

Systematics and Ecology of Indian Plants: I—On the Rainy Season Weeds of Gorakhpur

BY

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(With a sketch map)

INTRODUCTION

The author has tried in this paper to contribute towards the flora of Gorakhpur on the lines suggested in the address by Santapau (1956). The vegetation of many places has been commonly described in different seasons, but such a study has rarely been undertaken during the rainy season on account of inherent difficulties, and so the monsoon and cold months of the year have often been left out completely.

In this paper an attempt has been made to present the rainy season weeds of Gorakhpur. Among other difficulties during this season, as mentioned by Santapau (1956), the pressing and the preservation of plants is the main problem, because most of the plants collected during moist weather become unsuitable for preservation as herbarium materials. Excursions were made whenever possible, and features of interest connected with the phenology and ecology of these plants have been noted. Some of the plants, though quite obvious by their presence flower quite late in this season. Then there are plants which are present throughout the year, but flower profusely during this season. Some plants which do not strictly belong to this season have also been included here because of their particular character. Their density of population in certain localities has been recorded. The flowering time of plant species has been indicated as precisely as possible. The time of seed germination of those plants which could be identified at the seedling stage has also been recorded. The author was advised to include the medicinal properties of the plants recorded here. In this connection no help has been taken from published literature, but only information gathered from local inhabitants has been made use of.

Hewetson (1951 & 1952) and Santapau (1956) have stressed the necessity of a systematic plan in the study of the flora of a place, by extending the scope of such studies beyond the usual practice. The

mere enumeration of plants is not of much avail. The record of distribution, information about soils on which the plants flourish, altitude, phenology, fruit setting, relative abundance and scarcity, and the associations they form are very important, as also the various stages, namely germination, vegetative growth, and finally the formation of seeds.

It is only in recent years that attention has been drawn to such a field of study by a number of botanists. But apparently not many have dealt with this subject matter from the ecological point of view, at least in Uttar Pradesh. The earliest records in this field are those of Dudgeon (1920) and Kanji Lal (1933), which do not deal particularly with the vegetation of Gorakhpur. There are records of a systematic study by Raizada (1931, 1935, 1936, 1939) and Srivastava (1938). As to the ecological and morphological aspects, Misra (1944, 1946) has included them in a number of papers on the vegetation of Banaras. Recently Srivastava (1955), Jain (1956), Gupta (1956), and Bhargava & Gupta (1958) have contributed to the vegetation of different regions of Uttar Pradesh. The last mentioned workers emphasize mainly the phenology of plants in Naini Tal.

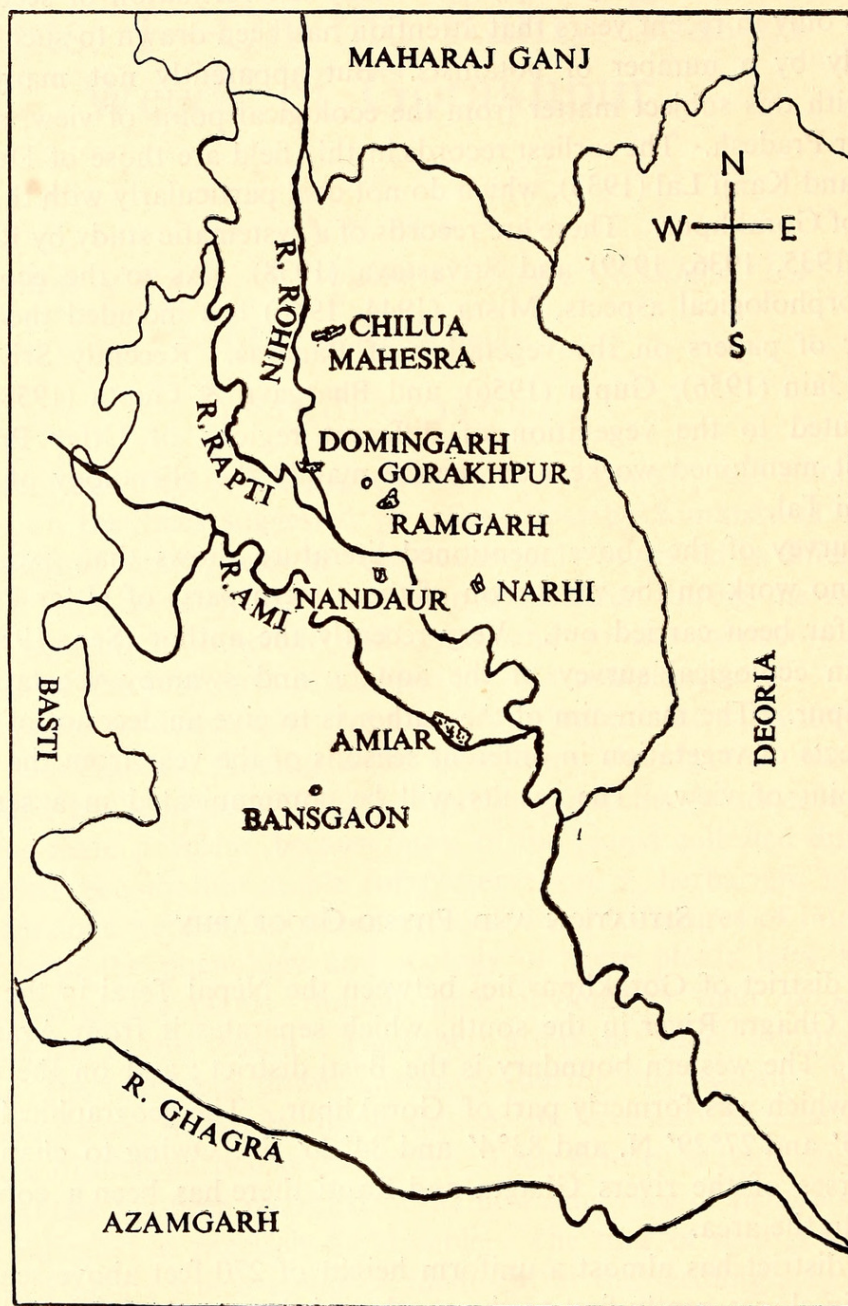
A survey of the above mentioned literature shows that, except for Misra, no work on the vegetation of the eastern parts of Uttar Pradesh has so far been carried out. Very recently the author (Sen, 1959) has made an ecological survey of the aquatic and swampy vegetation of Gorakhpur. The main aim of the author is to give an account of different aspects of vegetation in different seasons of the year from the ecological point of view. The results will be communicated in a series of papers.

SITUATION AND PHYSIO-GEOGRAPHY

The district of Gorakhpur lies between the Nepal Terai in the north and the Ghagra River in the south, which separates it from Azamgarh district. The western boundary is the Basti district; and on the east is Deoria which was formerly part of Gorakhpur. The geographical limits are $26^{\circ}5'$ and $27^{\circ}29'$ N. and $83^{\circ}4'$ and $84^{\circ}26'$ E. Owing to changes in the courses of the rivers Ghagra and Rapti there has been a continual change in the area.

The district has almost a uniform height of 270 feet above sea-level. The plain slopes gently first to the south and then to the east, indicating the general drainage of the country from NW. to NE. A remarkable feature of its landscape is the total absence of marked topographical features. The region comprises several low-lying areas irregular in shape and size, where owing to defective drainage, water accumulates during the rainy season. There are large bodies of stagnant water locally known as *tals*. These low-lying areas are depressions in the flood plains,

which the rivers by flooding are trying to bring to the general level. Many such areas are seen in the north of Gorakhpur city (see Sen, 1959). The tract is completely devoid of any hill or conspicuously marked high land.



Map of Gorakhpur showing some localities

Floods have been a regular menace in the district of Gorakhpur. The river Rapti is one of the largest Himalayan tributaries of the river Ghagra. It flows in a south-easterly direction and drains a large basin. The river Ghagra rises in Tibetan mountains ; like most Himalayan rivers it first flows south and then takes an easterly turn. Gorakhpur,

being very close to the Nepal Himalayas and lying in the windward side of the monsoon, gets more rain than other more southern districts; the latter through these two important rivers, the Ghagra and the Rapti, very often suffer serious floods.

The district is part of the Gangetic plain. Its formation, therefore, is of the same geological structure and history as the plains of Uttar Pradesh. This plain has been continually filled with alluvial deposits since the first uplift of the Himalayas. Attempts have been made to ascertain the depth of the alluvial deposit, but no definite results have been achieved.

CLIMATE

In the rainy season the average temperature of Gorakhpur is 29°C., which is a little lower than the average temperature of dry summer. The difference may be due to the humidity.

