

# fungifromindia: the first online initiative to document fungi from India

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**Abstract:** The first on-line fungal website from India has been launched with seven databases of Indian fungi containing 7528 specimen records representing 384 families, 1385 genera, and 5906 species. Every species has been given a unique identity number that can be cited in any publication. Every record in this database has the name checked in MycoBank, and will be linked to other fungal databases throughout the World. This is also the first Indian initiative towards the international documentation of the country's biodiversity.

**Key words:** database, MycoBank, MyCoPortal, mycology.

## INTRODUCTION

Fungi are essential to such crucial activities as decomposition, nutrient cycling, and nutrient transport and are indispensable for achieving sustainable development (Palm & Chapela 1998). The ultimate aim of the present study was to compile the dispersed data on Indian fungi from various mycological resources to give easy access to researchers and students to this important information. The present work has tremendous mycological significance by updating the knowledge of fungi reported so far from every corner of India (Bhide 1987, Butler *et al.* 1960, Crous 2004, Dasgupta 2005, Hosagoudar 1996, Jamaluddin *et al.* 2004, Kamat *et al.* 1971, Lellavathy & Ganesh 2000, Mahabale 1987, Nagarkar 2000, Patel *et al.* 1948, Ranade *et al.* 2011, Ranadive *et al.* 2011, Roy & De 1996, Sharma 1995, Thind 1977). This is the first online Indian resource in the form of

multiple databases on seven groups of fungi. The databases will inspire students as well as researchers to study aphylophoraceous fungi, aquatic fungi, ascomycetes, lichens, mushrooms, myxomycetes and rusts from India (Table 1). These types of user-friendly databases provide information in a very short period which help researchers save time.

## MATERIALS AND METHODS

### Digitization work – Database preparation Manual Card Preparation

More than 8000 reference cards (17.5 × 12.5 cm) were prepared from extensively surveyed Indian literature

including reference books, research papers, explanatory notes, etc. The latest nomenclatural changes were added to the cards with different colored ink. The basic reference is quoted in the right hand corner of the ruled card. The important references of the same species are added on the reverse of the reference card. The information on the card is kept in similar format for all the cards (Fig. 1).

### Digitization

There are many nationally and internationally funded activities being undertaken simultaneously by diverse institutions and agencies in India. Digitization programs however, are in their initial stages and this is now a most favoured activity in the field of information generation, processing, dissemination and preservation. Applying digital technologies is necessarily a complex process of experimentation, involving gains and losses, triumphs and failures (Dasgupta 2005, Nagarkar 2000).

Since Indian decision makers now understand that information is power, and that information-based decision making has become the order of the day, the Government of India and other agencies are taking steps to improve telecommunication and other technical facilities to make IT based information access a reality and contribute to a substantial improvement in the quality of life of every Indian (Dasgupta 2005).

### Database Building

The database management system used is MySQL Server 5.0, the serverside script : PHP 5.2.9, and the server Apache 2.2,

**Table 1.** The databases represented in fungifromindia.

Databases <sup>1</sup>	Records in the databases			
	Families	Genera	Species	Total
IAD	52	190	1217	1646
IMD	11	50	351	394
IMFD	52	146	233	233
IASD	128	460	1160	1604
IMUD	31	98	286	335
IRFD	25	93	221	227
ILD	85	348	2438	3089
<b>Total</b>	<b>384</b>	<b>1385</b>	<b>5906</b>	<b>7528</b>

**Abbreviations:** IAD, Indian Aphylo-Fungal Database; IMD, Indian Myxomycetous Database; IMFD, Indian Marine Fungal Database; IASD, Indian Ascomycetous Fungal Database; IMUD, Indian Mushroom Database; IRFD, Indian Rust Fungal Database; and ILD, Indian Lichen Database.

Short form of the reference at right hand side top corner  
 Recent name of the species  
 Old name of the species  
 Family  
 Host  
 Locality  
 Distribution  
 Reference cited

Fig. 1. Record card used in the fungifromindia database.

