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***Research article***

# INVESTIGATION OF DIVERSITY IN MUROPHYTES IN THE CAMPUS OF UNIVERSITY IN GORAKHPUR, INDIA

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**ABSTRACT:** The present study was conducted during November 2011 to October 2012 for investigation of diversity in murophytes of DDU Gorakhpur University campus. A total of 56 murophytic plants species have been recorded, out of which 52 plants species belonging to 41 genera under 21 families also, only 4 species was represented by Pteridophytes belonging to 3 families. No species of Gymnosperms was observed as murophytes in the University campus. The leading murophytic family of University campus were *Asteraceae* (9 species), *Poaceae* (9 species), *Cyperaceae* (4 species), *Amaranthaseae* (4 species), *Moraceae* (4 species), and *Scrophulariaceae* (2 species). The majority 19 family of Dicotyledonous and 2 monocotyledonus family were found. Seasonal analysis shows that 17 (30.35%), 18 (32.14%) and 5 (8.92%) plants species were recorded in rainy, winter and summer season respectively on the wall of university campus. At the same time 6 (10.71%) plants species were found to be common during both rainy and winter season. However 10 (17.85%) murophytic species were recorded throughout the year on the wall of University campus. Thus the study reveals that the *Asteraceae, Poaceae, Moraceae, Scrophulariaceae and Amaranthaceae* family exclusively by the most dominant families of the DDU Gorakhpur University campus.

**Key words:** Diversity, Murophyte, Gorakhpur

## INTRODUCTION

Deen Dayal Upadhyay (DDU) Gorakhpur University is a residential cum-affiliating University. The University came into existence in the year 1956 and it actually started functioning in September 1957. The University is spread over an area of about 300 acres and it consists of twelve major buildings in which different departments and offices run. The University campus has well maintained roads with extensive greenery all along and is encompassed by wall all around it. Murophytes, are the plant growing over the human constructed structures i.e. Dams, forts, monuments and the buildings etc., [1] are the prominent units which are detrimental to such structure, but it is a universal problem. History records the growth of Mural flora since the initiation of civilization of Man. The other theory is that the plants must be equipped for physiological point of view to meet out all its need from inorganic sources or in deficiency of organic materials. Mural flora developed in historical periods in which civilized man constructed buildings [2]. Brick walls are man-made artificial habitats. Wall may be generally categorised in 6 types (i) common stones like [(grey and yellow sandstone) (red sand stone) (black slate) and sang-i-marmar; white marble, and (sweet limestone)] were mixed with lime mortar to make it an ideal cementing material. (ii) brick cement wall, (iii) stone cement wall, (iv) brick mud wall (v) stone mud wall and (vi) mud wall. In the both brick cement and stone cement wall the cementing material used is cement and in the brick mud wall and stone mud wall the cementing material is mud [3]. Generally the walls having cracks and crevices often favour the growth and development of plant species [4]. Walls are a habitat widespread on all continents (perhaps except for Antarctica). The oldest walls are several thousand years old. They represent a specific type of habitat of anthropogenic origin to a great extend resembling natural rock faces and cliffs [5]. The murophytes are the result of spontaneous colonization unassisted of by human actions. Some studies have been conducted to analyze the wall habitats. Walls design a specific microhabitat in which only specific and specially equipped plants can germinate, grow, survive and flourish. Fist and the fore most condition for such plant is that they must withstand the scarcity of water because there is no direct source of water for such plants.

The 58 years old campus of DDU Gorakhpur University has several old constructions with walls developing cracks crevices with passage of time. The cracks and crevices in the walls provide anchorage to the plants roots thus supporting the growth of murophytes.

The objective of the study was to analyze the diversity and seasonal appearance of flora on the walls of the Campus of DDU Gorakhpur University.

