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## RESEARCH ARTICLE

# NATURE'S CORNUCOPIA: AN INVENTORY OF THE LILIOPSID PLANTS (*SENSU* TAKHTAJAN, 2009) IN THE ERSTWHILE UNDIVIDED BARDHAMAN DISTRICT OF WEST BENGAL, INDIA

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**ABSTRACT**

The present paper aims to document the plants belonging to the class Liliopsida (*sensu* Takhtajan, 2009) of the erstwhile undivided Bardhaman district of West Bengal, India. During the present investigation, a total of 300 species of monocotyledonous plants belonging to 177 genera and 47 families have been inventoried. The evolutionary tilt of this group of plants of the region towards cosmopolitan-, evolutionarily younger Liliopsid genera than endemic-, and evolutionarily older ones have also been indicated. Finally, some management strategies for the sustainable conservation of the inventoried plants have been suggested.



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## INTRODUCTION

The global biodiversity crisis has given rise to growing concern at the prospect of a rapidly accelerating loss of species population, domesticated varieties, medicinal plants, and natural habitats. Currently, biodiversity is declining at an unprecedented rate in response to anthropogenic changes. Natural and anthropogenic disturbances are both considered as major drivers of species diversity in plant communities. It has been found through different studies that the frequency and magnitude of disturbance are key factors for changes in species diversity. The relationship between disturbance and species diversity also depends on the spatial scale. The destruction of vegetation has been continuing at an alarming pace world over due to a variety of causes. India has 2.5% of the world's land area and 1.8% of the global forest area which supports 15.6% of the world's human population and 14% of the livestock population. However, increasing population and human activities tend to alter the energy demand and carbon budget (Myster, 2012). In India, habitat destruction, overexploitation, pollution, and species introduction are identified as major causes of diversity loss. But, species diversity is an important concept and one of the major attributes of a natural community.

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Floristic inventory and diversity studies help to understand the species composition and diversity status of an area and offer vital information for their conservation. Hence, a basic understanding of the species diversity through plant-inventorisation of a particular region is important for assessing the complexity and sustainability of the entire ecosystems of that region. Now, due to increasing human population over the years, the biotic pressure on regional vegetation of the erstwhile undivided Bardhaman district has been inevitable. The uncontrolled burning of ground vegetation, livestock grazing and harvesting of ground vegetation for forage and rapid rate of urbanization are some of the factors responsible for overexploitation of plants globally (Prescott-Allen and Prescott-Allen, 1990). Erstwhile Bardhaman district has not been an exception. Though some authors have worked on the plants of the Bardhaman district in isolated manner [Jacquemont (1835); Hooker (1848); Edgeworth (1849); Ghosh, Guha Bakshi, Mukherjee K.D. and Mondal (1971); Adhikary and Chatterjee (1972); Bhattacharyya (1974, 1985, 1986); Namhata and Mukherjee (1990); Bhattacharya Kamal and Palit (2000), Hotwani and Mukherjee (2005, 2008)] – there has been paucity of consolidated information on the plants belonging to the class Liliopsida of the district. Therefore, the present study was conducted to provide data that can be helpful in ensuring biodiversity conservation of the district, with special reference to the monocotyledons. The study was conducted during 2013 to 2017 to assess the Liliopsida (*sensu* Takhtajan, 2009) diversity of the erstwhile

undivided district of Bardhaman in West Bengal, India (hereafter referred as either Bardhaman district and / or erstwhile Bardhaman district) which has been divided into two sister districts – Purba Bardhaman district and Paschim Bardhaman district since 7th April, 2017.

## MATERIALS AND METHODS

**Study Area and Sites:** The erstwhile Bardhaman district was a district within the state of West Bengal in India (vide Figure – 1). The district extended from 23°53′ to 22°56′ North latitude and from 88°25′ to 86°48′ East longitudes. The undivided Bardhaman district is bound on the north by Dumka (of Jharkhand), Birbhum and Murshidabad districts; on the east by Nadia district; on the south by Hooghly, Bankura and Purulia districts and on the west by Dhanbad (again of the present-day Jharkhand). The river Barakar forms the state boundary to the west, the Ajay separates Birbhum and Dumka to the north with the exception of a portion of Katwa subdivision, the Damodar forms a southern boundary with Purulia and Bankura, while Bhagirathi forms the main eastern boundary with a few exceptions. The maximum length of the district, from east to west is 208 km. while the maximum breadth from north to south is 112 km. The average altitude of the district is 40 m. / 131 ft. above the sea-level.

***Physiographic Features:*** In shape the erstwhile district of Bardhaman, West Bengal, India - resembles a hammer. The riverine system of the district includes the Bhagirathi-Hooghly in the east, the Ajoy and its tributaries in the north and the Dwarakeswar, the Damodar and its branches in the south-west. Besides, there are innumerable Khals and old river beds all over the area.

***Meteorological parameters***

**Temperature:** The average temperature in extreme hot season is 49°C while in the extremely cold season - it is 5°C. The cold season starts from about the middle of November and continues till the end of February, each year. March to May is dry summer, intervened by tropical cyclones and storms. June to September is wet summer while October to November is autumn.

**Relative Humidity:** Relative humidity of the district is moderate. It reaches about 70 % in the month of January.

**Soil:** Different types of soil (vide Figure – 2) are encountered in different topographical, biological and hydrological as well as a geological condition within the Bardhaman district.

