

Vegetation of Pachpadra Salt Basin in Western Rajasthan

BY

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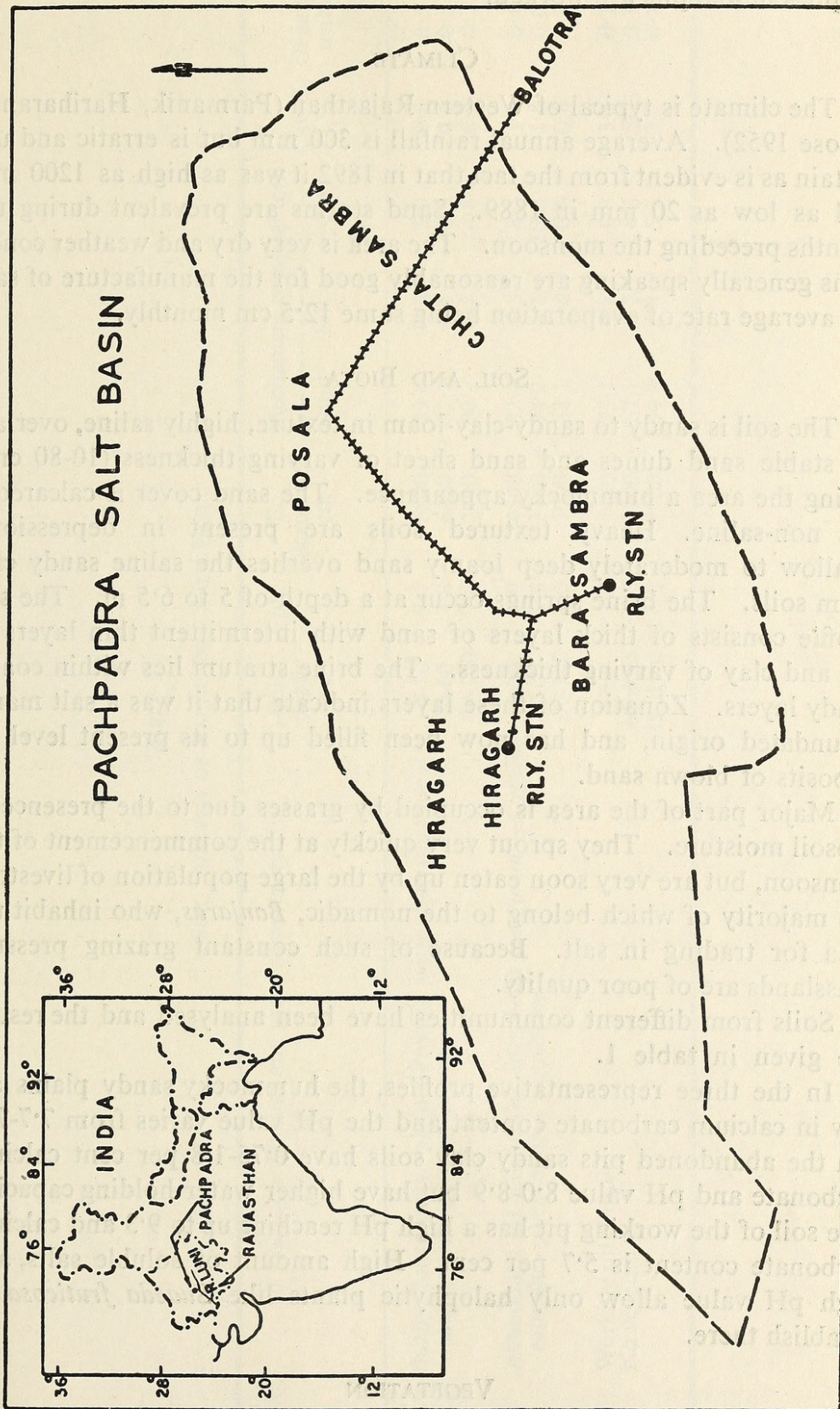
(With a map)

INTRODUCTION

Saline and sodic soils are widespread and extensive in the arid regions of India and form a conspicuous part of the landscape. Pachpadra Salt Basin is one such area where common salt is produced on a commercial scale. Divergent views regarding the origin of Salt have been expressed by Godebole 1951, Auden 1952, Holland & Christie 1909, and Ghose (1964). The area possesses sparse and specialised vegetation due to high salinity and where grasses grow, these are heavily grazed. Development of such areas for the production of palatable grasses is necessary in view of the acute shortage in cattle forage. No detailed information is available about the vegetation and flora of this basin except in the pioneer work of Blatter & Hallberg (1918-1921), Puri *et al.* (1964), Bhandari (1967), Satyanarayan & Shankarnarayan (1963), for central Luni Basin. The list of plants species along with a short description of vegetation of Pachpadra Salt Basin is presented in this paper.

LOCATION AND TOPOGRAPHY

The study area situated about 16 km to the west of River Luni and about 3 km in the same direction from the town of Pachpadra is an oval basin about 11-13 km long and 2-3 km wide in a sandy valley. It has a south-westerly course parallel to Luni River for several kilometres and then turns eastwards and joins the river. The eastern edge of the valley is capped by occasional hills and sand dunes sloping towards the Luni River, while to the west the sand dunes form an unbroken line. The total area of the basin is 32.3 sq km. The rain water leaches the salt from a catchment area of 560-640 sq km and carries it in to the subsoil of the shallow basin. About 1120 salt extraction pits are scattered all over this area, but the largest number lies in the western portion called



Hiragarh. Pits of the eastern part are generally silted up and abandoned. At present 428 pits are worked.

CLIMATE

The climate is typical of Western Rajasthan (Parmanik, Hariharan & Ghose 1952). Average annual rainfall is 300 mm but is erratic and uncertain as is evident from the fact that in 1892 it was as high as 1200 mm and as low as 20 mm in 1889. Sand storms are prevalent during the months preceding the monsoon. The area is very dry and weather conditions generally speaking are reasonably good for the manufacture of salt, the average rate of evaporation being some 12.5 cm monthly.

SOIL AND BIOTA

The soil is sandy to sandy-clay-loam in texture, highly saline, overlaid by stable sand dunes and sand sheet of varying thickness (10-80 cm), giving the area a hummocky appearance. The sand cover is calcareous but non-saline. Heavy textured soils are present in depressions. Shallow to moderately deep loamy sand overlies the saline sandy clay loam soils. The brine springs occur at a depth of 5 to 6.5 m. The soil profile consists of thick layers of sand with intermittent thin layers of silt and clay of varying thickness. The brine stratum lies within coarse sandy layers. Zonation of these layers indicate that it was a salt marsh of undated origin, and has now been filled up to its present level by deposits of blown sand.

