they regulate plant diversity, nutrient and carbon cycles, and influence soil structure and ecosystem multifunctionality. Because ECM fungi are obligate root symbionts, host plant can have a strong effect on ECM species richness and community composition. The biogeographic pattern and detailed functioning and regulation of these mycorrhizosphere processes are still poorly understood and require detailed study. More recent researches have placed emphasis on a wider, multifunctional perspective, including the effects of ectomycorrhizal symbiosis on plant and microbial communities, and on ecosystem processes. Over the years the main focus in ECM research has been on the study of diversity and specificity of ECM strains, the role of ECM in regeneration of degraded ecosystem, the growth and establishment of seedlings through nutrient acquisition and the mediation of plant responses to various types of stress. In this review, recent progresses in ectomycorrhizal biology are presented, especially the potential role of ECM symbioses in resistance or tolerance to various biotic and abiotic stresses, and in maintinance of plant diversity for proper ecosystem functioning.

Keywords Ectomycorrhizal symbiosis · Ecosystem · Evolution · ECM diversity · Afforestation

Introduction

It was Albert Bernard Frank (1885), a forest pathologist, who for the first time introduced the term mycorrhiza. In Greek language "mykes" refers to Fungus and "rhiza" refers to Root. Since Frank's description of mycorrhizal association in 1880's (Frank, 1885), a lot of work has been generated by different investigators as a consequence of which it is estimated that 86% of terrestrial plant species are benefited as they acquire their mineral nutrients via mycorrhizal roots (Brundrett, 2009). In fact the mutualistic phenomenon of symbiosis has been reported to result from the co-evolution between plants and fungi and became essential and obligatory for terrestrial

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New records of lamellate mushrooms associated with Sal from Shiwaliks, India

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ABSTRACT

This paper deals with four new records of fungal taxa from India. These were collected from Shiwalik range of North West, India, in association with *Shorea robusta*. These include *Amanita battarrae* (Boud.) Bon, *Asproinocybe lactifera* Heim., *Russula chlorinosma* Burl. and *R. nobilis* Velen. Morphological and microscopic characters are described and illustrated.

Key words: Ectomycorrhiza, diversity, Sal forest, taxonomy.

INTRODUCTION

Agarics are cosmopolitan basidiomycetous fungi which grow in a wide variety of habitats, from the tropics to arctic. These are mostly saprophytes and many of them form mycorrhizal association with variety of plants including trees. Studies on taxonomy and diversity of agarics are inviting more attention now a day's primarily because of their importance in human welfare and role in ecosystem functioning and stability. Although these macro-fungi are an integral part of the ecosystem, knowledge on their diversity in the tropical and subtropical regions including India are largely understudied (Lakhanpal, 2014). Many species are important as a source of food, medicine, nutraceuticals and also play a pivotal role in ecosystem strengthening and maintenance as mycorrhizal associates (Manoharachary *et al*., 2005). Present investigations are centred on identification of agaric diversity of Sal forests and ectomycorrhizal associates of *Shorea robusta* (Sal).

While investigating the EcM diversity of Sal forest, four taxa, *viz. Asproinocybe lactifera* Heim, *Russula chlorinosma* Burl., *Amanita battarrae* (Boud.) Bon, and *Russula nobilis* Velen were recorded for the first time from India (Upadhyay *et al*., 2017). These species are fully illustrated and described in this paper. Genus *Asproinocybe* forms a new genus record for India and earlier this genus was recorded from subtropical and tropical Africa (Heim, 1970; Heinemann, 1977), Malaysia, Mexico, Hungary (Guzmán *et al.,* 2004) and New Zealand and Australia (Lebel *et al*., 2020).

MATERIALS AND METHODS

Study area: Area selected for the present investigation is Sal forests of Shiwalik mountain range of North West India, which are geologically the lowest and youngest mountain range of Himalaya. The study area is located between 290° 58/ -310° 2/ -Northern latitude and 770° 34/ -78° 18/ -Eastern longitudes. Average elevation of the area is 400-1500 m and vegetation of the area is typical of tropical moist deciduous forests (Champion and Seth, 1968). *Shorea robusta* purely dominates the Sal forests of Shiwalik Mountain.