TABLE
METEOROLOGICAL DATA OF GORAKHPUR—1959

Months	Temperature in °C.		Relative Humidity %		Rain-fall in mm.	Average Wind Speed Kilom. p.h.	Mean Temp. in °C.
	Mean Max.	Mean Min.	At 08.30 I.S.T.	At 17.30 I.S.T.			
Jan.	24.6	11.3	81	56	31.0	2.4	17.91
Feb.	26.5	13.0	65	42	00.0	4.4	19.75
Mar.	34.4	17.9	46	23	2.5	5.7	26.15
Apr.	39.2	23.8	44	26	34.3	6.0	31.50
May	41.3	25.4	50	23	00.0	7.7	33.35
June	42.1	27.5	62	43	39.9	7.7	34.80
July	33.8	25.7	81	75	c.197.9	7.0	29.75
Aug.	31.7	24.7	88	86	c.535.7	4.1	28.20
Sep.	33.2	25.1	81	77	c.221.8	4.7	29.15
Oct.	31.8	22.3	75	70	70.6	2.4	27.05
Nov.	29.7	15.1	60	55	00.0	1.1	22.40
Dec.	24.1	12.6	80	71	00.3	2.0	18.35

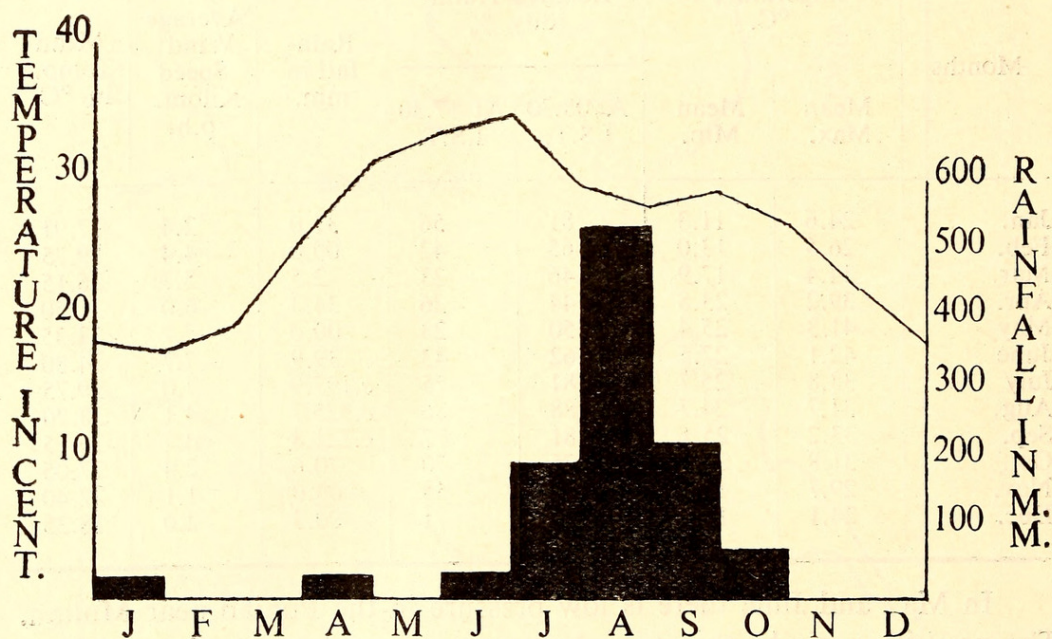
In May and June there is low pressure in the Punjab near Multan. The prevailing winds, therefore, become on-shore blowing from the sea to the land. In the beginning, while summer temperatures are rising, these sea winds move only a short distance from the Bay of Bengal. As the temperature rises these winds penetrate into the interior and are called the summer monsoon. The monsoon arrives in the month of June. The mean daily velocity varies between 7.0 and 7.7 kilometres per hour in these months.

Throughout the rainy season the monsoon winds are easterly. Their

velocity decreases as the rainy months pass on ; and then the direction of the wind changes, becoming ultimately from the east in the morning and the west in the afternoon.

The monthly relative humidity, as shown in the Table, indicates that March and April are the driest months in Gorakhpur. With the advent of the rainy season, the relative humidity increases considerably. It again goes down in October.

As a whole, Gorakhpur receives a heavier rainfall than any other part of the province excepting the hilly tracts, the average being no less than 94.5 mm. The Bay of Bengal branch of the south-west monsoon is mainly responsible for the heavy rains ; the district being on the windward side receives much rainfall. Usually the strength of the monsoon currents and the corresponding rainfall increase from June to July and remain more or less steady till about the end of August. The rain is unevenly distributed throughout the year. Nearly 78 % of the total rainfall of the year falls in the four months, July to October. Heavy downpours lead to considerable runoff, which results in soil erosion. The region north of Gorakhpur city, on account of defective drainage, the presence of forests, and the heavy rainfall in the northern tract, usually becomes marshy and moist.



Annual Temperature and Rainfall at Gorakhpur—1958

BIOTIC FACTORS

Among the biotic factors which influence the vegetation is the grazing by cattle. In places monkeys destroy the tender vegetation. Man also destroys much of the rainy season weeds, which grow quickly and, if not cleared up, give a wild look to the whole area.

GENERAL ASPECT OF VEGETATION

With the arrival of the rainy season (June to July) green herbs appear in every nook and corner. A vigorous and luxuriant growth of weeds starts with the first showers. The *ephemeral vegetation* consists mainly of herbaceous annuals, the existence of which mainly depends upon rain. After a week or two of rain, the ground is covered by plants which belong strictly to the rainy season. Among them *Cleome viscosa*, *Gynandropsis gynandra*, *Ionidium suffruticosum*, *Dentella repens*, *Indigofera* sp., *Cassia* sp., *Trienthera portulacastrum*, *Spermacoce hispida*, *Heliotropium* sp., *Ipomoea pes-tigridis*, *Bonnaya* sp., *Murdannia nudiflorum*, *Peperomia pellucida*, *Phyllanthus* sp., *Cyanotis* sp., *Commelina nudiflora*, *Sesamum indicum*, *Fleurya interrupta*, *Pouzolzia indica*, *Evolvulus alsinoides*, etc. Others germinate and grow vegetatively till late in the rainy season and then come into flower, like *Urena lobata*, *Sida* sp., *Triumfetta* sp., *Oldenlandia crystallina*, *Pergularia pallida*, *Ipomoea sindica*, *Physalis minima*, *Vitis trifolia*, *Ruellia* sp., *Acalypha indica*, etc. There is a third category of weeds which germinate late in rainy season ; they start flowering quite late and go on till about the middle of the winter season. Such weeds include *Oxalis corniculata*, *Tephrosia purpurea*, *Peristrophe bicalyculata*, *Andrographis paniculata*, *Ageratum conyzoides*, *Croton sparsiflorus*, *Scoparia dulcis*, *Adhatoda vasica*, *Ocimum americanum*, *Alternanthera sessilis*, *Nicotiana plumbaginifolia*, etc. There is a fourth category of plants, which are more abundant in other seasons of the year but may sprout and even flower at odd times during the rainy season ; some plants in this category flower throughout the year but do so more profusely in the rainy season. Such plants are *Malvas-trum coromandelianum*, *Tridax procumbens*, *Evolvulus nummularis*, *Solanum xanthocarpum*, *Achyranthes aspera*, *Tribulus terrestris*, and others.

Some of the plants complete their life-cycle in a few weeks. Plants first start drying out from the exposed habitats. Many plants in shaded places last for quite a long time. Some of the plants disappear with the departure of rain and the advent of the cold winter. Life without water and moisture is difficult for them. This will be clear from the periodicity chart at the end of this paper. The commonest and most successful weeds belong to Amarantaceae, Tiliaceae, Malvaceae, Compositae, Capparidaceae, Leguminosae, Convolvulaceae, Acanthaceae, Gramineae, and Commelinaceae.

CONCLUSION AND SUMMARY

In the present paper an attempt has been made to study the vegetation of Gorakhpur in the rainy season from the ecological point of view. Some advancement has been made in India during recent years on floristic and vegetational studies but most parts are still in need of very

thorough exploration. It would not be wise to separate systematic botany from ecological studies, and hence different observations have been included here ; the phenology of each plant, its short life-cycle, relative abundance, and distribution, as has been emphasized by Santapau (1956).

Keeping all this in mind, this study has been made, which in no way claims to be complete. Even a small area may be too large for intensive exploration. The grasses have not been included in this paper, otherwise it would become very unwieldy. The author intends to make a separate communication on the subject. The present paper mainly deals with those weeds which come up soon after the first showers of the season ; trees and shrubs are excluded, although many also come into flower at this time of the year. 147 species representing 107 genera from 39 families have been recorded. Plants belonging to Malvaceae, Tiliaceae, Leguminosae, Rubiaceae, Compositae, Boraginaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Labitae, Amaranthaceae, Euphorbiaceae, and Commelinaceae families are more common. Wherever possible some medicinal uses of the plants have also been given.

