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MPDB 2.0: a large scale and integrated medicinal plant database of Bangladesh

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Abstract

Medicinal plants are generally defined as rare herbals with potent medicinal activities that can be used as an alternative treatment for diseases. Recent studies exploring novel medicine developments, originating from folk-medicinal practices challenges this notion and suggests that both the circumference of the term medicinal plant and their potential application covers a substantially extensive verse than previously suggested. While medicinal plants are not limited to the borders of any country, Bangladesh and its south-east Asian neighbors do boast a huge collection of potent medicinal plants with considerable folk-medicine history compared to most other countries of the world. MPDB 2.0 is the continuation of MPDB 1.0, it serves as both a data repertoire for medicinal of Bangladesh and a user-friendly interface for researchers, health practitioners, drug developers, and students who wish to study the various medicinal & nutritive plants scattered around Bangladesh and the underlying phytochemicals contributing to their efficacy in folk medicine. While in developing MPDB 2.0 human diseases have been highly focused upon, the information in this database is not limited in its application for human diseases or diseases only, as many of the plants indexed here can serve in developing biofuel or bioremediation technologies or nutritive diets or cosmetics, etc. MPDB 2.0 comprises a collection of more than five hundred medicinal plants from Bangladesh along with a record of their corresponding scientific, family, and local names together with their utilized parts, information regarding ailments, active compounds, and PubMed ID of related publications.

Website: <https://www.medicinalplantbd.com/> and

Promotional video: <https://youtu.be/tibx8MA6-XsI>

Keywords: keyword 1; MPDB2.0, 2; medicinal plant, 3; medicinal plant database of Bangladesh, 4; folk medicine

1. Introduction

Since ancient times nature has always provided its favoured children (humans) with both remedies for fighting diseases and nutrition products to maintain good health via plants full of potent medicinal properties and nutritive values, [1] and our forefathers have utilized this boon from mother nature to the fullest, a sign of which can be still found in the local folk medicinal therapies [2–4]. While our predecessors hardly understood the underlying mechanisms and chemical mediators responsible for the efficacy of these plants, recent advancement in technology (which includes techniques, instrumentation, and automation in isolation and structural characterization) allows us to learn the underlying mechanisms of these herbal treatments in depth [5,6] and discover the full potential for the usage of these plants full of potent medicinal properties and nutritive values [7,8].

Several studies in recent times have suggested that plant active compounds or secondary metabolites possess immense potential for application in both research and clinical industries, for instance in developing nutraceuticals, nutrition products, biofuel technology, insecticides, flavouring agents, colouring agents, smelling agents, or fragrance, etc. [9–13]. According to records approximately 4,20,000 plant species are existing in nature among which about 10,000 to 15,000 plants have been studied for their medicinal and nutritional properties and about 200 of these plants or their active compounds have been adopted in western medicines [14,15]. While natural substances are no longer used in modern medicinal therapies since the early decades of the last century, studies on bioactive molecules originating from plants continue to play a vital role in the development of novel medicinal therapies for emerging new diseases [16–18] as the parallel advancement of both biology and technology opens up an inexhaustible repertoire of naturally occurring compounds that have the potential to lead to the development of efficient and novel treatment strategies for diseases, both old and new [1,7,15].

MPDB 2.0 database, like MPDB 1.0 [19] is a user-friendly interface committed to rendering information (including their scientific names, family names, local names, utilized parts, related ailments, and active compounds) of plants around Bangladesh which have been suggested to have potent medicinal and/or nutritive properties, for both national and international researchers, health practitioners, drug developers and students who wish to study the medicinal and nutritional plants of Bangladesh. To help the scientific community in advancing biological sciences the authors have dedicated the MPDB 2.0 database to be an open-source server. An updated medicinal plant database will enhance the scientific community to advance in the field of drug discovery (Figure 1).

2. Methods and Material:

2.1. Literature mining

To collect the necessary plant data for the MPDB 2.0 database, a cluster of 43 literatures retaining information regarding medicinal and nutritive values along with respective folk therapies of Bangladeshi medicinal plants corresponded by both national and international research groups have been studied. The scientific names, family names, local names, utilized parts, and active compounds or secondary metabolites of the related plants have been included in the search parameters. To identify synonymous plant scientific names and reduce redundancies, The Plant List web server (<http://www.theplantlist.org/>) has been utilized.

2.2. Active compounds

For assembling literature retaining information of active compounds of the indexed Bangladeshi medicinal plants a separate search was conducted by two researchers independently and the PubMed web server (<https://pubmed.ncbi.nlm.nih.gov/>) has been exclusively utilized for this. The scientific names and scientific name synonyms have been implemented as search keywords.