Major part of the area is occupied by grasses due to the presence of subsoil moisture. They sprout very quickly at the commencement of the monsoon, but are very soon eaten up by the large population of livestock the majority of which belong to the nomadic, *Banjaras*, who inhabit the area for trading in salt. Because of such constant grazing pressure grasslands are of poor quality.

Soils from different communities have been analysed and the results are given in table 1.

In the three representative profiles, the hummocky sandy plains are low in calcium carbonate content and the pH value varies from 7.7-7.9. On the abandoned pits sandy clay soils have 0.75-1.8 per cent calcium carbonate and pH value 8.0-8.9 but have higher water holding capacity. The soil of the working pit has a high pH reaching up to 9.3 and calcium carbonate content is 5.7 per cent. High amount of soluble salts, and high pH value allow only halophytic plants like *Suaeda fruticosa* to establish there.

VEGETATION

Blatter & Hallberg (1918-1921) mentioned a few halophytic species, Biswas & Rao (1953) listed halophytic species of Rajputana desert,

TABLE 1
SOIL ANALYSIS OF PACHPADRA SALT BASIN

S. No.	Location, Habitat and grass community	Soil depth cm.	pH	Ec. micromhos cm	Mechanical composition			CaCO ₃ %	Organic matter %
					Sand	Silt	Clay		
1	Sandy hummocky plain (Posali) with <i>Dactyloctenium</i> <i>sindicum</i> , <i>Eleusine compressa</i>	0-30	7.7	6800	89.4	3.8	5.0	0.8	0.3
		30-60	7.9	6400	87.3	4.5	6.3	0.6	0.5
		60-100	7.8	5400	90.7	4.3	4.8	0.9	0.2
2	Abandoned pit (Hiragarh) <i>Sporobolus marginatus</i> — <i>Cyperus</i> <i>rotundus</i> — <i>Dichanthum annulatum</i>	0-30	8.9	4500	82.1	3.5	8.3	1.4	0.4
		30-60	8.0	3700	78.2	4.5	10.8	1.8	0.0
		60-100	8.0	5000	82.1	7.0	6.8	0.8	0.1
3	Working pit (Posali) No vegetation	Top	7.9	4400	85.1	1.8	5.3	3.4	0.1
		Middle	9.3	3900	87.1	3.3	4.3	5.7	0.1
		Bottom	8.3	9500	84.8	1.8	5.3	3.8	0.2

Shantisarup (1958) studied the halophytes of Luni river-bed in relation to soil structure and composition. Recently Bhandari (1968) studied the flora of Western Rajasthan but no complete account has ever been made from this region.

The following habitats have been recognised based on the floristic survey of the region. 1. Sandy plain, (a) Flat older alluvial plain and (b) Undulating hummocky plain, 2. Saline depression, 3. Salt pit, (a) Working salt pit and (b) Abandoned pit either completely filled or partially filled up and, 4. Sand dunes. The floristic composition of each type is as follows :—

1. Sandy plain

(a) *Flat older alluvial plain* : A part of the basin occupies this habitat with deep sand cover and loose top. Soils are calcareous and carbonate content increases with depth. It is dominated by a plant community of *Prosopis juliflora* DC. with 90 per cent relative dominance. Main associate is *Salvadora persica* L. The ground is occupied by a grass community of *Sporobolus-Eleusine-Cenchrus* sp. with 5-7 per cent basal cover.

(b) *Hummocky older alluvial plain* : A major portion of the basin is covered by undulating topography with loose soil on the top. The vegetation cover is very sparse and distributed in patches. *Acacia jacquemontii*-*P. juliflora* community dominates with 65 and 30 per cent relative dominance. *Dactyloctenium scindicum-Eleusine compressa* is the grass community supported by this habitat with 5.4 per cent basal cover. The percentage composition of these two grasses is 57.7 and 18.6 per cent respectively. About 13 species have been recorded with *Zygo-phyllum simplex* as main associate. In this habitat one can rarely see *Lycium barbarum* due to the large scale extermination for the crystallization of salt. At present it is transported from the adjoining areas and hence large scale plantation of this species should be encouraged in the tract.

2. Saline depression

These are low lying patches which either occur in the interdunal areas or between two or more pits. Here the soils are heavier, deep, sandy-clay-loam, and highly saline. Fringes of these areas are occupied by a community of *Salvadora persica-Tamarix dioica* with 55 and 35 per cent relative dominance respectively. *Sporobolus marginatus-Cenchrus setigerus* is the grass community with 6.6 per cent basal cover.

3. Salt pit

(a) *Abandoned pits* : These are the old pits which are either fully or partially covered by gradual silting. These are surrounded by a community of *Prosopis juliflora-Salvadora oleoides* with 85 and 15 per cent

relative dominance. Some of the partially filled salt pits act as temporary ponds and support a pure community of *Fimbristylis ferruginea* (L.) Vahl. *Acacia nilotica* ssp. *indica* and *Suaeda fruticosa* (L.) Forsk. are the two chief associates.

(b) *Working pits*: Pits where salt is extracted. Practically devoid of any shrub vegetation. *Tragus biflorus*-*Aristida funiculata*-*Eleusine compressa* is the grass community with 3 per cent cover.

4. Sand dune

Medium to high, stabilised, transverse and longitudinal dunes demarcate the boundary of the basin. Few dunes are located in the basin itself. In the residential colony, office building and other small huts on the dunes are dominated by a community of *Calotropis procera*. Boundary dunes are generally cultivated for kharif crops. *Salvadora oleoides*-*Acacia jacquemontii*-*C. procera* form a sparse community while the ground community of grass is that of *Cenchrus biflorus*-*C. prieurerii* with two per cent cover. Stray plants of *Calligonum polygonoides* need mention.

ANNOTATED LIST OF PLANTS COLLECTED

The list of plants collected from the basin follows Bentham and Hooker's system of classification. Popular vernacular names, short description, time of flowering and fruiting and exact locality are given for each species. Based on available literature the nomenclature has been made up to date. The number after the description of each species refer to Herbarium sheets stored at the Herbarium of Central Arid Zone Research Institute, Jodhpur, India. A visual estimation of the plant species and their distribution on different habitat of the Basin has been given in Table 2.