**Geospatial Location of the district**

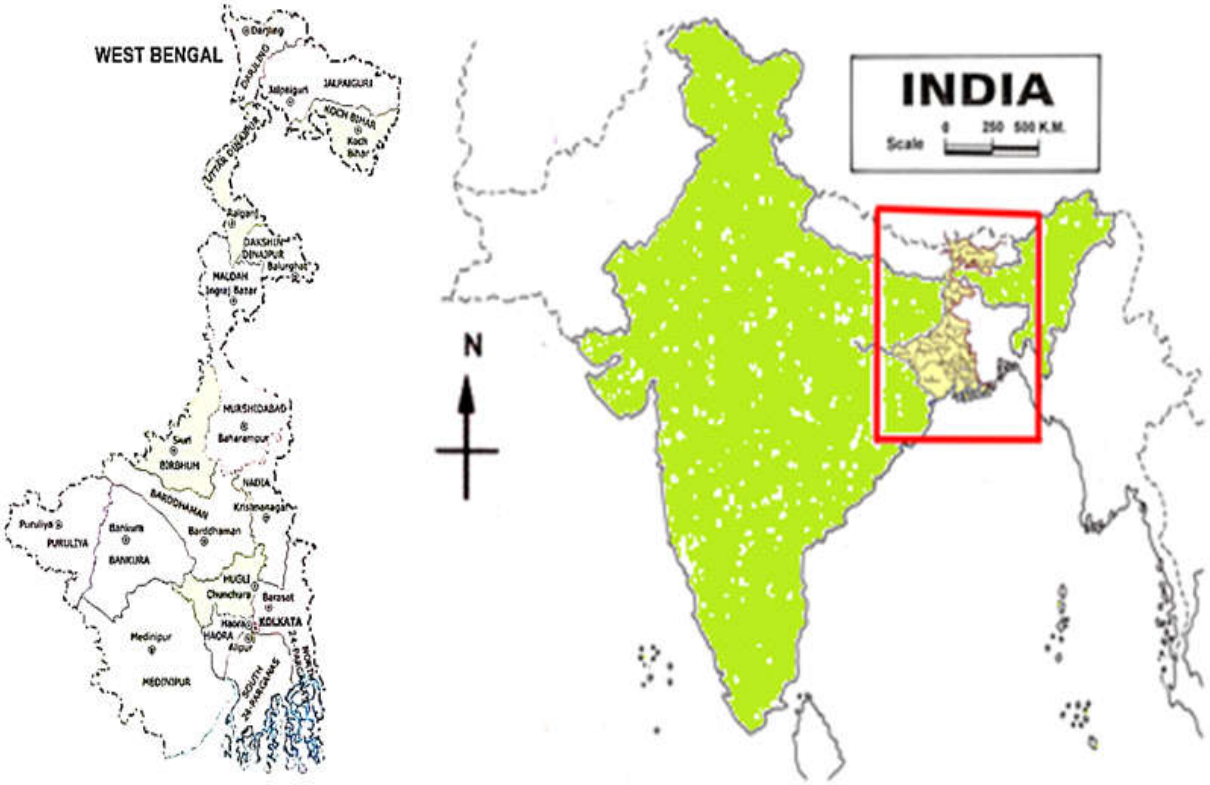


**Figure 1. Relative location of the Bardhaman district w.r.t. India and W.B**

**Table 1. Representational percentage of different taxa of Liliopsids (*sensu* Takhtajan, 2009) as found in the Bardhaman District, W.B., India w.r.t. the world**

| TAXA | WORLD | BARDHAMAN DISTRICT | REPRESENTATIONAL PERCENTAGE |
|---|---|---|---|
| Subclasses | 4 | 4 | 100 |
| Superorders | 12 | 10 | 83.33 |
| Orders | 31 | 20 | 64.52 |
| Families | 121 | 47 | 38.84 |
| Genera | > 3,000 | 177 | 5.90 |
| Species | c. 65,000 | 300 | 0.46 |

