

DEBDOM: Database Exploring Banana Diversity of Manipur

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Abstract:

Being poor man's apple, banana has a wide popularity worldwide. It's one of the important horticultural crops used irrespective of rich and poor alike. Manipur along with the other states of Northeast India harboured with plenty of wild and cultivated species of banana that are not fully explored. A data base named DEBDOM has been developed here describing the diversity of banana resources of Manipur and it comprises twenty eight genotypes of Musaceae. The database DEBDOM provides a sophisticated web base access to the details of the taxonomy, morphological characteristics, utility as well as sites of collection of *Musa* genotypes, and it would have contribute as a potential gene pool sources for the conservation, sustainability as well as for crop improvement in the future breeding programmes.

Availability: <http://ibsd.gov.in/debdom/>

Background:

Banana belonging to family Musaceae is the fourth most important crop after rice, wheat and corn. Its fruit is cheap and can be used by both rich and poor alike considering its nutritive and fruit value and hence it could be otherwise being considered as poor man's apple. Not only its nutritive value for carbohydrates, vitamins and minerals, banana also possesses potential applications in therapeutic as well as in industry. Banana flower and pseudostem have anti-diabetic and anti-advanced glycation end-products (AGEs) properties and are being beneficial as food supplements for diabetes [1]. Banana flakes can be used as safe and cost-effective treatments for diarrhoea in critically ill tube-fed patients [2]. Banana could also have a wider utility as a good source of natural antioxidants with free radical scavenging activities, in the production of alcohol, food and sugar industries and also as a drug binder and disintegrant in pharmaceuticals [3]. Banana fruit and its organic residues have the potential use as feed stocks in the production of ethanol [4].

Among the horticultural crops, banana occupies an important place cultivated varieties are grown for domestic supply while the wild species are distributing freely across undisturbed hilly terrains. Due to the practice of monoculture of a few selected cultivars and destruction of habitats by human encroachment, banana resources of Manipur are rapidly eroding and thus, there is need for further exploration, conservation and documentation of these resources for future exploitation.

The state of Manipur is situated in the northeastern border of India, lying between 23°50' and 25°41' North latitudes and 93°61' and 94°47' East longitudes covering a total geographical area of 22, 327 sq km, of which about 90 per cent are constituted of mountains and 10 percent are the central valleys. The region is also experiencing different type of climatic zones ranging from Tropical to Montane Temperate forests, including the elements of adjoining Myanmar flora. It is mostly in the tropical semi evergreen and sub tropical forest of Manipur where the wild banana species are harboured and thus flourishing many

banana forests. Being easy accessibility, these semi-evergreen forests are exposed to large scale exploitation and destruction as a result of shifting cultivation and thus leading to genetic erosion of banana, especially of wild type species.

Banana crops are also closely related to the socio-economic and cultural activities of the people of Manipur. Vegetative parts of the plant are symbol of goodwill in various ceremonies. Leaves are used as a substitute for dining plates and as well as for wrapping materials. Inner core of pseudostem (pith) and young inflorescence are consumed as vegetables. During social festival and other religious ceremonies, banana fruits, particularly of Meitei hei cultivars are in a huge demand with high price. Moreover, banana plants are important sources of rural income for people living in and around the hills of Manipur and they are also one of the components of the diet.

India is recognized as one of the major centres of origin and diversity of banana at the global level along with Southeast Asian countries and Papua New Guinea [5] and Northeast India is located within this centre of origin and diversity of banana. Though, wild and cultivated varieties of banana are spreading across the state of Manipur, little is known about this great wealth of *Musa* germplasm that comprises some of the rarest and unique cultivars like Meitei hei with pleasant taste and adaptability to local conditions and there is still need for further exploration and documentation so as to acquire more data on wild and cultivated Musaceae species of Manipur under natural condition.