Ecologically, the vegetation can be divided into : (1) those plants which are strictly of the rainy season, i.e. they come up with the rains and complete their life-cycle with the departure of the rains, like *Gynandropsis gynandra* and *Ionidium suffruticosum*, etc. ; (2) those which grow with the rains but complete their life-cycle after the rains are over, like *Physalis minima*, *Urena lobata*, etc. ; and (3) those which germinate late in the season and flower only in winter or so, like *Peristrophe bicalyculata*, *Leonotis nepetaefolia*, etc. Taking this division strictly into account, a few plants can be excluded from this list, but as there is no strict demarcation of changing seasons, so also the plants pass from one flowering season to the other, depending mainly on the environmental factors, which definitely affect them.

ACKNOWLEDGEMENTS

Thanks are due to Prof. U. N. Chatterji of Gorakhpur University for constant encouragement and constructive criticism in the preparation of this paper ; to Prof. M. O. Varkey, Principal, St. Andrew's College, Gorakhpur, who very kindly passed on his field notes to the author, and for the facilities provided ; to my colleague Prof. G. C. Srivastava for many suggestions and identifications. The author is thankful to Shri M. B. Raizada, Forest Botanist, F. R. I., Dehradun, for kindly helping him in the identification of a few plants, and to the Director, Meteorological Centre, for supplying the meteorological data. He is indebted to his colleagues and many students for help given in this study. Finally, he is extremely grateful to Rev. Fr. Santapau for kindly

going through the manuscript of the paper, which is the outcome of his most inspiring address.

LIST OF SPECIES

A list of weeds collected throughout the rainy season, with a brief description, the locality where they were collected, their local names (wherever possible), the time of seed germination, flowering, and fruiting. Medicinal uses of some of the plants have also been listed. The names are arranged according to Bentham and Hooker's system, as in Duthie's FLORA. Local names are given after the scientific names or synonyms.

CAPPARIDACEAE

1. *Cleome viscosa* Linn. (Peela Hurhur)

A very common rainy season weed. It has an offensive odour. Seeds germinate by middle of July, flowers up to September. Flowers yellow. Plants remain stunted if dry spell prolongs.

2. *Gynandropsis gynandra* (Linn.) Merr. Syn. *G. pentaphylla* DC. (Safaid Hurhur)

A common weed, but not as common as *C. viscosa*. Seeds germinate with the first showers. It flowers by middle of August and is in fruit generally by the end of the same month. Flowers white.

VIOLACEAE

3. *Ionidium suffruticosum* Ging. Syn. *I. heterophyllum* Vent.

Not common, only collected from Hui Park. Seeds germinate with the early showers. It flowers from July to October. Flowers purplish pink. Fruit setting starts quite early.

PORTULACACEAE

4. *Portulaca oleracea* Linn. (Kulfa)

A common plant collected from Ramgarh Tal side. It flowers and fruits in July-August. Flowers yellow.

5. *Portulaca quadrifida* Linn.

It is a common weed in gardens and flower pots ; flowers in July-August.

MALVACEAE

6. *Abutilon indicum* G. Don. (Kakahi)

A common, almost perennial, plant flowering abundantly during the rains and up to December. Flowers yellow.

7. **Malvastrum coromandelinum** Garcke ; syn. *M. tricuspidatum* A. Gray. (Baryara)

Common ; collected from SAC (St. Andrew's College) and Hui Park, germinates in the rains, flowering quite early. Flowers yellow. Roots are used as an aphrodisiac, powdered and mixed with sugar ; Hindu women worship the plant because of this property.

8. **Sida acuta** Burm. f.

Not common, collected from Ramgarh Tal side under trees. Plants quite stout, flowering in September.

9. **Sida cordifolia** Linn.

Common in Hui Park. Seeds germinate late in rainy season. Flowers abundantly in October. Used for virility in man and stomach complaints.

10. **Sida grewioides** Guill.

Not common, collected from Hui Park. Leaves are small, orbicular, and yellowish green. It flowers late in the season.

11. **Sida veronicaefolia** Lamk. Syn. *S. humilis* Willd.

Not common, trailing, sometimes very long. It flowers abundantly in early September, produces fruit in September-October.

12. **Urena lobata** Linn.

Very common in Hui Park. Seeds germinate quite early, it flowers profusely in September-October. Before flowering it looks very similar to *Triumfetta*-sp. Flowers pink.

13. **Urena repanda** Roxb.

Common in SAC and Hui Park. Not so high as the previous species. It flowers in September-October. Flowers whitish pink, mostly forming clusters at the top.

TILIACEAE

14. **Corchorus aestuans** Linn. Syn. *C. acutangulus* Lamk.

Common in SAC and Hui Park. Tallest and first to appear among the species of this genus collected here. More common in moist and shady places. It flowers August-October, forming 2-3 fruits about an inch long in each axil.

15. **Corchorus antichorus** Roensch.

Not very common, collected from Hui Park. Plants small ; leaves less than an inch long ; stems often prostrate with tortuous branches. Plants grow quite late and flower in September-October. Flowers yellow.

16. **Corchorus olitorius** Linn.

Not common, collected from Hui Park. It flowers September-October. Plants sometimes not much branched ; leaves $1\frac{1}{2}$ inch long.

17. **Triumfetta bartramia** Linn. ; syn. *T. rhomboidea* Jacq.

Common in SAC and Hui Park. It is a large shrub-like annual with polymorphous 3-lobed leaves. Seeds germinate by middle of July, flowering starts together with fruiting by October. Fruits are hooked and round.

18. **Triumfetta rotundifolia** Lamk.

Common in Hui Park. Seeds germinate by late July, flowers and fruits in October-November. Smaller than the previous species. Fruits hooked but pointed.

ZYGOPHYLLAEAE

19. **Tribulus terrestris** Linn. (Gokhru)

A prostrate herb with yellow flowers, collected from Domingarh and Aerodrome area. Not very common. Flowers and fruits in August. Powdered seeds are used for mouth blisters.

OXALIDACEAE

20. **Oxalis corniculata** Linn. (Tinpattia)

Very common in moist and shady places, annual or perennial. It flowers throughout the year, but more in rainy season.

21. **Oxalis acetosella** Linn. (Bari Tinpattia)

Rare, collected only from SAC. Larger than the previous species. Leaves are all radical. Seeds germinate in July and plants flower in August. Flowers purplish pink. Plants not very hairy. Not seen at other times of the year like the previous species.

VITACEAE

22. **Vitis trifolia** Linn. (Imirti)

A common climber at Ramgarh Tal side on the trees and in SAC. It sprouts abundantly by middle of July, flowers and fruits in September-November. Plants seem to sprout from a stout perennial rootstock.

SAPINDACEAE

23. **Cardiospermum halicacabum** Linn.

A slender climbing plant with thin and light green leaves. Flowers small and white. Common in Hui Park in early October, fruiting starts late in winter. Fruits are characteristically triangular with bladder and wings.

PAPILIONACEAE

24. **Abrus precatorius** Linn. (Ratti)

A common hardy twiner. Abundant seedlings come up in July. It flowers in August-September, and fruits during cold season. Seeds are poisonous.

25. **Aeschynomene aspera** Linn.

A marshy tall herb, collected from Asuran. Basal part of stem swollen and pith-like. It flowers abundantly late in the season. Flowers yellow.

26. **Alysicarpus monilifer** DC.

Commonly collected from Hui Park. Stem and leaves covered with hairs. Leaves simple. Flowers late in the season.

27. **Alysicarpus rugosus** DC.

A diffuse herb, common in Hui Park. Seeds germinate in July and plants flower till September.

28. **Argyrolobium roseum** Jaub. & Spach.

Collected near University cross-roads. Plants 1-2 feet in height. Seeds germinate late in the season. It flowers and fruits in November. Flowers yellow with brown streaks on petals. Inflorescence up to 10 inches long, in racemes.

29. **Clitoria ternata** Linn.

A common twiner. Seeds germinate with the first showers. It flowers profusely from August to October. Flowers blue.

30. **Crotalaria medicaginea** Lamk.

Collected from Hui Park only. Plants 1-1½ feet in height and much branched, silky hairy. Flowers in September-October, fruits late in October. Pods round and 2-seeded.

31. **Crotalaria prostrata** Roxb.

Not common, collected from Hui Park. A late rainy season weed. It flowers and fruits in November.

32. **Desmodium gangeticum** DC.

Very common in SAC and Hui Park. Seeds germinate by late July. It flowers abundantly in September-October. Fruits set in October-November. Flowers purplish pink and white.

33. **Desmodium pulchellum** Benth.

Not common ; shrub with downy branches. Flowers yellow.

34. **Desmodium triflorum** DC.

Very common. Prostrate, especially in fields and lawns. Flowers bright bluish purple. It continues to flower till late winter or even later.

35. **Indigofera enneaphylla** Linn.

Common. It flowers late in the season.

36. **Indigofera hirsuta** Linn.

A densely hairy plant, collected from Hui Park, 1-2 feet in height. Seeds germinate in August. Flowering starts in first week of September. Pink flowers crowded on racemes 2-3 inches long. Pods deflexed, densely pubescent, 4-gonous.