## MATERIALS AND METHODS

### Site description

Gorakhpur city lies on eastern bank of river Rapti and Rohani, a Ganga tributary originating Nepal 25° 5 - 27° 9 N latitude and 84° 26 E longitude levelled topography at an elevation of 95m above sea level. Gorakhpur is represents a typically monsoonic climate with average rainfall about 1814 mm; 87% rain falls during July to September. There mean maximum and minimum temperature during summer, winter and rainy season is 35.2° C, 27.6° C and 39.3° C and 26.2°, 12.1 and 24.2° C respectively. The soil is an old gangetic alluvium. The texture is sandy loam and soil reaction is nearly neutral. (Figure 1)**.** DDU Gorakhpur University main campus is located at a distance of about 2 km from the down town to the east and almost walking distance from railway station to the south of Gorakhpur city.


**Figure 1: Map of India, State U.P and district Gorakhpur**

### Field observation

Botanical excursions were conducted to survey the murophytes growing on the walls of the campus of DDU Gorakhpur University. An extensive field study was conducted from Nov 2011 to Oct 2012 to record the murophytes growing over the building of University campus. The visits were made in all the three seasons' rainy, winter and summer and five to six visits were conducted in each seasons to search of growing murophytes. During the process of investigation visit were made to every nook and corner of the building in search of murophytes. The occurrence of seasonal appearance and number of species were counted at each building plants were collected and identified with the help of local floras [6, 7, 8]. The survey of the following building are Administrative building, Art faculty, Biotechnology department, Central Library, Botany Research building, Chemistry research building, Deeksha bhawan, Law department, Geography department, Majeethia bhawan, Zoology research building, and Pant bhawan. (Figure 2).

## RESULT AND DISCUSSION

A total of 52 Angiospermic plant species were observed in addition to 4 species of Pteridophytes. No any species of Gymnosperms was reported from the wall of DDU Gorakhpur University campus, this finding was parallel to [8] (Table 1). The Angiosperms were represented by 41 genera and 52 species belonging to 21 families of which 19 were represented by dicotyledonous families while 2 were represented by monocotyledonous family (Figure 3).