Advance research on banana ranging from identification to expression profiling of gene unraveled conundrum on fruit, flower and plant parts retain since long and expands horizon to understand the molecular basis of evolution. Databases Retrieving comprehensive information on the family Musaceae will be extremely useful to modern researchers, and would have enabled new insights and discoveries concerning evolutionary relationship of gene and gene products anticipated. Though attempt has been made by Uma [6] for systematic documentation of the Musaceae found in the Northeast India, online interface will certainly be useful to the users to interpret and retrieve the desired information more effectively. Thus, we have designed a sophisticated web based database to provide comprehensive information on banana available in Manipur. Present study will be useful for sustainable utilization of banana which is declining faster from the region so that conservation strategies could be implemented effectively.

The database **DEBDOM** is first source that can provide comprehensive information related to the banana resources of Manipur and is a unique public domain web-interface that elaborates Database Exploring Banana Diversity Of Manipur (<http://ibsd.gov.in/debdom/>) which provides access to the taxonomy, morphology (male bud, bract, leaf, flower, fruit, seed etc.), geographical location, economic status, uses and links. And moreover, DEBDOMs' sophisticated web-based graphical user interface allows efficient retrieval of data where the reliable data content and links add an extra advantage while retrieving data so that it will make **DEBDOM** a comprehensive and intricate tool (**Figure 1**).

Methodology:

Explorations were carried out in all districts of Manipur (Imphal West, Imphal East, Bishnupur, Thoubal, Senapati, Tamenglong, Churchanpur, Chandel and Ukhrul) from 2010 to 2012. Preliminary information on banana growing areas of Manipur was gathered from local banana mini-markets. Suckers of banana were collected from their habitat and maintained at Bioresources Park, IBSD (Institute of Bioresources and Sustainable Development), Haraorou, Imphal. In the exploration, more than 25 accessions of Musaceae were collected and maintained.

Characterization and documentation of banana genotypes were carried out based on Descriptors for Banana (*Musa* spp) published by IPGRI-INIBAP/CIRAD (1996) [7]. Photographs and GPS data were also recorded from the collection site in order to extrapolate GPS navigation. Proper identification of banana accessions were carried out using taxonomic keys and standard referenced catalogues [8-11]. Samples were collected from healthy plants as suckers and information on utility and diseases were also gathered from the sites of collection. Collected samples were cleaned by cutting root and other debris and allowed staying for 3-5 days before transferring to field.

Database Content:

The database **DEBDOM** illustrated an extensive compilation on the diversity of banana of Manipur that can be visualized and analyzed by graphical web-interface. This database comprised 28 banana cultivars/landraces, of which mostly are used for edible purposes. Studies on the phylogenetic relationships amongst the genotypes are in progress so that it will give input in understanding the taxonomic conundrum retain since long. Molecular expansion and genomic studies are also taken up and it will keep on updated as and when the database is available.

Design and Implementation:

The database **DEBDOM** has been developed by extracting seamlessly integrating data from extensive questionnaire compiled in MS Excel. This data compiled in MySQL 5.1.41 (www.mysql.com) relational database along with cross references to taxonomy, morphology, gallery, links and site of collection. **Figure 2** demonstrates the architecture and outline display of **DEBDOM** database. The MySQL database was normalized and indexed to ensure efficient and accurate data retrieval through the query option available in DEBDOM web-interface and molecular and biochemical aspects of individual cultivar/s will further be updated after validation of results.

The **DEBDOM** web interface developed in Apache 2.2 Handler CGI 1.1 (www.apache.org) runs on the Windows 2003 web server and utilizes the MySQL (XAMPP-win32-1.7.7) module to query and retrieve data from back end MySQL 5.2 database (www.mysql.com). The graphical display of cultivars in flash at front end was implemented with JAVA Script 1.6 programming (<http://www.javascriptsource.com>). The Google map API developer implemented for graphical representation with respect to the GPS coordinates highlighting the specific site of collection for the cultivar/s.

