



[Science Archives \(ISSN:2582-6697\)](https://doi.org/10.47587/SA.2022.3305)

Journal homepage: www.sciencearchives.org



<https://doi.org/10.47587/SA.2022.3305>

Research Article



Anther types of angiosperms within floristic diversity of Durgawadi plateau, Northern Western Ghats of Maharashtra, India

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Received: July 12, 2022/ Revised: Aug 4, 2022/ Accepted: Aug 10, 2022

Abstract

Durgawadi plateau situated in the Northern Western Ghats of Junnar tehsil, Pune district (Maharashtra state) India comes under reserved biodiversity evergreen forest type. The continuous repetitive investigation of anther type special based on the mode of anther dehiscence considers 220 dicotyledonsyledon angiosperms species belonging to 161 genera of 66 plant families. The two main types of anther dehiscence were observed longitudinal and poricidal. Among these subtypes of longitudinal dehiscence, the extrorse dehiscence type is most commonly found in 25 families. Another sub-type of longitudinal dehiscences such as introrse dehiscence, latrorse dehiscence, and poricidal dehiscence types were found in 24, 18 & 1 families accordingly. Anther longitudinal dehiscence in introrse type is most commonly observed in 98 species, followed by extrorse, latrorse, and poricidal types were found in 70, 62, and 9 taxa respectively.

Keywords Angiosperm Diversity, Durgawadi Plateau, Anther Dehiscence

Introduction

The Western Ghats is one of the mega biodiversity centers in the world and second in India. Durgawadi plateau situated in the Northern Western Ghats (NWG) of Junnar tehsil, Pune district (Maharashtra state). The Northern Western Ghats is a floristic diversity having some important and unique species reported. Studied area coming under evergreen forest type (Myers et al., 2000; Rao, 2002). The weather conditions at Durgawadi Plateau is humid and cool during monsoon season. The average temperature of studied site is 11°C to 38°C annually, and average rainfall 1500 to 2000 mm annually (Rahangdale & Rahangdale, 2014). The studied area floristical diversity is very important because various number of new and endemic plant taxa reported such *Ceropegia rollae* (Koppula Hemadri, 1968); *Chlorophytum bharuchae* (Ansari et al., 1970); *Leucas deodikarii* (Billore & Hemadri, 1970); *Ischaemum raizadae* (Koppula Hemadri & Billore, 1970); *Isachne borii* (K. Hemadri, 1971a); *Alysicarpus vasavadae* and *Smithia agharkarii* (K. Hemadri, 1971b); *Bothriochola jainii* (Deshpande & Hemadri, 1971); *Ceropegia mahabalei* (Koppula Hemadri & Ansari, 1971); *Jansenella neglecta* (Yadav et al., 2010); *Mucuna sanjappae* (Aitawade &

Yadav, 2012). Microsporogenesis is a subsequent complex biological process of male reproductive development in angiospermous plants. Stamen is a male reproductive organ their originated in two important steps including stamen primordial formation, and stamen development (Zhang & Wilson, 2009). The stamen is the male reproductive organ in angiospermous plants. Pollen grains are two and three-celled. Generally, pollen grain remains attached in the form of dyads, tetrads, and pollinia (Fig. 5). In peculiar complete flowers, whorls consist of sepals, petals, stamens, and carpels. Meiosis the reduction of cell division occurs in the ovule (female gamet) and the anther (male gamet) (Keller & Korzun, 1996; Trigiano & Gray, 2005). *Brassica camflestris* and *Brassica napus* have reported embryogenesis haploid condition in anthers cultured (Keller & Armstrong, 1977; Keller & Armstrong, 1979). Somatic embryogenesis developed for production of *Euphorbia hypericifolia* (Manokari & Shekhawat, 2020). *In vitro* anther culture reported haploid conditions in some plant families, these are Euphorbiaceae, Salicaceae, Asteraceae, Poaceae, Solanaceae, Liliaceae, Scrophulariaceae, Compositae and Moraceae (Chand & Sahrawat, 2007). The stamens consists of filament and anther, it is a site of pollen development. Anther and filament joint to