Sampling, identification and characterization: Sporocarps were collected from different localities of pure Sal forests, during the rainy season of 2014-2016. Macromorphological features were recorded from fresh collections in the field and colour codes used are that of Kornerup and Wanscher (1978). After noting down morphological characters on the field key (Atri *et al*., 2005) some pieces of sporocarps from cap and stipe were preserved in liquid preservative [25 mL rectified alcohol (95%) + 5 mL formalin (37%) + 70 mL distilled water] for studying the microscopic characters. By adopting the standard procedures spore deposit was taken (Singer, 1986). Sporocarps were air dried at 40-45°C in a wooden drier especially designed for drying mushroom specimens (Atri *et al*., 2005). The dried specimens were finally packed in cellophane paper packets for permanent preservation in Punjabi University Herbarium under PUN. In each such packet small perforated sachets of Paradichlorobenzene was kept so as to check insect infestation. The cross sections of pileus and longitudinal section of stipe cut from wet/dried preserved material with the help of rajor blade were examined and details drawn under a compound microscope with the help of camera lucida and photographed under digital microscope (Leica DM4000 B LED). Line drawings and observation of basidia, cystidia and elements of pileipellis and stipitipellis were taken after staining the slides with Congo red. Melzer's reagent was used to observe the amyloidy in basidiospore ornamentation. The microscopic details were worked out as per standard methodology (Singer, 1986; Atri *et al*., 2017).

Scanning electron microscopy (SEM): Scanning electron microscopic (SEM) studies were carried out with JSM6610LV GEOL scanning electron microscope. For SEM examination basidiospores from spore print and lamellae tissue were mounted on a double-sided adhesive tape pasted on a metallic specimen holder or stub. The material was scanned at different magnification ranging from 3000-15000X in high vacuum mode to observe pattern of spore ornamentation.

TAXONOMIC DESCRIPTION

Asproinocybe lactifera Heim, *Revue de Mycologie* (Paris) **34** (4): 343, 1970. **Figs. 1(A-G) & 2(A-H)**

Basidiomata 8-13 cm in height. Pileus 8-13 cm diam., convex, flattened depressed to slightly infundibuliform at maturity; margin regular, non-splitting, surface greyish violet to deep violet (17B4/17D8) with orange white (6A2) tinge in the centre and dark violet (15F8) broken ring around the submarginal region of the pileus; margin feebly

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CHARACTERISATION AND IDENTIFICATION OF ECTOMYCORRHIZAE OF *RUSSULA* (RUSSULACEAE: BASIDIOMYCOTA) ASSOCIATED WITH *SHOREA ROBUSTA*

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The tropical moist deciduous forests of India are largely dominated by the dipterocarp tree *Shorea robusta* (also known as sal). Ectomycorrhizal (ECM) fungi form symbiotic association with sal trees and play an important role in the stability of the sal forests. A study was carried out to determine the occurrence and distribution of ECM fungi in tropical sal forests at the Shiwalik mountain range, north-west India. The genus *Russula* was the dominant fungi. In this paper the morphoanatomical details of mycorrhizal roots of *S. robusta* associated with three *Russula* species, namely, *R. cremeoavallanea, R. romagnesiana* and *R. nigricans* were investigated for the first time. The ECM colonised roots were distinguished by differences in the shape and colour of mycorrhizal system, surface texture, shape and size of cystidia, cell shape of mantle, as well as the differing chemical reactions. ECM roots of sal associated with *R. cremeoavallanea* were mostly greyish brown and have almost plectenchymatous outer mantle layers having subcylindrical to awl-shaped cystidia. Ectomycorrhizal roots of *R. romagnesiana* were reddish brown with silvery patches, and have purely plectenchymatous outer mantle layers having obpyriform to obclavate cystidia. *Russula nigricans*-associated ectomycorrhizal roots have greyish brown to black mycorrhizal system and have almost pseudoparenchymatous dark brown mantle with capitate cystidial elements.

Keywords: Dipterocarpaceae, Hartig net, sporocarps, rahizomorphs, sal, Shiwalik

INTRODUCTION

Shorea robusta which is commonly known as sal, is an important source of hardwood timber tree in India. It is a major constituent of moist deciduous broad-leaved tropical forests in India. The species is dominantly distributed on the plains, lower foothills and valleys of the Himalayas. Mycorrhizal fungi are ubiquitous and essential components of most ecosystems and are considered key ecological factors in governing and maintaining the terrestrial ecosystem (Wang et al. 2017). Ectomycorrhizal (ECM) associations are also considered key factors for the survival and growth of sal seedlings and trees by supplying nutrients to host plants, particularly immobile nitrogen and phosphorus (Tapwal et al. 2015).

