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FLOWERING SEASONS OF SOME COMMON ETHNOMEDICINAL PLANTS OF BANKURA DISTRICT, WEST BENGAL (INDIA)

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ABSTRACT

The present communication deals with the flowering seasons of 115 species (106 dicots and 9 monocots) of 104 genera (95 dicots and 9 monocots) belonging to 48 families (40 dicots and 8 monocots) of angiosperms which are very much in ethnomedicinal use in Bankura district of West Bengal. The flowering seasons as stated were recorded during field studies initiated in 2012 considering flowering response as the most important photoperiodic phenological event in the life of an angiosperm that has a direct bearing on its biotic potential and survival. Interestingly of all the concerned species 72 flowered in the pre-monsoon, 76 in the monsoon and 66 in the post- monsoon seasons. Only 14 species were found to flower throughout the year while 68 species flowered in two seasons and 26 in one season only.

KEYWORDS: Flowering, Angiosperms, Bankura District, Ethnomedicine, Phenology, Photoperiodic Event.

Preparation of flowering calendar of plants of an area is of great importance since such information is essential especially for the palynologists engaged in ascertaining the allergenic role of pollen grains released from the flowers of various species in different parts of the year (Shivpuri and Singh, 1971,Chanda *et al*., 1978; Shivpuri *et al.,* 1979; Singh *et al.,* 1979; Kundu *et al.,* 1981; Mandal and Chanda, 1981; Jadeja and Nakar, 2010; Nakar and Jadeja, 2013, 2014, 2015) and for the medical scientists for utilization of these facts for diagnosis and therapeutic treatment of patients suffering from allergic ailments caused by pollen grains (Mandal, 1982, Kumar, 1984; Kumar and Nayar, 1985). The database of flowering also proves very useful in accomplishment of taxonomy, pharmacognosy, horticulture, floriculture, landscape designing and also to the researchers in the fields of autecology, palynology (Bhattacharya (Sasmal) *et al*., 2015), conservation ecology, reproductive biology and aerobiology (Mukherjee, 1984). In view of taxonomic importance and multifarious applied implications of flowering time of angiosperms, the present study was undertaken on plants that are commonly used for medicinal purposes by the ethnic communities in the district. This study is in conformity with the earlier work of the present author (Biswas and Mukherjee, 2014, 2017; Biswas *et al*., 2016).

STUDY SITE

Bankura District lying within latitude 22° 38′and 23° 38′ north latitude, 86° 36' and 87 °46' east longitude covers an area of 6,788 square kilometers. On the north and north-east the district is bounded by Bardhaman district, from which it is separated by the Damodar River. On the south-east it is bounded by Hooghly district, on the south by Paschim Medinipur district and on the west by Purulia district. Bankura district has a dry and hot summer with moderate monsoon and cold winter. Major portion of the rain is received during the monsoon season (June-September), the annual mean rainfall being about 1400 mm. The mean maximum and minimum temperatures are around 45°C and 9^0 C experienced in the month of January and December respectively .

MATERIALS AND METHODS

Field observations on flowering response of ethnomedicinally used plants were recorded at different intervals of time since 2012 in different parts of the district especially in the forested areas inhabited by tribal communities. Flowering periods of different plants have been recorded in terms of three conspicuous seasons i.e. pre-monsoon (February to May), monsoon (June-September) and post-monsoon (October-January). The specimens were firstly collected,worked out and identified by standard taxonomic methods and reference to pertinent literature (Prains, 1913; Bennet, 1987; Guha Bakshi, 1984; Murti and Panigrahi, 1999; Bhattacharya and Sarkar,1988; Sanyal,1994). Nomenclature of each species was checked with that given in the latest publications. Websites of the International Plant Names Index (IPNI) [http://www.ipni.org/], The Plant List (http://www.theplantlist.org.) and Tropicos (http://www.tropicos.org/) were consulted for updating species names. The concerned species were tabulated in alphabetic order along with their respective flowering seasons.