37. **Indigofera linifolia** Retz.

A much branched spreading herb, with simple leaves. Collected from Hui Park, not common. It flowers late in the season. Flowers red.

38. **Tephrosia purpurea** Pers.

A perennial undershrub, collected only at Domingarh. Sprouts up with rains. Seeds may also germinate at this time. It flowers abundantly in September and onwards. Flowers rose-coloured, in leaf-apposed racemes. It sets fruit soon.

39. **Uraria neglecta** Prain.

Rare ; collected only from Kusmi Forest, 1-2 feet in height, with one trifoliate leaf and racemose inflorescence. Flowers in July. Flowers yellowish purple. Characteristic fruits in one-seeded joints folded over one another.

40. **Zornia diphylla** Pers.

Not common, collected only from Hui Park. It has sub-erect slender stem. Leaves of two leaflets. Seeds germinate in August and flowers appear in September-October. Flowers yellow.

CAESALPINIACEAE

41. **Cassia absus** Linn.

Abundant in Hui Park only. Seeds germinate by middle of August. Plants about one foot in height, start flowering by early September and continue the whole month. Flowers are beautiful rose-red and not yellow. Stamens mostly four, unequal in size, and not five as mentioned in Duthie.

42. **Cassia occidentalis** Linn. (Bara Chakwad)

One of the commonest rainy season weeds on roadsides. Seeds

germinate with the first showers, but the growth is slower than *C. tora*. Flowers in August-September. Flowers yellow.

43. ***Cassia pumila* Lamk.**

A common procumbent plant in Hui Park, with leaves 1-2 inches long, having 20-40 very small leaflets. Seeds germinate in August. It flowers in September-October. Flowers yellow. Stalked gland of petiole is characteristic.

44. ***Cassia tora* Linn.**

One of the commonest of rainy season weeds. Seeds germinate with the first rains. A number of seedlings grow close together. It starts flowering in late August and continues till September. Flowers yellow

45. ***Mimosa pudica* Linn. (Lajwanti)**

Cultivated and wild in Hui Park. It flowers abundantly in August.

LYTHRACEAE

46. ***Ammannia baccifera* Linn.**

Very common on moist margins of Ramgarh and Narhi tals and many other places. It flourishes well in swamps ; dry conditions are not congenial. It flowers mostly after rains and continues for a long period.

47. ***Ammannia pygmaea* Kurz.**

Very similar to previous species but very small. It flowers in rainy season, grows in dry situations also.

ONAGRACEAE

48. ***Jussiaea repens* Linn.**

Common in Ramgarh and Narhi tals, abundant at Asuran. Grows floating in water, showing very characteristic white respiratory spongy roots. Almost perennial, it grows on mud and even in dry land when water recedes. It flowers late in the season, and continues up to January and February. Flowers yellow.

49. ***Jussiaea suffruticosa* Linn.**

Not so common as *J. repens* collected from south margins of Ramgarh Tal and other places. Almost a perennial herb, which flourishes in water and shows spongy roots also. It flowers late in rainy season. Flowers yellow.

50. ***Ludwigia parviflora* Roxb.**

Rare, collected only from Asuran. A prostrate herb which grows near water. It flowers in December. Flowers small and yellow.

51. *Trapa bispinosa* Roxb. (Singhara)

An aquatic plant of economic importance which grows in seasonal pools. Seedlings planted in July. Plants flower abundantly in August and fruit in September-October.

CUCURBITACEAE

52. *Coccinia indica* W. & A. Syn. *Cephalandra indica* Naud. (Kala Jeur, Kundru)

A common climber ; plants spread abundantly by late July, and profusely flower in August-September. They bear more male than female flowers. Flowers white, fruits red when ripe. Leaves and roots are crushed and used in diabetes.

53. *Cucumis trigonus* Roxb. (Ghurma)

A trailing plant collected from Kusmi Forest, with small yellow staminate flowers. It flowers in August-September. Fruits with green and white stripes, becoming yellow when ripe.

MOLLUGINACEAE

54. *Trianthema portulacastrum* Linn. Syn. *T. monogyna* Linn.

Very common. Seeds germinate with the first showers. It flowers abundantly from August to October, as long as conditions are wet.

55. *Glinus lotoides* Linn. Syn. *Mollugo lotoides* O. Kze. and *M. hirta* Thunb.

Plants collected from drying ponds in low-lying areas after rains. A hairy prostrate herb. Leaves opposite or whorled. It flowers late in the season.

56. *Mollugo stricta* Linn.

Not common, collected from Kusmi Forest. It flowers by middle of August till September. Fruiting starts quite early.

RUBIACEAE

57. *Dentella repens* Forst.

A prostrate slender herb, common near Ramgarh Tal and Domingarh wayside ponds. Seeds germinate quite early in June-July. The plant is so small and insignificant that it can easily be overlooked. It flowers abundantly by late July. Flowers small and white.

58. *Oldenlandia crystallina* Roxb.

Not very common ; collected from Hui Park. Seeds germinate in late July and flower by the end of August. It is smaller than *O. dichotoma*. Flowers are small in pairs on long thin pedicels in the axils of leaves.

59. **Oldenlandia dichotoma** Hook.

Very common in Hui Park and in SAC. It grows profusely in fields by September-October, and flowers soon after. A much larger species.

60. **Spermacoe hispida** Linn. (Gidni)

A procumbent annual, collected from Kusmi Forest and Hui Park. Plants are sufficiently big by late August, and flowering starts soon after. Flowers are produced in axillary clusters. Not common. Flowers purplish blue. Roots after powdering are applied on breast abscesses and ulcers.

COMPOSITAE

61. **Ageratum conyzoides** Linn.

A very common, softly hairy annual; springs up in abundance soon after rains in July-August: it is 6-16 inches in height. It flowers in September. This plant flourishes well in shady and moist ground. Flowers purplish white.

62. **Bidens pilosa** Linn.

Common, 10-20 inches in height, collected from Hui Park. It flowers in September-October.

63. **Caesulia axillaris** Roxb.

Not very common, collected by the side of a stream on way to Tilonia Forest range. It flourishes in swamps, and flowers late in the season. Flowers greyish white in the axils of long sessile leaves.

64. **Chrysanthemum indicum** DC.

A procumbent small diffuse herb. Heads are small. The plant commonly grows on roadside shady places, and flowers late in the season. Flowers yellow.

65. **Eclipta prostrata** Linn. Syn. *E. alba* Hassk., *E. erecta* Linn. (Bhangraia)

An erect or prostrate herb, common, but abundant only in moist soil. It flowers in rainy season and later. Flowers white. The leaves are used for hair dye, and are an important ingredient in medicated oils. Leaf extract is used in ear-ache and also in boils etc. Latex is used for tattooing.

66. **Tridax procumbens** Linn.

Common. Seen almost throughout the year, but more prominent in the rainy season. It flowers late in the season and continues till winter. Flowers light yellow.

67. **Xanthium strumarium** Linn. (Gokhroo)

Common all over for most of the year. Seedlings seen at Kusmi Forest in the middle of August. In other places plants were collected in flower and fruit. Not strictly a rainy season weed.

APOCYNACEAE

68. **Ichnocarpus frutescens** Br.

A large shrubby twiner, not very common. Flowering in August-September for a comparatively short time.

69. **Tabernaemontana coronaria** Willd. Syn. *Ervatamia coronaria* Stapf. (Chandni)

An ornamental shrub, become wild all over. It flowers in August to October. Leaves are shining green, flowers white.

ASCLEPIDACEAE

70. **Pergularia pallida** Wt. & Arn.

A twining shrub, collected from SAC, climbing on hedges. It grows in July and flowers abundantly with yellowish white coloured umbellate cymes. Pollinia waxy with reddish brown translator. Not seen elsewhere.

BORAGINACEAE

71. **Heliotropium indicum** Linn.

Hairy plants, common. Seeds germinate in May-June, and flower soon after. Fruits are produced abundantly in July-August. Flowers pale violet. Fruits characteristic with one-seeded pyrenes.

72. **Heliotropium ovalifolium** Forsk.

Erect, decumbent or prostrate, densely clothed with hairs; collected from Domingarh and SAC. Seeds germinate very early; fruiting abundant in July. There are invariably 4 sepals in the specimens collected, which is different from other records.

73. **Heliotropium subulatum** Hochst.

Erect, the largest in the genus: collected from Domingarh and SAC. It grows on comparatively dry soil. Plants are seen very early in the season and continue to flower after rainy season. A common plant.

74. **Heliotropium supinum** Linn.

Villous herbs, common on roadside in moist shady places. Seeds germinate very early in June-July. The plant flowers and fruits by early August. From a distance the plant looks very similar to *Salvia plebeia*.

75. **Heliotropium strigosum** Willd.