**Table 1: Murophytes of DDU Gorakhpur University Campus, Gorakhpur**

| Family | Plant species | Buildings of DDU Gorakhpur University, Gorakhpur | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J | K | L | Total no of plants on buildings |
| Acanthaceae | Peristrophe bicalyculata | | | | | | | | | | | | ✓ | 01 |
| Amaranthaceae | Achyrenthus aspera | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | ✓ | 07 |
| | Alternanthera sessilis | | | | ✓ | | | | | ✓ | | ✓ | | 03 |
| | Amaranthus spinosus | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | 08 |
| | Amaranthus viridis | ✓ | ✓ | | | | | | | ✓ | ✓ | | | 04 |
| Apocynaceae | Catheranthus roseus | ✓ | | | ✓ | ✓ | | ✓ | | | | | ✓ | 05 |
| Asclepiadaceae | Calotropis procera | ✓ | ✓ | | | | | ✓ | | | | | | 03 |
| Asteraceae | Ageratum conyzoides | ✓ | | | | | | ✓ | | | | | ✓ | 03 |
| | Blumea aromatic | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| | Eclipta alba | | | | ✓ | | | ✓ | | | | | | 02 |
| | Parthenium hysterophorus | | | | ✓ | | | ✓ | | | | | ✓ | 03 |
| | Sonchus arvensis | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | 10 |
| | Sonchus oleraceus | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | | ✓ | 06 |
| | Taraxacum officinale | ✓ | | | ✓ | ✓ | | | | | | | ✓ | 03 |
| | Tridex procumbens | ✓ | | ✓ | ✓ | | | ✓ | | | ✓ | | ✓ | 06 |
| | Vernonia strumarium | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| Chenopodiaceae | Chenopodium album | | | | | | | | | | | | | 03 |
| Cucurbitaceae | Coccinia grandis | ✓ | | ✓ | | | | ✓ | | | | ✓ | | 04 |
| Cyperaceae | Cyperus compressus | | ✓ | | | | | | | ✓ | ✓ | ✓ | ✓ | 05 |
| | Cyperus difformis | | ✓ | | | | ✓ | | | ✓ | | ✓ | ✓ | 05 |
| | Cyperus rotundus | ✓ | | | ✓ | | ✓ | | | ✓ | | ✓ | | 05 |
| | Kyllinga triceps | | | | | | | | | | | | ✓ | 01 |
| Euphorbiaceae | Acylypha indica | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| | Euphorbia hirta | ✓ | | ✓ | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | 07 |
| | Phylenthus niruri | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| Lamiaceae | Hyptis suaveolens | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| Miliaceae | Azadirachta indica | ✓ | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | 06 |
| Moraceae | Ficus religiosa | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| | Ficus benghalensis | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 12 |
| | Ficus glomarata | ✓ | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | 07 |
| | Ficus virance | | ✓ | | | | | | | | | ✓ | ✓ | 03 |
| **Nyctaginaceae** | *Boerhavia diffusa* | | | | | | | | | | | ✓ | ✓ | **02** |
| **Oxalidaceae** | *Oxalis corniculata* | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | **08** |
| **Piperaceae** | *Peperomia pellucid* | | | | | | ✓ | | | | | | ✓ | **02** |
| **Poaceae** | *Cynodon dactylon* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **12** |
| | *Chloris virgata* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **12** |
| | *Eleusine indica* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **12** |
| | *Dactyloctenium aegyptium* | ✓ | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | **08** |
| | *Digitaria sanguinalis* | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | | ✓ | **06** |
| | *Digitaria marginata* | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | ✓ | **08** |
| | *Echinochloa colonum* | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | **08** |
| | *Setaria glauca* | | ✓ | | | ✓ | | | ✓ | | | | | **03** |
| | *Sporobolus diander* | ✓ | | | | | | | ✓ | | ✓ | | ✓ | **04** |
| **Primulaceae** | *Anagalis arvensis* | | | ✓ | | | | | | | | ✓ | ✓ | **03** |
| **Rubiaceae** | *Oldenlandia corymbosa* | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **10** |

**A** – Administrative building, **B** – Art Faculty**, C** –Biotechnology Dept. **D** –Central Library, **E** – Botany Research building**, F** – Chemistry Research building, **G** -Deeksha bhawan, **H** – Law faculty, **I** – Geography Dept., **J** –Majithiya Bhawan, **K** – Zoology Research building, **L** – Pant Bhawan.

