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# FLORA OF RAJASTHAN

VOLUME 3

Edited by  
**B.V. SHETTY & V. SINGH**



BOTANICAL SURVEY OF INDIA

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Volume 3

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B.V. SHETTY & V. SINGH

With contributions by

V. Singh, P. J. Parmar & R. P. Pandey



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*Cover Photo : Adhatoda zeylanica* Medic.—a medicinal plant.

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## FOREWORD

Desert ecosystems present interesting aspects for research. Study of plant wealth with remarkable adaptive features to survive the ecological stresses in an arid and semi-arid state like Rajasthan is not only fascinating but is essential for several reasons.

The task of studying the plant resources and preparing a detailed flora of the state was taken up by the scientists of the Arid Zone Circle of the Botanical Survey of India since its start in 1972 at Jodhpur. Based on detailed surveys and study of the plants occurring in the state the flora has been prepared by Shri B.V. Shetty and Dr. V. Singh (Editors) with contributions made by Drs. V. Singh, P.J. Parmar and R.P. Pandey.

It was originally envisaged that the entire manuscript dealing over 2000 species with introduction, keys, up-to-date nomenclature, descriptions and notes on ecology and phenology etc. could be published in two volumes as stated in the foreword to the 1st volume published in 1987. The remaining manuscript meant for vol. 2 seemed rather unweildy for another volume, necessitating to split it into two, for easy handling during reference. Accordingly the vol. 2 was published in 1991.

With the publication of the third volume, the entire flora for the State is made available to students, teachers, researchers, and planners to appropriately use the knowledge on plant wealth in this large desert ecosystem in the country.

I like to congratulate the editors and contributors for completing the work and the Printing and Publication Section of the Survey for getting the flora published.

*Calcutta*  
*6th August, 1992.*

B. D. SHARMA  
*Director*  
*Botanical Survey of India*



**Plate 1 : *Adhatoda zeylanica* Medic. - Known for medicinal value.**



**Plate 2 : *Cuscuta reflexa* Roxb. - A stem parasite with wide host range.**



Plate 3 : *Arnebia hispidissima* (Lehm.) DC. - Roots yield red dye.



Plate 4 : *Convolvulus prostratus* Forsk.



Plate 5 : *Heliotropium europaeum* L. var. *lasiocarpum*  
(Fish. & Mey) Kazmi





Plate 6 : *Salvadora persica* L.



Plate 7 : *Solanum virginianum* L.



Plate 8 : *Orobanche aegyptiaca* Pers.



**Plate 9 : *Asparagus racemosus* Willd.**



Plate 10 : *Ephedra foliata* Boiss.



Plate 11 : *Withania coagulana* (Stocks) Dunal –  
A rare plant of the desert.



Plate 12 : *Tecomella undulata* (Sm.) Seem.

## 141. ARECACEAE (PALMAE *nom. alt.*)

(P.J. Parmar)

### PHOENIX L.

Stem short, bulbiform.	...	1. <i>P. acaulis</i>
Stem well developed.	...	2. <i>P. sylvestris</i>

1. *Phoenix acaulis* Buch. Ham. ex Roxb. Fl. Ind. 3 : 783. 1832 ; Beccari & Hook. f. in Hook. f. Fl. Brit. India 6 : 426. 1892 ; Duthie, Fl. Gangetic Plain 3 : 287. 1929.

Stem bulbiform, 15 - 20 cm in diam., densely clothed with sheaths and bases of petioles. Leaves 60 cm - 2m long. Leaflets in subopposite fascicles, multifarious, subglaucous. Spathes 15 - 20 cm long, lanceolate, rigid. Spadix short, 15 - 25 cm long. Fruits elliptic-oblong, mucronate, bright red to blue-black. Groove of seeds broad.

*Fl. & Fr.* : February - August.

Rare, in wastelands.

*Selected specimen* : Jhalawar : NKS 1435 (RUBL. not seen).

2. *Phoenix sylvestris* (L.) Roxb. Fl. Ind. 3 : 787. 1832 ; Beccari & Hook. f. in Hook. f. Fl. Brit. India 6 : 425. 1892 ; Duthie, Fl. Gangetic Plain 3 : 286. 1929. *Elate sylvestris* L. Sp. Pl. 1189. 1753, 'Khajoor' (Hindi).

Tall, unbranched, monoecious, graceful palms, with straight or crooked trunk. Leaves 1.5 - 3.0 m long, pinnate ; leaflets 20 - 30 × 1.0 - 2.5 cm, linear-lanceolate, conduplicate, coriaceous, spinous pointed, glaucous. Inflorescence a spadix. Spathes woody, scurfy, separating into boat-shaped valves. Male flowers numerous, fragrant, creamish-yellow. Female flowers distant, roundish. Drupes scattered, ellipsoid-oblong, orange-yellow. Seeds rounded at the both ends, deeply grooved on one side.

*Fl. & Fr.* : February - August.

Common in wastelands ; abundant in low-lying areas.

Pl. 3 : 293. 1929 ; Mahesh. Illus. Fl. Delhi f. 206. 1966. 'Patera, Pata' (Hindi).

Erect, perennial, rhizomatous herbs, c. 2 m tall ; rhizomes not deep seated. Leaves spongy, vertical, thick, linear, acute, convex beneath, as long as the scape. Spikes cylindrical, 40-50 cm long, the upper male ; lower female spikes interrupted by long interval, dark brown. Bracteoles spatulate. Pollens simple. Ovary born on gynophore, surrounded by closely set white hairs at the base. Achenes elongate-ovoid, with obtuse apex and acute base, brownish, pericarp easily separable.

*Fl. & Fr.* : August-June.

Common in marshy and aquatic places.

*Selected specimens* : Ajmer : *Lourie* 2126 (DD) ; Alwar : Alwar to Jai Samand, *Hira Lal* 34598 (LWG) ; Banswara : Ghatol, *Singh* 2946 (BSJO) ; Ganganagar : Anupgarh, *Roy* 3803 (BSJO) ; Jaipur : Chaksu, *Wadhwa* 8390 (BSA) ; Jhalawar : *Verma* 3340 (BSA) ; Jodhpur : Birai dam, *Moorthy* 401 (BSJO).

2. *Typha elephantina* Roxb. Fl. Ind. 3 : 566. 1832 ; Hook. f. Fl. Brit. India 6 : 489. 1893 ; Duthie, Fl. Gangetic Plain 3 : 293. 1929 ; Sharma & Gopal in Aquat. Bot. 9 : 382. f. 1 b, 3 b & 4 b. 1980.