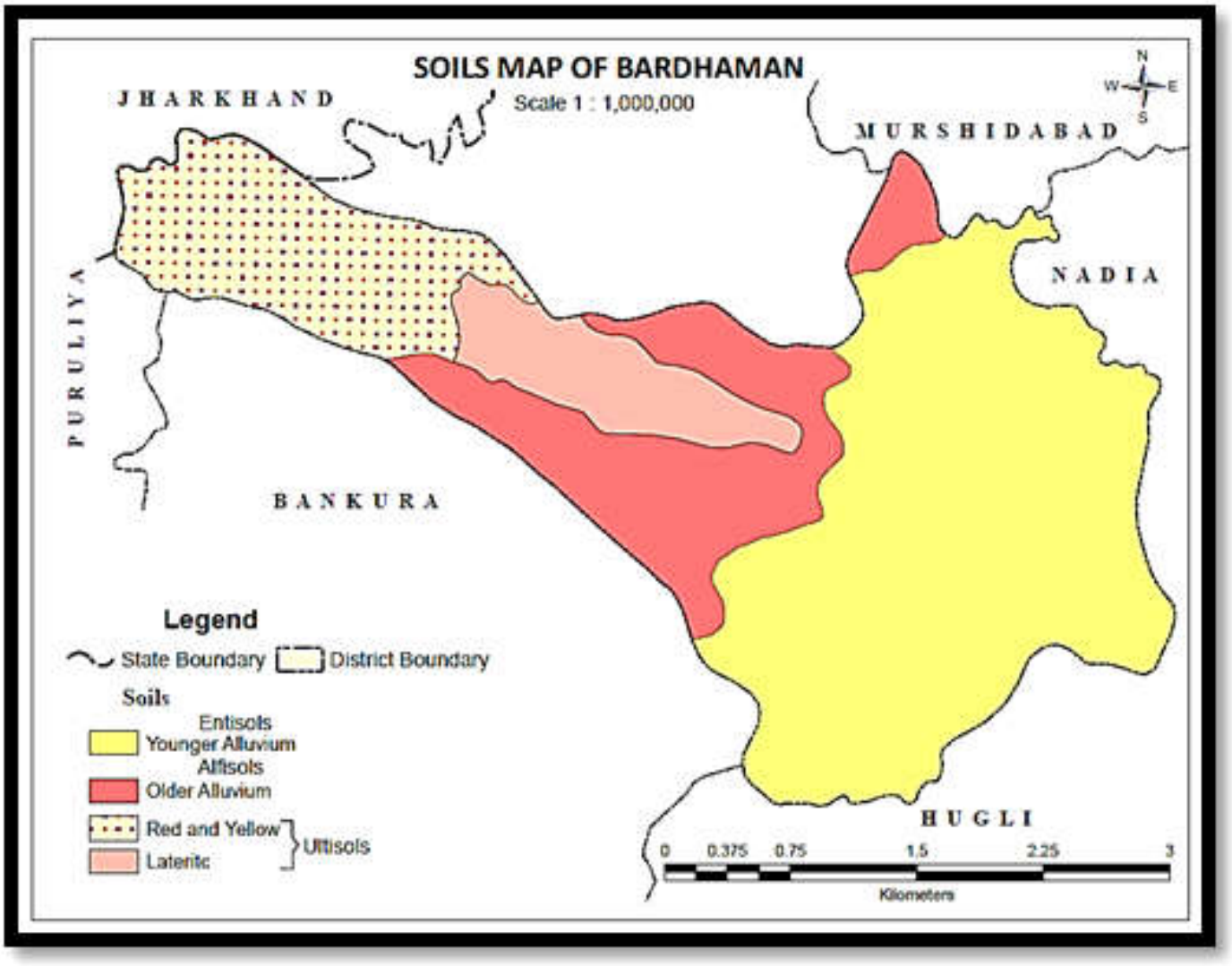


**Figure 2. Soil map of the erstwhile district of Bardhaman**

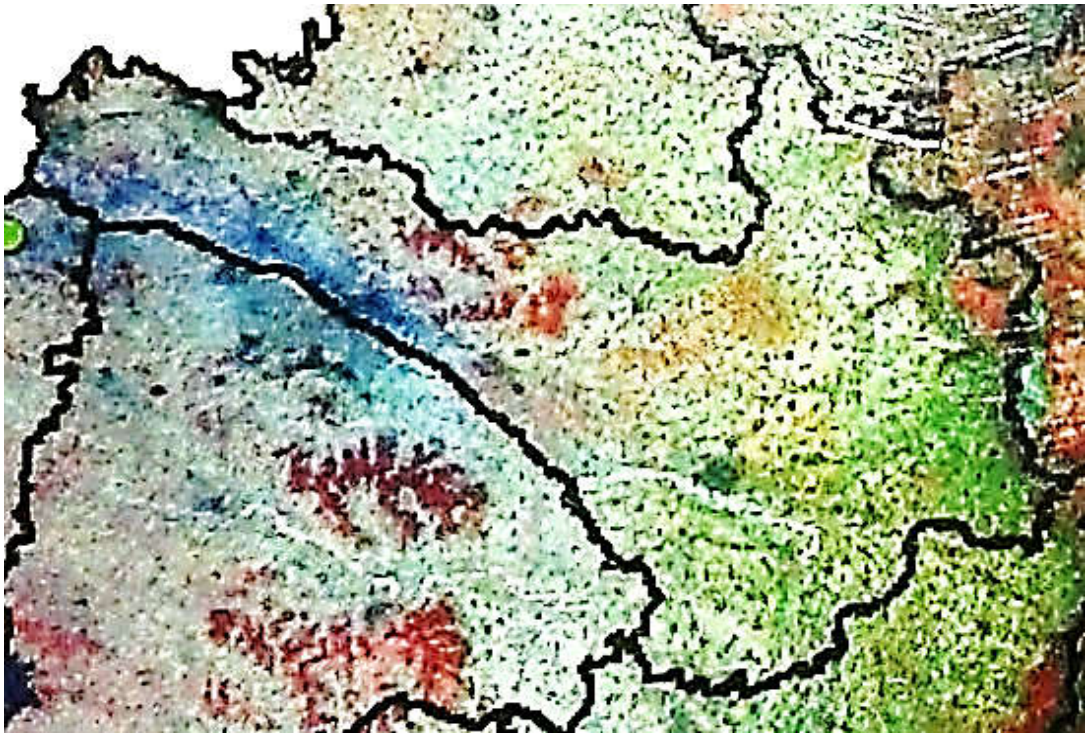

**Figure 3. GIS map of the erstwhile district of Bardhaman (source: Forest Department, Govt. of West Bengal)**

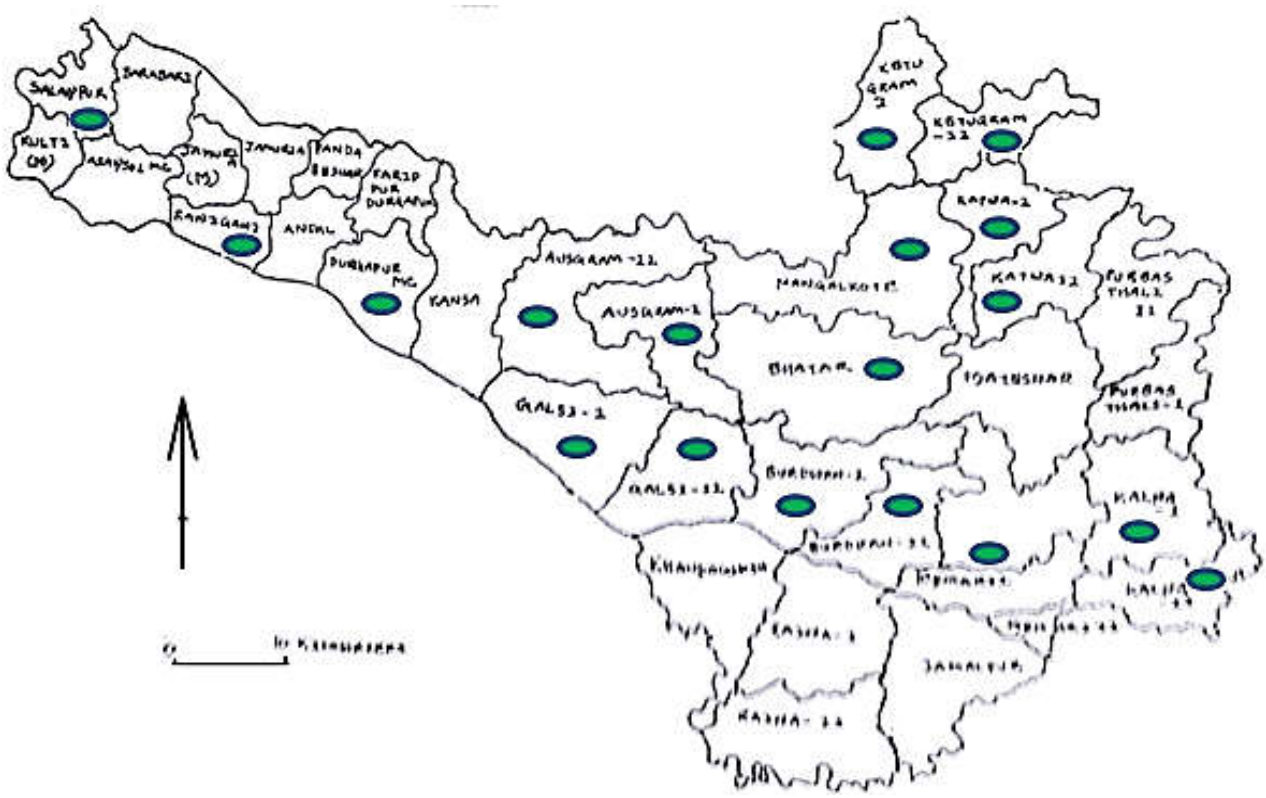

**Figure 4. A map of the Bardhaman district showing the different study sites marked as**

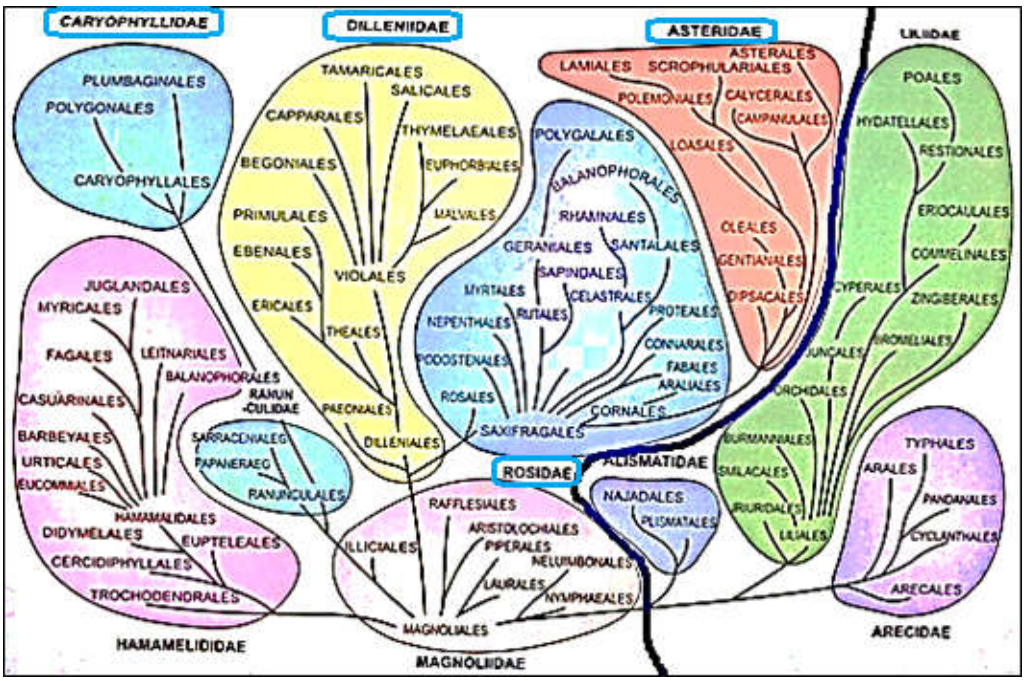


**Figure 5. Putative relationships among the classes, subclasses, and orders of flowering plants (after Takhtajan, 1980)**