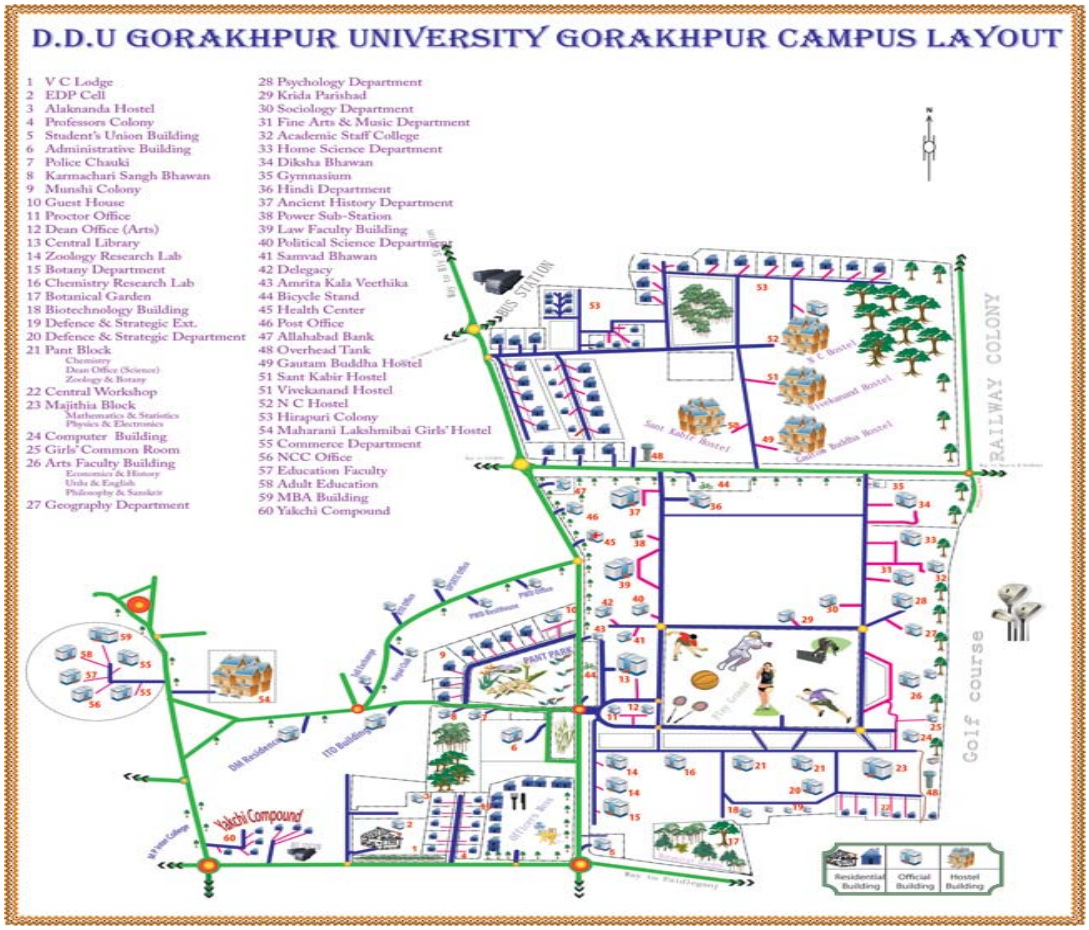


**Figure 2: Map of DDU Gorakhpur University**

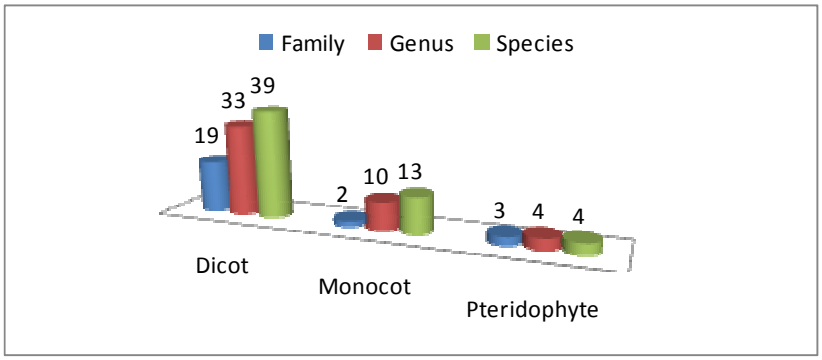


**Figure 3: Number of murophytic family, genus and species within dicots and monocots in DDU Gorakhpur University Campus.**

**Table 2: Dominating murophytic families of angiosperm in DDU Gorakhpur University Campus. Gorakhpur.**

| Family | Genus | Species |
|---|---|---|
| Asteraceae | 08 | 09 |
| Poaceae | 08 | 09 |
| Cyperaceae | 02 | 04 |
| Amarathaceae | 03 | 04 |
| Moraceae | 01 | 04 |
| Scrophulariaceae | 01 | 02 |