each other with the help of connective. Anther development in experimental model plant *Arabidopsis* have reported four lobed anther during development of the tapetal cell layer (Browne et al., 2018). In angiospermic plants basically two locular and four locular presents in that two locular anther dehiscence by single line and in four locular anther dehiscence by two lines. In angiospermic flower Stamens and pollen development are closely linked (Johri et al., 1992; Scott et al., 2004; Jordan, 2006). Mature pollen grain is a multilayered wall structure consisting of an outer exine (outer sexine and the inner nexine) and inner intine (Fig. 5) (Erdtman, 1969; Gómez et al., 2015). Study of pollen grain under Palynology. Palynology is a broad branch in that study of fossil pollen grains belong to geopalynology, pollen grains found in atmospheric air belong to aeropalynology, medicinal or criminal aspect pollen grain study under iotopalynology, study of pollen grains in honey belong to melittopalynology. Pollen grains transfers through various agencies and settled down on stigmatic surface of female gametophytes. Pollen grain outer exine ornamentation very helpful for stability of pollen grain on stigmatic surface of female gametophytes (Maheshwari, 1950; Bhojwani & Bhatnagar, 1974). Anther dehiscence mainly occurs longitudinal (anthers crack by longitudinal single side ex. Solanaceae), transverse (anther crack transversely monotheous ex. Malvaceae), poricidal (anthers crack by at the tip of anther ex. Solanaceae), valvular (anther crack occurs through valves ex.

Lauraceae). In Umbellifers found a exerted type of anther i.e. stamens far away the petals. The longitudinal type is again divided into three basic sub types (a) Extrorse: anthers dehiscence outward side to the center of flower (b) Introrse: anthers dehiscence inward side to the centre of flower (c) Latrorse: anthers dehiscence from lateral side walls. The typical pollinium type anther observed in orchidaceae and Asclepiadaceae family (Nels R. Lersten, 2004; Simpson, 2010; Singh, 2010). During the ground study above information anther types and different manor of anther arrangement we took their observation repetitively.

Materials and Methods

Different flowers of dicotyledonsyledonous angiosperms plant species repetitively filed visit and taken observation after anther dehiscence were collected from different localities of Durgawadi plateau. Distinctive flowers anthers were observed for their shape and mode of dehiscence under dissecting simple microscope, compound light microscope (LABOMED microscope Lx 300) and Stereo microscope (Magnus MS24 Binocular). Repeated survey of the Durgawadi plateau by using G.P.S. (Google map) and collection of plants sample. The specimens were indentified with the help of floras and other available literature (Singh et al., 2000; Singh et al., 2001; Rahangdale & Rahangdale, 2014).



Fig. 1 Location of study area- NWG, India

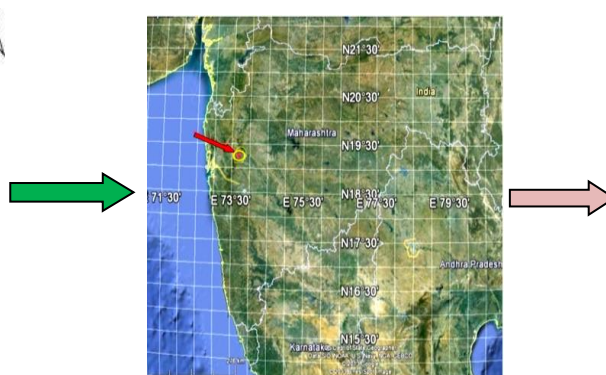


Fig. 2 Location of study area- Durgawadi red spots near the tip of arrow.



Fig. 3 The topography map of the Durgawadi plateau.

Result & Discussion

The floristic composition of the Durgawadi plateau is 65 families belonging to dicotyledons of 161 genera and 218 species. Dicotyledons floristic study of Durgawadi plateau finds out the anther dehiscence such as longitudinal and poricidal. Within the longitudinal anther dehiscence, all three subtypes such as extrorse introrse and latrorse have been observed. In all studied families out of 65 families 17 families have latrorse anther dehiscence while extrorse, introrse, and poricidal anther dehiscence types were found in 25, 24, and 1 family respectively (Table 1, 2; Fig. 6, 7). Anther longitudinal dehiscence in introrse type is most commonly observed in 98 species, followed by

extrorse, latrorse, and poricidal types were found in 70, 62, and 9 taxa respectively. Only one family Euphorbiaceae has the poricidal type of dehiscence. In the present investigation poricidal type was reported in the family Euphorbiaceae (Table 1) (Singh et al., 2001). However, during the study, we noted a unique observation is Lamiaceae family species have two anther types extrorse and latrorse likewise in Euphorbiaceae family species latrorse and poricidal (Table 1). The androgenic haploids (N) chromosomal immature conditions reported in *Datura innoxia*, *Nicotiana tabacum*, *Beta vulgaris*, *Allium cepa*, and *Gerbera jamesonii* (Keller & Korzun, 1996). During the study ornamented Exine outer layer of pollen grains was reported (Fig. 5) (Gómez et al., 2015).