TABLE 2

DISTRIBUTION OF PLANT SPECIES ON DIFFERENT HABITATS AT PACHPADRA SALT BASIN

Species	Habitat				
	Loose sandy soils	Saline depression	Working pits	Old pits	Dunes
TREES					
<i>Salvadora oleoides</i> Decne.	—	—	—	R	R
<i>S. persica</i> L.	—	—	R	A	—
<i>Prosopis cineraria</i> (L.) MC. bride	—	—	—	—	R
<i>P. juliflora</i> DC.	—	R	R	A	—
<i>Maytenus emarginata</i> (Willd.) Dinght-Hou.	—	—	—	—	C
<i>Acacia nilotica</i> (L.) Del. ssp. <i>indica</i> (Benth) Branan.	—	—	—	R	—

TABLE 2 (Contd).

Species	Habitat				
	Loose sandy soils	Saline depression	Working pits	Old pits	Dunes
SHRUBS					
<i>Acacia jacquemontii</i> Benth.	A	—	—	—	R
<i>Calotropis procera</i> R.Br.	F	—	—	R	A
<i>Capparis decidua</i> (Forsk.) Edgew.	R	—	—	R	A
<i>Zizyphus nummularia</i> (Burm. f.) Wt. & Arn.	F	—	—	—	—
<i>Leptadenia pyrotechnica</i> Decne.	R	—	—	—	—
<i>Tamarix dioica</i> Roxb.	R	—	C	R	—
<i>Calligonum polygonoides</i> L.	—	—	—	—	C
<i>Lycium barbarum</i> L.	R	—	—	—	R
<i>Suaeda fruticosa</i> Forsk.	C	C	A	F	—
<i>Haloxylon salicornicum</i> Bunge ex Boiss.	C	—	R	R	—
<i>Salsola baryosma</i> (Schult.) Dandy	F	R	C	C	—
UNDER-SHRUBS					
<i>Aerva persica</i> (Burm. f.) Merrill.	F	—	—	R	A
<i>A. pseudotomentosa</i> Blatt. & Hallb.	A	—	—	R	C
<i>Crotalaria burhia</i> Buch.-Ham.	C	—	R	R	F
<i>Sericostoma pauciflorum</i> Stocks	—	—	—	—	R
HERBS					
<i>Tephrosia purpurea</i> (L.) Pers.	C	R	R	C	C
<i>Convolvulus microphyllus</i> Sieb. ex Spreng.	C	—	—	—	R
<i>Tribulus alatus</i> Delile	R	—	—	—	—
<i>T. terrestris</i> L.	A	—	—	—	R
<i>Cressa cretica</i> L.	R	A	F	C	—
<i>Zygophyllum simplex</i> L.	C	F	A	C	—
<i>Citrullus vulgaris</i> Schrad.	R	—	—	—	C
<i>C. colocynthis</i> (L.) Schrad.	—	—	—	—	C
<i>Amaranthus spinosus</i> L.	C	—	—	—	—
<i>Portulaca oleracea</i> L.	R	A	F	R	—
<i>Trianthema decandra</i> L.	A	F	—	F	—
<i>Cleome gynandra</i> (L.) Briquet.	A	—	—	—	—
GRASSES					
<i>Sporobolus marginatus</i> Hochst. ex A. Rich.	A	C	C	C	—
<i>S. helvolus</i> (Trin.) Dur et Schinz.	A	C	C	C	—
<i>Dichanthium annulatum</i> (Forsk.) Stapf	R	F	—	A	—
<i>Dactyloctenium indicum</i> Boiss.	A	—	F	R	R
<i>Cenchrus ciliaris</i> L.	C	R	C	C	F
<i>C. setigerus</i> Vahl	C	—	C	A	C
<i>Eleusine compressa</i> (Forsk.) Asch. ex Schw.	A	—	R	C	F
<i>Aeluropes lagopoides</i> (L.) Trin. ex Thw.	—	A	—	C	—
<i>Aristida funiculata</i> Trin. et Rupr.	A	—	C	A	C
<i>Cenchrus biflorus</i> Roxb.	C	—	—	R	A
SEDGES					
<i>Cyperus rotundus</i> L.	C	A	C	A	C
<i>C. laevigatus</i> C. B. Clarke	C	—	—	—	A
<i>Fimbristylis ferruginea</i> (L.) Vahl	—	—	—	A	—

A=Abundant, C=Common, F=Frequent, R=Rare.

MENISPERMACEAE

Cocculus pendulus (Forsk.) Diels (Vern. Pilwan)

A large woody climber, common on *Salvadora persica* L. and *Tamarix dioica* Roxb. Flower greenish yellow; Oct.-Feb. Common around abandoned pits. Hiragarh. (Saxena 2542).

BRASSICACEAE

Farsetia hamiltoni Royle (Vern. Pilang)

40-45 cm high, slender, annual herb. Flower white; July-Oct. Fruit papery. Common on deep sandy soils. Hiragarh siding-2. (Saxena 2574).

CAPPARIDACEAE

Capparis decidua (Forsk.) Edgew. (Vern. Kair)

1-2 m tall spiny, leafless shrub. Flower deep orange red; July-Sept. and March-May. On loose sandy soil and hummocky plain. Hiragarh. (Saxena 2583).

Cleome gynandra (L.) Briquet (Vern. Bagra)

40-45 cm. high, annual herb. Flower white to creamy; July-Sept. Common on loose sandy soils near habitation. Posala siding-3. (Saxena 2649).

POLYGALACEAE

Polygala erioptera DC. (Vern. Chota Bekharia)

15-25 cm high, procumbent annual herb. Flower whitish pink to violet; July-Dec. Circuit House. (Saxena 2529).

PORTULACACEAE

Portulaca oleracea L. (Vern. Noonkhuri, Lunki, Noonia)

A prostrate, succulent herb. Flower yellow; Aug.-Nov. Common on saline depressions and abandoned pits. Hiragarh pit 296. (Saxena 2587).

TAMARICACEAE

Tamarix dioica Roxb. (Vern. Faras, Jhau)

1-2 m tall shrub. Flower pink; Aug.-Dec. Common on water logged saline areas and abandoned pits. Hiragarh siding-2. (Saxena 2535).

MALVACEAE

Abutilon indicum D. Don (Vern. Tarakanchi, Dabi, Jhili)

60-80 cm tall undershrub. Flower yellow; Aug.-Dec. Growing under shade of *S. persica* L. on abandoned pit. Bara Samra pit 288. (Saxena 2671).

Hibiscus punctatus Dalz.

90-100 cm tall suffruticose undershrub. Flower pale rose; Aug.-Dec. Hiragarh siding-3. (Saxena 2585).

Sida ovata Forsk. (Vern. Bila)

30-40 cm high, woody perennial. Flower yellow; Aug.-Dec. Circuit House. (Saxena 2528).

TILIACEAE

Corchorus depressus (L.) Stocks (Vern. Kagla-ki-tamaku, Hadu-ka-Khet)

Small, woody, perennial herb. Flower yellow; July-Dec. Hiragarh siding-2. (Saxena 2568).