Based on surveys of sporocarps, sal trees have been reported to be putatively associated with species of various fungal genera such as *Russula, Boletus, Agaricus, Amanita, Lactarius, Laccaria, Pisolithus, Suillus* and *Cantharellus* (Natarajan et al. 2005, Tapwal et al. 2013). Many ECM genera have been proposed, but in most of the studies, evidence for hypothesised ECM species is lacking.

The genus *Russula* is one of the highly diverse ECM groups in Agaricomycetes and plays a critical role in maintaining forest ecosystems and biodiversity (Henkel et al. 2011, Corrales et al. 2016). The dominance of *Russula* in low nutrient soil in terrestrial ecosystem has been linked to its unique role in nutrient uptake from the soil (Malysheva et al. 2016, Uesugi et al. 2016). To date, approximately 1100 *Russula* species have been reported worldwide (Kirk 2014) and distributed across a wide range of habitats from the tropics to arctic zones. In an extensive study of ECM fungi of *S. leprosula* occurring in Malaysia, Lee et al. (1997) reported 28 ECM fungi of which, 15 were members of the genus *Russula. Russula* was the dominant component of ECM communities associated with *Castanopsis fargessii* in subtropical evergreen broad leaved forest (Wang et al. 2011). Corrales

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ETHNOBOTANICAL USES OF MEDICINAL PLANTS AMONG THE RURAL PEOPLE OF PABBAR VALLEY IN DISTRICT SHIMLA, HIMACHAL PRADESH, INDIA

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Abstract

An ethnobotanical survey was carried out on traditional use of medicinal plants in folk medicine by local people in Pabbar valley of Himachal Pradesh state, in western Himalaya. The information was gathered from 92 informants through interviews, group discussions and semi structure questionnaire. A total of 61 plant species belonging to 53 genera and 34 families were used as medicinal plants. Leaves (32.91%) were the most used part followed by roots (22.78%). The medicinal plants were used for treating various ailments like; diarrhea, dysentery, cough, cold, fever, wounds, skin problems and reproductive disorder. The traditional prescription of folk medicine include paste, powder, decoction, tea, smoking and direct applications etc. Informant Consensus Factor (ICF) ranges from (0.59) to (0.86) with an average of (0.73); highest ICF for gastrointestinal problems and the Use value varied from (0.2) to (0.83), with *Rheum australe* being most valued plant. The anthropogenic pressure on forest, unscientific exploitation of medicinal plants is causing severe depletion of species in nature. 18 medicinal species reported from the area are in different categories of threat. Suitable measures are needed to conserve and protect the medicinal plant species in local ecosystem for future sustainable use. Further research and documentation of traditional knowledge on medicinal plant should be done before it is lost forever.

Key words : Ethnobotany, Informant Consensus Factor, medicinal plants, Pabbar valley, traditional use, Use value.

Introduction

Utilizing the healing properties of plants is an ancient practice. There are many remote areas in Himalayan region where rural population depend on traditional health care, even though allopathic medicine are available. According to WHO, 65- 80% people of developing countries are dependent on traditional care system (WHO. 2011). The dependency of large number of poor on traditional practices can be thought of as an alternative type of medicine, where the cost and side effects are negligible (Namsa *et al.,* 2011). Today more than 90% of plant species used in herbal industries comes from wild and a large percentage of crude drug (50%) to market comes from western Himalayas (Singh & Rawat,2011). There has been increasing pressure on the commercially valuable biological resources such as medicinal plants. To cater to pharmaceutical industries of state and outside the state about 165 MPS are traded in Himachal Pradesh every year. Out of these species, 24 species are amongst the most traded 100 medicinal plants in India. The total harvest of medicinal plants is more than 2,500 tonnes, which contributes to about INR 14, 000/- annually to the household economy of the collectors (HPMPSP, 2006; Kaisth & Sharma, 2006). The many medicinal plant species are threatened due to over harvesting.

Himachal Pradesh state is part of Western Himalayas, one of the biodiversity hotspots, has 8 forest types and 38 sub-types as per Champion and Seth's classification (1968). The region of Pabbar Valley is located in district Shimla, the eastern most part of state. The area is rich in

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A new texture of neutrino mass matrix with three constraints

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ABSTRACT

We present a new texture of neutrino mass matrix having three complex relations among its elements and study in detail the phenomenological implications. A characteristic feature of the resulting neutrino mass matrix is that the atmospheric neutrino mixing angle is predicted to lie in a very narrow region near 45°. We illustrate how such a form of the neutrino mass matrix can be realized using the non-Abelian flavor symmetry A_4 in the framework of type-I+II seesaw mechanism.

