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# Documentation of several drought tolerance vascular plants associated with walls in Dindori district (M.P.) India

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**Abstract**
This study was conducted to analyze the drought tolerance Vascular plants associated with walls in Dindori District, Madhya Pradesh. A total of 40 vascular plants were recorded. The angiosperms were represented by 38 genera under 25 different families. Only two species were represented by Pteridophytes *viz*. Dryopteris filix-mas and *Pteris vittata*. Asteraceae, Amaranthaceae, and Euphorbiaceae were dominant families during the survey period associated with walls in Dindori District.

**Keywords:** Documentation, drought tolerance, vascular plants, walls, Dindori district

## Introduction
Wall, one of the most distinct man-made constructions, is an extreme environment in many respects, such as the available room for settlement, the hardness and the alkalinity of the substratum, the scarcity of soil and humus, the inclination, the temperature and the humidity (Segal, 1969) [23]. Thus, being a peculiar habitat, which is suitable for only a limited number of taxa, walls are the subject of an increasing number of publications. In the frame of a wider research concerning the urban and suburban flora of Dindori District, the old fortification walls of the city were studied (Lagiou *et al*., 1998) [14]. Several scientists also took part in describing the importance of walls as modified cliff-like habitats in urban and semi-urban localities in different countries (Gilbert, 1989; Gilbert, 1992; Larson *et al*., 2009; Crowe, 1979; Kent *et al*., 1999; Hill *et al*., 2002; Lundholm and Marlin, 2006; Francis, 2011; Singh, 2011; Singh and Singh, 2014; Shimwell, 2009; Altay *et al*., 2010) [10, 9, 15, 4, 13, 12, 16, 7, 26, 27, 25, 1]. Different plant groups such as Angiosperms, some Bryophytes and Pteridophytes were frequently distributed on old walls with ecological importance in different environmental conditions like high temperature, hot climate, scarcity of water and humus, extreme pollution by vehicles on roadsides, etc. Drought is a natural event arising due to extreme temperature, deficiency of precipitation, scarcity of water, global warming, etc. (Sharafi *et al.*, 2019; Mirzaee *et al*., 2018) [24, 18]. Drought conditions make it unfavorable for plants and vegetation cover to survive (Fahri Saadi, 2019) [6]. Under drought conditions, the vascular plants have inherent dormancy mechanisms that protect their seeds, spores, etc. from germination into such adverse environments (Gul & Kausar, 2019) [11]. In this context, the present work was undertaken as research work for documentation of vascular plant species associated with walls in Dindori District.

## Study sites
Dindori is a district of Madhya Pradesh state of central India. The town of Dindori is the district headquarters. It was created on 25th May, 1998 with total 927 villages. The district is a part of Jabalpur Division. The district covers an area of 7470 sq.km. and is located on the eastern part of Madhya Pradesh, bordering the state of Chhattisgarh. It is surrounded by Shahdol in the east, Mandla in the west, Umaria in the north, and Bilaspur district of the state of Chhattisgarh in the south. Mathematically, the district is situated between the latitudes 22.17N and 23.22N and longitudes 80.35E and 80.58E.

## Bajag town
Bajag is located at 22.38°N 81.23°E. Bajag is a Tehsil in Dindori District of Madhya Pradesh State, India. Bajag Tehsil Head Quarters is Bajag town.

**Shahpura town**

Shahpura is located at 23.18°N 80.70°E. It has an average elevation of 381 metres (1249 feet). Shahpura City is Located very close to Maa Sharda tekri, Gughwa National Park, Radha krishna Temple Radha Rani Chock, Ram Temple bajar chock, Durga Temple & hanuman Temple, Paras Nath, Mrwari Dame, Bdkera ashram temple, Badaa dev temple Bargaon, Malpur sangam Wharf Narmada River, Kosam Wharf Narmada River, Takin Wharf Narmada River, Bilgada dam.

**Dindori town**

It is situated between the latitudes 22.17N and 23.22N and longitudes 80.35E and 80.58E. Dindori has many historical as well as spiritual places. Dindori town is significant as a spiritual destination. Laxman Mandva, Kukaramath, Kalchuri Kali Mandir, Mudiakhurd temples are places of great religious significance.