C. tridens L. (Vern. Kagla-ki-tamaku, Hadu-ka-khet)

20-30 cm high, annual herb. Flower yellow; Aug.-Nov. Hiragarh and Posala. (Saxena 2649, 2538).

ZYGOPHYLLACEAE

Tribulus alatus Delile (Vern. Bokhra)

Procumbent to spreading herb. Flower light yellow, fruit winged; Aug.-Dec. Common on sandy soil. Posala siding-3. (Saxena 2644).

T. terrestris L. (Vern. Kanti)

A prostrate annual herb. Flower bright yellow, fruit spiny; July-Nov. Common on sandy plains. Posala siding-3. (Saxena 2643).

Zygophyllum simplex L. (Vern. Lunwa, Lunio)

20-30 cm high or procumbent, annual herb. Stem yellow to violet red. Flower yellow; July-Nov. Abundant on pit wall and inter pit areas. Hiragarh siding-2. (Saxena 2547).

There are two strains in the locality, one with pure yellow and the other with violet-red stem. Both were recorded growing side by side.

MELIACEAE

Azadirachta indica Juss. (Vern. Neem)

A cultivated tree around Barabbangla and office. Bara Bangla. (Saxena 2678).

CELASTRACEAE

Maytenus emarginata (Willd.) Ding Hou (Vern. Kangkeran)

3-4 m tall, spiny tree. Flower pinkish white, ripe fruit light purple ; Oct.-Jan. On sandy gravelly soil and sand dunes. Hiragarh boundary dune. (Saxena 2624).

RHAMNACEAE

Zizyphus nummularia (Burm. f.) Wt. & Arn. (Vern. Bordi)

1-2 m tall, spiny shrub. Flower pale whitish, ripe drupe red ; Aug.-Dec. Hiragarh siding-2. (Saxena 2536).

PAPILIONACEAE

Alhagi pseud-alhagi (M. Bieb.) Desv. (Vern. Jawasa)

30-40 cm high, spiny undershrub. Flower red ; Oct.-Feb. On abandoned pits and saline areas. Hiragarh. (Saxena 2597).

Crotalaria burhia Buch.-Ham. ex Benth (Vern. Sannia)

60-80 cm high, spreading perennial undershrub. Flower yellow ; Aug.-March. Common on sandy soils. Hiragarh. (Saxena 2556).

Indigofera cordifolia Heyne ex Roth (Vern. Bekar, Bekario)

20-30 cm long, prostrate to procumbent, annual herb. Flower pinkish red. Pod 2-seeded ; July-Nov. Common on sandy soils. Circuit House. (Saxena 2526).

I. linifolia (L.) Retz. (Vern. Bekri, Bekar)

Small, wiry, annual herb. Flower pink. Pod globose, one-seeded ; Aug.-Nov. Hiragarh boundary dune. (Saxena 2614).

I. hochstetteri Baker (Vern. Bekrio)

30-40 cm long, prostrate to procumbent annual herb. Flower pinkish. Pod flat ; Aug.-Nov. Common on sandy soil. Hiragarh siding-2. (Saxena 2537).

I. linnaei Ali (Vern. Bekar)

20-30 cm high, prostrate to procumbent, woody herb with pink flowers. Pod 2-3 seeded Aug.-Dec. Common on loose sandy soils. Hiragarh. (Saxena 2527).

I. oblongifolia Forsk. (Vern. Goila)

80-100 cm tall, pubescent shrub. Flower pink to orange pink. Sept.-Feb. Common on abandoned pits. Hiragarh. (Saxena 2635).

Phaseolus trilobus Ait. (Vern. Panri, Jangli moth)

20-30 cm long, trailing, annual herb. Flower bright light yellow. Pod 6-8 seeded ; Aug.-Oct. Rare on sandy soils. Hiragarh Boundary dune. (Saxena 2618).

Tephrosia purpurea (L.) Pers. (Vern. Dhamasia, Sarphunka)

30-60 cm tall biennial or perennial undershrub with violet pink to red flowers. Pod flat ; July-Nov. Abundant on sandy plain. Hiragarh siding-2. (Saxena 2567).

Sesbania bispinosa (Jacq.) Fawe & Rend. (Vern. Ekar)

80-120 cm tall, soft-wooded shrub. Flower yellow with reddish spot ; July-Nov. Frequent on old pit walls. Hiragarh siding-2. (Saxena 2575).

Heylandia latebrosa DC. (Vern. Gorakh-batti, Sonda)

20-25 cm long, prostrate to procumbent, annual herb. Flower yellow ; Aug.-Nov. On dry pit walls. Bara Samra Pit 288. (Saxena 2667).

Psoralea odorata Blatt. & Hallb. (Vern. Goir, Guir)

30-50 cm high, perennial undershrub. Flower pinkish violet ; Aug.-March. On abandoned pits only. Hiragarh siding-2. (Saxena 2661).

CAESALPINACEAE

Cassia obtusa Roxb. ex W. & A. (Vern. Beephini)

60-75 cm tall, woody undershrub. Flower pale yellow. Pod flat & wrinkled ; Aug.-Dec. On abandoned pit. Hiragarh. (Saxena 2633).

Cassia siamea Lamk.

A cultivated tree with reddish glaucous branches. Flower yellow ; July-Dec. Circuit House. (Saxena 2681).

MIMOSACEAE

Acacia nilotica (L.) Del. ssp. **indica** (Benth.) Bernan (Vern. Babul)

Thorny tree. Flower heads yellow. Pods tomentose; Aug.-Nov. and March-May. Frequent on fringes of abandoned pit. Chota Samra. (Saxena 2576)

Acacia jacquemontii Benth. ex Hook. (Vern. Bawli)

1-2 m tall, armed shrub. Flower heads yellow; Aug.-Dec. Common on sandy hummocky soils. Hiragarh siding-2. (Saxena 2645).

Albizzia lebbek (L.) Benth. (Vern. Siris)

A large tree. Flower greenish white to white. Pod long flat. Good top-feed species. Cultivated around office and quarters.

Prosopis cineraria (L.) Mac. bride (Vern. Khejri)

6-8 m tall, spiny tree. Flower yellow; Aug.-Dec. and March-July. Common on sandy soils. A good top-feed plant. Hiragarh. (Saxena 2595).

P. juliflora (Swarti) DC. (Vern. Vilayti babul, vilayti bawli)

3-5 m tall, spiny tree. Catkin yellow. Pods eaten by goats; Aug.-May. Hiragarh. (Saxena 2544).