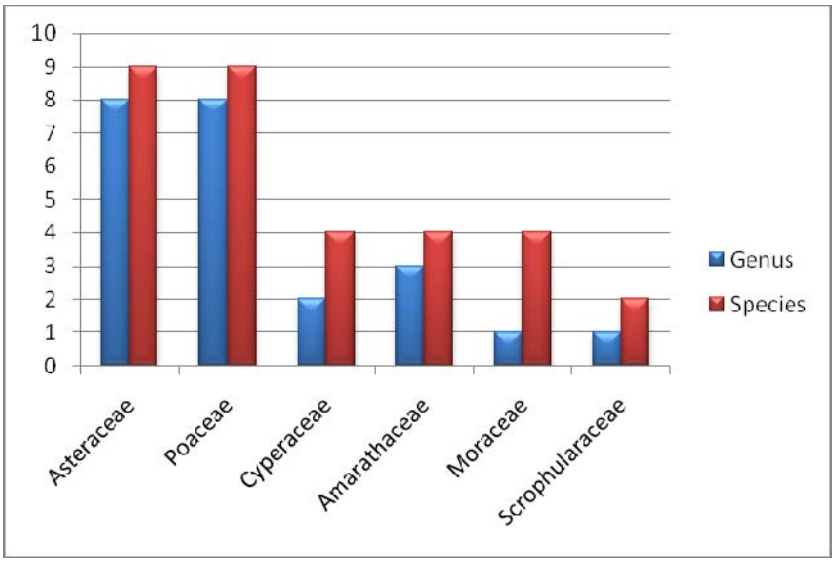


**Figure 4: Dominating murophytic families of angiosperm in DDU Gorakhpur University Campus. Gorakhpur.**

Of the total 52 Angiosperms species were recorded the maximum number of species showed (Figure 4) and (Figure 5) that is 9 (16.07%) belongs to Asteraceae family, 8 (14.28%) to Poaceae whereas 4 (7.14%) species were represented by Moraceae family this finding was parallal to [9] (Table 2).

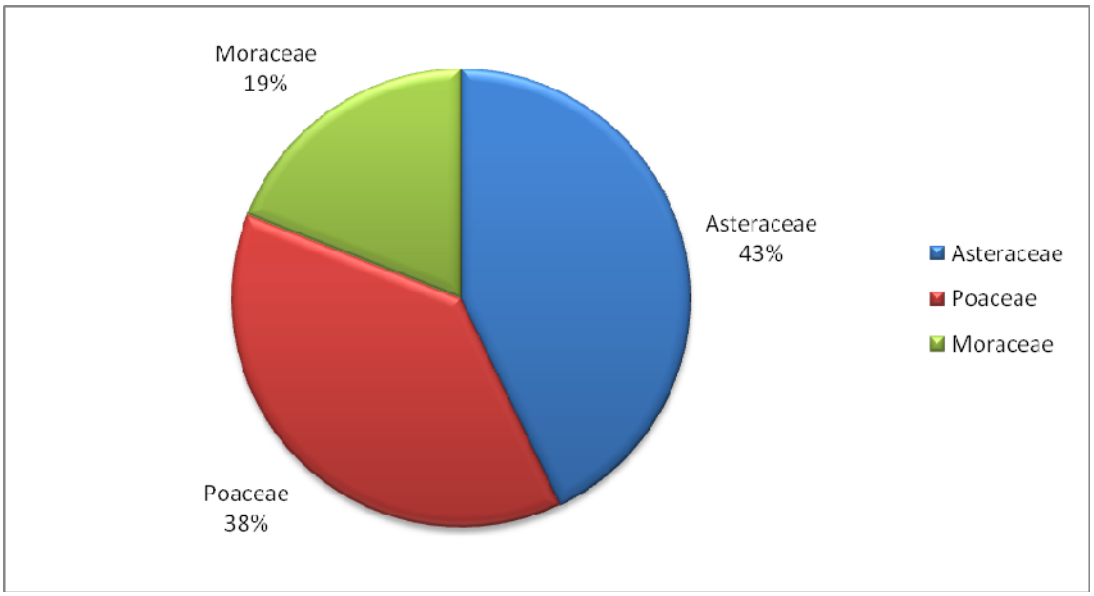


**Figure 5: Dominating murophytic families of angiosperm in *DDU Gorakhpur University Campus*. Gorakhpur**

Thus the study reveals that *Asteraceae, Poaceae* and *Moraceae* are the dominant murophytic family of Deen Dayal Upadhayay Gorakhpur University campus.