Rhizomatous, erect, perennial herbs, upto 3.5 m tall ; rhizomes deep seated, robust. Leaves basal, trigonous, 3.0-3.5 cm broad, margins often undulate and white ; sheath membranous. Spikes cylindrical, more than 50 cm long. Male flowers with 3 or more bracts ; pollens 4-globate. Female flowers mixed with clavate pistillodes ; bracteoles shorter than the stigmas. Pericarp of seeds easily removable.

*Fl. & Fr.* : August-May.

Common in swampy areas.

*Selected specimens* : Ajmer : *Lourie* 2127, 4894 (DD) ; Bharatpur : Bund Baretha, *Bharadwaj* Acc. No. 8608 (LWG) ; Jalore : Sunda-hill, *Vyas* 6850 (BSJO). Also reported from Udaipur (Ramdeo, 1969).

## 144. ARACEAE

(P.J. Parmar)

1a. Plants aquatic :

2a. Free floating aquatic herbs. Leaves rosulate,  
obovate-cuneate, pubescent. ...

4. *Pistia*.

- 2b. Submerged attached herbs. Leaves radical, glabrous, grass-like. ... 3. *Cryptocoryne*
- 1b. Plants terrestrial, often at marshy places :
- 3a. Leaves peltate, entire :
- 4a. Spadix with an apical barren appendage, adnate to the spathe at base. ... 2. *Colocasia*
- 4b. Spadix without an apical appendage, entirely free from the spathe. ... 6. *Remusatia*
- 3b. Leaves not peltate, variously dissected :
- 5a. Spadix with an apical barren appendage :
- 6a. Plants dioecious. Male flowers shortly pedicelled. ... 1. *Arisaema*
- 6b. Plants monoecious. Male flowers sessile. ... 7. *Saurontatum*
- 5b. Spadix without an apical barren appendage. ... 5. *Plesmonium*

### 1. ARISAEMA Mart.

*Arisaema tortuosum* (Wall.) Schott in Schott & Endl. Melet. Bot. 1 : 17. 1832 ; Hook. f. Fl. Brit. India 6 : 502. 1892 ; Duthie, Fl. Gangetic Plain 3 : 298. 1929.

Perennial dioecious herbs, with depressed, globose tubers. Leaves 2-3, arising from the root-stock, padately 7 to 9-partite ; segments lanceolate-elliptic, acuminate, entire, glabrous ; petioles 20 - 60 cm long. Peduncles 15 - 70 cm long ; spathes greenish, with a cylindrical, 3 - 6 cm long tube and an erect, ovate-oblong, long-acuminate, 10 - 15 cm long limb. Spadix curved or sigmoid, narrowed into a long acute point. Stamens 3 - 4, purple brown. Fruits ovoid, red.

*Fl. & Fr.* : July - August.

Rare, in shady localities in the gardens, ravine slopes and forest edges.

*Selected specimen* : Jhalawar : NKS 919 (RUBL, not seen).

### 2. COLOCASIA Schott

*Colocasia esculenta* (L.) Schott in Schott & Endl. Melet. Bot. 1 : 18. 1832. *Arum esculentum* L. Sp. Pl. 965. 1753. *Colocasia antiquorum* Schott, l.c. 1 : 18. 1832 ; Wight, Ic. 3(1) : 6. t. 386. f. 1. 1844 ; Hook. Fl.



## 6. REMUSATIA Schott

**Remusatia vivipara** (Roxb.) Schott in Schott & Endl. Melet. Bot. 1 : 18. 1832 ; Hook. f. Fl. Brit. India 6 : 521. 1893 ; Duthie, Fl. Gangetic Plain 3 : 303. 1929. *Arum viviparum* Roxb. Fl. Ind. 3 : 496. 1832 ; Wight, Ic. 3(1) : 6. t. 798. 1844.

Perennial herbs, with short, 2 - 3 cm broad, depressed tubers. Leaves on 15 - 45 cm long petioles, 10 - 30 × 6 - 20 cm, ovate-triangular, abruptly acute, cordate at base with a triangular sinus. Bulbiferous shoots 1 to many, suberect, simple or branched. Bulbils in clusters, ovoid-globose or oblong, squarrosely scaly. Spathes 10 - 12 cm long ; tube ovoid-oblong, green, 2 - 3 cm long ; limb ovate-cordate, golden yellow. Spadix yellow above.

*Fl. & Fr.* : January & July.

Rare, in the forests.

*Selected specimens* : Mt. Abu, Mehta 1839, 2322 (JAC). Also reported by Raizada (1954) & Jain (1962).

## 7. SAUROMATUM Schott

**Sauromatum pedatum** (Willd.) Schott in Schott & Endl. Melet. Bot. 1 : 17. 1832. *Arum pedatum* Willd. Enum. Suppl. 54. 1809. *A. guttatum* Wall. Pl. As. Rar. 2 : 10. t. 115. 1830. *A. sessiliflorum* Roxb. Fl. Ind. 3 : 507. 1832 ; Wight, Ic. 3(1) : 6. t. 800. 1844. *Sauromatum guttatum* (Wall.) Schott, l.c. 1 : 17. 1832 ; Hook. f. Fl. Brit. India 6 : 508. 1893 ; Duthie, Fl. Gangetic Plain 3 : 299. 1929.

Perennial, deciduous herbs, with depressed-globose tubers. Leaves solitary, palmately deeply 7 to 9-lobed, appear after flowers on a 50 - 80 cm long, purple-blotched petiole ; segments c 30 cm long, elliptic-obovate or oblong, acute or cuneate at apex and narrowed at base. Spathes shortly peduncled, lanceolate-oblong, purple outside, dark-purple & blotched inside. Spadix as long as spathe, with a long terminal appendage. Fruits ovoid, black.

*Fl. & Fr.* : March - April.

Occasionally found in moist and shady places in dry deciduous forests.

*Selected specimens* : Chittorgarh : Bansi, Majumdar 12348 (BSA) ; Sirohi : Mt. Abu, Jain 5342 (BSI) ; Udaipur : Gemawat 216 (BSI).