In the west coarse gritty soil blended with rock, fragments are formed from the weathering of pegmatite, quartz veins, and conglomeratic sandstones. Sandy soil characteristic of granitic rocks and sandstones is of a reddish colour, medium to coarse in texture, acidic in reaction, low in nitrogen, calcium, phosphate, and other plant nutrients. Water holding capacity of this soil increases with depth as well as with the increase of clay portions. Towards the east alluvial soil attains an enormous thickness in the low-level plains to the east. This alluvial soil is formed of alluvium brought down by the Ajay, Damodar, Bhagirathi and numerous other rivers. These soils are sandy, well-drained and slightly acidic in nature.

***Study of the phytodiversity with special reference to the Liliopsida (sensu Takhtajan, 2009) of the district through remote sensing:*** Temporal changes in forest cover of the district of Bardhaman was ascertained in a study (Gupta *et al.,* 2007) using advanced technologies of remote sensing. Again, being a participant in the UNDP project of the Forest Department, Govt. of West Bengal – a GIS map of the district

of Bardhaman (having the RF= 1:24,99,636), taken in 2006 – was made available to the author (vide Figure – 3). Therefore, on the basis of the related literature review on the district of Bardhaman, along with the consideration of the Remote Sensing data – eighteen blocks of the district were selected as the study sites (vide Figure – 4). The blocks were Ausgram - I, Ausgram - II, Bhatar, Burdwan - I, Burdwan-II, Durgapur, Galsi-I, Galsi-II, Kalna –I, Kalna –II, Katwa-I, Katwa-II, Ketugram-I, Ketugram-II, Memari, Mongalkote, Raniganj, and Salanpur.

**Plant collection and preservation methods:** The routine procedure has been followed for collecting and processing the specimens for preservation in the Herbarium. Several excursions were undertaken during the last few years (2013 – 2017) to cover the study sites in different seasons so as to collect most of the plants in flowering and fruiting stages. Immense help in this regard was provided by some of the native and enthusiastic local people acting voluntarily as field assistants! In general, for collection, pressing, drying, poisoning, mounting, etc. the routine herbarium methods recommended by Jain & R.R. Rao (1977) had been adopted.

**Plant Identifications:** Plant identifications were done by consulting different floras [Prain (1903), Hajra (1997), Bhattacharyya and Sarkar (1998), Panigrahi and Murti (1999)] and also by personal interactions with some of the specialists in the area of Plant Taxonomy and Biosystematics. Correct names are checked for each of the enlisted plants from Mabberley's Plant Book (Mabberley, 2008) and author citations are confirmed from Brummit's book (Brummitt and Powell, 1992). All the specimens were identified with the help of available literature and are later matched and confirmed in the Central National Herbarium i.e., CNH of the Botanical Survey of India at Howrah (CAL). From the official website of Kew Herbarium (K) as http://www.kew.org/ - it has been possible to verify the authenticity of the identification of some critical specimens, as the high-resolution image of the same is available there.

**Presentation of the Inventory:** While not proposing a system of its own, all the Liliopsid (*sensu* Takhtajan, 2009) plant species of the erstwhile district of Bardhaman are presented here following the classification system of Armen Takhtajan (2009) only. The monocotyledonous angiosperms of the Bardhaman district have been grouped under the class Liliopsida (*sensu* Takhtajan, 2009) and shown as distributed amongst the four subclasses. One point to be noted here is that there is a thorough reshuffling of placement of families of Liliopsida in this system. In some cases, circumscriptions of certain families have also been greatly altered by Takhtajan.

Though the genera and species under each family are arranged in simple alphabetical sequence, the Takhtajan's (2009) original serial (including the different serial numbers mentioned here in the inventory) of the different taxa up to the level of Family has been followed. In the citation of a species, an extensive synonymy is avoided and only the latest 'ACCEPTED' name is given after consulting the latest version of The Plant List (Version 1.1; September 2013), having the URL - *http://www.theplantlist.org*. All the Liliopsid (*sensu* Takhtajan,2009) plant species that have been found in the Bardhaman District, West Bengal and inventoried here in this paper - have already been described in detail in several of the published floristic works on Indian Botany.

**Data Analysis:** The inventoried data has been analyzed both qualitatively and quantitatively for different taxonomic ranks following Takhtajan's system of Classification (2009).

## RESULTS

An inventory of 300 species of monocotyledonous plants growing in the Bardhaman district, as found in this study, has been documented here (Annexure - 1). Elementary taxonomic analyses, both qualitative and quantitative, of that inventory, have been represented in the relevant Tables (i.e., Table – 1, Table – 2 and Table – 3) and Figures (i.e., Figure – 6, Figure – 7 and Figure – 8) for ready reference.

***Findings at a glance:*** This study has been able to enlist 300 monocotyledonous angiospermic plant species belonging to 47 families following Takhtajan's system of classification (2009) as represented below:

**Elementary taxonomic analyses on the diversity of the Liliopsid flora of the Bardhaman district**

**Representation of the different subclasses of the Class Liliopsida (*sensu* Takhtajan, 2009) at different lower taxonomic ranks up to the species level:** From the Table – 2, it can be understood that the erstwhile undivided Bardhaman district housed the maximum number of liliopsid plant species (i.e., 187 species) of the Subclass Commelinidae. This alone amounts to about 62 % of all the liliopsid plant species inventoried in that region from this particular study.

**Subclass wise percent distribution of orders**

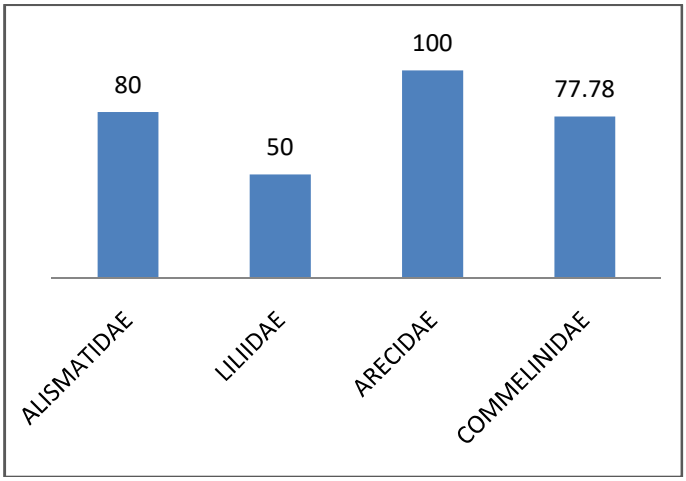


**Figure 6. Bar-diagram showing percent distribution of orders in the global context among the different subclasses of Liliopsida (*sensu* Takhtajan, 2009) that could be found at the Bardhaman district**

The percent distribution of the different orders in the global context among the different subclasses of Liliopsida (*sensu* Takhtajan, 2009) that could be found at the Bardhaman district during this particular study has been depicted in the Figure – 6 above.