## Material and methods

To carry out the work on drought tolerance Vascular plants associated with the stone and bricks wall in Dindori District, Madhya Pradesh, at first, the study area was selected and divided into different localities in different blocks for prevalence percentage of Angiospermic plants and their systematic study. To study the floristic diversity in different selected areas, the frequent visits were conducted to the study area in different localities, so that the taxonomic study of "Documentation of several drought tolerance angiosperms associated with walls in Dindori District, Madhya Pradesh" could be performed. A general survey was carried out from January 2022 to May 2022 and different habits of plant vegetation such as herbs, shrubs, and trees were observed. During this period (at the end of Post- monsoon and Pre-monsoon) the temperature of study sites was high. During Pre-monsoon Season, some of the sources of water become dry in Dindori District. Dindori district is considered as dry as well as a backward region of Madhya Pradesh where rainfall is considered as a limiting factor for the successful growth of agriculture (Asutosh, 2019) [2]. The general associations of plants were observed in all the unprotected areas. Apart from the study of vegetation, plant species were collected, Herbarium sheets were prepared and identified with the help of pertaining literature (Prain, 1963; Roy and Mukherjee, 2011; Mandal and Mukherjee, 2016; Dey, and Das, 2017; Paul, 2018; Pal *et al.*, 2000) [21, 22, 17, 5, 20, 19]. During the survey period we visited different tehsil and blocks of Dindori district such as Bajag, Shahpura and Dindori town and the vegetation of drought tolerant species in walls were recorded. Herbarium specimens were preserved in the Botany Department of Pt. S.N.S. University Shahdol for further studies.

## Results and Discussion

**Table 1:** An account of the prevalence of plant Species in different walls.

| S. No. | Name of the plant | Family | Attendance in study | | | Prevalence (%) | Availability |
|---|---|---|---|---|---|---|---|
| | | | Site - I | Site - II | Site - III | | |
| 1. | *Acalypha indica* L. | Euphorbiaceae | | | + | 33.33 | Less common |
| 2. | *Aerva lanata* (L.) Juss ex. Schult. | Amaranthaceae | | | + | 33.33 | Less common |
| 3. | *Alternanthera sessilis* (L.) R. Br. ex Dc | Amaranthaceae | | | + | 33.33 | Less common |
| 4. | *Amaranthus viridis* L. | Amaranthaceae | | + | + | 66.66 | Common |
| 5. | *Ammannia baccifera* L. | Lythraceae | | | + | 33.33 | Less common |
| 6. | *Anisomeles indica* (L.) Kuntze | Lamiaceae | + | | | 33.33 | Less common |
| 7. | *Antigonon leptopus* Hook & Arn. | Polygonaceae | + | | | 33.33 | Less common |
| 8. | *Blumea lacera* Dc. | Asteraceae | | | + | 33.33 | Less common |
| 9. | *Boerhaavia repens* L. | Nyctaginaceae | | + | | 33.33 | Less common |
| 10. | *Calotropis procera* (Ait) R. Br. | Asclepiadaceae | | + | | 33.33 | Less common |
| 11. | *Catharanthus roseus* (L.) G. Don | Apocynaceae | | + | | 33.33 | Less common |
| 12. | *Cleome rutidosperma* Dc. | Cleomaceae | | | + | 33.33 | Less common |
| 13. | *Cleome viscosa* L. | Cleomaceae | | | + | 33.33 | Less common |
| 14. | *Commelina benghalensis* L. | Commelinaceae | + | | | 33.33 | Less common |
| 15. | *Croton bonplandianus* Baill. | Euphobiaceae | + | + | + | 100.00 | Common |
| 16. | *Dryopteris filix-mas* (L.) Scholt. | Dryopteridaceae | + | | | 33.33 | Less common |
| 17. | *Eclipta prostrata* (L.) L | Asteraceae | + | + | + | 100.00 | Common |
| 18. | *Eragrostis tenella* (L.) P. Beauv. | Poaceae | | + | | 33.33 | Less common |
| 19. | *Euphorbia hirta* L. | Euphorbiaceae | + | | + | 66.66 | Common |
| 20. | *Evolvulus nummularius* (L.) L. | Convolvulaceae | | | + | 33.33 | Less common |
| 21. | *Glinus oppositifolius* (L.) Aug. | Molluginaceae | + | | + | 66.66 | Common |
| 22. | *Gomphrena celosioides* Mart. | Amaranthaceae | + | | | 33.33 | Less common |
| 23. | *Kyllinga monocephala* Rott. | Cyperaceae | | | + | 33.33 | Less common |
| 24. | *Lantana camara* L. | Verbenaceae | | + | | 33.33 | Less common |
| 25. | *Lindenbergia indica* (L.) Vatke | Scrophulariaceae | | | + | 33.33 | Less common |
| 26. | *Nicotiana plumbaginifolia* Viv. | Solanaceae | | | + | 33.33 | Less common |
| 27. | *Oldenlandia corymbosa* L. | Rubiaceae | + | | + | 66.66 | common |
| 28. | *Oxalis corniculata* L. | Oxalidaceae | | | + | 33.33 | Less common |
| 29. | *Phyllanthus fraternus* G. L. webster | Euphorbiaceae | + | | + | 66.66 | common |
| 30. | *Portulaca oleracea* L. | Portulacaceae | | | + | 33.33 | Less common |
| 31. | *Pteris vittata* L. | Pteridaceae | + | | | 33.33 | Less common |
| 32. | *Ranunculus sceleratus* L. | Ranunculaceae | | | + | 33.33 | Less common |
| 33. | *Ruellia tuberosa* L. | Acanthaceae | | | + | 33.33 | Less common |
| 34. | *Scoparia dulcis* L. | Scrophulariaceae | | | + | 33.33 | Less common |
| 35. | *Solanum nigrum* L. | Solanaceae | | | + | 33.33 | Less common |
| 36. | *Solanum sisymbriifolium* Lam. | Solanaceae | | + | + | 66.66 | common |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 37. | *Sonchus arvensis* L. | Asteraceae | | | + | 33.33 | Less common |
| 38. | *Tridax procumbens* L. | Asteraceae | + | + | | 66.66 | common |
| 39. | *Verbascum chinense* (L.) Santapau | Asteraceae | | | + | 33.33 | Less common |
| 40. | *Vernonia cinerea* (L.) Less. | Asteraceae | | + | + | 66.66 | common |