Table 1. Dicotyledons plant families and their anther types

Sr. No.	Families	Total Species	Type of anther			
			Extrorse	Introrse	Latrorse	Poricidal
1.	Acanthaceae	9	-	-	+	-
2.	Amaranthaceae	3	-	+	-	-
3.	Anacardiaceae	1	-	-	+	-
4.	Apiaceae	6	-	+	-	-
5.	Apocynaceae	2	-	+	-	-
6.	Asclepiadaceae	7	-	+	-	-
7.	Asteraceae	20	-	+	-	-
8.	Balsaminaceae	5	-	+	-	-
9.	Begoniaceae	2	+	-	-	-
10.	Boraginaceae	2	+	-	-	-
11.	Brassicaceae	1	+	-	-	-
12.	Buddlejaceae	1	-	-	+	-
13.	Caesalpinaceae	1	-	+	-	-
14.	Campanulaceae	1	-	-	+	-
15.	Capparaceae	2	-	+	-	-
16.	Caryophyllaceae	1	-	-	+	-
17.	Celastraceae	1	-	+	-	-
18.	Combretaceae	2	+	-	-	-
19.	Convolvulaceae	5	-	-	+	-
20.	Crassulaceae	1	+	-	-	-
21.	Cucurbitaceae	4	+	-	-	-
22.	Droseraceae	1	-	+	-	-
23.	Ebenaceae	2	-	+	-	-
24.	Elaeagnaceae	1	-	+	-	-
25.	Euphorbiaceae	9	-	-	+	+
26.	Fabaceae	25	-	+	-	-
27.	Flacourtiaceae	2	+	-	-	-
28.	Gentianaceae	7	+	-	-	-
29.	Lamiaceae	12	+	-	+	-
30.	Lauraceae	1	-	+	-	-
31.	Lecythidaceae	1	-	+	-	-
32.	Leeaceae	1	+	-	-	-
33.	Lentibulariaceae	4	-	+	-	-
34.	Linaceae	1	+	-	-	-
35.	Loranthaceae	1	-	-	+	-
36.	Lythraceae	4	-	-	+	-
37.	Malvaceae	5	+	-	-	-
38.	Melastomataceae	2	+	-	-	-
39.	Menispermaceae	4	+	-	-	-
40.	Menyanthaceae	1	-	+	-	-
41.	Mimosaceae	1	+	-	-	-
42.	Moraceae	1	-	-	+	-
43.	Myrsinaceae	2	+	-	-	-
44.	Myrtaceae	1	-	+	-	-
45.	Oleaceae	2	-	+	-	-
46.	Orobanchaceae	1	-	-	+	-
47.	Oxalidaceae	1	-	-	+	-
48.	Papaveraceae	1	-	+	-	-
49.	Piperaceae	1	-	-	+	-
50.	Polygalaceae	2	+	-	-	-
51.	Primulaceae	1	+	-	-	-
52.	Ranunculaceae	3	-	+	-	-
53.	Rhamnaceae	2	+	-	-	-
54.	Rubiaceae	11	+	-	-	-
55.	Rutaceae	3	-	-	+	-
56.	Salicaceae	1	+	-	-	-

57.	Santalaceae	1		+	-	-
58.	Sapindaceae	1	+	-	-	-
59.	Sapotaceae	1	+	-	-	-
60.	Scrophulariaceae	5	-	+	-	-
61.	Solanaceae	2	-	-	+	-
62.	Sterculiaceae	1	+	-	-	-
63.	Thymelaeaceae	1	+	-	-	-
64.	Tiliaceae	5	-	-	+	-
65.	Urticaceae	2	-	+	-	-
66.	Verbenaceae	4	-	-	+	-