A small much-branched procumbent herb, growing abundantly in rains in playground near SAC Hostel. Seeds germinate with the first rains, the plant flowers profusely by the end of July. Flowers small and white. Not common.

CONVOLVULACEAE

76. **Evolvulus nummularis** Linn.

Very common, much-branched creeping perennial herb in fields at SAC, Domingarh, and other places, on comparatively dry and hard soil. It sprouts with the first showers after hot summer, although the plant is met with throughout the year. White small flowers are abundantly produced from July to October. Flowering is withheld for the winter months, and it appears again in April, but the plants do not look fresh.

77. **Evolvulus alsinoides** Linn.

A diffuse hairy herb, not common. It is a strict rainy season weed, collected after rains in July from SAC and Hui Park. Seeds germinate with early rains, and flower in August-September. Plants are not seen late in the season. Flowers light blue on comparatively long pedicels.

78. **Ipomoea aquatica** Forsk. Syn. *I. reptans* Poir. (Karmua)

An aquatic or semi-aquatic herb, which flourishes on swampy and moist margins of ponds etc. It flowers in late rainy season, and continues flowering till the ground is completely dry. Plants are supposed to be effective for stomach disorders.

79. **Ipomoea pes-tigridis** Linn.

Not very common. A small twining herb, collected only from Hui Park. Seeds germinate late in August. Leaves and stem fulvous hairy. It flowers in September-October and finishes soon after. Flowers purplish.

80. **Ipomoea sindica** Stapf.

A late rainy season weed, collected only from Hui Park in guava orchard twining over grasses etc. Stems many from the base, prostrate, slender and hispid. Leaves hastate, up to 2 inches long. It flowers in October-November, and finishes soon after.

81. **Porana paniculata** Roxb. (Safaid Bel)

A large climbing shrub, only recorded from Afaq Park. It does not appear to be wild. It flowers in October-November, with numerous small white flowers, arranged in large axillary, terminal drooping panicles.

SOLANACEAE

82. **Datura fastuosa** Linn. (Dhatura)

A wild form not very common, small and shrubby. It flowers late in rainy season and afterwards. Seeds are used in asthma. Seeds boiled in oil are used for gout ; they are also smoked for intoxication.

83. **Datura stramonium** Linn.

Annual. Seeds germinate in late July, collected from Domingarh. It flowers late in the season till winter. Flowers white.

84. **Nicotiana plumbaginifolia** Viv. (Jungli Tamakhu)

Common in fields and SAC. Seeds germinate in early July. Leaves radical and cauline, the latter lanceolate. Stems 6-12 inches in height. It flowers abundantly from July to October, and then again in April. Flowers purplish white. No mention of this plant in Duthie.

85. **Physalis minima** Linn. (Ban Makoi)

Common. Seeds germinate with the rains. Flowering starts by August and continues till late in the season. Flowers yellowish white.

86. **Solanum xanthocarpum** Schrad & Wendl. (Bhaktoi)

Not strictly a rainy season weed, but flourishes well in rains and starts flowering. Collected from roadside near aerodrome in middle of July. Flowers abundantly in December. Water, in which leaves are boiled, is given for fever. Seeds, after keeping on red hot earthen pot, give out fumes which are inhaled for carious teeth.

SCROPHULARIACEAE

87. **Bonnaya brachiata** Link & Otto.

Not common. Collected from moist and shaded spots near Ramgarh Tal and SAC. Seeds germinate with the early showers. Plants 3-8 inches in height, leaves spinose-serrate and glabrous. It starts flowering by the end of July and continues till the end of the season. Flowers purple and white.

88. **Bonnaya veronicaefolia** Spreng.

A common decumbent herb collected from shaded spots in Hui Park and SAC. Small plants, like the previous species. Seeds germinate in August and flower during the whole rainy season and continue till late winter in places. Leaves sub-entire or with distantly serrate margins. Flowers purplish white.

89. **Limnophila gratioloides** R. Br.

Grows in water or in swamps ; collected from Asuran. Plants

show heterophylly. Pinkish coloured flowers are produced abundantly in September-October. It continues to flower and produce fruits till late in the season.

90. **Mazus rugosus** Lour.

Very common small glabrous annual with tufted stems ; at SAC and other places. It grows late in the season, and flowers throughout winter. Flowers purplish white.

91. **Moniera cuneifolia** Mich.

From the records of Prof. M. O. Varkey, who collected it on 10-10-1946, but not recorded by the author.

92. **Scoparia dulcis** Linn.

Common. It does not seem to be a true plant of this season, possibly the rootstock sprouts in rains. Flowers white.

LENTIBULARIACEAE

93. **Utricularia flexuosa** Vahl.

A very common aquatic plant, which flourishes well in Asuran Poklhra, Bitia ponds, and others. It starts flowering in early winter and not in hot season as mentioned in Duthie. Flowers yellow.

94. **Utricularia stellaris** Linn.

Not common. Collected from a roadside pond on way to Domingarh. Inflorescence is held up above the water by a whorl of 4 floats on the peduncle, with yellow flowers. It flowers in early winter.

PEDALIACEAE

95. **Martynia diandra** Glox. (Bichhu, Kaua)

From the records of Prof. M. O. Varkey, who collected it on 27-9-1946. Fruits characteristic with 2 hard curved spines. It flowers during and after rains.

96. **Sesamum indicum** Linn. (Tilli)

An erect annual herb, common in Hui Park and many other places, 1-2 feet in height. It germinates in August and flowers in September. Flowers bilabiate and pinkish purple.

ACANTHACEAE

97. **Adhatoda vasica** Nees. Syn. *Justicia adhatoda* Linn. (Adhus)

Very common shrub. Rootstock sprouts up in rains. It starts flowering in early winter and continues onwards. Flowers large

and white. Leaves are made use of in ripening of fruits by covering the latter with them. Leaves oil-smeared and warm are kept on wounds, etc.

98. **Aechmanthera tomentosa** Nees.

From the notes of Prof. M. O. Varkey who collected it on 28-8-1945, and recorded that the plant is not hairy, as mentioned in Duthie, has no bracteoles, and also ovary is not so hairy. Not recorded by the author.

99. **Andrographis paniculata** Nees. (Kalmegh, Kalpnath)

Common ; grows and flowers late in the season by October to December. Flowers pink. Leaf extract after boiling is used as blood purifier.

100. **Barleria strigosa** Willd.

An unarmed shrub, cultivated and wild, not common as a weed. Seeds germinate with late rains ; it flowers for a short period in early winter. Flowers blue.

101. **Hygrophila polysperma** T. Anders.

Common near margins of ponds and ditches, collected from Domin-garh and a number of other places. It flowers abundantly in September-October and continues till winter season. Flowers pinkish white. Stamens two, and not four as mentioned in Duthie.

102. **Justicia procumbens** Linn. Syn. *J. diffusa* Willd.

A diffuse much-branched herb ; not very common, collected near Rani ka Pokhra. Seeds germinate with rains, flowers in September-October. Plants are not seen after November. Flowers purplish pink.

103. **Peristrophe bicalyculata** Nees.

Very common in waste land after rains. Stem characteristically 6-angled. It flowers late in the season and early winter. Flowers pink. Crushed plants mixed with pepper are given in fever.

104. **Ruellia patula** Jacq.

A small hoary pubescent plant, collected from Hui Park and Domin-garh. Not common ; flourishes during the rains only. It flowers rather sparsely in late August. Plants do not live very long.

105. **Thunbergia grandiflora** Roxb.

Not common, mostly cultivated. Plants come up with rains, flower abundantly in September-October. It is a climber with large and showy flowers. Flowers light blue.

VERBENACEAE

106. *Lippia nodiflora* Rich. (Bukkam)

Common near water and other places. It flowers throughout, but more so in July, with shining spikes of violet colour. Fruits are also formed at the same time. Plants, especially leaves, after crushing are applied on forehead for headache.

107. *Verbena officinalis* Linn.

An erect herb, collected from Ramgarh Tal side and Bitia. Spikes are 4-6 inches long. It flowers late in July till August. Flowers lilac.

LABIATAE

108. *Anisomeles indica* O. Kze. Syn. *A. ovata* R. Br.

Plants 3-6 feet in height, densely pubescent; collected from Hui Park. This is more common towards the west of Gorakhpur on the sides of railway line. It grows late in September, and flowers by October. Plants form seeds and die off by middle of November.

109. *Leucas cephalotes* Spreng. (Gom)

Plants appear by early August; they are soft and hairy, the leaves long and serrate. Inflorescence globose, about $\frac{3}{4}$ inch in diameter. It flowers by August-September. Flowers white. Crushed leaves are put in the nostrils for cold and applied on forehead for headache.

110. *Leucas lavandulaefolia* Rees. Syn. *L. linifolia* Spreng.

Not common; collected from Kusmi Forest; about 1 foot in height. Leaves linear lanceolate. It flowers in August-September. Flowers white.

111. *Leonurus sibiricus* Linn.