Abbreviations: Site - I = Bajag; Site - II = Shahpura; Site - III = Dindori.

## Discussion

The present study enclosed drought tolerance species associated with the wall of three major areas of Dindori District, *viz*. Bajag Town, Shahpura twon, and Dindori Town could record about 40 species belonging to 38 genera under 25 different families. The number of species was very low in association with the wall flora studied. There was a lack of awareness among people about the importance of plant vegetation on the wall in Dindori District. The grasses appeared in large numbers during monsoon but at the end of post-monsoon and pre-monsoon, only *Eragrostis tenella* was enlisted.

The highest number of species took shelter in the walls of Dindori Town *i.e.* 28 species. The second position is occupied by Bajag Town with 13 species. There were only 11 species in Shahpura during the survey period (Table 1).

In Shahpura, a large number of dry grasses were observed due to high temperatures and hot climate. Two different types of walls were studied in Dindori District *viz*. cemented brick wall and the other type of wall was constructed by brick, mud, and lime. The cemented brick walls tolerate the highest number of species *i.e.* 28 and 13 in Dindori Town and Bajag Town respectively. The walls made of brick, mud, and lime could accommodate 11 species in the case of Shahpura town (Fig. 1).

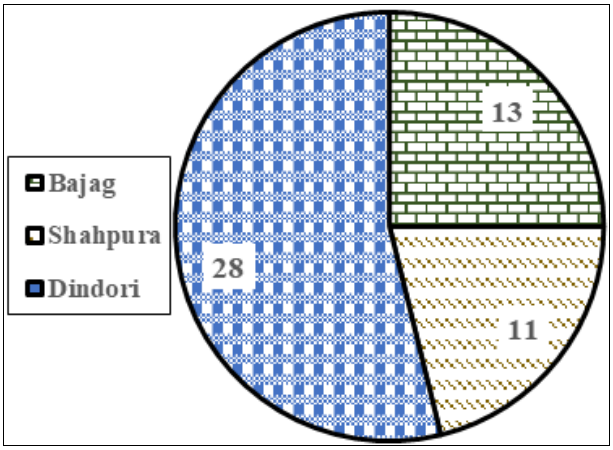


**Fig 1:** Number of plants in the study siets

Only the highly xeric species like *Anisomeles indica, Antigonon leptopus, Blumea lacera, Cleome viscosa, Croton bonplandianus, Gomphrena celosioides, Lantana camara, Ruellia tuberosa*, etc. were capable of enduring under such stressful habitats. The cemented brick walls were mostly old with cracks and porosity due to sand mixed with cement. The conditions were suitable for accommodation in the case of 28 and 13 species in procuring retained water and moisture and aeration in walls (Table 1).

