

Ectomychorrhal DB: a symbiotic association database

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Abstract:

Ectomycorrhizal (ECM) fungal species, a “Symbiotic” relationship between trees and fungi in forest has a great ecological and economic importance. Here is an attempt to describe database named “EctomycorrhizalDB”, addressing ECM diversity of Central Himalaya (Kumaun region), with special emphasis on their characterization, physical properties and morphological features along with specifications. This database would help the scientific community to draw a better understanding of the environmental factors that affects species diversity.

Availability: <http://www.kubic.nic.in/ectomychorhiza>

Keywords: Ectomycorrhiza, fungi, Himalayan, HTML, Pubmed, Real time, Database, MeSH, Symbiotic

Background:

Mycorrhizal symbiosis is likely to influence plant nutrition, competition and soil nutrient cycling [1]. The importance of the mycorrhizal colonization for life survival has been widely acknowledged, as 90% of plant species have an association with mycorrhizal fungi [2]. The role of mycorrhizal fungi in nutrient uptake by host plant may vary from one group of fungi to another, and with changing environmental conditions. However, it remains the least known component from the standpoint of species diversity. They are majorly classified into various categories like endo, ecto, ectoendomycorrhiza etc. Ectomycorrhizal (ECM) fungi accounts for 25% or more of the root mass of forest plants such as pine (*Pinus*), spruce (*Picea*), fir (*Abies*), poplar (*Populus*), willow (*Salix*), beech (*Fagus*), birch (*Betula*), dipterocarp, eucalyptus, oak (*Quercus*) and rose families [3, 4]. So, it is representing a major underneath structural component of the forest ecosystem. The Central Himalaya (Kumaun region) shows rich diversity in Oak and Pine trees, accounting ECM association more than 50% [5]. The

importance of ECM fungi in determining plant diversity relative to other mechanisms such as species competition and species coexistence has been studied extensively [6]. Since ECM is considered to be a multipurpose net having about 500 documented uses [7, 8], its importance has been increased many folds in the last few decades. There are distinct assemblages of some new unknown ECM species associated with Gymnosperms/ Angiosperms first time in Central Himalaya in comparison with other species, making the formation of common mycorrhizal networks (CMNs) between them unlikely [3,9]. This academic database is first of its kind available in a public domain worldwide. Considering the ecological and economical significance of ECM in Kumaun region, authors are making first effort to explore this region with the consultation of a taxonomist. The primary goal of this database is to extensively address the published literature on ECM taxonomy, edible properties, morphological features etc. ECMdb is an attempt to give compiled information on various species of mycorrhizae encountered in the same.

Methodology:

DATABASE:

A relationally organized database was designed to serve as a repository of species with Ectomycorrhizal identity. The database was implemented using MySQL (<http://www.mysql.com>), a free-to-use RDBMS while the scripts were written in HTML. Linux web server was used to deliver the interface.



Figure 1: a snap shot of ectomycorrhizal database

Database construction

The methodology followed in constructing ECMdb is as per Middha *et al.*, 2009 [10].

Data collection

Initially an extensive fieldwork was done to collect ECM fungi associated with oak and pine trees. After getting the samples from the field, identifications were made by examining various macroscopic, microscopic, and chemical characteristic as per our previous studies [4]. A search with MeSh terms "Ectomycorrhiza" and "Central Himalaya" or "Kumaun Region" was carried out on all literature databases available such as PubMed [11], ScienceDirect [12], Mary Ann Liebert [13], BlackWell Synergy [14], Scirus [15], Bentham Publishers [16], BioMedAsia [17], Indian Journals [18] and others. This resulted in an initial list of 102. In order to remove cross-database (Xref) redundancy, searches were repeated with the same keyword through the internet, local agencies, researchers, local people through a questionnaires and results downloaded onto local machines. Unless otherwise explicitly stated, all further processing was carried out locally using default parameters.

The final lists of 79 species obtained at this stage were manually scrutinized and scientifically proved 51 species were retained in the database, based on their primary annotations. For every entry, vital information pertaining to the species name, morphological characterization, and their real time pictures, structure, source, were included.

Curation of data

All ECM species identifications, abstracts, titles, and articles were reviewed by two experts, and all divergences were resolved by consensus. We have tabulated all the mycorrhizal genera and species found in the Central Himalaya, particularly

Kumaun region, with their specific host species by conducting an extensive search of contents of the published papers related to macro fungi of the area. ECM pictures exhibited in this database had been clicked by one of the authors and are real time. The major genera in terms of species were Amanita (7 sp.), Russula (4 sp.), Boletus (6 sp.), Lactarius (5 sp.), Hygrophorus (1 sp.) and Cortinarius (2 sp.).

Results:

The ECMdb, thus created using the above mentioned methodology, contains a total number of 51 Ectomycorrhizal species of Kumaun region. The outlook of ECMdb is as illustrated in (Figure 1).

Discussion:

ECMdb provides an easy-to-use web interface with flexibility to select for an entry or a collective set of entries matching user's criteria such as name of the species, morphological features. Empirical evidence of efficacy of this database for mycorrhiza would be helpful to identify areas for potential research in future to provide a rapid review on numerous mycorrhizal species for the benefit of the scientific community.

Future development:

ECM db is the first approach as a free accessible academic real time database for ECM species found in Kumaun region. We are going to incorporate more scientific information regarding mycorrhizal species of this region as well as worldwide. Periodically continuous updates shall be unconfined to embrace other mycorrhizal species. We plan to incorporate a provision to avail the required information using keywords.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

References:

- [1] Karkouri El *et al. Microbiol Res.* 2005 **160**: 47 (2005) (PMC 15782937)
- [2] Pande V *et al. curr Sci.* 2007 **92**: 80
- [3] Wang B & Qiu YL, *Mycorrhiza.* 2006 **16**: 299 (PMID: 16845554)
- [4] Pande V *et al. Curr Sci.* 2004 **86**: 1619
- [5] Reinhardt D, *Curr Opin Plant Biol.* 2007 **10**: 98 (PMC 1712709).
- [6] CJET Yu *et al. Mycorrhiza* 2001 **11**: 167
- [7] Eastwood DC *et al. Science.* 2011 **333**: 762 (PMID 21764756)
- [8] Rosling A *et al. Science.* 2011 **333**: 876
- [9] Bent E *et al. Applied and Environmental Microbiol.* 2011 **3351**: 9
- [10] SK Middha *et al. Bioinformation,* 2009 **4**: 78 [PMC2823386]
- [11] <http://www.ncbi.nlm.nih.gov>
- [12] <http://www.sciencedirect.com>
- [13] <http://www.liebertpub.com>
- [14] <http://www.blackwellsynergy>

[15] <http://www.scirus.com/srsapp/>

[16] <http://www.bentham.org>

[17] www.bma.org.in

[18] www.indianjournals.com

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