It was observed that mostly the Asteraceae and Rubiaceae member exclusively colonize on the wall in winter season while the Poaceae and Cyperaceae member colonize in rainy season. On the other hand Amaranthaceae members generally colonize on the walls in summer season [10]. In this study 17 (30.35%), 18 (32.14%) and 5 (8.92%) plants species were recorded in rainy, winter and summer seasons respectively. However 6 (10.71%) plant species were observed during both rainy and winter seasons and 10 (17.85%) murophytes species were recorded throughout the year on the walls. Thus it is evident from the study that most of the murophytes colonizes the walls during rainy season and winter season.

Several of the murophyte inhibiting the walls of Gorakhpur University Campus in the present study like; *Achyrenthus aspera, Amaranthus spinosus, Amranthus viridis, Boerhavia diffusa, Euphorbia hirta, Tridex procumbens, Sonchus arvensis, Sonnchus oteraceus, oxalis corniculata, Ageratum conyzoides, Chenopodium album, Solanum nigrum, Cynodon dactylon, Ficus benghalensis, Ficus religiosa, Ficus virens, Ficus glomerata, and Dryopteris filix-mas, Adiantum capillus-veneris, Pteridium aquilinum,*and *Pteris ansiformis* have also been observed as murophyte in other studies conducted on wall habitats. The most commonly visible murophyte on the walls of the DDU Gorakhpur University Campus in rainy season include; *Acylypha indica, Blumea aromatic, Eclipta alba, Cyperus compressus, Cyperus difformis, Cyperus rotundus, Kyllinga triceps, Peperomia pellucid, Chloris virgata, Dactyloctenium aegyptiu*m, *Digitaria sanguinalis, Digitaria marginata, Echinochloa colonum, Lindenbergia indica,* and *Lindernia crustacean*. The commonly occurring murophytes of the University campus in winter season is represented by *Catheranthus roseus, sonchus arvensis, Sonchus oleraceus, Taraxacum officinale, Chenopodium album, Oldenlandia corymbosa, Oldenlandia dicotoma, Oldenlandia diffusa, Solanum nigrum, Gnaphalium indicum,* and *Ageratum conzoites.*The common summer season murophytes of DDU Gorakhpur University Campus is represented by *Amaranthus viridis, Tridex procumbens, Eleusine indica, Scoparia dulcis, Achyranthus aspera,* and *Cynadon dactylon.* (Table 3). *Calotropis procera,* and *Tinospora cordifolia* are reported first time as murophyte visible on the walls of DDU University Campus**.**