CUCURBITACEAE

Blastiniaf imbristipula (Fenzl) Kotschy et Peyr. (Vern. Ankh-phutni-bel)

A large climber on *Capparis decidua* (Forsk.) Edgew. and *Salvadora* bushes. Flower white, fruit globose; Aug.-Nov. Hiragarh siding-2. (Saxena 2689).

Citrullus colocynthis (L.) Schrad. (Vern. Tastumba, Tumba)

1-2 m long trailing perennial herb. Flower light yellow; Aug.-Dec. Common on sandy soil and sand dunes. Seeds utilized for oil extraction. Bara Samra. (Saxena 2613).

C. vulgaris (L.) Schrad. (Vern. Matera)

1-2 m long trailing, annual herb. Flower yellow, fruit juicy with white or pinkish pulp; Aug.-Dec. Natural as well cultivated. Oil is extracted from seed. Hiragarh boundary dune. (Saxena 2612).

Coccinia grandis (L.) Voigt. (Vern. Ankh-phutni bel)

Large perennial climber on *Capparis*, *Zizyphus* and *Salvadora* bushes. Flower white, fruit bright scarlet; Aug.-Dec. Hiragarh siding-2. (Saxena 2631, 2537).

Cucumis callosus (Rottb.) Cogn. (Vern. Kachri)

1-2 m trailing, scabrid herb. Flower yellow ; Aug.-Nov. Posala. (Saxena 2684).

AIZOACEAE

Gisekia pharnaceoides L. (Vern. Sardi, Morang)

10-20 cm long, prostrate to sub-erect annual herb. Stem pinkish-red ; July-Oct.

Glinus lotoides L. (Vern. Badka)

10-15 cm high, spreading herb. Flower greenish white ; Aug.-Dec. Common on silted pits. Pachpadra. (Shankarnarayan 1845).

Sesuvium sesuvioides (Fenzl.) Verde (Vern. Lonia)

10-15 cm long, procumbent annual herb. Flower axillary, red to pink ; Aug.-Dec. Common on saline heavy soils. Pachpadra. (Shankarnarayan 1126, 1221).

Trianthema portulacastrum L. (Vern. Safedsanter, Sarta)

20-30 cm long prostrate, succulent, annual herb. Flower axillary solitary ; Aug.-Dec. Pachpadra. (Shankarnarayan 1222).

T. decandra L. (Vern. Sarta, Sato, Santar)

20-30 cm long, prostrate, annual herb. Flower red, fruit violet-pink ; Aug.-Dec. On loose sandy soils with some organic content. Rly. Station. (Saxena 2633).

T. triquetra Willd. ex Rottl. (Vern. Lunia, Lunaki)

10-20 cm long prostrate, annual herb. Flower greenish white ; Aug.-Dec. Common on low lying areas. Hiragarh boundary dune. (Saxena 2608).

ASTERACEAE

Eclipta prostrata L. (Vern. Jalbhangra)

20-40 cm long, prostrate, annual herb. Floral heads white ; Aug.-Feb. Common on old silted pits. Bara Samra. (Saxena 2661).

Glossocardia bosvallia (L.f.) DC.

8-15 cm long, prostrate, annual herb. Flower head yellow ; Oct.-Jan. Pachpadra. (Shankarnarayan 1856).

Dichotoma tomentosa Cass. (Vern. Vajradanti)

20-30 cm high, spiny, annual herb. Floral head spiny ; Sept.-Dec. Frequent on sandy hummocky terrain. Hiragarh. (Saxena 2623 A).

Gnaphalium pulvinatum Delile (Vern. Kallali)

30-40 cm tall, woody perennial undershrub. Leaves whitish with wax coating. Flower heads yellow; Sept.-Jan. Common on silted pits. Hiragarh siding-3. (*Saxena* 2636).

Launaea chondrilloides Hook. f. (Vern. Dudhia)

10-30 cm tall, perennial herb with yellow juice. Heads terminal and yellow; Oct.-Feb. Frequent on silted pits. Bara Samra. (*Saxena* 2666).

L. nudicaulis Hook. f. (Vern. Janglio-gobhi)

15-30 cm tall, perennial herb. Floral heads yellow. Achenes thickly ribbed; Oct.-Feb. Frequent on silted pit. Bara Samra. (*Saxena* 2665).

Pulicaria angustifolia DC. (Vern. Soneli)

20-30 cm high, annual herb. Floral heads deep yellow; Aug.-Feb. Common on sandy soil. Hiragarh siding-3. (*Saxena* 2636, 2525).

P. wightiana (DC.) Benth. ex Clarke (Vern. Sonela, Soneli)

30-45 cm tall, annual herb. Flower heads bright yellow; Sept.-Feb. Frequent on sandy soil. Pachpadra. (*Shankarnarayan* 247).

Vernonia cineraria (L.) Less. (Vern. Phulni, Shadair)

20-30 cm tall, annual, hairy herb. Flower heads pinkish violet, white at maturity; Aug.-Dec. Common on silted pit walls. Bara Samra. (*Saxena* 2670).

V. cinerascens Sch.-Bip. (Vern. Bari phulni, Lalia)

50-70 cm tall, woody, spreading undershrub. Flower heads purple violet; Aug.-Nov. Common on silted pit surface. Hiragarh pit 85. (*Saxena* 2637).

Voluterella ramosa (Roxb.) Sant. (Vern. Lin-katmanda, Telkant)

20-30 cm high, spiny, much branched herb. Flower heads pink; Aug.-Dec. Common on sand dunes. Hiragarh boundary dune. (*Saxena* 2626).

SALVADORACEAE

Salvadora oleoides Decne. (Vern. Mitha-jal)

3-5 m tall tree. Flower white. Drupe orange yellow; Jan.-June. Bara Bangla dune. (*Saxena* 2659).

S. persica L. (Vern. Khara-jal)

4-7 m tall tree. Flower white, fruit violet red ; Dec.-June. Plenty around old and silted pits. Hiragarh siding-2. (*Saxena* 2541).

ASCLEPIADACEAE

Calotropis procera (Ait.) R.Br. (Vern. Ak, Akda, Akra)

1-2 m tall, perennial undershrub. Flower whitish-violet ; Aug.-Jan. Common around old pit and hummocky areas. Hiragarh siding-3. (*Saxena* 2594).

Leptadenia pyrotechnica (Forsk.) Decne. (Vern. Khimp, Khinmpira)

1-1.5 m tall, leafless undershrub. Flower yellowish green ; Aug.-Dec. Frequent on hummocky areas. Bara Samra. (*Saxena* 2679).

GENTINACEAE

Enicostemma verticillatum (L.) Engl. (Vern. Jalbhangra)

Small, procumbent herb. Flower yellow ; Sept.-Jan. Hiragarh boundary dune. (*Saxena* 2620).