(+) Present (-) Absent

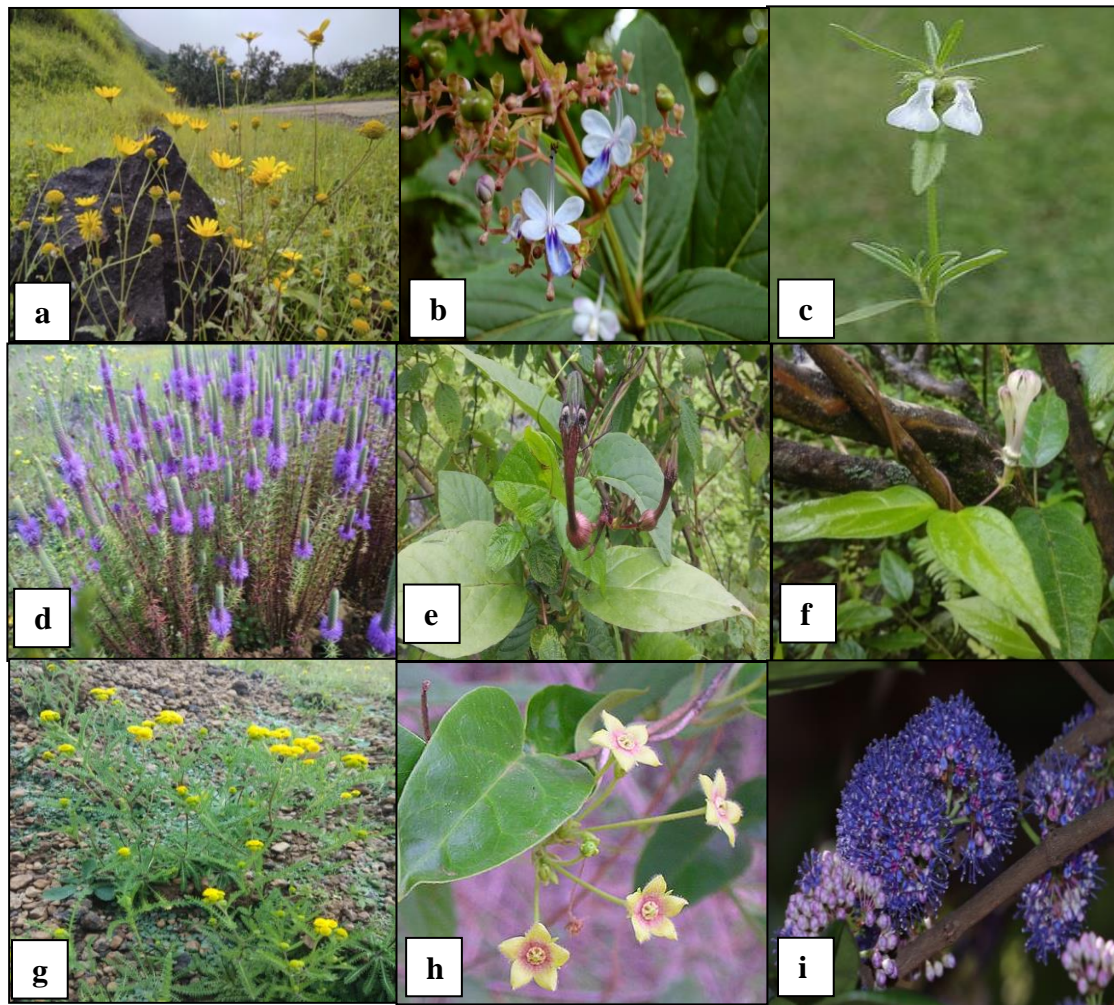


Fig. 4 Some plants habit (a) *Senecio bombayensis*; (b) *Clerodendrum seratum*; (c) *Leucas indica*; (d) *Pogostemon deccanensis*; (e) *Ceropegia oculata*; (f) *Ceropegia media*; (g) *Cyathocline lutea*; (h) *Tylophora dalzellii*; (i) *Memecylon umbellatum*

Finally, discussion can be concluded that amongst all of the Durgawadi plateau dicotyledon plant species have longitudinal introrse anther dehiscence is most common and this extended information will be utilized for taxonomic characterization at species, generic, and family levels.