## DOUBTFUL TAXON

**Amorphophallus commutatus** Engler in DC. Monog. Phan. 2 : 319. 1879 ; Hook. f. Fl. Brit. India 6 : 515. 1893.

Perennial herbs, with solitary, deeply variously lobed leaves. Scapes 30 - 60 cm tall. Spathes ovate-lanceolate. Spadix columnar, as long as spathe. Ripe berries deep-orange.

This species is chiefly concentrated in Concan region. Sankhala (1951) reported it from North-west Rajasthan. Authors could not trace out any specimen from Rajasthan and consider its occurrence doubtful.

## CULTIVATED SPECIES

**Alocasia decipiens** Schott - Perennial herbs, with globose or ovoid tubers covered with leaf scars and roots. Leaves oblong, sagittate-cordate. Flowers unisexual and naked. Stamens united to form a 6-angled body. Berries reddish. Cultivated in the gardens for ornamental purposes.

**Alocasia macrorrhiza** (L.) G. Don (*Arum macrorrhizon* L.) 'Arvi' (Hindi). Stout herbs, with long root-stocks. Leaves 60 - 90 cm long, ovate-undulate, deeply sagittately cordate, bright green. Spathes pale yellowish green. Commonly cultivated for its edible starchy root-stocks and leaves.

**Amorphophallus paeoniifolius** (Dennst.) Nilcolson (*Dracontium paeoniifolium* Dennst.) 'Suran' (Hindi). - Deciduous, cormous herbs. Corm upto 35 cm in diam., subglobose with depressed top. Leaf-segments bifurcate-pinnatifid with oblong lobes of varying sizes. Spathes campanulate, purplish within. Spadix stout. Cultivated at some places for the corms used as vegetable.

**Monstera deliciosa** Liebm. - Straggling climbers, with hanging cord-like roots and ovate or oblong, pinnatifid leaves. Spathes with revolute margins. Fruits cohering into a cone-like body as long as spadix. Native of Central America and Tropical Mexico ; planted in the gardens for its spectacular ornamental foliage.

**Typhonium trilobatum** (L.) Schott (*Arum trilobatum* L.) 'Jangli Jamikand' (Hindi). Tuberos herbs, with subglobose tubers 3 - 4 cm in diam and hastately 3-lobed or partite leaves. Spathes narrowed in a fine point at apex, pinkish-green below the basal constriction, pink or red above the constriction. Occasionally grown in moist and shady places in orchards.

## 145. LEMNACEAE

(R.P. Pandey)

- 1a. Fronds flat above, with one to many roots and two marginal reproductive pouches. Inflorescence spathaceous with two male and one female flowers :
- 2a. Fronds 3 to 18 nerved, with a dorsal and ventral scale and two to many roots. Stipe ventrally attached. Anthers longitudinally dehiscent. Utricles winged. ... 2. *Spirodela*
- 2b. Fronds 1 to 3-nerved, without scales and with a solitary root. Stipe marginally attached. Anthers transversely dehiscent. Utricles smooth, not winged... 1. *Lemna*
- 1b. Fronds subglobose, not flat, rootless and with a solitary basal reproductive pouch. Inflorescence not spathaceous, with one male and one female flowers. ... 3. *Wolffia*

## 1. LEMNA L.

- 1a. Fronds tailed ; root-cap acute :
- 2a. Submerged plants ; fronds symmetric, young ones hastate, older ones elliptic-lanceolate or oblanceolate, crenate-serrate near apex. Root-sheath indistinct. Seeds horizontal, semi-anatropous. ... 3. *L. trisulca*
- 2b. Floating plants ; fronds asymmetric, obovate-oblong or suborbicular, entire. Root-sheath winged at the base. Seeds erect, orthotropous. 2. *L. perpusilla*
- 1b. Fronds sessile, not tailed ; root-cap obtuse. 1. *L. minor*

1. *Lemna minor* L. Sp. Pl. 970. 1753 ; Hook. f. Fl. Brit. India 6 : 556. 1893 ; Hartog & Plas in Blumea 18 : 362. 1970 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 287. 1976.

Minute, floating, annual herbs. Root-sheath not appendaged at the base ; root-cap obtuse. Fronds up to 0.25 cm long, sessile, symmetrical, obovoid or oblong, more or less flat on both surfaces. Flowers in marginal clefts of fronds, surrounded by 2-lipped spathe. Stamens 2, each representing a male flower. Style long ; ovules solitary. Seeds horizontal, semi-anatropous, albuminous.

*Fl. & Fr.* : July - September.

Commonly found in pools, ponds, and ditches.

*Selected specimen* : Alwar : Vyas 671 A (Udaipur Univ.). Also reported from Sikar (Ratnam, 1951) and Udaipur (Ramdeo, 1969).

*Notes* : Closely related to *L. perpusilla* Torrey ; the latter, however can be distinguished by the asymmetric fronds, root-sheath winged at the base, root-cap acute and erect and orthotropous seeds.

2. *Lemna perpusilla* Torrey in Fl. New York 2 : 245. 1843 ; Hartog & Plas in Blumea 18 : 363. 1970 ; Plas in van Steenis, Fl. Males I. 7 : 231. 1971. *L. paucicostata* Hegelm. Lemnac. 139. t. 8. 1868 ; Hook. f. Fl. Brit. India 6 : 556. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 305. 1929 ; Subram. Aquat. Angiosp. 78. 1962. 'Chowpatti' (Hindi).

Minute, floating, aquatic, annual herbs. Fronds upto  $3.0 \times 1.5$  mm, flat, glabrous. Spathes membranous, with 2 male and 1 female flowers. Stamens 2. Ovary one.

*Fl. & Fr.* : July September.

Common in ponds, pools, canals etc. in stagnant water.

*Selected specimens* : Ajmer : Akhajtgarh, Duthie 4899 (DD) ; Jodhpur : Bhandari 1814 (JAC) ; Kota : Kelwara, Singh 90699 (LWG) ; Pali : Near Phulad, Shetty 1833 (BSJO) ; Tonk : Near Malpura, Shetty 1309 (BSJO).

3. *Lemna trisulca* L. Sp. Pl. 970. 1753 ; Hook. f. Fl. Brit. India 6 : 557. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 305. 1929 ; Hartog & Plas in Blumea 18 : 364. 1970 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 287. 1976.

Small, submerged, annual, aquatic herbs. Fronds 4 - 8 mm long, thin, flat. Flowers naked or in a spathe. Stamens 1 - 2. Ovary 1-celled ; style very short ; ovules solitary. Seed testa rough, grooved.