**Subclass wise percent distribution of families:**

**Figure - 7:** Bar-diagram showing percent distribution of families in the global context among the different subclasses

of Magnoliopsida (*sensu* Takhtajan, 2009) that could be found at the Bardhaman district

The percent distribution of the different families in the global context among the different subclasses of Liliopsida (*sensu* Takhtajan, 2009) that could be found at the Bardhaman district during this particular study has been depicted in the Figure – 7.

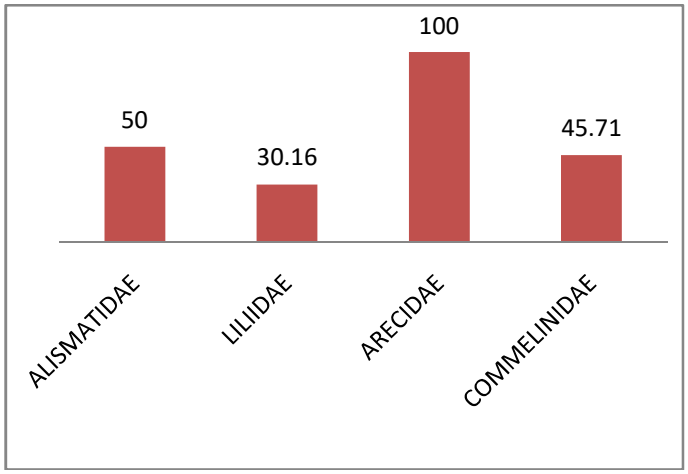


**Figure 7. Bar-diagram showing percent distribution of families in the global context among the Different subclasses of Magnoliopsida (*sensu* Takhtajan, 2009) that could be found at the Bardhaman district**

**Nine dominant Liliopsid (*sensu* Takhtajan, 2009) families of the district of Bardhaman:** The total number of species covered by the Nine dominant Liliopsid (*sensu* Takhtajan, 2009) families (vide Table – 3) of the Bardhaman district of West Bengal, India has been found to be 220 as documented in this study.

**Table 2. Representation of the different subclasses of the Class Liliopsida ( *sensu* Takhtajan, 2009) at different lower taxonomic ranks up to the species level**

| Subclasses | No. of Superorders | No. of Orders | No. of Families | No. of Genera | No. of Species |
|---|---|---|---|---|---|
| Alismatidae | 2 | 4 | 11 | 32 | 39 |
| Liliidae | 2 | 8 | 19 | 44 | 65 |
| Arecidae | 1 | 1 | 1 | 8 | 9 |
| Commelinidae | 5 | 7 | 16 | 93 | 187 |

**Table 3. Nine dominant Liliopsid (*sensu* Takhtajan, 2009) families of the district of Bardhaman**

| Name of the Family | No. of Species |
|---|---|
| Poaceae | 108 |
| Cyperaceae | 33 |
| Commelinaceae | 15 |
| Araceae | 15 |
| Orchidaceae | 12 |
| Amaryllidaceae | 11 |
| Arecaceae | 9 |
| Zingiberaceae | 9 |
| Agavaceae | 8 |

**Table 4. Five dominant Liliopsid (*sensu* Takhtajan, 2009) genera of the district of Bardhaman**

| Genera | Family | No. of Species |
|---|---|---|
| *Cyperus* | Cyperaceae | 12 |
| *Fimbristylis* | Cyperaceae | 10 |
| *Eragrostis* | Poaceae | 10 |
| *Panicum* | Poaceae | 7 |
| *Brachiaria* | Poaceae | 6 |

This is about 73 % of the total number of Liliopsid plant species that were found in the district. The total number of species covered by the Five dominant Liliopsid (*sensu* Takhtajan, 2009) genera of the Bardhaman district of West Bengal, India is 45. This is almost about 15 % of the total number of Liliopsid plant species that were found in the district from this study.

**S/G ( Species / Genera ) ratio among the different Liliopsid families (*sensu* Takhtajan, 2009):** Comparatively lesser numbers of genera (vide Figure – 8) having S/G ratio ≥ 2.01 indicate that in the district of Bardhaman, cosmopolitan-, evolutionarily younger Liliopsid genera are more in number than the endemic-, evolutionarily older ones as it has been an established fact that a genus having more species richness i.e., higher S/G ratio is more likely to be an endemic, evolutionarily older one than a genus having lesser species richness i.e., lower S/G ratio (Krug *et al.*, 2008 ).

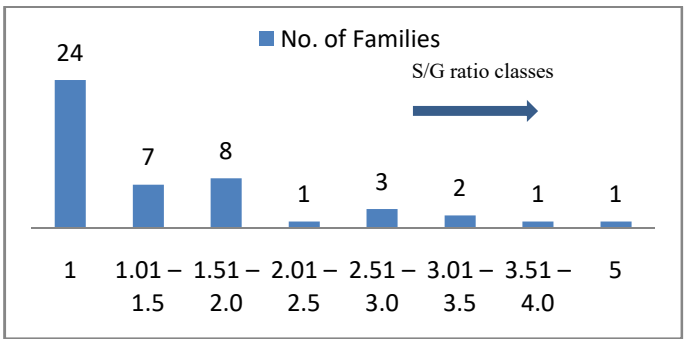


**Figure 8. Bar-diagram showing S/G ratio distribution among the Families of Liliopsida (*sensu* Takhtajan, 2009) of the Bardhaman district**

- No. of Monogeneric Families = 26
- No. of Monospecific Genera constituting a Monogeneric Family each = 17

Therefore, there exist 9 monogeneric Liliopsid families (*sensu* Takhtajan, 20009) which are not monospecific.

## DISCUSSION

***Importance of the present phytodiversity study with special reference to the class Liliopsida of the erstwhile undivided district of Bardhaman (sensu Takhtajan, 2009):*** Under extensive disturbance - species diversity normally declines, but moderate disturbance can enhance or reduce it depending on the spatial scale and types of species. Hence, understanding the relationship between disturbance and species diversity is fundamental during the setting of conservation policy. An increasing interest in understanding the community structure and ecosystem stability has given rise to the need to prepare plant inventories of regions as it has been found that vegetation plays a key role in regulating climate, conserving biodiversity and providing a livelihood to the people of a particular region. They are the primary sources to rejuvenate the productivity of land through recycling of nutrients, which make physicochemical conditions of the soils favorable for plant growth. From the results of the present phytodiversity study discussed above, it is quite evident that the Liliopsid Flora of the erstwhile Bardhaman district is mainly composed by the comparatively evolved subclasses (*sensu* Takhtajan, 2009) i.e., the Subclasses – Arecidae and Commelinidae house about 65.45 % of the monocotyledonous plant specimens encountered there. Now, this has also been established by the