Table 2. The floristic composition of Durgawadi plateau

Family	Genera	Species
66	161	220

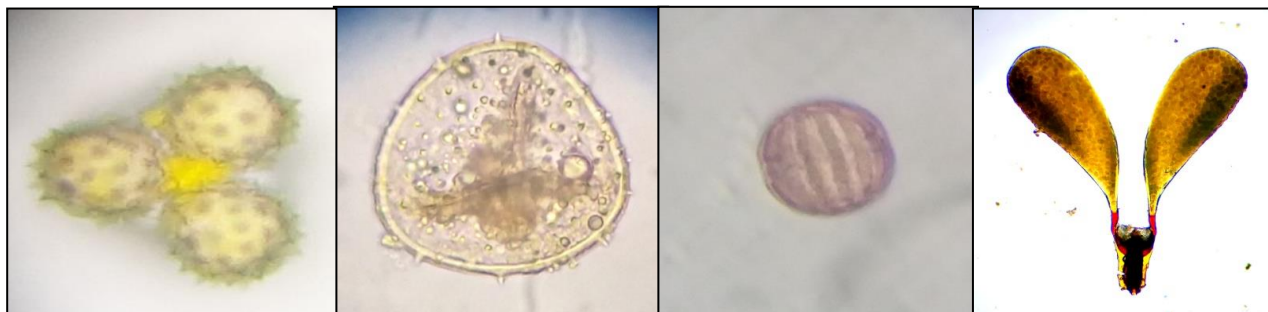


Fig. 5 Some plants pollen grain (a) *Senecio bombayensis*; (b) *Clerodendrum seratum* (c) *Polygala arvensis*; (d) *Tylophora dalzellii*

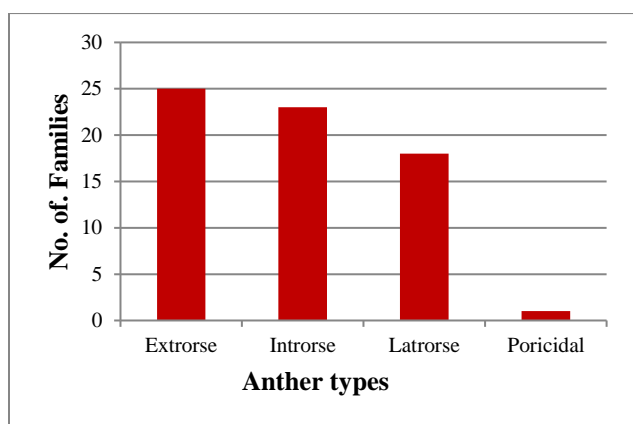


Fig. 6 Bar graph between number of families and anther types

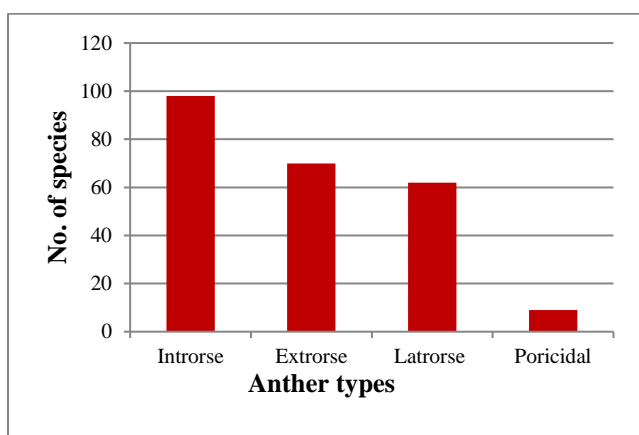


Fig. 7 Bar graph between number of species and anther types

Acknowledgement

Author would like to thank Shantilal Kale, Shashikala Kale, Ankush Kale, Dhanashri, Kale, Vinayak Modhe for their help.

Conflict of Interest

The author hereby declares no conflict of interest.

Consent for publication

The author declares that the work has consent for publication

Funding support

The author declares that they have no funding support for this study

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How to cite this article

Kale, B. S. (2022). Anther types of angiosperms within floristic diversity of Durgawadi plateau, Northern Western Ghats of Maharashtra, India. *Science Archives*, Vol. 3(3), 175-180. <https://doi.org/10.47587/SA.2022.3305>

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