Not common, collected near University cross roads. About 4 feet in height, the plant flowers in early November. Flowers bluish pink.

112. *Plectranthus coetsa* Buch.-Ham.

From the records of Prof. M. O. Varkey who collected it on 27-9-1946, but not recorded by the author.

113. *Leonotis nepetaefolia* R. Br.

Not very common; collected from Hui Park. Seeds germinate by early October. It flowers in November. Flowers yellowish orange. Not recorded by Kanjilal.

114. *Ocimum americanum* Linn. Syn. *O. canum* Sims. (Tulsi)

Common, collected near University cross roads. Leaves 1 inch long,

gland-dotted on lower surface. It grows in October, flowers early November.

NYCTAGINACEAE

115. *Boerhavia diffusa* Linn. (Gajphunna)

One of the commonest perennial weeds which flourishes in rains, spreading and trailing on ground. It flowers by July to September. Plants look dull in winter, they flower again though not so profusely in March-April. Flowers pink. Roots are boiled and given in fever.

AMARANTHACEAE

116. *Achyranthes aspera* Linn. (Chitchita)

Very common ; grows in August-September, and flowers late in the season and onwards.

117. *Alternanthera sessilis* (Linn.) DC.

A prostrate herb, common near ponds and ditches. It produces white and shining axillary heads. Plants grow in July and flower late in the season.

118. *Amaranthus polygamus* Linn.

A rare plant, collected from Ramgarh Tal side. It grows with rains and flowers in September.

119. *Amaranthus spinosus* Linn. (Jungli Chaulai)

A very common spiny annual. It grows with the early rains and flowers soon after. It is bigger than *A. viridis*. A troublesome weed, whose stem is often tinged with red.

120. *Amaranthus viridis* Linn. (Chaulai)

An erect much-branched annual 1-2 feet in height. Not so common as the previous species. It grows with the rains and flowers soon after.

121. *Gomphrena globosa* Linn.

An annual herb, not common : collected only near Domigarh railway station by the side of the rails. Inflorescence globose of white silky heads. It flowers in September.

122. *Nothosaerua brachiata* Wight.

An erect slender herb, collected near Ramgarh Tal and Bitia side. It is more common in wet places. It flowers in July-August.

POLYGONACEAE

123. **Polygonum hydropiper** Linn. (Pani Mirch)

An aquatic or semi-aquatic plant, collected from Ramgarh Tal side. The stem is branched and swollen at nodes. It flowers in July. Flowers pink.

124. **Polygonum glabrum** Willd.

An aquatic or semi-aquatic plant, common in Ramgarh Tal. Inflorescence 2-4 inches long. Flowers abundantly by late July till September, opening of flowers is irregular. Flowers pink.

125. **Antigonon leptopus** Hook. et Arn.

Commonly cultivated in hedges, but becomes wild on roadsides. It flowers abundantly in late rainy season. Flowers pinkish rose. Not recorded by Duthie.

PIPERACEAE

126. **Peperomia pellucida** H.B.K.

A rare succulent annual, collected only from Hui Park. Seeds germinate in August. Stems sometimes rooting at nodes. It flowers abundantly at a young stage by August-September.

EUPHORBIACEAE

127. **Acalypha indica** Linn. (Fursh Buti)

An erect annual, common. Plants grow in July, and start flowering in early August and continue later. Leaf extract is taken in cow's milk for strength.

128. **Chrozophora rottleri** A. Juss.

Very common near Bitia side, it grows in summer and flowers abundantly in rainy season. Male flowers yellow.

129. **Croton sparsiflorus** Morong.

One of the commonest weeds on roadsides. Has a repulsive smell. It grows throughout the year, but flourishes well in rainy and cold seasons. Not recorded by Duthie.

130. **Euphorbia hirta** Linn. (Bari Dudhi)

A small prostrate herb with erect branches and opposite leaves. Common, almost throughout the year. It flowers for a considerable part of the year.

131. **Euphorbia thymifolia** Linn. (Chhoti Dudhi)

Very common on gravel paths. Seeds germinate with the rains ; plants change from a green to coppery hue, and flower for a long time in the season. Leaf extract is given in mother's milk to infants suffering from dysentery.

132. **Phyllanthus niruri** Linn.

Grows very early in the rainy season, a true rainy season weed, very common. Flowering starts by late July. Flowers are very small and axillary.

133. **Phyllanthus simplex** Retz.

A glabrous herb, common in Hui Park. Plants appear quite early in the season. Flowers are solitary on stout long pedicels, capsule rough but not echinulate. It flowers in July-August and fruits set in soon after.

134. **Phyllanthus urinaria** Linn.

A common small weed, collected from Hui Park and SAC. Plants look very similar to *P. niruri*, but they are smaller and dark green in colour. It flowers in August-September. Fruits are faintly echinulate.

URTICACEAE

135. **Cannabis sativa** Linn. (Bhang)

Very common, mostly on southern side. It sprouts up abundantly with rains, and grows till late winter. It flowers in early winter.

136. **Fleurya interrupta** Gaud. (Bichhu)

Rare ; collected only from SAC campus. It grows in August and flowers soon after. It does not live very long.

137. **Pouzolzia indica** Gaud.

It has not been recorded except from SAC ; collected together with *Fleurya interrupta*. Seeds germinate with the early rains, flower till September. A rare plant.

ORCHIDACEAE

138. **Vanda roxburghii** R. Br.

Not very common, collected from Turra Nulla. It is an epiphyte, and flowers by middle of August. Flowers yellowish cream.

SCITAMINACEAE

139. **Globba** sp.

Very common in Hui Park all along the boundary. It grows with rains and flowers profusely in August. Flowers purplish red. It looks like a canna.

DIOSCOREACEAE

140. **Dioscorea sativa** Linn.

A climbing plant, collected from Hui Park. It flowers late in August, in drooping spikes. Not common.

PONTEDERIACEAE

141. **Monochoria vaginalis** Persl.

An aquatic plant ; flowers commonly in rainy season. It is common in Ramgarh Tal.

COMMELINACEAE

142. **Murdannia nudiflorum** Linn. Syn. *Aneilema nudiflorum* R.Br.

A common slender weed, collected from Hui Park and SAC ; grows by early August. Leaves 1-2 inches long ; inflorescence is a panicle on a scape. It flowers by late August and early September for a short time.

143. **Commelina benghalensis** Linn.

Common near moist margins of ditches and in low-lying areas. It flowers abundantly during the rains.

144. **Commelina nudiflora** Linn.

Very common near bathrooms of SAC Hostel and Ramgarh Tal side ; grows by early July. Plants are bigger in size than the previous species, leaves broad and sessile. Flowering starts by early August and continues till September. Flowers blue. Leaf extract is applied in wasp stings.

145. **Cyanotis axillaris** Schult.

Rare ; collected from Hui Park in shade. Leaves 2-3 inches long and linear. Inflorescence axillary in helicoid cymes. Stamens have bearded filaments, anthers are yellow.

146. **Cyanotis cristata** Schult.

Rare ; collected only from Domingarh near old buildings on a wall ; looks very similar to *Commelina* sp. Flowers abundantly by the first week of September for a short time ; stamens six with bearded filaments.

NAIADACEAE

147. **Aponogeton monostachyon** Linn. f.

An aquatic plant collected from Domingarh in August-September, when it flowers abundantly. White flowers emerge out of the water surface.

INCIDENCE OF FREQUENCY ABUNDANCE REGARDING GROWTH AND
PHENOLOGY OF WEEDS DURING RAINY SEASON—1958

In the following chart the monthly incidence of frequency-abundance regarding growth and phenology of rainy season weeds is given. The symbols used are : R-rare (1-5) ; F-frequent (5-15) ; C-common (50-100) ; A-abundant (100-200) ; D-dominant (over 200). The numbers within brackets are the approximate numerical values of the symbols for the localities from which the plants have been collected as mentioned in the case of each plant. v and l are used as prefix for 'very' and 'local'.