*Fl.* : March - April.

Rare, found in ponds and ditches. Included on the authority of Majumdar (1969, 1976) from Lohargarh (Jhunjhunu) and southern Rajasthan respectively.

## 2. SPIRODELA Schleid.

*Spirodela polyrhiza* (L.) Schleid. in Linnaea 13 : 392. 1839 ; Parker in Duthie, Fl. Gangetic Plain 3 : 305. 1929 ; Subram. Aquat. Angiosp. 77. 1962 ; Hartog & Plas in Blumea 18 : 360. 1970. *Lemna polyrhiza* L. Sp. Pl. 970. 1753 ; Hook. f. Fl. Brit. India 6 : 557. 1893.

Minute, floating, aquatic herbs. Fronds upto  $8 \times 7$  mm, flat, orbicular or broadly ovate-oblong, opaque, dark green above and purplish beneath. Spathes open at the top, with two male and one female flowers. Stamen one. Ovary two-ovuled. Fruits one-seeded. Seeds semi-anatropous, smooth or faintly reticulate.

*Fl. & Fr.* : February - April.

Common in ponds, pools, ditches etc. in stagnant water.

*Selected specimens* : Jodhpur : *Bhandari* 1966 (JAC) ; Kota : *Singh* 90698 (LWG) ; Sirohi : Mt. Abu, *Mehta* 813 (JAC) ; Tonk : Mor village, *Shetty* 1309 A (BSJO). Also reported from Alwar (Vyas, 1967) and Jaipur (Sharma, 1974).

### 3. WOLFFIA Horkel ex Schleid. *nom. cons.*

Fronds subglobose beneath.	...	1. <i>W. arrhiza</i>
Fronds subcylindric or conical beneath.	...	2. <i>W. microscopica</i>

1. *Wolffia arrhiza* (L.) Horkel ex Wimmer, *Fl. Schles.* ed. 3. 140. 1857 ; Hook. f. *Fl. Brit. India* 6 : 557. 1893, *pro parte* ; Parker in Duthie, *Fl. Gangetic Plain* 3 : 306. 1929 ; Subram. *Aquat. Angiosp.* 79. 1962 ; Hartog & Plas in *Blumea* 18 : 367. 1970. *Lemna arrhiza* L. *Mant. Alt.* 2 : 294. 1771.

Smallest and simplest plants resembling small dots or grains floating on still water. Fronds upto  $1.5 \times 1.0$  mm, orbicular or ellipsoidal, upper surface slightly convex. Male and female flowers solitary, inserted in a cup-like groove on the upper surface of the frond.

*Fl. & Fr.* : July - October.

Abundant in tanks and pools in still water.

*Selected specimens* : Bhiilwara : Shahapura, *Singh* 7174 (BSJO) ; Jodhpur : *Bhandari* 1813 (JAC). Also reported from Alwar (Vyas, 1964, 67), Kota (Majumdar, 1976), Udaipur (Ramdeo, 1969) and N.W. Rajasthan (Sankhala, 1951).

2. *Wolffia microscopica* (Griff. ex Voigt) Kurz in *Journ. Linn. Soc. Bot.* 9 : 265. 1866 ; Hook. f. *Fl. Brit. India* 6 : 558. 1893 ; Parker in Duthie, *Fl. Gangetic Plain* 3 : 306. 1929 ; Hartog & Plas in *Blumea* 18 : 367. 1970. *Grantia microscopica* Griff. ex Voigt, *Hort. Suburb. Calc.* 692. 1845.

Floating, aquatic herbs. Fronds flat on the upper surface, ovate or obovate, glabrous, entire, with a conical root-like appendage beneath. Male and female flowers solitary, inserted in a groove on upper surface of the frond.

*Fl. & Fr.* : July - October.

Occasional, in ponds and ditches. Included on the authority of Dhiloon & Bajwa (1969) from Ganganagar.

## 146. ALISMATACEAE

(P. J. Parmar)

- |  |                       |
|--|-----------------------|
| Flowers polygamous. Stamens 6. Receptacles flat. Achenes obovoid, swollen. ...                         | 1. <i>Limnophyton</i> |
| Flowers unisexual. Stamens usually more than 6. Receptacles globose or oblong. Achenes compressed. ... | 2. <i>Sagittaria</i>  |

### 1. LIMNOPHYTON Miq.

*Limnophyton obtusifolium* (L.) Miq. Fl. Ind. Bat. 3 : 242. 1855 ; Hook. f. Fl. Brit. India 6 : 560. 1893 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 288. 1976. *Sagittaria obtusifolia* L. Sp. Pl. 993. 1753.

Perennial, robust, scapigerous, aquatic herbs, with a stout root-stock. Leaves petiolate, 10 - 15 × 7.5 - 9.5 cm, broadly sagittate, pellucid-punctate, apex tapering to a fine point, basal lobes long. Flowers in whorls, borne on 65 - 95 cm long scapes, pale-blue to almost white, upper whorls mostly male, the lower bisexual. Achenes obovoid, wrinkled, numerous collected into a globose head.

*Fl. & Fr.* : September - October.

Occasionally found along the margins of ponds, tanks, ditches etc.

*Selected specimens* : Ajmer : *Lourie* 4901 (DD) ; Banswara : Lamero tank, *Singh* 3634 (BSJO) ; Bharatpur : *Raizada* 62169, 64502 (DD).

### 2. SAGITTARIA L.

- |   |   |
|---|---|
| Leaves hastate or sagittate, with acute or acuminate basal lobes, acute at apex. Seeds with blunt spiny wing. ... | 1. <i>S. guayanensis</i><br>subsp. <i>lappula</i> |
|---|---|

Leaves broadly ovate, with rounded basal lobes, obtuse at apex. Seeds with smooth wing. ...

2. *S. sagittifolia*

1. *Sagittaria guayanensis* Kunth subsp. *lappula* (D. Don) Bogin in Mem. New York Bot. Gard. 9 : 192. f. 5. 1955 ; Subram. Aquat. Ang. 87. 1962. *S. lappula* D. Don, Prodr. Fl. Nep. 22. 1825. *S. guayanensis* auct. pl. non. Kunth 1816 ; Hook. f. Fl. Brit. India 6 : 561. 1893 ; Duthie, Fl. Gangetic Plain 3 : 310. 1929.