**Table 3: Species found in the Campus of DDU Gorakhpur University, Gorakhpur**

| S.No | Name of Species | Family | No. of buildings where found | Seasonal appearance |
|---|---|---|---|---|
| 1. | *Peristrophe bicalyculata* | Acantheceae | 1 | Winter |
| 2. | *Achyrenthus aspera* | Amaranthaceae | 07 | Whole year |
| 3. | *Alternanthera sessilis* | ” | 03 | Rainy & Winter |
| 4. | *Amaranthus spinosus* | ” | 07 | Rainy & Winter |
| 5. | *Amaranthus viridis* | ” | 04 | Summer |
| 6. | *Catheranthus roseus* | Apocynaceae | 05 | Winter |
| 7. | *Calotropis procera* | Asclepiadaceae | 03 | Whole year |
| 8. | *Ageratum conyzoides* | Asteraceae | 03 | Summer |
| 9. | *Blumea aromatica* | ” | 12 | Rainy |
| 10. | *Eclipta alba* | ” | 02 | Rainy |
| 11. | *Parthenium hysterophorus* | ” | 04 | Whole year |
| 12. | *Sonchus arvensis* | ” | 10 | Winter |
| 13. | *Sonchus oleraceus* | ” | 06 | Winter |
| 14. | *Taraxacum officinale* | ” | 03 | Winter |
| 15. | *Tridex procumbens* | ” | 06 | Summer |
| 16. | *Vernonia strumarium* | ” | 12 | Winter |
| 17. | *Chenopodium album* | Chenopodiaceae | 02 | Winter |
| 18. | *Coccinia grandis* | Cucurbitaceae | 04 | Winter |
| 19. | *Cyperus compressus* | Cyperaceae | 05 | Rainy |
| 20. | *Cyperus difformis* | ” | 05 | Rainy |
| 21. | *Cyperus rotundus* | ” | 05 | Rainy |
| 22. | *Kyllinga triceps* | ” | 01 | Rainy |
| 23. | *Acylypha indica* | Euphorbiaceae | 12 | Rainy |
| 24. | *Euphorbia hirta* | ” | 07 | Rainy & Winter |
| 25. | *Phylenthus niruri* | ” | 12 | Rainy & Winter |
| 26. | *Hyptis suaveolens* | Lamiaceae | 12 | Rainy |
| 27. | *Azadirachta indica* | Miliaceae | 06 | Whole year |
| 28. | *Ficus religiosa* | Moraceae | 12 | Whole year |
| 29. | *Ficus benghalensis* | ” | 12 | Whole year |
| 30. | *Ficus glomarata* | ” | 07 | Whole year |
| 31. | *Ficus virens* | ” | 03 | Whole year |
| 32. | *Boerhavia diffusa* | Nyctaginaceae | 02 | Rainy & Winter |
| 33. | *Oxalis corniculata* | Oxalidaceae | 08 | Rainy & Winter |
| 34. | *Peperomia pellucid* | Piperaceae | 02 | Rainy |
| 35. | *Cynodon dactylon* | Poaceae | 12 | Whole year |

| | | | | |
|---|---|---|---|---|
| 36. | *Chloris virgata* | ” | 12 | Rainy |
| 37. | *Eleusine indica* | ” | 12 | Summer |
| 38. | *Dactyloctenium Aegyptium* | ” | 08 | Rainy |
| 39. | *Digitaria sanguinalis* | ” | 06 | Rainy |
| 40. | *Digitaria marginata* | ” | 08 | Rainy |
| 41. | *Echinochloa colonum* | ” | 08 | Rainy |
| 42. | *Setaria glauca* | ” | 03 | Winter |
| 43. | *Sporobolus diander* | ” | 04 | Rainy |
| 44. | *Anagalis arvensis* | Primulaceae | 03 | Winter |
| 45. | *Oldenlandia corymbosa* | Rubiaceae | 10 | Winter |
| 46. | *Oldenlandia dichotoma* | ” | 08 | Winter |
| 47. | *Oldenlandia diffusa* | ” | 12 | Winter |
| 48. | *Lindenbergia indica* | Scrophulariaceae | 09 | Rainy |
| 49. | *Lindernia crustacean* | ” | 06 | Rainy |
| 50. | *Scoparia dulcis* | ” | 12 | Summer |
| 51. | *Solanum nigrum* | Solanaceae | 05 | Winter |
| 52. | *Lantana camara* | Verbenaceae | 04 | Whole year |
| 53. | *Dryopteris filix-mas* | Pteridophytes | 12 | Winter |
| 54. | *Adiantum* | ” | 01 | Winter |
| 55 | *Pteridium* | ” | 12 | Winter |
| 56. | *Pteris ansiformis* | ” | 11 | Winter |

## CONCLUSION

It can be concluded from the study that murophyte on the wall of the DDU Gorakhpur University campus is dominated by Angiosperms. The most of the murophytes appears during the rainy season and winter seasons of the year. The study provides that the Asteraceae, Poaceae, Moraceae, Scrophulariaceae and Amaranthaceae families represented exclusively by the most dominant murophytes of DDU Gorakhpur University Campus.

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