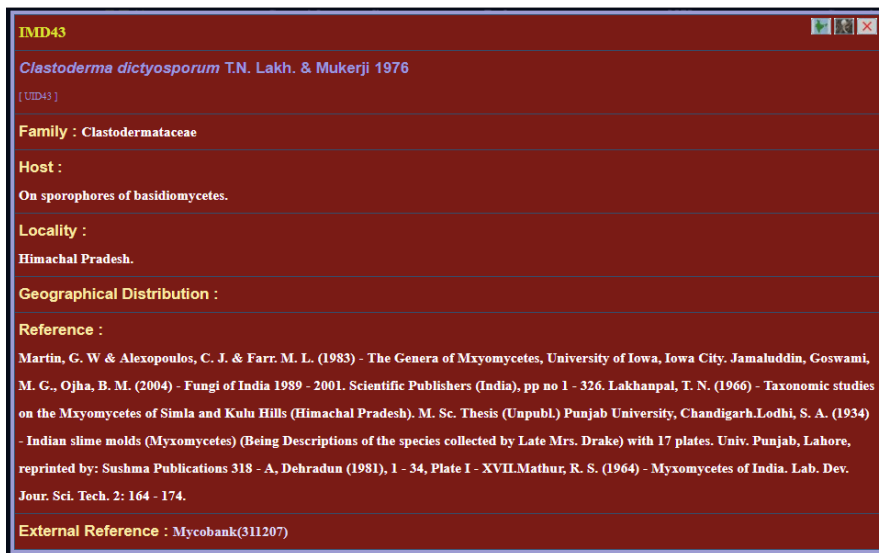


Fig. 2. Example of an output card, which has fields for all basic information.

and the Javascript library Scriptaculous these reference data are not complex in terms of relationships between the files, but the complexity is present in terms of repeating phrases/words and different words with same/similar meaning. The database primary key for the record table is defined by the collection of three columns, viz. generic name, species name, and source reference. The original source field had to be added in the primary key to make it unique since there could be repeating genus-species combinations obtained from different sources of data so there is a unique identification number for each record.

## Description of All Pages of Database

The website contains the following pages: Home, General search (Simple search), Advanced Search, Output of the search, Browse, Card viewer, Card, References, Contact, Site Map, Help, Publications and Data entry.

*Home page:* Contains introductory information and links to other pages, data statistics given on the front page will change

automatically with updates to the data records.

*General search (Simple Search) Page:* Contains a text input field where a user can type keywords to be searched. There is also a dropdown box for selecting the operator (AND/OR). A button is added to the page, which is used to initiate the querying process. When this search button is pressed a 'onclick' event is fired and subroutine is called. This subroutine (written in java script) takes key words and operator from corresponding fields of the pages and sends it to the serverside script that accesses the database (here it is simple search.php). This script works in the background to search for the data. If the data matching the query is found, the script generates a tabular output in html format and returns it to the client. Being in the "html format", the data can then be viewed in the browser as the html page that contains the search results.

*Advanced Search Page:* This page contains three input fields as follows: (1) *Dropdown box* for selecting database field to be searched; (2) *Text input field* for Keywords, and dropdown box for logical

Operator ; and (3) *Row join operator* for joining multiple searches. This set of three basic input fields forms a single search. More than one search can be performed by adding such sets of three fields and joining them by 'row join operator'. For, this add and remove buttons are given.

## Output

Both simpleSearch.php and advSearch.php generate output in same format. The searched records are presented in a tabular format with serial number, IMD-ID number, generic name, species name, and family name as the columns. The output generated by this script is in a card format and is not presented to the user as a different page but is dynamically embedded in the existing search results page. This achieves the purpose of both user friendliness and the minimum amount of data transfer. The embedded page is formatted in such a way that the user feels as if they are looking at the hardcopy of the card. The card can be closed using the provided 'close' button and other cards can be reviewed in the same page without querying the database again and again.

*Browse page:* This provides family, or species-specific queries and the output of browse queries is the same as that for search queries.

*Card viewer:* Displays the results in the card format (Fig. 2) with the background showing glimpses of the result of the query entered by the user/visitor. This function facilitates the user/visitor to return to the species of interest.

## Other pages available

*References page:* This includes more than 19 major references used for construction of this database. This includes pertinent reference books and PhD theses are given sequentially.

*Contacts page:* This shows the photographs and biodata of the contributors of the databases for any further queries about the same.