1. Introduction

The neutrino experiments aim to reconstruct the neutrino mass matrix which contains information about neutrino masses, mixing angles and CP-violating phases. We now have rather accurate measurements of the three mixing angles ($\theta_{12}, \theta_{13}, \theta_{23}$) and two mass squared differences ($\Delta m^2_{21}, \Delta m^2_{23}$). However, the octant of θ_{23}, sign of Δm^2_{23}, and CP-violating phases are yet to be determined. The direct and cosmological searches of neutrino mass have considerably reduced the upper bound on the absolute neutrino masses scale. In order to determine the neutrino mass matrix, we need the full knowledge of all the nine physical observables: three neutrino masses, three mixing angles and three CP-violating phases.

Even with the incomplete knowledge of these neutrino parameters, we can still obtain valuable information about the possible structure of the neutrino mass matrix. For example, the not so small value of θ_{13} disfavors Tribimaximal (TBM) [1]. However, the variations of TBM like TM1 and TM2 mixings are still allowed [2,3]. There are many other structures of the neutrino mass matrix like texture zeros [4,5], vanishing cofactors [6], equalities [7], hybrid textures [8] that are consistent with the current neutrino oscillation data.

One can construct models for specific structures of neutrino mass matrix by incorporating flavor symmetries in the standard model (SM) of particle Physics. The first attempt to accommodate TBM mixing scheme in a neutrino mass model was based upon the non-Abelian discrete symmetry group A_4 [9]. Many other non-Abelian discrete symmetry groups were later used to construct neutrino mass models with TBM mixing [10]. The observation of non-zero θ_{13} lead to modifications of such models [11].

Other successful attempts to constrain the structure of neutrino mass matrix are texture zeros and vanishing cofactors. These patters are generally realized using Abelian discrete flavor symmetries. While TBM mixing and its variants predicted mixing angles or relations among them, the texture zeros, vanishing cofactors, and equalities predict relations between neutrino masses, mixing angles, and CP violating phases. Another approach combines variants of TBM mixing with texture zeros/vanishing cofactors [12].

2. Neutrino mass matrix

In the present work we propose the following texture of the neutrino mass matrix in the flavor basis:

$$M_\nu = \begin{pmatrix} x & y & -y \\ y & 2y & z \\ -y & z & -2y \end{pmatrix}. \tag{1}$$

The number of free parameters in the above neutrino mass matrix are reduced from 12 to 6 by imposing three independent relations among the neutrino mass matrix elements:

$$M_{12} = -M_{13} \tag{2}$$

$$M_{22} = -M_{33} \tag{3}$$

$$M_{22} = 2M_{12} \tag{4}$$

The fourth relation $M_{33} = 2M_{13}$, derivable from the first three, is not independent.

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molecules

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Review

Applications of Fruit Polyphenols and Their Functionalized Nanoparticles Against Foodborne Bacteria: A Mini Review

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Abstract: The ingestion of contaminated water and food is known to cause food illness. Moreover, on assessing the patients suffering from foodborne disease has revealed the role of microbes in such diseases. Concerning which different methods have been developed for protecting food from microbes, the treatment of food with chemicals has been reported to exhibit an unwanted organoleptic effect while also affecting the nutritional value of food. Owing to these challenges, the demand for natural food preservatives has substantially increased. Therefore, the interest of researchers and food industries has shifted towards fruit polyphenols as potent inhibitors of foodborne bacteria. Recently, numerous fruit polyphenols have been acclaimed for their ability to avert toxin production and biofilm formation. Furthermore, various studies have recommended using fruit polyphenols solely or in combination with chemical disinfectants and food preservatives. Currently, different nanoparticles have been synthesized using fruit polyphenols to curb the growth of pathogenic microbes. Hence, this review intends to summarize the current knowledge about fruit polyphenols as antibacterial agents against foodborne pathogens. Additionally, the application of different fruit extracts in synthesizing functionalized nanoparticles has also been discussed.

Keywords: fruit types; extraction of polyphenols; antibacterial activity; safety

1. Introduction

Food illness often occurs following the ingestion of contaminated water, food, chemicals, toxins, and pathogenic microbes (such asbacteria, viruses, parasites, and fungi) [1]. As per published literature, most foodborne illnesses are linked to bacteria (66%), and then by chemicals (26%), parasites (4%), and viruses (4%). The two highly common categories of foodborne illness are infections and intoxications [1].