Laticiferous, aquatic or semi-aquatic herbs. Leaves floating, 2.7 × 1.5-4.0 cm, ovate or suborbicular with a triangular sinus at the base. Scape (incl. peduncle) upto 36 cm long. Racemes with 2-6 whorls of 2-3 flowers ; upper whorls male-flowered and lower ones bisexual, white. Achenes many, obovoid-elliptic, shortly stalked.

*Fl. & Fr.* : June - September.

Common in ponds along the roads and in other marshy places in the eastern parts of the state.

*Selected specimens* : Bhilwara : Bijolia. Singh 6063 (BSJO) ; Jaipur : Amolao tank - Naraina, Sharma 1592, 2296 (RUBL) ; Kota : Shahabad, Majumdar 13160, 10855 (BSA) ; Tonk : Benthela village, Shetty 1043 (BSJO).

2. *Sagittaria sagittifolia* L. Sp. Pl. 993. 1753 ; Hook. f. Fl. Brit. India 6 : 561. 1893 ; Duthie, Fl. Gangetic Plain 3 : 310. 1929 ; Subram. Aquat. Ang. 86. 1962.

Specigerous, monoecious, aquatic herbs, with thick, stoloniferous rhizomes. Leaves 5-20 × 1.8-5.0 cm, raised above the surface of water, basal lobes more or less equal to the rest of the blade. Scape c. 25 cm long ; flowers 3-6 in each whorl ; lower whorls females, sessile or shortly pedicelled ; upper ones male, pedicellate, white or tinged with pink. Achenes obliquely ovate, flat, with broad dorsal and ventral wings, sides smooth.

*Fl. & Fr.* : December - February.

Occasional, in ponds, rivers, rice-fields and other marshy areas in the eastern parts of the state. Often confused for *Limnophyton obtusifolium* (L.) Miq.

*Selected specimen* : Jaipur : Digotha, Sharma 3704 (RUBL).

## 147. BUTOMACEAE

(R. P. Pandey)

## TENAGOCHARIS Hochst.

**Tenagocharis latifolia** (D. Don) Buchen. Abh. Naturw. Ver. Bremen 2 : 2, 3, 6. 1868 ; van Steenis, Fl. Males. I. 5 : 118. f. 1. 1954 ; Subram. Aquat. Angiosp. 88. t. 4. f. 53. 1962. *Butomus latifolius* D. Don, Prodr. Fl. Nep. 22. 1825. *Butomopsis lanceolata* Kunth, Enum. Pl. 3 : 165. 1841 ; Hook. f. Fl. Brit. India 6 : 562. 1893 ; Duthie, Fl. Gangetic Plain 3 : 311. 1929.

Aquatic herbs Leaves 5 - 12 × 1.5 - 3.0 cm, oblong to oblong-lanceolate, mucronate, upto 5-nerved. Flowers white, in umbels. Sepals c. 4.5 × 3.0 mm, elliptic to obovate, rounded. Petals longer than the sepals. Ovary reticulately veined ; stigma yellow. Fruits upto 10 mm long. Seeds c. 0.5 mm long, elliptic, shiny brown.

*Fl. & Fr.* : October March.

Rare, in ponds and lakes.

*Selected specimen* : Kota : Shahabad, *Majumdar* 13197 (BSA).

## 148. APONOGETONACEAE

(R. P. Pandey)

## APONOGETON L. f.

**Aponogeton natans** (L.) Engl. & Krause in Engl. Pflanzenr. 24 : 22. 1906 ; Subram. Aquat. Angiosp. 92. t. 5. f. 54. 1962 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 288. 1976. *Saururus natans* L. Mant. Alt. 2 : 227. 1771. *Aponogeton monostachyon* L. f. Suppl. Pl. 214. 1781 ; Hook. f. Fl. Brit. India 6 : 564. 1893.

Submerged, aquatic herbs, with edible stoloniferous root-stock. Leaves petiolate, upto 7.5 × 1.5 cm, lanceolate to linear-oblong, base and apex narrowly cuneate, with 2 - 3 parallel nerves ; floating leaves upto 15 × 3 cm, 5 to 7-nerved. Flowers white, pink or lilac, in a solitary spike. Spathe upto 15 mm long, caducous. Tepals 2, spatulate, c. 1.5 × 0.75 mm, 1-nerved. Stamens 6. Ovaries 3. Fruits upto 3.5 × 2.0 mm, beaked. Seeds c. 1.5 × 0.7 mm, winged, transparent and reticulately veined.



*Fl. & Fr.* : Most part of the year, particularly after the rains.

Commonly occurs in stagnant shallow water in tanks, pools and marshes.

*Selected specimens* : Bhilwara : Bijolia, Singh 6083 (BSJO) ; Jaipur : Digotha, Sharma 3734 (RUBL). Also reported from Jhunjhunu (Nair & Kanodia, 1959).

## 149. POTAMOGETONACEAE

(R. P. Pandey)

### POTAMOGETON L.

- 1a. All leaves submerged, sessile :
- 2a. Leaves narrowly linear to filiform ; sheath upto 2 cm long. ... 3. *P. pectinatus*
- 2b. Leaves not linear to filiform ; sheath free, forming stipules :
- 3a. Leaves ovate-cordate, entire, amplexicaul, 5 to 9-nerved. Tepals elliptic-obovate. Druplets globose, short-beaked. ... 4. *P. perfoliatus*
- 3b. Leaves linear-oblong, margins crisped and finely serrulate, semi-amplexicaul, 3-nerved. Tepals suborbicular. Druplets obliquely ovoid, long beaked. ... 1. *P. crispus*
- 1b. At least upper leaves floating, petiolate. ... 2. *P. nodosus*

1. *Potamogeton crispus* L. Sp. Pl. 126. 1753 ; Hook. f. Fl. Brit. India 6 : 566. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 315. 1929 ; Mahesh. Illus. Fl. Delhi f. 210. 1966.

Submerged, slender, branched, glabrous herbs. Leaves 2.0 - 15.0 × 0.5 - 1.5 cm. translucent. Spikes lax, terminal, upto 20 cm long, few-flowered. Druplets obliquely ovoid, tipped with a compressed, recurved beak.

*Fl. & Fr.* : November - June.

Common in ponds, ditches, rivers and canals in still and slow running fresh water.