distributional pattern of the S/G (Species / Genera) ratio that the land of Bardhaman has given shelter to the cosmopolitan and comparatively younger (in other words, comparatively more evolved ) Liliopsids. The entry of several migrant species from surrounding countries and/or regions and their naturalization has added richness to the flora and vegetation of the district of Bardhaman. This phenomenon, observed through this study, has some greater implications e.g., it sheds light on the present vegetational types, landscape, climatic conditions and other aspects of the region that are directly / indirectly dependent on the floristic composition there. Ecological factors like - soil types, heterogeneity in resources, slopes, etc. affected the sustenance and diversity of the monocotyledonous plant species of the erstwhile Bardhaman district. The rapid rate of urbanization, along with population explosion, is a serious threat to the conservation of plant species. Hence, a clear understanding of the ecological and economic values of each of the plant species is essential. The growth of weeds adversely affects the growth of the desirable plants for which chemical and biological control for the sustainable development of plant species of the district becomes an integrated process. Conservation of plant community cannot be a mutually exclusive phenomenon as the conservation of the district fauna demands equal weightage. Thus, a PPP ( i.e., Private, Public Partnership ) model for conservation of the entire biodiversity of the district might become the best solution to the problem of plant species loss over the temporal scale of the area. To begin with, therefore, the preparation of a comprehensive inventory of monocotyledonous plant species found in the erstwhile Bardhaman district is a positive step towards the realization of the goal of Conservation - of not only the Phytodiversity but also Biodiversity as a whole for the region. In this noble motto, drawings of at least traditionally useful plant species, at their seedling stages, may become very useful for common people for their desired discrimination at the field level from apparently similar unwanted plants and/or weeds. The more these drawings and associated short descriptions are realizable by the common people - the more will be their involvement in the conservation of these species. Apart from these, periodic surveys of gross phytodiversity of the district using GIS technique may turn out to be an important tool for plant conservation in the region.

By this survey work – diversity of the Liliopsid (*sensu* Takhtajan, 2009) plants of the erstwhile district of Bardhaman have been documented. These documentations afford scopes in Pharmacognosy, Agriculture, Plant-based industries and Biodiversity conservation. Again, this work has put forward many possibilities for a plethora of future investigations in the lines of rapidly developing dynamic fields of Botany, like – Biotechnology, Molecular Biology, Plant Tissue Culture, etc.

If not acted upon at once, the somewhat unique phytodiversity with special reference to Liliopsida (*sensu* Takhtajan, 2009) of the district of Bardhaman will be lost forever due to the rapid rate of urbanization in the district, coupled with the population explosion. This will have an imminent adverse effect in the phytodiversities of the adjoining districts of West Bengal as well.

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**ANNEXURE – 1: An inventory of the plants belonging to the class Liliopsida (*sensu* Takhtajan, 2009) in the erstwhile undivided Bardhaman district**

**Phylum MAGNOLIOPHYTA (FLOWERING PLANTS)**

**Class LILIOPSIDA (MONOCOTYLEDONS)**

**Subclass I. Alismatidae**

**SUPERORDER ALISMATANAE**

***Order 2. Hydrocharitales***

Family 1. Aponogetonaceae
- *Aponogeton natans* (L.) Engl. and K.Krause
- *Aponogeton crispus* Thunb.

Family 3 Najadaceae
- *Najas faveolata* A. Br. ex Magnus
- *Najas indica* (Willd.) Cham.
- *Najas minor* All.

Family 4 Hydrocharitaceae
- *Hydrilla verticillata* (L.f.) Royle
- *Nechamandra alternifolia* (Roxb. ex Wight) Thwaites
- *Ottelia alismoides* (L.) Pers.
- *Vallisneria spiralis* L.

***Order 3. Alismatales***
Family 1 Limnocharitaceae
- *Limnocharis flava* (L.) Buchenau*
- *Butomopsis latifolia* (D.Don) Kunth

Family 2 Alismataceae
- *Caldesia parnassifolia* (L.) Parl.
- *Sagittaria sagittifolia* L.

***Order 4. Potamogetonales***

Family 3 Potamogetonaceae
- *Potamogeton crispus* L.
- *Potamogeton nodosus* Poir.
- *Stuckenia pectinata* (L.) Börner

Family 6 Zannichelliaceae
- *Zannichellia palustris* L.

**SUPERORDER ARANAE**
***Order 5. Arales***

Family 1. Acoraceae
- *Acorus calamus* L.

Family 2. Araceae
- *Aglaonema nitidum* (Jack) Kunth
- *Alocasia cucullata* (Lour.) G.Don
- *Alocasia macrorrhizos* (L.) G. Don
- *Amorphophallus paeoniifolius* (Dennst.) Nicolson
- *Anthurium lanceolatum* (L.) Schott
- *Caladium bicolor* (Aiton) Vent.
- *Colocasia esculenta* (L.) Schott
- *Cyrtosperma merkusii* (Hassk.) Schott
- *Dieffenbachia seguine* (Jacq.) Schott
- *Epipremnum aureum* (Linden and André) G.S.Bunting
- *Lasia spinosa* (L.) Thwaites
- *Monstera deliciosa* Liebm.
- *Scindapsus officinalis* (Roxb.) Schott
- *Typhonium trilobatum* (L.) Schott
- *Xanthosoma sagittifolium* (L.) Schott

Family 3. Pistiaceae

1. *Pistia stratiotes* L.

Family 4. Lemnaceae
- *Lemna trisulca* L.
- *Spirodela oligorrhiza* (Kurz) Hegelm.
- *Spirodela polyrrhiza* (L.) Schleid.
- *Wolffia arrhiza* (L.) Horkel ex Wimm.
- *Wolffia microscopica* (Griff.) Kurz

**Subclass II. Liliidae**
**SUPERORDER LILIANAE**

Family 2. Colchicaceae
- *Gloriosa superba* L.
- *Iphigenia indica* (L.) A.Gray ex Kunth

***Order 9. Burmanniales***

Family 1. Burmanniaceae
- *Burmannia coelestis* D.Don

***Order 11. Smilacales***

Family 3. Smilacaceae
- Smilax zeylanica L.

***Order 12. Orchidales***
Family 2. Asteliaceae
- *Cordyline fruticosa* (L.) A.Chev.
- *Cordyline indivisa* (G.Forst.) Endl.
- *Cordyline stricta* (Sims) Endl.

Family 4. Hypoxidaceae
- *Curculigo orchioides* Gaertn.
- *Molineria capitulata* (Lour.) Herb.

**Family 5. Orchidaceae**

- *Acampe praemorsa* (Roxb.) Blatt. and McCann
- *Bulbophyllum striatum* (Griff.) Rchb.f.
- *Coelogyne cristata* Lindl.
- *Dendrobium speciosum* Sm.
- *Didymoplexis pallens* Griff.
- *Eulophia spectabilis* (Dennst.) Suresh
- *Geodorum densiflorum* (Lam.) Schltr.
- *Nervilia plicata* (Andrews) Schltr.
- *Phaius tankervilleae* (Banks) Blume
- *Spiranthes sinensis* (Pers.) Ames

- *Vanda tessellata* (Roxb.) Hook. ex G.Don
- *Zeuxine strateumatica* (L.) Schltr.