*Site Map:* This includes short-cut links to all major topics in the database, and is located occurs on the task bar. It makes access easier for every visitor to the database.

*Help page:* This is really an encouraging page for every visitor to the database providing guidance on how it should be used. It includes screen shots of pages to help the student as well as researchers to

solve any difficulties in using the database.

**Publications:** This contains publications by contributors of the database.

## RESULTS AND DISCUSSION

This project has facilitated, for the first time in India, the compilation of 7528 species records from various groups (Table 1). Over 8000 reference cards were prepared in a standardized way. In total database contains 5906 species names from 384 families and 1385 genera of fungi from all over India. These reference databases have been launched online on [www.fungifromindia.com](http://www.fungifromindia.com) and can also be found on MyCoPortal ([www.mycportal.com](http://www.mycportal.com); Miller & Bates 2017). Every species name in this database has been linked to [www.mycobank.org](http://www.mycobank.org). The literature on fungi is scattered in journals, not easily accessible to Indian students, and this unavailability can frustrate students. The new databases from India on a single click will minimize the efforts and time needed to the search for literature records. This is the first Indian effort to complete such a contribution to the history of Indian mycology and is made available free of cost for every researcher in the world. This is expected to serve as an initial step towards better understanding of the fungal groups throughout India.

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## REFERENCES

- Bhide VP, Sathe AV, Pande A, Patwardhan PG, Rao VG (1987) *Fungi of Maharashtra Supplement I*. Pune: Maharashtra Association for the Cultivation of Science.
- Butler EJ, Bisby GR [revised by RS Vasudeva] (1960) *The Fungi of India*. New Delhi: Indian Council of Agricultural Research.
- Crous PW, Gams W, Stalpers JA, Robert V, Stegehuis G (2004) MycoBank: an online initiative to launch mycology into the 21<sup>st</sup> century *Studies in Mycology* 50: 19–22.
- Dasgupta K (2005) Digitization, sustainability and access in the Indian context. In: *World Library and Information Congress: 71<sup>st</sup> IFLA General Conference and Council, "Libraries- A voyage of discovery"*:132-E.
- Hosagoudar VB, Abraham TK, Pusphangadan P (1996) *Fungi of Kerala*. Kerala: Tropical Botanic Garden and Research Institute.
- Jamaluddin S, Goswami MG, Ojha BM (2004) *Fungi of India 1989–2001*. Jodhpur: Scientific Publishers (India).
- Kamat MN, Patwardhan PG, Rao VG, Sathe AV (1971) *Fungi of Maharashtra, Bulletin No. 1*. Rahuri, Maharashtra: Maharashtra Association for Cultivation of Science, 1–124.
- Leelavathy KM, Ganesh PN (2000) *Polypores of Kerala*. Delhi: Daya Publishing House.
- Mahabale TS (1987) *Maharashtra State Gazetteers*. [General State Series, Botany Part IV, Botany and Flora of Maharashtra.] Pune: Maharashtra Association for the Cultivation of Science.
- Miller AD, Bates ST (2017) The Mycology Collections Portal (MyCoPortal). *IMA Fungus* 8: (65)–(66).
- Nagarkar S (2000) Pune-Net: Current Status. *Information Today and Tomorrow* 19 (3): 16–18.
- Palm ME, Chapela IH (eds) (1998) *Mycology in Sustainable Development: expanding concepts, vanishing borders*. Boone, NC: Parkway Publishers.
- Patel MK, Kamat MN, Bhide VP (1948) The Fungi of Bombay, Supplement I. *Indian Phytopathology* 2: 142–155
- Ranade VD, Korade ST, Jagtap AV, Ranadive KR (2012) Checklist of myxomycetes from India *Mycosphere* 3: 358–390.
- Ranadive KR, Vaidya JG, Jite PK, Ranade VD, Bhosale SR, et al. (2011) Checklist of *Aphylophorales* from the Western Ghats of Maharashtra State, India. *Mycosphere* 2: 91–114.
- Roy A, De A (1996) *Polyporaceae of India*. Dehra Dun: International Book Distributor.
- Sharma JR (1995) *Hymenochaetaceae of India*. Calcutta: Botanical Survey of India.
- Thind KS (1977) *The Myxomycetes of India*. New Delhi: Indian Council of Agricultural Research.