RESULTS AND DISCUSSION

The present study could record a total of 115 species (106 dicots and 9 monocots) of ethnomedicinal

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plants belonging to 104 genera (95 dicots and 9 monocots) and 48 families (40 dicots and 8 monocots). Flowering periods of these plants were found to occur in different seasons (Pre-Monsoon, Monsoon, Post-Monsoon). As many as 72 species were seen to flower in the pre- monsoon season, 76 species in monsoon and 66 species in the post-monsoon seasons (Fig.1). While analysing range of flowering season(s) of the concerned species only 14 were found to flower throughout the year while 68 species flowered in two seasons and 26 in one season only (Fig.2). The variable responses of the species regarding flowering can be attributed to the timing of vegetative phenology that strongly determines the flowering periods. Variation in flowering time relative to vegetative phenology, especially leafing events (Singh and Kushwaha,2006), is induced by a variety of factors (significant rain in winter/summer, decreasing or increasing photoperiod, or drought-induced leaf fall), results in a number of flowering patterns in tropical trees (Borchert *et al*., 2004). As such flowering at least depends indirectly on environmental periodicity (Rivera *et al*., 2002). That the variation in vegetative and flowering phenology in forest herbs can be caused by environmental heterogeneity has been shown by (Dahlgren *et al.,* 2007). The importance of understanding the determinants of phenological patterns has been emphasized to predict responses of specific communities to global climate change (vanVliet and Schwartz, 2002). Thus recording of flowering periods of the species composing a community at periodic intervals is certain to give an idea about the trend of environmental changes which is very essential in monitoring and optimizing environment especially at places with a monsoonal bio-climate.

There appears to be somewhat even spatial partitioning of flowering responses which speaks of a compromise to avoid competition for pollinating agents. Moreover majority of the species used in ethnomedicine have long span of flowering period which speaks of a biotic potential to build up resilience against the resistance offered to them through overexploitation very often.

Table 1: An enumeration of the ethnomedicinally used plants in Bankura district and their flowering seasons.

Name of the plant	Family	Flowering period		
		Pre-monsoon (February-May)	Monsoon (June-September)	Post-monsoon (October-January)
Abelmoschus angulosus Wall.ex Wight &Arn.	Malvaceae	+		+
Abelmoschus moschatus Medik.	Malvaceae		+	+
Abroma angusta (L.) L. f.	Sterculiaceae	+		
Abrus precatorius L.	Fabaceae	+		
Abutilon indicum (L.)Sw.	Malvaceae		+	+
Acacia nilotica (L.)Delile	Mimosaceae		+	+
Acalypha indica L.	Euphorbiaceae	+	+	+
Achyranthes aspera L.	Amaranthaceae	+	+	
Acorus calamus L.	Araceae	+	+	
Ageratum conyzoides L.	Asteraceae	+	+	
Aloe barbadensis Mill.	Liliaceae	+		+
Alstonia scholaris (L.)R.Br.	Apocynaceae	+		+
Amaranthus spinosus L.	Amaranthaceae	+	+	+
Andrographis paniculata (Burm.f.)Nees	Acanthaceae	+	+	
Anisomeles indica(L.)Kuntze	Scrophulariaceae			+
Antigonon leptopus Endl.	Polygonaceae	+		
Argemone mexicana L.	Papaveraceae		+	+
Aristolochia indica L.	Aristolochiaceae	+	+	