BORAGINACEAE

Arnebia hispidissima (Lehm) DC. (Vern. Rambas)

20-25 cm high, suberect herb. Root violet red. Flower yellow ; Sept.-March. Rare on sandy soils. Hiragarh boundary dune. (*Saxena* 2615).

Heliotropium bacciferum Forsk. var. *subrosa* (Vern. Kalibui)

15-20 cm high, annual herb. Flower sessile, numerous in rigid spike ; Aug.-Nov. On silted pits. Pachpadra. (*Shankarnarayan* 1215).

H. paniculatum R. Br. (Vern. Kalibui)

25-30 cm high, annual herb. Flower white in cylindric raceme, fruit four lobed ; Aug.-Dec. On sandy soil. Hiragarh siding-3. (*Saxena* 2554).

H. strigosum Willd. (Vern. Choti-santri)

A scabrid, prostrate to procumbent herb. Flower white in elongated spike ; Aug.-Dec. Bara Bangla. (*Saxena* 2655).

H. subulatum Hochst. ex DC (Vern. Kalibui)

30-40 cm high, perennial, woody herb. Flower pale white; Aug.-Dec. Common on moist sandy soil. Hiragarh boundary dune. (Saxena 2617).

Sericostoma pauciflorum Stocks (Vern. Kharsan, Kharsni)

30-40 cm tall, perennial undershrub, clothed with appressed hairs. Flower white; Aug.-March. On sand dunes only. Bara Bangla dune. (Saxena 2654).

Trichodesma indicum R. Br. (Vern. Sal-kanta, Phuldar)

20-30 cm high, hispid herb. Flower light blue; Aug.-March. Pachpadra salt basin. (Shankarnarayan 1138).

CONVOLVULACEAE

Convolvulus microphyllus Sieb. ex Spreng. (Vern. Phulwati, Santri, Kerjan).

30-35 cm long, prostrate to procumbent, perennial herb. Flower white or light pink; Aug.-Jan. Common on sandy soil. Hiragarh siding-3. (Saxena 2695, 2586).

Cressa cretica L. (Vern. Lana, Ovindo, Kharia)

10-15 cm high, procumbent, annual herb. Flower white in small axillary clusters; Aug.-Jan. Abundant on saline soils. Hiragarh siding-2. (Saxena 2555).

Ipomoea pes-tigridis L. (Vern. Panwa, Pherwana)

60-70 cm long, twining, annual herb, clothed with spreading hairs. Flower whitish pink on sessile heads; Aug.-Dec. On moist sandy places. Bara Samra. (Saxena 2669).

I. verticillata Forsk. (Vern. Chirawri)

40-60 cm long, prostrate, annual herb. Flower white; Aug.-Nov. Common on shady places. Chota Samra. (Saxena 2676, 2684).

SOLANACEAE

Lycium barbarum L. (Vern. Murali, Morali)

1-2 m tall, spinous, shrub. Flower white solitary or in fascicle; Aug.-Jan. On hummocks and dunes. Hiragarh. (Saxena 2639).

Physalis minima L. (Vern. Janglo-bheri)

40-60 cm long, prostrate, perennial herb. Flower creamy ; Sept.-Dec. On moist shady places below *S. ersica* tree. Hiragarh pit 85. (Saxena 2634).

SCROPHULARIACEAE

Anticharis senegalensis (Walp.) Bhand.

30-45 cm high, branched, annual herb. Flower reddish-violet ; Aug.-Dec. On sandy saline soils. Hiragarh siding-2. (Saxena 2558).

Striga angustifolia (D. Don) Saldhana (Vern. Misso)

20-30 cm high, annual herb. Flower in the axil of floral bract ; July-Oct. Bara Samra. (Saxena 2665).

ACANTHACEAE

Justicia vahlii Roth (Vern. Kagnero, Mokrogas)

20-30 cm high, slender, annual herb. Flower violet-pink ; Aug.-Dec. On moist shady places. Hiragarh. (Saxena 2680).

Blepharis sindica T. Anders. (Vern. Bhangri)

Small, spiny undershrub. Flower bluish ; Aug.-Nov. On sandy gravelly soils. Hiragarh siding-2. (Saxena 2548).

Peristrophe bicalyculata (Retz.) Nees (Vern. Kagner)

80-100 cm tall, perennial herb. Flower deep violet-pink ; July-Oct. Frequent under the shade of trees. Hiragarh siding-3. (Saxena 2539).

LABIATAE

Leucas urticaefolia (Vahl) R. Br. [Vern. Goma (Hindi)]

25-30 cm high, hairy, annual herb. Flowers white, in globose terminal heads ; Aug.-Dec. Common on sandy soils. Bara Samra. (Saxena 2638).

NYCTAGINACEAE

Boerhaavia diffusa L. (Vern. Chelavri, Pawa, Sata)

50-70 cm long, trailing perennial herb. Flower light to dark pink ; July-March. Common on sandy soils. Posala. (Saxena 2641).

B. repanda Willd. (Vern. Bara-sata)

1-1.5 m long, climbing, perennial herb. Flower pink ; July-Feb. Common on moist shady places. Posala. (Saxena 2646).

B. elegans Choisy (Vern. Chirio-panio)

25-35 cm high, annual herb. Stem dichotomously and panicle trichotomously branched ; July-Sept. On old working pits. Hiragarh siding-2. (Saxena 2672).

AMARANTHACEAE

Achyranthus aspera L. (Vern. Unda-kanta, Andhajaro, Narkanta)

40-60 cm tall herb. Flower whitish pink, deflexed against large rachis, fruit prickly ; Aug.-Dec. Among bushes in shady places. Hiragarh siding-2. (Saxena 2540).

Aerva persica (Burm. f.) Merrill (Vern. Bui, Buida)

40-80 cm tall, woody, perennial undershrub with thick tomentum. Greenish white spike ; Oct.-Feb. Common. Hiragarh siding-2. (Saxena 2566).

A. pseudotomentosa Blatt. & Hallb. (Vern. Choti-Bui)

60-100 cm tall, woody perennial. Panicle leafy ; Sept.-March. Hiragarh pit 85. (Saxena 2632).

Amaranthus spinosus L. (Vern. Kateli-cholai)

40-60 cm high, spiny herb. July-Oct. On waste places near habitation. Bara Bangla. (Saxena 2606).

Digera muricata (L.) Mart. (Vern. Laler, Latoor, Lulero)

20-30 cm high, annual herb. Flower deep pink in lax spike ; Aug.-Oct. Common on sandy soils. Hiragarh siding-2. (Saxena 2580).