2.3. Database preparation

VueJS, (<https://vuejs.org/>) a Javascript framework has been implemented for building the frontend of MPDB 2.0. ElasticSearch, (<https://www.elastic.co/>) a distributed storage and analytics engine has been utilized as the backend of this database. For ensuring the robustness of search functionality Edge-ngram tokenizer has been employed alongside ElasticSearch's standard tokenizer when indexing the documents. FastAPI, (<https://fastapi.tiangolo.com/>) a Python web framework has been utilized in building the middleware for this database which translates the request-response between frontend and ElasticSearch.

2.4. Database access

The MPDB 2.0 database contains five pages among which the "Search" (Figure 2) page displays and gives access to the indexed Bangladeshi medicinal plants information along with their active compounds list. The search functionality within this page enables a user to query the database using one or more keywords (scientific name, local name, utilized parts, ailments, active compounds, and PMID) for normal or Boolean search. Every keyword entered is attempted to match with all the fields unless the field is specified. Several singles keyword queries matched with different fields are illustrated in Figure 2. Users can search by stitching the keywords with AND/OR operator. Some plant entries contain multiple PMID entries as when collecting active compounds data, the authors used multiple references, in such cases clicking on the PMID section allows the users to see which active compounds belong to which publications, improving the overall user-friendliness of the database (Figure 2).

3. Conclusion

MPDB 2.0 is the continuation of MPDB 1.0, while it is established upon the same initial structure as MPDB 1.0, it contains a much larger data repository compared to its predecessor and the released version is much more refined and user friendly than MPDB 1.0. The MPDB 2.0 database has been dedicated to being a promising webserver engine for initial screening of phytochemicals in *in silico* drug development.

4. Author contributions

N.H. and R.C. prepared the background material for the database. R.A.A. and M.A.M. M.K.H supervised and coordinated the project. M.A.A. adopted the idea and coordinated the database project. All the authors involved in this project participate in writing and editing the final version of the manuscript.

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5. Conflict of interest

Authors declare no conflict of interest.

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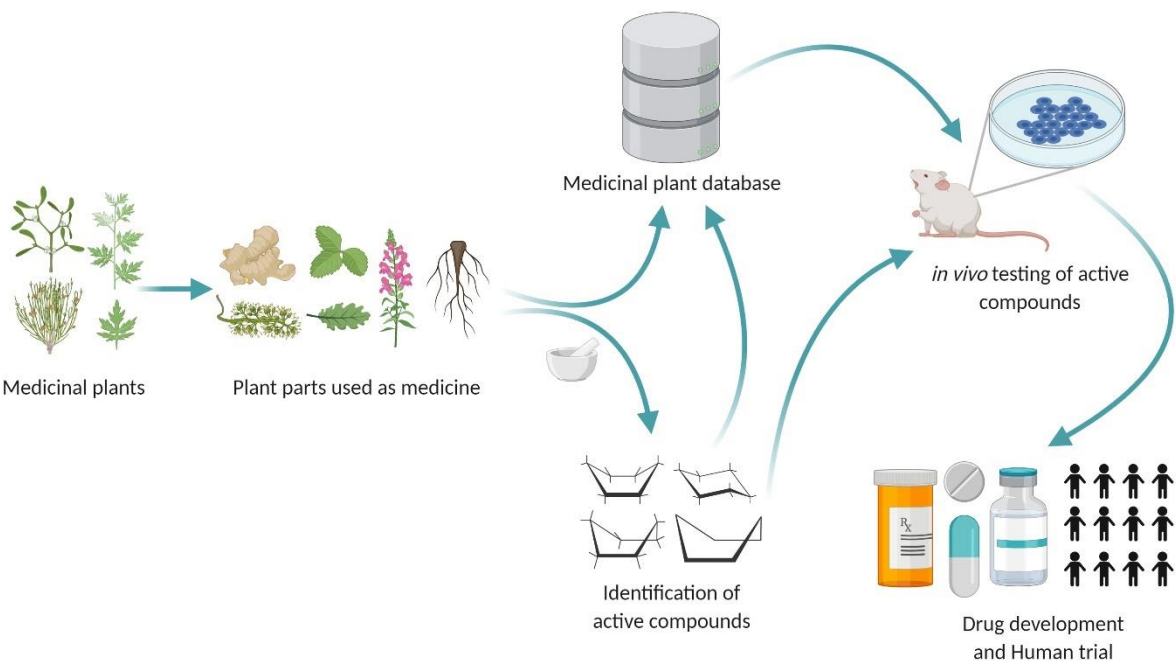


Figure 1: Involvement of medicinal plant databased such as MPDB1.0 and MPDB2.0 in drug discovery initiative.