***Order 13. Iridales***

Family 7. Iridaceae
- *Cipura paludosa* Aubl
- *Gladiolus x colvillei* Sweet
- *Iris domestica* (L.) Goldblatt and Mabb.

***Order 14. Amaryllidales***

Family 1. Hemerocallidaceae
- *Hemerocallis fulva* (L.) L.

Family 2. Phormiaceae

- *Dianella longifolia* R.Br.

Family 4. Asphodelaceae

- *Aloe arborescens* Mill.
- *Aloe vera* (L.) Burm.f.
- *Asphodelus tenuifolius* Cav.

Family 6. Antheriaceae
- *Chlorophytum tuberosum* (Roxb.) Baker

Family 9. Agavaceae
- *Agave americana* L.
- *Agave cantala* (Haw.) Roxb. ex Salm-Dyck
- *Agave potatorum* Zucc.
- *Agave vera-cruz* Mill.
- *Agave vivipara* L.
- *Furcraea acaulis* (Kunth) B.Ullrich
- *Polianthes tuberosa* L.
- *Yucca aloifolia* L.

Family 12. Alliaceae
- *Allium cepa* L.
- *Allium sativum* L.

Family 13. Amaryllidaceae
- *Crinum latifolium* L.
- *Crinum viviparum* (Lam.) R.Ansari and V.J.Nair
- *Hippeastrum vittatum* (L'Hér.) Herb..
- *Hymenocallis liriosme* (Raf.) Shinners
- *Pancratium biflorum* Roxb.
- *Pancratium longiflorum* Roxb. ex Ker Gawl.
- *Scadoxus multiflorus* (Martyn) Raf.
- *Zephyranthes candida* (Lindl.) Herb.
- *Zephyranthes carinata* Herb.
- *Zephyranthes minuta* (Kunth) D.Dietr.
- *Zephyranthes rosea* Lindl.

***Order 15. Asparagales***

Family 1. Convallariaceae

1. *Ophiopogon intermedius* D.Don

Family 2. Dracaenaceae
- *Dracaena surculosa* Lindl.
- *Sansevieria cylindrica* Bojer ex Hook.
- *Sansevieria roxburghiana* Schult. and Schult.f.
- *Sansevieria trifasciata* Prain
- *Sansevieria zeylanica* (L.) Willd.

Family 3. Nolinaceae
- *Beaucarnea recurvata* Lem.

Family 5. Asparagaceae
- *Asparagus racemosus* Willd.
- *Asparagus setaceus* (Kunth) Jessop

**SUPERORDER PANDANANAE**

***Order 16. Pandanales***

Family 1. Pandanaceae
- *Pandanus amaryllifolius* Roxb.
- *Pandanus foetidus* Roxb.
- *Pandanus odorifer* (Forssk.) Kuntze
- *Pandanus princeps* B.C.Stone
- *Pandanus tectorius* Parkinson ex Du Roi

**Subclass III. Arecidae**

**SUPERORDER ARECA**NAE

***Order 22. Arecales***

Family 1. Arecaceae
- *Areca catechu* L.
- *Borassus flabellifer* L.
- *Calamus viminalis* Willd.
- *Caryota urens* L.
- *Cocos nucifera* L.
- *Corypha utan* Lam.
- *Phoenix acaulis* Roxb.
- *Phoenix sylvestris* (L.) Roxb.
- *Roystonea regia* (Kunth) O.F.Cook

**Subclass IV. Commelinidae**

**SUPERORDER BROMELIANAE**

***Order 23. Bromeliales***

Family 1. Bromeliaceae
- *Ananas comosus* (L.) Merr**.**

**SUPERORDER ZINGIBERANAE**

***Order 24. Zingiberales (Cannales)***

Family 1. Strelitziaceae
- *Ravenala madagascariensis* Sonn.

Family 3. Musaceae
- *Musa balbisiana* Colla
- *Musa* × *paradisiaca* L.
- *Musa acuminata* Colla

Family 4. Heliconiaceae
- *Heliconia caribaea* Lam.

Family 5. Zingiberaceae
- *Alpinia zerumbet* (Pers.) B.L.Burtt and R.M.Sm.
- *Curcuma amada* Roxb.
- *Curcuma angustifolia* Roxb.
- *Curcuma aromatica* Salisb.
- *Curcuma longa* L.
- *Globba marantina* L.
- *Hedychium coronarium* J.Koenig
- *Kaempferia rotunda* L.
- *Zingiber officinale* Roscoe

Family 6. Costaceae
- *Cheilocostus speciosus* (J.Koenig) C.D.Specht

Family 7. Cannaceae
- *Canna indica* L.

Family 8. Marantaceae
- *Calathea zebrina* (Sims) Lindl.
- *Maranta arundinacea* L.
- *Maranta cristata* Nees and Mart.

**SUPERORDER COMMELINANAE**
***Order 25. Commelinales***

Family 2. Commelinaceae
- *Commelina benghalensis* L.
- *Commelina caroliniana* Walter
- *Commelina diffusa* Burm.f.
- *Commelina erecta* L.
- *Commelina longifolia* Lam.
- *Commelina paludosa* Blume
- *Cyanotis adscendens* Dalzell
- *Cyanotis axillaris* (L.) D.Don ex Sweet
- *Cyanotis cristata* (L.) D.Don
- *Callisia fragrans* (Lindl.) Woodson
- *Murdannia nudiflora* (L.) Brenan
- *Murdannia vaginata* (L.) G.Brückn.
- *Tradescantia pallida* (Rose) D.R.Hunt
- *Tradescantia spathacea* Sw.
- *Tradescantia zebrina* Bosse

Family 4. Pontederiaceae
- *Eichhornia crassipes* (Mart.) Solms
- *Monochoria hastata* (L.) Solms
- *Monochoria vaginalis* (Burm.f.) C.Presl

***Order 26. Xyridales***
Family 2. Xyridaceae
- *Xyris indica* L.
- *Xyris pauciflora* Willd.

Family 4. Eriocaulaceae
- *Eriocaulon cinereum* R.Br.
- *Eriocaulon oryzetorum* Mart.
- *Eriocaulon truncatum* Buch.-Ham. ex Mart.
- *Eriocaulon xeranthemum* Mart.

**SUPERORDER JUNCANAE**
***Order 28. Juncales***

Family 2. Juncaceae
- *Juncus prismatocarpus* R.Br.