CHENOPODIACEAE

Salsola baryosma (Roem. et Schult.) Dandy (Vern. Jerio-lana, Iani)

0.8-1.2 m high, much branched undershrub. Flower in short cylindric spike ; Oct.-Jan. Common in the area. Hiragarh. (Saxena 2627, 2543).

Suaeda fruticosa Forsk. (Vern. Kala-lana, Lunki)

0.8-1.5 m high, diffusely branched undershrub. Leaves thick & fleshy, turn black on drying ; July-Dec. Abundant on saline soils, salt pit and silted up pits. Hiragarh siding-2. (Saxena 2577, Shankar-narayan 1130, 1180, 1217, 1849).

Haloxylon salicornicum Bunge ex Boiss. (Vern. Sajjio-lano, Lana)

1-1.5 m tall, much branched, leafless shrub. Flower yellow; Oct.-March. On loose sandy soils. Chota-Samra. (Saxena 1673).

POLYGONACEAE

Calligonum polygonoides L. (Vern. Phoog, Phogra)

1-1.5 m tall, leafless shrub. Stem reddish woody. Flower pinkish white; Feb.-June. On boundary dunes. Hiragarh boundary dune. (Saxena 2672).

EUPHORBIACEAE

Euphorbia granulata Forsk. (Vern. Dudhi)

10-20 cm long, prostrate, annual herb. Leaves coriaceous; Aug.-Oct. Common on sandy soils. Hiragarh siding-2. (Saxena 2569).

E. jodhpurensis Blatt. & Hallb. (Vern. Duheli)

10-15 cm high, slender, procumbent, annual herb. Capsule trilobular; Aug.-Oct. Common on sandy soils. Posala. (Saxena 2652).

Phyllanthus fraternus Webster

20-30 cm high annual herb. Stipule peltate; Aug.-Dec. Common on moist sandy soils. Circuit house. (Saxena 2530).

P. maderaspatensis L. (Vern. Hazardana)

40-60 cm tall, annual herb. Flower axillary, greenish; Aug.-Jan. Hiragarh. (Saxena 2596).

LILIACEAE

Aloe barbadensis Mill (Vern. Guar-patta)

A cultivated succulent under-shrub with dense, aggregate of narrow leaves.

CYPERACEAE

Cyperus laevigatus L. = *C. arenarius* Retz. (Vern. Motha)

15-30 cm high, sedge with creeping rhizome; Aug.-Dec. Common on loose sandy soils. Hiragarh boundary dune. (Saxena 2611).

C. bulbosus Vahl (Vern. Motto Mothrio)

15-25 cm high, perennial, rhizomatous sedge, bulbous root. Spike violet-red; Aug.-Dec. Common on sandy soil. Hiragarh pit 204. (Saxena 2604).

C. rotundus L. (Vern. Motha)

20-45 cm high, perennial, rhizomatous sedge. Flower spike brownish-red ; Aug.-Jan. Abundant on silted pits. Hiragarh siding-2. (Saxena 2562, 2592).

C. tuberosus Rottb.

0.9-1.2 m tall, rhizomatous, perennial, amphibious sedge. Spike red when mature ; Aug.-Dec. Common on water logged area. Posala siding-3. (Saxena 2642).

Fimbristylis ferruginea (L.) Vahl

40-45 cm tall, perennial, amphibious sedge. Spike umbellate, spikelets, pale brown ; Sept.-March. Common on semi-silted pits. Chota-Samra. (Saxena 2675).

POACEAE

Aeluropus lagopoides (L.) Trin. ex Thw. (Vern. Kharia-ghas)

30-80 cm long, trailing grass with convolute leaves. Spike terminal ; Aug.-Dec. Common on clayey saline soils or rann. Hiragarh siding 2. (Saxena 2628, Shankarnarayan 1851).

Aristida adscensionis L. var. **adscensionis** (Vern. Lump, Lompra)

40-60 cm tall, diffused annual grass. Awn dark blackish on maturity ; Aug.-Oct. Common on sandy soils. Hiragarh siding-2. (Saxena 2673).

A. funiculata Trin. et Rupr. (Vern. Lomp, Lompra)

25-40 cm high, slender, annual grass. Awn very troublesome ; July-Oct. Abundant on sandy soils. Hiragarh siding-2. (Saxena 2565).

A. funiculata Trin. et Rupr. var. **mallica** (Edgew.) Henr. (Vern. Lompra)

40-50 cm high, annual grass. Awn bigger than in *funiculata* and troublesome ; July-Nov. Posala. (Saxena 2642).

A. mutabilis Trin. & Rupr. (Vern. Lompra)

45 cm tall, annual grass. Spikelets brown ; July-Sept. Common on sandy soils. Posala (Saxena 2581).

Brachiaria ramosa (L.) Stapf (Vern. Kuri)

20 cm high, procumbent to spreading, annual grass. Spikelets turgid ; Aug.-Oct. Frequent on moist soils. Hiragarh siding-2. (Saxena 2552, Shankarnarayan 1214).

Cenchrus biflorus Roxb. (Vern. Bhurut)

30-40 cm high, annual grass. Involucres echinate spiny ; July-Oct. Common on sandy soils. Hiragarh siding. (Saxena 2563).

Cenchrus ciliaris L. (Vern. Safed-Dhaman, Anjan)

A tussocky perennial grass. Involucre not spiny ; Aug.-Dec. Common on old pit walls on sandy soil. Three different strains have been recorded :

1. 60-70 cm tall ; spike 8-10 cm long, violet on ripening (Saxena 2598).

2. 25-30 cm tall ; with small clump. Spike 4-5 cm long, light violet on ripening. (Saxena 2599).

3. Same as No. 2. Spike colourless on ripening. (Saxena 2571, 2579).

C. prieurii (Kunth) Maire. (Vern. Dhaman)

40-50 cm high, annual grass. Long spike ; Aug.-Nov. Common on sandy soils. Hiragarh siding-2. (Saxena 2549).

C. pennisetiformis Hochst. et Steud. ex Steud. (Vern. Dhaman)

50-90 cm tall, perennial grass ; Aug.-Dec. Rare on moist sandy soils. Hiragarh. (Saxena 2599)

C. setigerus Vahl (Vern. Kala Dhaman)

30-50 cm high, perennial tussocky grass. Spike of various colours, some lax while others compact ; Aug.-Dec. Common on sandy soils of the old pits. Three distinct strains have been recognized :

1. 30 cm tall, small, tussocky grass. Common on alluvial plain. (Saxena 2601).

2. 30-45 cm tall, small tussocky grass. On old pit walls. (Saxena 2589).