*Selected specimens* : Ajmer : Ajmer-lake, *Wadhwa* 8419 (BSA) ; Banswara : *Verma* 226 (BSA) ; Bikaner : Kodemdasar tank, *Roy* 1692 (BSJO) ; Jaipur : Sagar, *Sharma* 455 (RUBL) ; Jhalawar : *Sharma* 551, 552 (RUBL) ; Jodhpur : Akhraj ji ka tank, *Singh* 4485 (BSJO) ; Sirohi : Mt. Abu - Achalgarh, *Kanodia* 62209 (BSA).

2. *Potamogeton nodosus* Poir. in Lam. Encycl. Meth. Bot. Suppl. 4 : 535. 1816 ; Subram. Aquat. Angiosp. 95. 1962. *P. indicus* Roxb. Fl. Ind. 1 : 471. 1820, non Roth ex Rcem. & Schult. 1818 ; Hook. f. Fl. Brit. India 6 : 565. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 314. 1929.

Submerged herbs, rooting at nodes. Leaves 3 - 8 × 1.5 - 2.5 cm, floating, upper ones opposite, thinly coriaceous, elliptic-lanceolate, oblong or suborbicular, acute or obtuse ; lower submerged, linear to elliptic-lanceolate, acute, often undulate-margined. Stipules free, scarious. Spikes 3.0 - 7.5 cm long, dense, reddish-brown, projecting above the surface of the water. Tepals 4, clawed, suborbicular, concave. Drupelets 2.5 × 3.0 mm, oblique, shortly beaked and keeled. Seeds subreniform.

*Fl. & Fr.* : May - September.

Common throughout in ponds, ditches and canals.

*Selected specimens* : Bikaner : Lift canal R.D. 264 near Lunkaransar, *Roy* 2158 (BSJO) ; Chittorgarh : Deogarh, *Verma* 276 (BSA) ; Jaipur : Chaksu, *Sharma* 1727 (RUBL) ; Jodhpur : Akhraj ji ka tank, *Singh* 4483 (BSJO) ; Kota : Shahabad *Wadhwa* 9306 (BSA) ; Pali : Bar, *Duthie* 4902 (DD).

3. *Potamogeton pectinatus* L. Sp. Pl. 127. 1753 ; Hook. f. Fl. Brit. India 6 : 567. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 315. 1929 ; Subram. Aquat. Angiosp. 95. f. 55. (1 - 3). 1962.

Submerged, profusely branched, aquatic herbs. Stems filiform. Leaves 3 - 10 cm long, acute. Stipules with short free point. Spikes 2 - 3 cm long, white. Tepals 4, limb suborbicular or broadly obovate. Drupelets c. 3.0 × 2.5 mm, turgid, dimidiate-obovoid, with a very short beak, scarcely keeled.

*Fl. & Fr.* : February - November.

Common in ponds, tanks, canals, rivers, streams etc. in slow running water.

*Selected specimens* : Ajmer : Jawaj tank, *Duthie* 4903 (DD) ; Banswara : Jalawara village, *Singh* 4299 (BSJO) ; Jaipur : Baragaon, *Sharma*

1880 (RUBL) ; Jaisalmer : *Bhandari* 627 (JAC) ; Jodhpur : Luni river-bed near Pichiyak, *Singh* 3533 (BSJO) ; Kota : Chhipabaraut, *Singh* 74089 (LWG) ; Sirohi : Mt. Abu, *Kanodia* 62212 (BSI).

4. *Potamogeton perfoliatus* L. Sp. Pl. 126. 1753 ; Hook. f. Fl. Brit. India 6 : 566. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 314. 1929 ; Subram. Aquat. Angiosp. 95. f. 55 (4 - 5). 1962.

Submerged, stoloniferous herbs, with terete, laxly branched stems. Leaves 2.0 - 3.75 × 1.75 cm. Peduncles axillary, 2.5 - 5.0 cm long. Spikes few-flowered, 1.5 - 2.5 cm long. Drupelets 0.2 mm long, globose, compressed, smooth.

*Fl. & Fr.* : January - April, rarely upto July.

Common in fresh and stagnant water of ponds and tanks and slow running water of rivers and streams.

*Selected specimens* : Bhilwara : Guwari dam, *Singh* 7098 (BSJO) ; Bundi : Maugi river, *Majumdar* 16422 (BSA) ; Chittorgarh : Pratapgarh, *Majumdar* 16214 (BSA) ; Kota : Kothari tank, *Singh* 90856 (LWG). Also reported from Mt. Abu (Jain, 1962).

## 150. ZANNICHELLIACEAE

(R. P. Pandey)

### ZANNICHELLIA L.

*Zannichellia palustris* L. Sp. Pl. 969. 1753 ; Hook. f. Fl. Brit. India 6 : 568. 1893 ; Parker in Duthie, Fl. Gangetic Plain 3 : 316. 1929. *Z. palustris* L. subsp. *pedicellata* Wahlenb. & Rosen in Nov. Act. Soc. Sci. Upsal. 8 : 254. 1821 ; Subram. Aquat. Angiosp. 97. f. 56. (7 - 9). 1962 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 289. 1976.

Fragile, submerged, fresh or blackish water herbs ; stems slender, filiform, branched. Leaves opposite or in whorls, linear or filiform. Spathe with 1 male and 2 - 5 female flowers. Male flowers without perianth. Stamen solitary. Female flowers with a cupular, hyaline perianth. Carpels 1 - 9 ; stigma peltate. Achenes stipitate, 4.5 - 5.75 mm long, rostrate, back curved, tuberculate. Seeds oblong, pendulous.

*Fl.* : January - April ; *Fr.* : April - July.

Common in stagnant or slow running water in the ponds, tanks and river-beds.

*Selected specimens* : Jhalawar : *Verma* 3379 (BSA) ; Kota : *Atru, Singh* 9035 (LWG) ; Tonk : Banar river-bed near Raj Mahal, *Shetty* 459 (BSJO). Also reported from N.W. Rajasthan (Sankhala, 1951).

151. NAJADACEAE

(P.J. Parmar)

NAJAS L.