A

MPDB 2.0

Home Search Guide Team Publications

Welcome to MPDB 2.0

An extensive phytochemical data repertoire for indigenous medicinal plants of Bangladesh

Search

Search using plant's name, active compounds, ailments and PMID

Publication

View list of publications that referenced this database in their work

Guide

This is an easy to use database, find step by step instruction here

B

MPDB 2.0

Home Search Guide Team Publications

Search

diabetes 0

#	Scientific Name	Family Name	Local Name	Utilized part	Ailment	Active Compound	PMID
1	<i>Andropogon paniculatus</i> (Lam.)	Acanthaceae	Kalmogh; Nilong	Leaf, Stem, Root, Whole Plant, Leaves	Liver Disorders, Hemorrhoids, Acidity, Diabetes , Hemiparesis in Children, Stomach Disorders, To Improve Digestion, Boasting With Burning Sensations In The Chest, Fever, Long-Term Fever, Any Type Of Severe Body Pain, Intestinal Worms, Low Sperm Count, Jaundice, Skin Disorders, Liver Dysfunction, Malaria, Stomach And Heart Disorders	Andrographolide, Neandrographolide, 14-deoxyandrographolide, Isoandrographolide, Andrographide, 14-deoxy 11,12-didehydroandrographolide, Andrographenin, Andrographidin, Luteolin, Andrographidin, Apigenin, Oxylin, Echidin, Andrographolactone	25950015
4	<i>Jussiaea eschscholae</i> L.	Acanthaceae	Bashok, Baulukh, Kali Bashok, Dankun, Hantakisho, Har Bakshu, Kalo Bashok, Har-Bakshu, Baulukh	Leaf, Bark	Colds, Coughs, Fever, Ear Lobe Infection, Coughs In Human, Any Porcine Diseases, Jaundice, Whooping Cough, Pneumonia, All Types Of Pain, Gonorrhea, Chronic Asthma, Leprosy, Malaria, Chest Pain, Biliary Problem (Bile Turns The Color Of Blood), Frequent Thirst, Respiratory Problems, Vomiting Tendency, Diabetes , Tuberculosis, Severe Fever With Mucous, Asthma, Chronic Cough	3,3'-4'-trihydroxyflavone, Tetrahydroxanthone hexamethyl	28870433 , 28001112
14	<i>Aloe vera</i> (L.) Burm.f.	Alaceae	Gumkanchon, Gumto Kumari, Gumto-Kanchon, Gumto-Kumari	Leaf, Soft Foli, Water, Leaf, Whole Plant	Sexually Transmitted Diseases In Men, Skin Disorders, Gonorrhea, Burns, Mental Weakness Due To Nerve Local Term Used By The Kachars, Usually Denoting Urinary Problem Arising From Embryological Disorder Or Diabetes , Diabetes In Elderly People, Constipation, Hypertension/Anxiety, Weakness, Kibay Rogh (Having Term: Literal Translation Wasting Away Of Body, Usually Denotes Tuberculosis)	Aloin	31019122
15	<i>Andropogon squarrosus</i> L.	Acanthaceae	Uomargo, Agona, Ubuli Nangra, Lal Chondro, Bhandhuar, Chondro, Ubuli Chondro, Apong, Chondro, Biall Huda, Kucha-Kanthi, Ubuli Nangra, Sopang, Chon Shond, Chondro	Root, Stem, Leaf, Whole Plant, Stem	Tooth Infection, Irregular Menstruation, Gonorrhea, Dermatitis, Chronic Dysentery, Menorrhagia, Blood Dysentery, Eczema, Abdominal Pain, Diabetes , Liver Diseases, Piles, Leucorrhea, Menstruation Problems, Tumor, Carb U N CIE, Abscess, Edema, Jaundice, Toothache, Hemorrhoids (Tooth Infection), Believed By The Kachars To Be Caused By Insect Infestation Of Tooth), Severe Pain (Arising From Tumor)	Quinic acid, Chirogenic acid, Kaempferol, Quercetin, Oxylin	24196493
16	<i>Asiaticum</i> (L.) A. L. Juss	Asarumaceae	Dan Khodai, Para	Whole Plant, Stem, Whole Plant, Leaf, Flowers	Facial Infections In Children, Diabetes , Oral Lesions	Alpha amylase, Beta amylase	25224159

Figure 2: (A) Interface of MPDB2.0 database. (B) Keyword search result demonstrates related plant, their scientific names, source of plant, utilized parts, ailment, available active compounds, source of article, and hyperlinked PubMed ID of the reference papers.