Plant species	July	Aug.	Sept.	Oct.	Nov.	Dec.
1. <i>Cleome viscosa</i> Linn. ..	D	A	A	F	..	..
2. <i>Gynandropsis gynandra</i> (Linn.) Merr. ..	lA	lC	F	F	..	..
3. <i>Ionidium suffruticosum</i> Ging. ..	R	vF	C	F	..	..
4. <i>Portulaca oleracea</i> Linn. ..	vF	vF	F	..	..	..
5. <i>P. quadrifida</i> Linn.* ..	..	..	*	..	..	..
6. <i>Abutilon indicum</i> G. Don ..	lF	F	F	C	F	F
7. <i>Malvastrum coromandelinum</i> Garcke. ..	lF	lF	lF	F	F	..
8. <i>Sida acuta</i> Burm. f. ..	..	..	lF	lF	..	..
9. <i>S. cordifolia</i> Linn. ..	..	F	C	lA	A	..
10. <i>S. grewoides</i> Guill. ..	..	F	vF	C	F	..
11. <i>S. veronicaefolia</i> Lamk. ..	..	..	vF	F	..	..
12. <i>Urena lobata</i> Linn. ..	C	C	lA	lA	C	..
13. <i>U. repanda</i> Roxb. ..	..	lF	lC	lA	F	..
14. <i>Corchorus aestuans</i> Linn. ..	F	C	C	C	F	..
15. <i>C. antichorus</i> Roensch. ..	..	F	F	F	..	..
16. <i>C. olitorius</i> Linn. ..	..	..	F	F	..	..
17. <i>Triumfetta bartramia</i> Linn. ..	R	F	C	C	F	..
18. <i>T. rotundifolia</i> Lamk. ..	..	F	F	C	vC	..
19. <i>Tribulus terrestris</i> Linn. ..	lR	lR	..	..	..	..
20. <i>Oxalis corniculata</i> Linn. ..	lF	lF	lF	lF	lF	..
21. <i>O. acetosella</i> Linn. ..	lF	lC	lR	..	..	..
22. <i>Vitis trifolia</i> Linn. ..	lF	lC	lC	lC	lF	..
23. <i>Cardiospermum halicacabum</i> Linn... ..	..	..	lF	lF	lF	..
24. <i>Abrus precatorius</i> Linn. ..	..	lF	lF	..	..	..
25. <i>Aeschynomene aspera</i> Linn. ..	..	..	lF	lF	lF	lF
26. <i>Alysicarpus monilifer</i> DC. ..	..	..	..	lF	lF	..
27. <i>A. rugosus</i> Linn. ..	lR	lF	lC	lR	..	..
28. <i>Argyrolobium roseum</i> Jaub & Spach. ..	..	..	..	lR	lF	..
29. <i>Clitoria ternatea</i> Linn. ..	lF	lA	lA	lF	lF	..
30. <i>Crotalaria medicaginea</i> Lamk. ..	..	lF	lC	lA	lF	..
31. <i>C. prostrata</i> Roxb. ..	..	..	..	lF	lF	..
32. <i>Desmodium gangeticum</i> DC. ..	F	C	vA	C	..	..
33. <i>D. pulchellum</i> Benth. ..	..	..	lR	lR	..	..
34. <i>D. triflorum</i> DC. ..	..	A	A	A	A	A
35. <i>Indigofera enneaphylla</i> Linn. ..	..	..	..	F	F	F
36. <i>I. hirsuta</i> Linn. ..	..	R	C	C	..	..
37. <i>I. linifolia</i> Retz. ..	..	F	C	C	..	..
38. <i>Tephrosia purpurea</i> Pers. ..	F	F	C	C	F	F
39. <i>Uraria neglecta</i> Prain. ..	lR	lR	..	..	..	..
40. <i>Zornia diphylla</i> Pers. ..	..	lR	lF	lF	..	..
41. <i>Cassia absus</i> Linn. ..	..	C	vC	A	..	..
42. <i>C. occidentalis</i> Linn. ..	vA	D	D	vA	C	..
43. <i>C. pumila</i> Lamk. ..	..	lF	lC	lA	..	..
44. <i>C. tora</i> Linn. ..	F	vC	vC	F	..	..
45. <i>Mimosa pudica</i> Linn. ..	F	F	C	C	..	..
46. <i>Ammania baccifera</i> Linn. ..	C	A	A	A	C	..

Plant species	July	Aug.	Sept.	Oct.	Nov.	Dec.
47. <i>A. pygmaea</i> Kurz. ..	C	C	C	C	F	F
48. <i>Jussiaea repens</i> Linn. ..	F	F	F	F	F	..
49. <i>J. suffruticosa</i> Linn. ..	R	F	F	R	..	..
50. <i>Ludwigia parviflora</i> Roxb. ..	..	IR	IR	IR	..	..
51. <i>Trapa bispinosa</i> Roxb. ..	C	A	A	A	F	R
52. <i>Coccinia indica</i> W. & A. ..	F	C	C	C	..	..
53. <i>Cucumis trigonus</i> Roxb. ..	F	F	F	R	..	..
54. <i>Trianthema portulacastrum</i> Linn. ..	vC	A	A	A	vC	..
55. <i>Glinus lotoides</i> Linn. ..	IF	IF	F	F	..	..
56. <i>Mollugo stricta</i> Linn. ..	..	R	R	..	..	..
57. <i>Dentella repens</i> Forst. ..	C	A	vC	F	..	..
58. <i>Oldenlandia crystallina</i> Roxb. ..	..	F	vF	..	..	..
59. <i>O. dichotoma</i> Hook. ..	..	F	C	vC	F	..
60. <i>Spermacoce hispida</i> Linn. ..	..	F	C	F	..	..
61. <i>Ageratum conyzoides</i> Linn. ..	C	vC	IA	IA	C	C
62. <i>Bidens pilosa</i> Linn. ..	..	..	F	F	..	..
63. <i>Caesulia axillaris</i> Roxb. ..	..	..	F	F	..	..
64. <i>Chrysanthemum indicum</i> DC. ..	..	..	F	F	..	..
65. <i>Eclipta prostrata</i> Linn. ..	C	A	A	A	C	C
66. <i>Tridax procumbens</i> Linn. ..	C	C	C	C	F	F
67. <i>Xanthium strumarium</i> Linn. ..	F	F	F	F	F	F
68. <i>Ichnocarpus frutescens</i> Br. ..	..	F	C	F	..	..
69. <i>Tabernaemontana coronaria</i> Willd. ..	..	F	C	F	..	..
70. <i>Pergularia pallida</i> W. & A. ..	IR	IR	IF	IF	..	..
71. <i>Heliotropium indicum</i> Linn. ..	vF	vF	IF	IF	..	..
72. <i>H. ovalifolium</i> Forsk. ..	F	F	F	F	F	..
73. <i>H. subulatum</i> Hochst. ..	C	vC	vC	C	C	F
74. <i>H. supinum</i> Linn. ..	C	C	vC	C	C	C
75. <i>H. strigosum</i> Willd. ..	IA	IA	IA	IC	..	..
76. <i>Evolvulus nummularius</i> Linn. ..	A	vA	vA	C	F	F
77. <i>E. alsinoides</i> Linn. ..	R	F	F	R	..	..
78. <i>Ipomoea aquatica</i> Forsk. ..	F	F	F	F	F	F
79. <i>I. pes-tigridis</i> Linn. ..	..	F	vF	F	..	..
80. <i>I. sindica</i> Stapf. ..	..	..	F	F	..	..
81. <i>Porana paniculata</i> Roxb. ..	..	..	IC	IA	..	..
82. <i>Datura fastuosa</i> Linn. ..	..	F	F	F	..	..
83. <i>D. stramonium</i> Linn. ..	..	F	F	F	..	..
84. <i>Nicotiana plumbaginifolia</i> Viv. ..	vF	C	C	vF	..	..
85. <i>Physalis minima</i> Linn. ..	F	C	vC	C	..	..
86. <i>Solanum xanthocarpum</i> Schr. et Wendl. ..	IF	IF	..	..	F	vC
87. <i>Bonnaya brachiata</i> Link & Otto. ..	vC	vC	vC	vF	F	..
88. <i>B. veronicaefolia</i> Spreng. ..	vC	vC	A	vC	vF	F
89. <i>Limnophila gratioloides</i> R.Br. ..	IC	IA	IA	ID	IA	..
90. <i>Mazus rugosus</i> Lour. ..	..	..	F	vC	A	C
91. <i>Moniera cuneifolia</i> Mich.* ..	..	..	..	*	..	..
92. <i>Scoparia dulcis</i> Linn. ..	F	F	F	F	F	F
93. <i>Utricularia flexuosa</i> Vahl. ..	..	..	..	F	C	vC
94. <i>U. stellaris</i> Linn. ..	..	..	..	IF	IF	..
95. <i>Martynia diandra</i> Glox.* ..	..	..	*	..	..	..
96. <i>Sesamum indicum</i> Linn. ..	..	F	vF	C	F	..
97. <i>Adhatoda vasica</i> Nees. ..	R	..	..	..	F	C
98. <i>Aechmanthera tomentosa</i> Nees.* ..	..	*	..	..	..	..
99. <i>Andrographis paniculata</i> Nees. ..	..	R	F	C	vC	F
100. <i>Barleria strigosa</i> Willd. ..	..	..	vF	C	C	..
101. <i>Hygrophila polysperma</i> T.Anders. ..	F	C	vC	A	vC	vC
102. <i>Justicia procumbens</i> Linn. ..	..	C	C	C	..	..
103. <i>Peristrophe bicalyculata</i> Nees. ..	R	F	C	vC	C	F
104. <i>Ruellia patula</i> Jacq. ..	F	F	F	F	..	..
105. <i>Thunbergia grandiflora</i> Roxb. ..	..	F	F	F	..	..