- 1a. Plants dioecious. Back of the leaves and internodes with spinous teeth. ... 3. *N. marina*
- 1b. Plants monoecious ; usually glabrous :
  - 2a. Flowers of both sexes, or at least males, enclosed in spathes :
    - 3a. Flowers of both sexes enclosed in spathes :
      - 4a. Older leaves with transverse markings, apex spinulate. Sheath with short obtuse auricles... 5. *N. welwitschii*
      - 4b. Leaves without any markings, apex not spinulate. Auricles of sheath variable, truncate or lobed. ... 2. *N. indica*
    - 3b. Spathes absent in female flowers. ... 4. *N. minor*
  - 2b. Flowers of both sexes without spathes. ... 1. *N. graminea*

1. *Najas graminea* Del. *Descr. Egypt. Hist. Nat.* 2 : 282. t. 50. f. 3. 1813 ; *Hook. f. Fl. Brit. India* 6 : 569. 1893 ; *Parker in Duthie, Fl. Gangetic Plain* 3 : 317. 1929.

Grass-like, submerged herbs, with mucronated stem rooting at lower nodes. Leaves 1.5 - 3.0 × 0.06 - 0.1 cm, very narrowly linear, marginal spinules minute, numerous, spreading, sheathing at base ; sheath-auricles about half the length of sheath, toothed. Flowers solitary or 2 to 4-together. Male-perianth ending directly above the anther in 2 ear-like lobes. Fruits ellipsoid-oblong, attenuate at the apex ; arcoleles minute, subquadrate or polygonal.

*Fl. & Fr.* : November - March.

Common in tanks, lakes and other water reservoirs throughout the state.

*Selected specimens* : Banswara : Near Shergarh village, *Singh* 3096 (BSJO) ; Barmer : West of Gadra road, *Shetty* 3315 (BSJO) ; Churu :

Chhaper tank, Roy 4032 (BSJO); Jaipur: Ramgarh, Sharma Acc. No. 11695 (RUBL); Kota: Shahabad, Majumdar 13136 (BSA); Udaipur: Majumdar 12477 (BSA).

2. *Najas indica* (Willd.) Cham. in *Linnaea* 4: 501. 1829; Subram. *Aquat. Ang.* 101. 1962. *Caulinia indica* Willd. Mem. Acad. Roy. Sci. Hist. Berlin 1798: 89. t. 1. f. 3. 1801. *Najas falciculata* A. Br. in *Journ. Bot.* 2: 278. f. 4. 1864; Hook. f. *Fl. Brit. India* 6: 569. 1893. *N. minor* non All. 1785; Hook. f. *l.c.* 6: 569. 1893. *pro majore parte, pro syn. indica.*

Submerged, aquatic, slender herbs. Leaves 2 - 4 × 0.05 - 0.1 cm, linear, marginal spinules few, often as long as the width of leaf. Auricles of sheath never elongate. Flowers of both sexes enclosed in the spathes; spathe of male flowers narrowed into an irregularly toothed mouth, ending in 2, opposite, linear prolongations, 1 to 2-spined at the apex; spathe of female flowers with a small neck and spinulose mouth. Fruits ellipsoid, enclosed in persistent spathes; areole quadrate.

*Fl. & Fr.* : After rainy season.

Rare, in ponds, lakes, ditches etc, particularly in the south and south-eastern parts of the state.

*Selected specimens* : Chittorgarh: Dhanarar Mahadev near Bhadhrar, Singh & Pandey 6994 (BSJO); Jodhpur: Bap, Khisti 40767 (BSA); Kota: Cooke et Gut. s.n., Jan. 1976 (BSA); Udaipur: Kanodia 82354 (BSA).

3. *Najas marina* L. Sp. Pl. 1015. 1753; Majumdar in *Bull. Bot. Surv. India* 18: 78. 1979. *N. major* All. *Fl. Pedem.* 2: 221. 1785; Hook. f. *Fl. Brit. India* 6: 569. 1893; Parker in *Duthie, Fl. Gangetic Plain* 3: 316. 1929.

Submerged, perennial herbs. Stem stout, terete, rigid, dichotomously branched, armed with 1 - 2 mm long spines. Leaves whorled, 2.0 - 3.8 × 0.2 - 0.4 cm, linear, pinnatifid or toothed; spines 4 - 15 on each margin and 3 - 5 on dorsal surface. Anther 4-celled. Female flowers represented by sessile, solitary, ovoid, 1-ovuled carpel. Achenes 4 - 5 × 2.0 - 2.5 cm, oblong-ellipsoid. Seeds ovoid, with crustaceous testa.

*Fl. & Fr.* : September - December.

Rare, in the rivers, lakes etc. in association with *Ceratophyllum* L. and *Hydrilla* Rich. in south-eastern part of the state.

*Selected specimens* : Bundi: Falera river, Singh 74497 (LWG); Jhalawar: Jhanganbara stream, Verma 3379 (CAL); Kota: Cooke & Gut. s.n. Jan. 1976 (BSA).

4. *Najas minor* All. *Auct. Syn. Meth. Strip. Hort. Taurin.* 3. 1773 & *Fl. Pedem.* 2: 221. 1785; Hook. f. *Fl. Brit. India* 6: 569. 1893.

*pro parte* ; Parker in Duthie, Fl. Gangetic Plain 3 : 317. 1929. *Fluvialis minor* Pers. Syn. 2 : 530. 1807.

Submerged, fragile, dichotomously branched herbs. Leaves 0.8 - 2.5 × 0.04 - 0.05 cm, with 6 - 12 broad-based up-curved, spinules on the margins. Spathes necked, ellipsoid, enclosing male flowers only, ending above the perianth in a short cylindrical neck. Perianth closely inresting the anther. Fruits ellipsoid ; areoles in the shape of ladder-like pits.

*Fl. & Fr.* : September - December.

Frequent in shallow, still-watered ponds, rivers etc.

*Selected specimens* : Banswara : Lasara tank, Singh 3621 (BSJO) ; Chittorgarh : Pratapgarh, Majumdar 10180 (BSA) ; Jodhpur : Luni river, Tiwari 641 (BSJO) ; Jaipur : Ramgarh, Kumar Acc. No. 12903 (RUBL).

5. *Najas welwitschii* Rendle in Cat. Afr. Pl. Welwitsch. 2 : 95. 1899 ; Blatter & Hallberg in Journ. Bombay Nat. Hist. Soc. 26 : 974. 1920 ; Bhandari, Fl. Ind. Desert 359. 1978.

Submerged, aquatic herbs. Stem c. 30 cm long, spreading rooting at nodes, lower internodes long, becoming gradually smaller upwards. Leaves 2.0 - 2.5 × 0.04 - 0.05 cm, linear, midrib evident, marginal teeth 12 - 16, broadly subtriangular. Male flowers sessile ; female ones brown. Spathes of female flowers similar to that of male but with a much longer neck. Fruits pale-brown, with many quadrilateral markings.