Asparagus recemosus Willd.	Asparagaceae	+		+
Azadirachta indica Juss.	Meliaceae	+		+
Bacopa monnieri (L.)Wettst.	Scrophulariaceae	+	+	+
Bauhinia acuminate L.	Fabaceae	+	+	
Berleria prionites L.	Acanthaceae		+	+
Boerrahavia diffusa L.	Nyctaginaceae	+	+	+
Borassus flabellifer L.	Arecaceae	+		
Brassica cadmea Heldr.ex O.E.Schulz	Brassicaceae		+	
Bryophyllum pinnatum (Lam.)Oken	Crassulaceae	+		+
Cajanus cajan (L.)Millsp.	Fabaceae		+	
Calotropis procera (Aiton) Dryand.	Asclepiadaceae		+	+
Carica papaya L.	Caricaceae	+	+	+
Cassia fistula L.	Fabaceae	+	+	+
Catharanthus roseus (L.)G.	Apocynaceae	+	+	+
Centella asiatica (L.) Urb.	Apiaceae		+	+
Cinnamomum tamala (Buch.-Ham.)T.Nees & Eberm.	Lauraceae	+	+	
Cissus quadrangularis L.	Vitaceae	+	+	
Citrullus lanatus(Thunb.)Matsum.&Nakai	Cucurbitaceae		+	
Citrullus melo L.	Cucurbitaceae		+	
Cleome icosandra L.	Capparidaceae		+	+
Clerodendrum serratum (L.)Moon.	Verbenaceae	+		+
Clitoria ternatea L.	Fabaceae	+		+
Coccinia grandis (L.)Voigt	Cucurbitaceae	+		+
Coleus amboinicus Lour	Lamiaceae			+
Crotalaria pallida Ait.	Fabaceae	+		+
Crotalaria retusa L.	Fabaceae	+		+
Croton bonplandianus Baill.	Euphorbiaceae		+	+
Cucumis sativa L.	Cucurbitaceae		+	
Cucurbita maxima Duchesne	Cucurbitaceae		+	
Curcuma longa L.	Zingiberaceae		+	
Cyperus rotundus L.	Cyperaceae		+	
Datura metel (pers.) Stapf	Solanaceae	+	+	
Desmodium motorium (Houtt.)Merr.	Fabaceae		+	+
Eclipta alba (L.)Hassk.	Asteraceae	+	+	+
Emblica officinales Gaertn.	Euphorbiaceae	+	+	
Enhydra fluctans Lour.	Asateraceae	+		+

Eupatorium triplinerve Vahl.	Asteraceae	+	+	
Euphorbia nerifolia L.	Euphorbiaceae		+	+
Gymnema sylvestre (Retz.)R.Br.ex Schult	Asclepiadaceae	+		+
Heliotropium indicum L.	Boraginaceae	+		+
Hemidesmus indicus R.Br.	Asclepiadaceae	+	+	
Holarrhena antidysenterica (Buch-Ham)Wall.ex G.Don	Apocynaceae	+		+
Hygrophila schulli (Buch-Ham)M.R.et S.M.Almeia	Acanthaceae		+	+
Jatropha gossypifolia L.	Euphorbiaceae	+	+	
Justicia adhatoda L.	Acanthaceae	+		+
Lagenaria siceraria(Molina) Standl.	Cucurbitaceae		+	
Lantana camara L.var.*aculeata* Molenke	Verbenaceae	+	+	+
Laportea interrupta L.	Urticaceae		+	+
Luffa acutangula(L.)Roxb.	Cucurbitaceae	+	+	
Madhuca longifolia(J.Koenig ex L.)J.F.Macbr.	Sapotaceae	+		
Mangifera indica L.	Anacardiaceae	+		+
Mentha spicta L.	Lamiaceae	+		+
Mimosa pudica L.	Fabaceae	+	+	+
Mirabilis jalapa var *procera*(Bertol.)Choisy.	Nyctaginaceae	+		
Momordica charantia L.	Cucurbitaceae		+	
Momordica coichinchinensis(Lour.)Spreng.	Cucurbitaceae	+	+	
Musa paradisiaca var. *acicularis* G.Forst.	Musaceae	+	+	+
Nerium odorum Solan.	Apocynaceae	+	+	
Nyctanthes arbortristis L.	Oleaceae		+	+
Ocimum gratissimum L.	Lamiaceae			+
Ocimum kilimanscharicum Gurke	Lamiaceae		+	+
Ocimum sanctum L.	Lamiaceae	+	+	+
Ocimum teneuiflorum L.	Lamiaceae	+	+	+
Oldenlandia accedens (Miq.)Kuntze	Rubiaceae	+	+	+
Paederia foetida var.*microcarpa* Kurz.	Rubiaceae	+		
Passiflora suberosa L.	Passifloraceae	+		+
Phlogacanthus thyrsiflorus (Hardw.) Mabberley	Acanthaceae		+	+
Piper longum L.	Piperaceae	+		
Plumbago indica L.	Plumbaginaceae		+	+
Plumbago zeylanica L.	Plumbaginaceae		+	
Polygala crotalarioides Buch-Ham. ex DC.	Polygalaceae		+	+
Polygonum orientale L.	Polygonaceae	+	+	
Psidium guajava L.	Myrtaceae	+	+	
Rauwolfia serpentina Benth.ex Kurz	Apocynaceae	+		