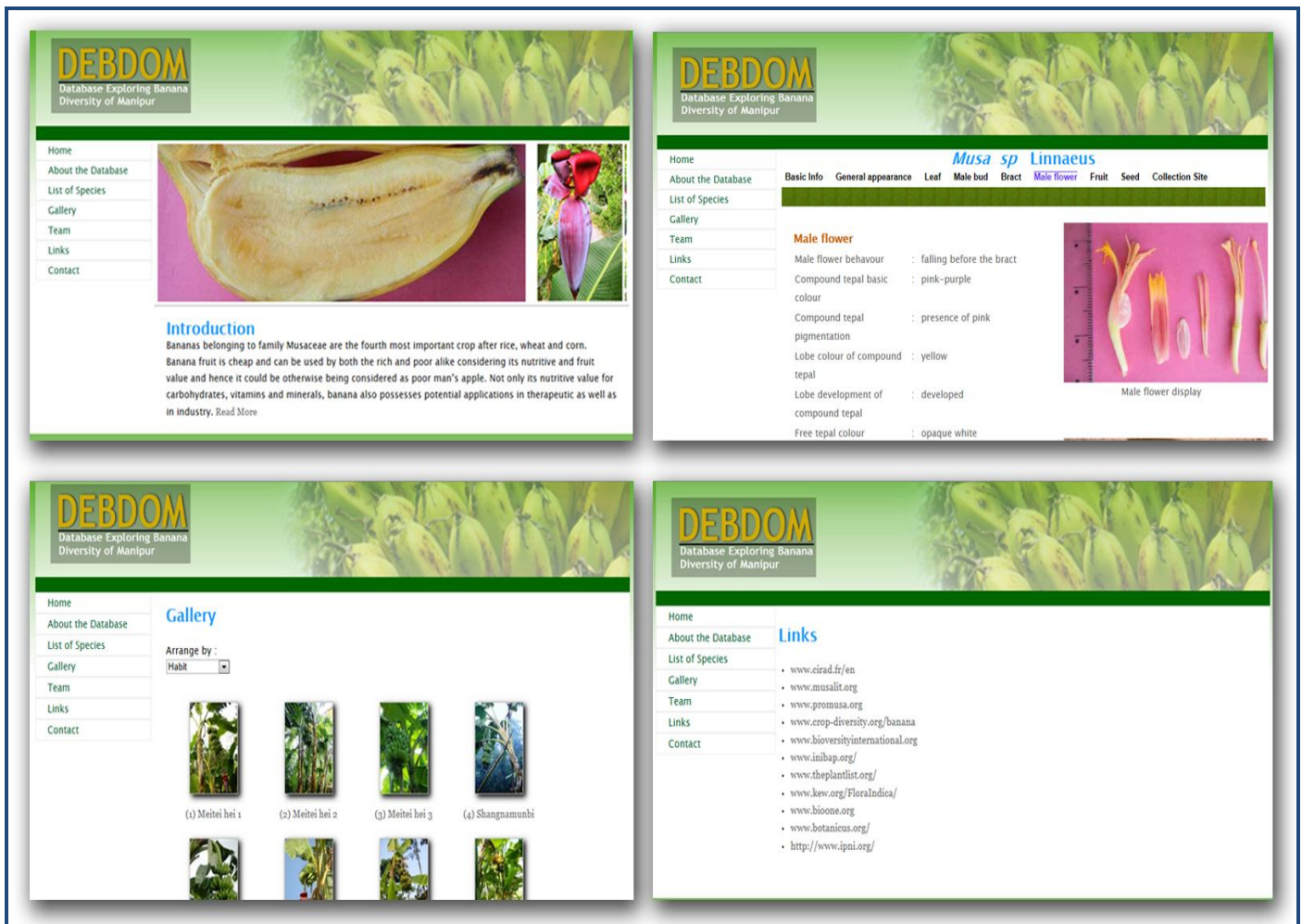


Figure 1: Snapshot demonstrating Home, Male flower, Gallery and Links page/s of DEBDOM.