The taxonomic account of the wall flora reveals that Asteraceae was the most dominant family with five species followed by Amaranthaceae and Euphorbiaceae having four species each. The family of Scrophulariaceae and Solanaceae had three species each. Cleomaceae had only two species. The rest of the nine teen families had only single species each (Fig. 2).

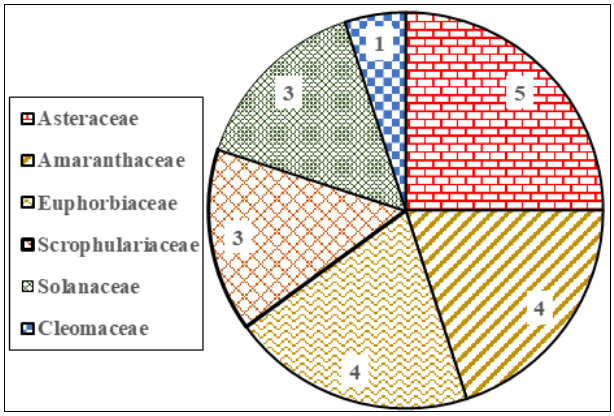


**Fig 2:** Representation of dominant families in walls of Dindori district

Only two species *viz*. *Croton bonplandianus* and *Eclipta prostrata* occupy 100% of the prevalence value of the wall types. Only 8 species *viz*. Amaranthus viridis, Euphorbia hirta, *Glinus oppositifolius, Oldenlandia corymbosa, Phyllanthus fraternus, Solanum sisymbriifolium, Tridax procumbens* and *Vernonia cinerea* showed their efficiency to use 66.66% and remaining 30 species *viz*. *Acalypha indica, Anisomeles indica, Oxalis corniculata, Pteris vittata, Verbascum chinense*, etc. 33.33% of wall flora in drought-prone District of Dindori. On the other hand, only 10 species *viz, Amaranthus viridis, Croton bonplandianus, Eclipta prostrata, Euphorbia hirta, Glinus oppositifolius, Oldenlandia corymbosa, Phyllanthus fraternus, Solanum sisymbriifolium, Tridax procumbens, and Vernonia cinerea* were common and the remaining 30 species *viz*. *Cleome rutidosperma, Pteris vittata, Solanum nigrum, Verbascum chinense* etc. were less common in wall flora of Dindori District.

Although, *Ranunculus sceleratus* grows on aquatic and semiaquatic habitats, it was frequently observed on the wall of Vivekananda pally and Bal Bharati Lane with dense vegetation. Because the wall is moisture by the drainage water. Drought is a condition of reduced or very low availability of water to plants for a prolonged period of time, hence, distressing for plant growth, development, water relations, and efficiency of many terrestrial plants. Plants acclimatize themselves to different sophisticated biochemical, physiological, and morphological changes to conquer drought conditions (Butt *et al.*, 2017) [3]. The occurrence of desiccation tolerance in the seed plants is overwhelmingly in the aerial reproductive parts, the pollen, and seed embryos (Gaff and Oliver, 2013) [8].

## Conclusion

Dey *et al.* (2017) [5] in their contribution to the wall of Burdwan District also reported several species such as *Acalypha indica, Amaranthus viridis, Eclipta prostrata, Glinus oppositifolius, Oxalis corniculata* and *Vernonia cinerea* (Dey and Das, 2017) [5]. Paul (2018) [20] observed the seasonal distribution in the wall of Bishnupur Town and reported *Alternanthera sessilis, Cleome viscosa, Acalypha indica, Croton bonplandianus, Euphorbia hirta, Lindenbergia indica, Oxalis corniculata, Calotropis procera, Lantana*

*camara* and *Scoparia dulcis particulary* in premonsoon season (Paul, 2018) [20].

But in the present study, we have reported several unique drought-tolerant vegetation like *Aerva lanata, Anisomeles indica, Cleome rutidosperma, Dryopteris filix-mas, Eragrostis tenella, Portulaca oleracea, Ranunculus sceleratus, and Solanum sisymbriifolium* on the cemented brick wall and the wall was made of bricks, mud, and lime, which were not reported in the district of Dindori (M.P.). We concluded that the cemented brick wall is more suitable for accommodation than the wall composed of bricks, mud, and lime due to cracks and porosity during this climatic condition.

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