3. 70-110 cm tall, large tussocky grass. Rare on moist shady places. (Saxena 2650). Hiragarh pit 296, Hiragarh siding-3 and Posala. (Saxena 2601, 2589, 2650).

Chloris virgata Sw. (Vern : Gharnia-ghas)

24-30 cm tall, annual grass. Digits 4-5 rayed. Blackens when ripe ; Aug.-Dec. Common on saline soils. Hiragarh pit 296. (Saxena 2602).

Dactyloctenium aegyptium (L.) P. Beauv. (Vern. Kuri, Makro, Mansa)

15-20 cm tall suberect spreading annual. Digits 3-4 rayed ; Aug.-Oct. Common on sandy, clay, loam, soils. Rly. Station. (Saxena 2534).

Dactyloctenium indicum Boiss. (Vern. Makra, Ganthia ghas)

25-40 cm tall small tussocky perennial. Stolons rooting at nodes ; Aug.-Dec. On hummocky terrain. Circuit House. (Saxena 2525).

Desmostachya bipinnata (L.) Stapf (Vern. Dab)

40-60 cm tall, perennial, tussocky grass. Spike in long raceme ; Aug.-Feb. Common on moist sandy soils. Hiragarh siding-2. (Saxena 2549).

Dichanthium annulatum (Forsk.) Stapf (Vern. Karad)

50-90 cm tall, perennial, tussocky grass. Spike reddish to brown purple ; Aug.-Dec. Common on silted pits. A very good fodder grass. Hiragarh pit 85. (Saxena 2630).

Digitaria adscendens (H.B.K.) Henr. (Vern. Tara, Kuri)

25-35 cm high, slender annual grass with terminal spike, highly palatable ; Aug.-Oct. Hiragarh siding-2. (Saxena 2550).

Echinochloa colonum (L.) Link (Vern. Soma, Homa)

A decumbent annual grass. Stem violet-red ; July-Nov. On moist clayey soils or on semi-silted pits. Bara Samra pit 288. (Saxena 2664).

Eleusine compressa (Forsk.) Asch. ex Schw. (Vern. Tandia, Gandil)

Stoloniferous, trailing perennial grass. Spike 4-5 digitate ; July-Dec. Common on hummocky terrain. A very good sheep grass. Hiragarh siding-2. (Saxena 2557).

Enneapogon brachystachys (Jaub. et Spach.) Stapf

8-10 cm tall, small tufted, perennial grass. Spike 2-3 cm long ; July-Oct. On gravelly soils. Circuit House. (Saxena 2653).

Eragrostis ciliaris (L.) R. Br. (Vern. Chirio-ghas)

15-20 cm tall, annual grass. Spike solitary ; July-Dec. Common on sandy soil. Hiragarh boundary dune. (Saxena 2570).

E. poaeoides P. Beauv. (Vern. Chirioro-ghas)

20-35 cm tall, annual grass. Culm shining, bluish white ; Aug.-Nov. Common on sandy soils. Hiragarh boundary dune. (Saxena 2626).

E. tremula Hochst. ex Steud. (Vern. Kiria, Phunkia)

30-35 cm tall, annual grass. Spike in lax panicle ; July-Nov. On sandy soils. Hiragarh pit 85. (Saxena 2621).

Lasiurus indicus Henr. (Vern. Sewan)

40-60 cm tall, stoloniferous, woody perennial grass. Spike terminal ; Aug.-Feb. On dune bases. Hiragarh boundary dune. (Saxena 2619).

Latipes senegalensis Kunth (Vern. Kuri)

20-30 cm tall, annual grass. Stem light pink on maturity ; Aug.-Dec. Hiragarh siding-2. (Saxena 2560).

Melanocenchris jacquemontii Jaub. et Spach. (Vern. Phoolia, khargose-chutti)

10-15 cm tall, annual grass. Spike lax and woolly ; Aug.-Nov. Common on sandy soils of old pits. Hiragarh siding-2. (Saxena 2578).

Panicum antidotale (L.) Retz. (Vern. Gramna, Girona)

100-150 cm tall, tussocky, perennial grass. Spike long in lax panicle ; Aug.-Feb. Recorded in bushes of *Capparis decidua*. Hiragarh siding-3. (Saxena 2582).

Panicum turgidum Forsk. (Vern. Murut)

70-100 cm tall, tussocky perennial grass. Old culm woody ; Aug.-Dec. On dunes and hummocks. Hiragarh pit 265. (Saxena 2593).

Sporobolus coromandelianus (Retz.) Kunth

20-25 cm tall, densely tufted annual grass ; Aug.-Dec. On gravelly soils. Hiragarh siding-2. (Saxena 2553).

S. helvolus (Trin.) Dur. et Schniz. (Vern. Deva, Lunagas, Kharia)

40-70 cm high, tufted perennial grass ; Aug.-Dec. Common on sandy saline and clayey soils. Hiragarh siding-2. (Saxena 2564).

S. marginatus Hochst. ex A. Rich. (Vern. Deva, Kharia-ghas)

40-60 cm tall, tussocky perennial grass. Panicle pyramidal ; Aug.-Feb. Common in the area. Hiragarh siding-2. (Saxena 2564).

Schoenofeldia gracilis Kunth (Vern. Tarwaria)

30-45 cm high, slender, annual grass. Spike terminal ; Aug.-Oct. On low lying saline soils. Hiragarh siding-2. (Saxena 2576).

Tetrapogon tenellus (Roxb.) Chiov.

30-40 cm high, annual grass ; Aug.-Nov. Common on gravelly soils under protection. Hiragarh siding-3. (Saxena 2588).

Tragus biflorus (Roxb.) Schult. (Vern. Sitagas, Charchada)

6-10 cm high, annual grass ; July-Oct. On gravelly soils. Hiragarh siding-2. (Saxena 2572).

EPHEDERACEAE

Ephedra foliata Boiss. (Vern. Lanra)

A straggling climber recorded on *Capparis* and *Lycium* bushes. Bhandari (1954) described in detail its distribution in Western Rajasthan.

SYNOPSIS OF SALT BASIN FLORA

Out of 58 families, 226 genera and 440 species recorded indigenous in Western Rajasthan. 36 families covering 97 genera and 137 species are collected from Pachpadra Salt Basin. Thirteen families have only single species viz. Menispermaceae, Brassicaceae, Polygalaceae, Portulacaceae, Tamaricaceae, Meliaceae, Celastraceae, Rhamnaceae, Gentinaceae, Labiatae, Polygonaceae, Liliaceae and Ephedraceae, Poaceae (Graminae) has the maximum genera (34) while Papilionaceae (12) and Asteraceae (Compositae) (11) stand second and third respectively.

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