Plant species	July	Aug.	Sept.	Oct.	Nov.	Dec.
106. <i>Lippia nodiflora</i> Rich. . .	C	C	C	F	..	..
107. <i>Verbena officinalis</i> Linn. . .	C	F	F	..	..	..
108. <i>Anisomeles indica</i> O.Kze. . .	..	..	F	C	C	F
109. <i>Leucas cephalotes</i> Spreng. . .	F	vF	C	F	..	..
110. <i>L.lavandulaefolia</i> Rees. . .	R	F	F	F	..	..
111. <i>Leonurus sibiricus</i> Linn. . .	..	..	F	vF	..	..
112. <i>Plectranthus coetsa</i> Buch.-Ham.* . .	..	..	*	..	..	..
113. <i>Leonotis nepetaefolia</i> R.Br. . .	..	..	F	C	C	C
114. <i>Ocimum americanum</i> Linn. . .	..	..	F	F	F	..
115. <i>Boerhavia diffusa</i> Linn. . .	A	D	vA	C	F	..
116. <i>Achyranthes aspera</i> Linn. . .	..	R	F	vF	C	C
117. <i>Alternanthera sessilis</i> (Linn.) DC... .	C	C	C	C	C	C
118. <i>Amaranthus polygamous</i> Linn. . .	R	R	R	..	..	..
119. <i>A. spinosus</i> Linn. . .	vC	A	D	A	C	..
120. <i>A. viridis</i> Linn. . .	C	C	vC	C	..	..
121. <i>Gomphrena globosa</i> Linn. . .	..	R	R	..	..	..
122. <i>Nothosaerua brachiata</i> Wight. . .	vF	C	C	..	..	..
123. <i>Polygonum hydropiper</i> Linn. . .	vF	vF	F	..	..	..
124. <i>P. glabrum</i> Willd. . .	vF	C	vF	F	..	..
125. <i>Antigonon leptopus</i> Hook et Arn. . .	..	R	F	C	vC	..
126. <i>Peperomia pellucida</i> H.B.K. . .	..	IF	IC	IF	..	..
127. <i>Acalypha indica</i> Linn. . .	F	F	vF	C	C	vF
128. <i>Chrozophora rottleri</i> A.Juss. . .	vF	F	..	..	..	..
129. <i>Croton sparsiflorus</i> Morong. . .	A	A	A	A	C	C
130. <i>Euphorbia hirta</i> Linn. . .	A	A	A	A	vC	F
131. <i>E. thymifolia</i> Linn. . .	A	A	A	vC	vC	..
132. <i>Phyllanthus niruri</i> Linn. . .	C	vC	vC	C	..	..
133. <i>P. simplex</i> Retz. . .	C	vC	vC	..	..	..
134. <i>P. urinaria</i> Linn. . .	..	F	C	C	..	..
135. <i>Cannabis sativa</i> Linn. . .	IF	IF	IF	IF	IF	IF
136. <i>Fleurya interrupta</i> Gaud. . .	IF	IC	IC	IF	..	..
137. <i>Pouzolzia indica</i> Gaud. . .	IF	IC	IC	IF	..	..
138. <i>Vanda roxburghii</i> R.Br. . .	F	C	C	F	..	..
139. <i>Globba</i> sp. . .	IC	IC	IF	..	..	..
140. <i>Discorea sativa</i> Linn. . .	..	F	F	F	..	..
141. <i>Monochoria vaginalis</i> Persl. . .	F	F	F	F	..	..
142. <i>Murdannia nudiflorum</i> Linn. . .	..	C	vC	F	..	..
143. <i>Commelina benghalensis</i> Linn. . .	F	vF	vF	F	..	..
144. <i>C. nudiflora</i> Linn. . .	vC	A	A	vC	C	..
145. <i>Cyanotis axillaris</i> Schult. . .	R	R	R	..	..	..
146. <i>C. cristata</i> Schult. . .	..	IF	IC	IF	..	..
147. <i>Aponogeton monostachyon</i> Linn.f. . .	IF	IC	IF	IR	..	..

REFERENCES

- Arber, A. (1920): Water Plants. Cambridge.
- Bakshi, T. S. (1954): The Vegetation of Pilani & its neighbourhood. *J. Bombay nat. Hist. Soc.* **52**: 484-514.
- Bamber, C. J. (1915): Plants of the Punjab. Simla.
- Bhargava, K. S. & Gupta, R. K. (1958): Seasonal Material for a Flora of Nainital. *Agra Univ. Jour. Res. (Sc.)* **7**: 1-48.
- Collet, H. (1921): Flora Simlensis. Calcutta & Simla.
- Dudgeon, W. (1920): A contribution to the ecology of Upper Gangetic Plain. *Jour. Indian bot. Soc.* **1**: 296-324.
- Duthie, J.F. (1905-15): Flora of Upper Gangetic Plain. Calcutta.
- Fasset, J. F. (1940): A Manual of Aquatic Plants. New York & London.
- Gupta, R. K. (1956): Botanical Exploration in the Bhillangana Valley of the erstwhile Tenri Garhwal State. *J. Bombay nat. Hist. Soc.* **53**: 581-594.
- Hewetson, C. E. (1952): Systematics and Ecology of Indian Plants or What can we demand of a Modern Flora? *J. Bombay nat. Hist. Soc.* **56**: 140-144.

- Hooker, J. D. (1872-97): Flora of British India. Vol. 1-7. London.
- Jain, S. K. (1956): On a Botanical Trip to Nainital. *Indian For.* **82**: 22-38.
- Kanjilal, P. C. (1933): A Forest Flora for Pilibhit, Oudh, Gorakhpur, and Bundelkhand. Allahabad.
- Kenoyer, B. L. A. (1924): Weed Manual of Gwalior State & adjacent Parts of India. Calcutta.
- Misra, R. (1944): The Vegetation of Rajghat Ravines. *Jour. Ind. bot. Soc.* **23**: 113-121.
- (1946): An ecological study of the vegetation of the Benares Hindu University grounds. *Ibid.* **25**: 39-59.
- (1946a): A study in the ecology of low-lying lands. *Indian Ecol.* **1**: 27-46.
- Mitra, J. N. (1958): Flowering plants of Eastern India. Vol. 1 Monocot. Calcutta.
- Mukherji, S. K. (1953): Vegetation of Delhi 'Ridge'. *J. Bombay nat. Hist. Soc.* **51**: 439-465.
- Pattnaik, H. (1956): Some useful weeds in and around Cuttack. *Ibid.* **54**: 140-152.
- Raizada, M. B. (1931): Contribution to Duthie's Flora from the neighbourhood of Dehradun. *Jour. Indian bot. Soc.* **10**: (2).
- (1935): Recently introduced or otherwise imperfectly known plants from the Upper Gangetic Plain. *Ibid.* **14**: 339-348 and (1936) **15**: 149-167.
- (1939): New or noteworthy plants from Upper Gangetic Plain. *Indian Forest Records* **1** (5): 223-235 and *Indian Forester* **76** (1950): 489-497.
- Santapau, H. (1947): Notes on the Convolvulaceae of Bombay. *J. Bombay nat. Hist. Soc.* **47**: 337-355.
- (1954): The genus *Murdannia* in Bombay State. *Ibid.* **52**: 658.
- (1956): The Botanical Exploration of India. *Jour. Indian bot. Soc.* **35**: 1-6.
- (1957): *Eclipta prostrata* *E. erecta*, or *E. alba*: Which is the correct name? *J. Bombay nat. Hist. Soc.* **54**: 173-174.
- (1957): The Flora of Purandhar. New Delhi.
- Sen, D. N. (1959): Ecological Studies on Aquatic and Swampy Vegetation of Gorakhpur. *Agra Univ. Jour. Res. (Sc.)* **8**: 1-14.
- Singh, K. P. (1950): The Human and Economic Geography of the Gorakhpur district. (Unpublished M.A. thesis of B.H.U.).
- Srivastava, G. D. (1949): Flora of Allahabad. *University Studies Supplement. Botany Section.* **1**: 1-20.
- & Tandon, R. K. (1951): A study in the Autecology of *Trapa bispinosa* Roxb. *Proc. Nat. Acad. of Sc.* **21**: B: 57-66.
- Srivastava, J. G. (1955): A note on the Flora of Mirzapur (U.P.) *J. Bombay nat. Hist. Soc.* **53**: 152-153.
- Tadulingam, C. & Venkatanarayana, G. (1955): A Handbook of some South Indian Weeds. Madras.
- Thakur, C. (1954): Weeds In Indian Agriculture, Patna.
- Weaver, J. E. & Clement, F. E. (1938): Plant Ecology, New York.
- Willis, J. C. (1951): A dictionary of the Flowering Plants and Ferns. Cambridge.



Sen, D N . 1960. "Systematics and Ecology of Indian Plants: I. on the Rainy Season Weeds in Gorakhpur." *The journal of the Bombay Natural History Society* 57, 144–172.

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