Family 3. Cyperaceae

- *Bulbostylis densa* (Wall.) Hand.-Mazz.
- *Cyperus alternifolius* L.
- *Cyperus corymbosus* Rottb.
- *Cyperus corymbosus* Rottb.
- *Cyperus difformis* L.
- *Cyperus exaltatus* Retz.
- *Cyperus imbricatus* Retz.
- *Cyperus iria* L.
- *Cyperus michelianus* (L.) Delile
- *Cyperus pangorei* Rottb.
- *Cyperus pilosus* Vahl
- *Cyperus platystylis* R.Br.
- *Cyperus rotundus* L.
- *Eleocharis atropurpurea* (Retz.) J.Presl and C.Presl
- *Fimbristylis acicularis* R.Br.
- *Fimbristylis acuminata* Vahl
- *Fimbristylis complanata* (Retz.) Link
- *Fimbristylis dichotoma* (L.) Vahl
- *Fimbristylis littoralis* Gaudich.
- *Fimbristylis ovata* (Burm.f.) J.Kern
- *Fimbristylis quinquangularis* (Vahl) Kunth
- *Fimbristylis spadicea* (L.) Vahl
- *Fimbristylis tetragona* R.Br.
- *Fimbristylis tristachya* R.Br.
- *Kyllinga brevifolia* Rottb.
- *Kyllinga odorata* subsp. *cylindrica* (Nees) T.Koyama
- *Lipocarpha gracilis* (Rich. ex Pers.) Nees
- *Lipocarpha squarrosa* (L.) Goetgh.
- *Pycreus sanguinolentus* (Vahl) Nees
- *Rhynchospora colorata* (L.) H.Pfeiff.
- *Schoenoplectiella articulata* (L.) Lye
- *Scleria parvula* Steud.
- *Scleria pergracilis* (Nees) Kunth

**SUPERORDER POANAE**
***Order 29. Typhales***

Family 2. Typhaceae
- *Typha domingensis* Pers.

***Order 31. Poales***

Family 1. Poaceae

- *Alloteropsis cimicina* (L.) Stapf
- *Apluda mutica* L.
- *Aristida adscensionis* L.
- *Aristida redacta* Stapf
- *Aristida setacea* Retz.
- *Avena fatua* L. i
- *Avena sterilis* L.
- *Bambusa bambos* (L.) Voss
- *Bambusa vulgaris* Schrad.
- *Bambusa tulda* Roxb.
- *Bothriochloa bladhii* (Retz.) S.T.Blake
- *Bothriochloa pertusa* (L.) A.Camus
- *Brachiaria distachya* (L.) Stapf
- *Brachiaria eruciformis* (Sm.) Griseb.
- *Brachiaria kurzii* (Hook.f.) A.Camus
- *Brachiaria ramosa* (L.) Stapf
- *Brachiaria reptans* (L.) C.A.Gardner and C.E.Hubb.
- *Brachiaria subquadripara* (Trin.) Hitchc.
- *Chrysopogon aciculatus* (Retz.) Trin.
- *Chrysopogon gryllus* (L.) Trin.
- *Chrysopogon zizanioides* (L.) Roberty
- *Coix lacryma-jobi* L.
- *Cymbopogon schoenanthus* (L.) Spreng.
- *Cynodon barberi* Rang. and Tadul.
- *Cynodon dactylon* (L.) Pers.
- *Cynodon radiatus* Roth
- *Dactyloctenium aegyptium* (L.) Willd.
- *Dendrocalamus strictus* (Roxb.) Nees
- *Desmostachya bipinnata* (L.) Stapf
- *Dichanthium annulatum* (Forssk.) Stapf

- *Dichanthium aristatum* (Poir.) C.E.Hubb.
- *Digitaria abludens* (Roem. and Schult.) Veldkamp
- *Digitaria ciliaris* (Retz.) Koeler
- *Digitaria longiflora* (Retz.) Pers.
- *Digitaria stricta* Roth
- *Echinochloa colona* (L.) Link
- *Echinochloa frumentacea* Link
- *Eleusine coracana* (L.) Gaertn.
- *Eleusine indica* (L.) Gaertn.
- *Enteropogon dolichostachyus* (Lag.) Keng
- *Eragrostis amabilis* (L.) Wight and Arn.
- *Eragrostis ciliaris* (L.) R.Br.
- *Eragrostis coarctata* Stapf
- *Eragrostis gangetica* (Roxb.) Steud.
- *Eragrostis japonica* (Thunb.) Trin.
- *Eragrostis pilosa* (L.) P.Beauv.
- *Eragrostis riparia* (Willd.) Nees
- *Eragrostis tremula* Hochst. ex Steud.
- *Eragrostis unioloides* (Retz.) Nees ex Steud.
- *Eragrostis viscosa* (Retz.) Trin.
- *Eriochloa procera* (Retz.) C.E.Hubb.
- *Heteropogon contortus* (L.) P.Beauv. ex Roem. and Schult.
- *Hordeum vulgare* L.
- *Hygroryza aristata* (Retz.) Nees ex Wight and Arn.
- *Hymenachne amplexicaulis* (Rudge) Nees
- *Imperata cylindrica* (L.) Raeusch.
- *Ischaemum rugosum* Salisb.
- *Isachne albens* Trin.
- *Iseilema laxum* Hack.
- *Leersia hexandra* Sw.
- *Leptochloa chinensis* (L.) Nees
- *Leptochloa panicea* (Retz.) Ohwi
- *Miscanthus fuscus* (Roxb.) Benth.
- *Mnesithea laevis* (Retz.) Kunth
- *Oplismenus burmanni* (Retz.) P.Beauv.
- *Oplismenus compositus* (L.) P.Beauv.
- *Oplismenus hirtellus* (L.) P.Beauv.
- *Oryza rufipogon* Griff.
- *Oryza sativa* L.
- *Panicum atrosanguineum* Hochst. ex A.Rich.
- *Panicum curviflorum* Hornem.
- *Panicum humile* Steud.
- *Panicum miliaceum* L.
- *Panicum paludosum* Roxb.
- *Panicum repens* L.
- *Panicum sumatrense* Roth
- *Paspalidium flavidum* (Retz.) A.Camus
- *Paspalum dilatatum* Poir.
- *Paspalum scrobiculatum* L.
- *Pennisetum pedicellatum* Trin.
- *Perotis indica* (L.) Kuntze
- *Phragmites karka* (Retz.) Trin. ex Steud.
- *Pleioblastus fortunei* (Van Houtte) Nakai
- *Polypogon monspeliensis* (L.) Desf.
- *Pseudoraphis minuta* (Mez) Pilg.``
- *Pseudoraphis sordida* (Thwaites) S.M.Phillips and S.L.Chen
- *Pseudosorghum fasciculare* (Roxb.) A.Camus
- *Rottboellia cochinchinensis* (Lour.) Clayton
- *Saccharum bengalense* Retz.
- *Saccharum officinarum* L.
- *Saccharum spontaneum* L.
- *Sacciolepis indica* (L.) Chase
- *Schizachyrium exile* (Hochst.) Pilg.
- *Sehima nervosum* (Rottler) Stapf
- *Setaria barbata* (Lam.) Kunth
- *Setaria intermedia* Roem. and Schult.
- *Setaria italica* (L.) P.Beauv.
- *Setaria pumila* (Poir.) Roem. and Schult.
- *Setaria verticillata* (L.) P.Beauv.
- *Sorghum bicolor* (L.) Moench
- *Sporobolus agrostoides* Chiov.
- *Sporobolus diandrus* (Retz.) P.Beauv.
- *Sporobolus virginicus* (L.) Kunth
- *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda
- *Tragus racemosus* (L.) All.
- *Triticum aestivum* L.
- *Urochloa panicoides* P.Beauv.
- *Zea mays* L.

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