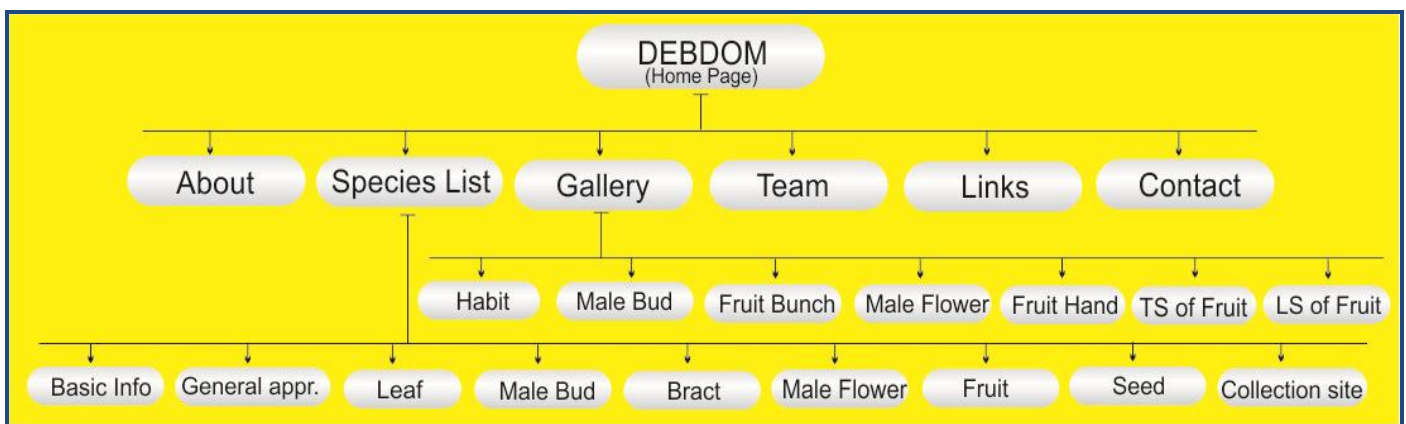


Figure 2: Basic architecture of DEBDOM displaying various fields and subfields which holds key information on cultivar/s.

Utility:

Collection, characterization and conservation are starting points of any breeding strategy for crop improvement. It is through prospection and collection, the germplasm gene pool can be enhanced. In this study, maximum morphological characters were included about the cultivated and wild Musaceae species available in Manipur and thus provided detailed characteristic of banana accessions and it would help in proper identification of duplicates and synonyms that were existed in different

language and dialects. Moreover, characterization based on morphological descriptors is very much prerequisite for any crop improvement programme as evaluation and selection of superior genotypes is mainly relies on good agronomic characteristics that are highly heritable in all environments. It is also known that wild species are of relevance for genetic improvement as they can show traits of agronomic value which cultivars do not have because of their narrow genetic bases and introgression of such traits by breeding or genetic

transformation would have resulted in cultivars with resistance or tolerance to disease and/ or environmental stress. Besides, insufficient knowledge on wild species is also hampering in the establishment of phylogeny and genetic dynamics behind them. Thus, in view of food security, job creation, sustainability and supply for domestic consumption as well as export markets, cultivation and conservation of local varieties as well as wild species that are well adapted to local conditions is of utmost important.

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Reference:

- [1] Jamuna J *et al.* *J Physiol Biochem.* 2011 **67**: 415 [PMID: 21476022]
- [2] Emery EA *et al.* *Nutr Clin Pract.* 1997 **12**: 72 [PMID: 9155405]
- [3] Eleazu *et al.* *Afr J Biotechnol.* 2011 **10**: 16948
- [4] Valasquez HI *et al.* *Int J of Thermodynamics.* 2009 **12**: 155
- [5] Simmonds NW & Shepherd K, *Linnaean Soc Bot.* 1955 **55**: 302
- [6] <ftp://ftp.fao.org/docrep/fao/011/i0548e/i0548e.pdf>
- [7] www.pdf.usaid.gov/pdf_docs/PNACH855.pdf
- [8] www.bioversityinternational.org/fileadmin/.../704_Musalogue.pdf
- [9] www.ctu.edu.vn/~dvxe/doc/ebook/Musalogue-1.pdf
- [10] www.flora.ac.cn/content.aspx?Taxonid=10588
- [11] www.vedamsbooks.com

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