Ruellia tuberosa L.	Scrophulariaceae	+		+
Saraca asoca (Roxb.) de Wilde.	Fabaceae	+		
Scoparia dulcis L.	Scrophulariaceae		+	
Senna alata (L.)Roxb.	Fabaceae	+	+	
Senna sophera (L.)Roxb.	Fabaceae		+	+
Senna tora (L.)Roxb.	Fabaceae		+	+
Shorea robusta Gaertn.	Dipterocarpaceae	+		+
Sida cordifolia L.	Malvaceae		+	+
Smilax ovalifolia Roxb.	Smilaceae	+	+	
Solanum indicum L.	Solanaceae		+	+
Spondias pinnata (L.f.) Kurz	Anacardiaceae			+
Stephania japonica (Thunb.)Miers.	Menispermaceae		+	
Tabernamontana C coronaria R.Br.	Apocynaceae	+	+	
Tamarindus indica L.	Menispermaceae	+	+	
Tephrosia purpurea (L.)Piers.	Fabaceae		+	+
Terminalia bellirica (Gaertn.)Roxb.	Combretaceae	+		
Terminalia chebula Retz.	Combretaceae	+	+	
Tinospora cordifolia (Willd.)Miers.	Menispermaceae	+		+
Vitex negundo L.	Verbenaceae		+	
Wedelia chinensis Merrill	Asteraceae	+	+	+
Zingiber officinale Rosc.	Zingiberaceae		+	+

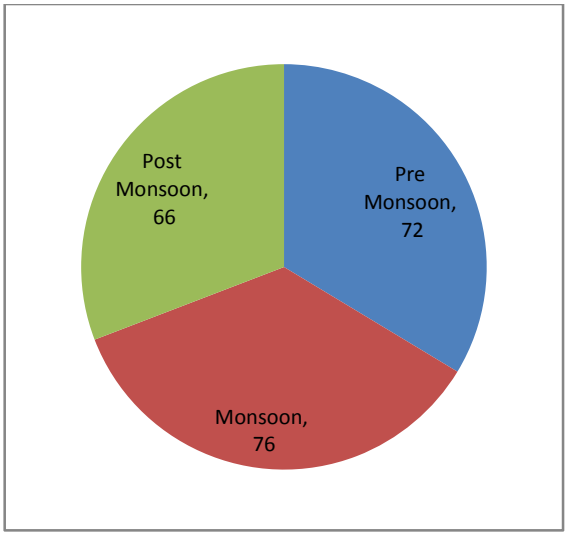

Figure 1: Number of species flowering in different seasons

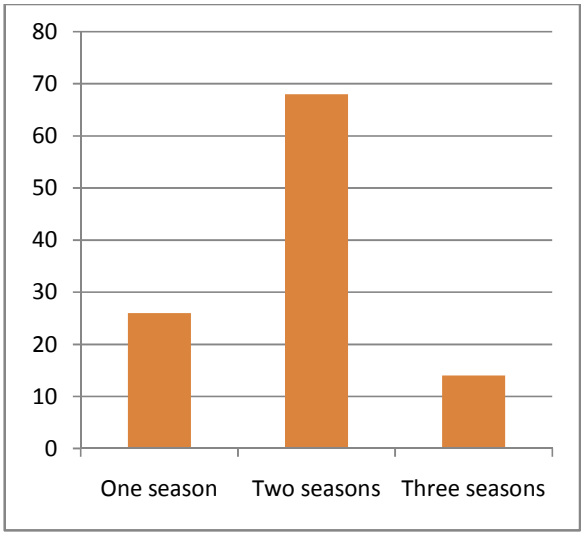

Figure 2: Species number vis-à-vis flowering season(s)

CONCLUSION

The information presented here regarding the flowering seasons of each species can prove helpful in collection of flowers for description and identification of species as well as for use as drugs for medicinal use. The flowering calendar of plants occurring in a place can also enable speculating the species of pollen grains likely to be present in air samples in different seasons to cause pollinosis, asthma and other forms of allergy so that the concerned pollen can get easily detected, isolated and used for therapeutic control of the allergic ailments thus caused. Periodic surveillance of flowering seasons of plants can also be helpful in monitoring environmental state since the physiological response is environmentally controlled to a great extent.

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