*Fl. & Fr.* : September - December.

Rare, found in ponds, lake, ditches etc. in the north-western parts of the state.

*Selected specimens* : Jodhpur : Bap, Blatter 9336 (BLAT), Bhandari 1137 (JAC).

#### DOUBTFUL TAXON

*Najas australis* Bory ex Cham. in Linnaea 4 : 501. 1829 ; Blatter & Hallberg in Journ. Bombay Nat. Hist. Soc. 26 : 974. 1920 ; Bhandari, Fl. Ind. Desert 359. 1978.

Blatter & Hallberg (*l.c.*) reported this taxon from Kailana lake near Jodhpur for the first time in India. Sarup (1960) and Bhandari (*l.c.*) included this species in their works on the authority of Blatter and Hallberg (*l.c.*). No subsequent worker could trace the specimen Blatter 9337 (BLAT). The taxon finds its distribution in Madagascar and Mauritius. Its occurrence in Rajasthan is doubtful.

## 152. ERIOCAULACEAE

(P. J. Parmar)

## ERIOCAULON L.

- 1a. One of the petal of male flowers larger and extruded beyond its floral bract. ... 6. *E. polycephalum*
- 1b. Petals of male flowers equal or nearly so, not extruded beyond the floral bract :
- 2a. Involucre bracts quite glabrous :
- 3a. All sepals of female flowers winged :
- 4a. Anthers white or yellow. ... 1. *E. cinereum*
- 4b. Anthers black or dark green :
- 5a. Involucre bracts hyaline. ... 4. *E. margaretae*
- 5b. Involucre bracts not hyaline. ... 5. *E. minutum*
- 3b. Two sepals of female flowers winged and one wingless. ... 3. *E. eleanorae*
- 2b. Involucre bracts pilose or distinctly pubescent :
- 6a. Petals of female flowers with an apical gland :
- 7a. Sepals of male flowers penicillate at the tip. Heads grey or snow-white. Floral bracts sub-rhomboid or oblanceolate, acuminate ... 7. *E. quinquangulare*
- 7b. Sepals of male flowers glabrous. Heads dark-grey. Floral bracts cuneate-obtuse or sub-acute, not acuminate. ... 8. *E. sollyanum*
- 6b. Petals of female flowers without any apical glands. ... 2. *E. diana* var. *richardiana*

1. *Eriocaulon cinereum* R. Br. Prodr. 254. 1810 ; Moldenke in *Phytologia* 3 : 185. 1949 et 26 : 19. 1973 ; Webb. in Tutin *et al.* *Fl. Europaea* 5 : 117. 1980. *E. sieboldianum* Sieb. & Zucc. ex Steud. *Syn. Pl. Glum.* 2 : 272. 1855 ; Hook. f. *Fl. Brit. India* 6 : 577. 1893 ; Parker in Duthie, *Fl. Gangetic Plain* 3 : 318. 1929.

Stemless, monoecious, glabrous, tufted annual herbs, upto 8 cm high. Leaves basal, in rosette, 20 - 40 × 0.5 - 1.5 mm, subulate to narrowly linear, entire, acute, opaque. Peduncles many, exceeding the leaves. Heads 2 - 3 mm across, ovoid-globose, grey. Involucre bracts many, scarious, outer oblong or oblong-lanceolate and obtuse, inner ones narrower. Floral bracts 1.2 - 1.5 mm long. Receptacles columnar. Male flowers stipitate ; outer perianth-segments 3, united basally to form a cupular structure which is apically tridentate. Corolla tubular, irregularly tridentate at apex. Female flowers with 2, free, linear, acute sepals. Petals absent. Seeds ellipsoid-ovoid, smooth, pale-brown.

*Fl. & Fr.* : August - November.

Common in marshy/aquatic habitats, in the east of Aravalli.

*Selected specimens* : Banswara : Looda, *Majumdar* 10271 A (BSA) ; Bhilwara : Parvatipur, *Singh* 6573 (BSJO) ; Chittorgarh : Pratapgarh, *Majumdar* 12305 (BSA) ; Dholpur : *Joneson* 33615 (DD) ; Sirohi : Mt. Abu, *Mehta* 611 (JAC) ; Tonk : Near Rampura village, *Shetty* 1040 (BSJO).

2. *Eriocaulon diana* Fyson var. *richardiana* Fyson in Journ. Ind. Bot. 2 : 260. t. 14. 1921 ; Fischer in Gamble, Fl. Madras 3 : 1620. 1931 ; Moldenke in Phytologia Mem. 2 : 261. 1980 ; Singh, Fl. Banswara 233. 1983.

Erect herbs, upto 25 cm high. Leaves ligulate, 5 - 30 cm long, many - nerved, narrowed to an obtuse apex. Peduncles many, about 8 - ribbed, 10 - 30 cm long ; sheath lax, upto 7.5 cm long, obtuse. Involucre bracts lanceolate or ovate, acute or sub - acute, pale. Floral bracts cuneate or oblong - obovate, cuspidate, dark - green with white apex, hairy. Calyx of male flowers spathaceous, split down one side, obovate, more or less white papillose - hairy at apex. Female flowers with 3 - sepals, all boat - shaped or one much narrow ; petals spathulate, pilose. Seeds oblong - subglobose, finely transverse - striate, brown.

*Fl. & Fr.* : January - May.

Rare, in marshy habitats in southern & south - eastern parts of the state.

*Selected specimens* : Banswara : Looda, *Majumdar* 10271 (BSA) ; Kota : Shahabad, *Majumdar* 13132 (BSA) ; Sirohi : Mt. Abu, *Mehta* 668, 692 (JAC), *McCann* 2791 (BLAT).

3. *Eriocaulon eleanorae* Fyson in Journ. Ind. Bot. 2 : 316. 1921 ; Fischer in Gamble, Fl. Madras 3 : 1619. 1931 ; Gandhi in Saldanha & Nicolson, Fl. Hassan 652. 1976 ; Moldenke in Phytologia Mem. 2 : 261. 1980.

Tufted annuals. Leaves 6×0.13 cm, linear, acicular or subulate, glabrous, sharply acuminate. Sheaths upto 2 cm long. Peduncles many, upto 12 cm long ; heads monoecious, c. 3 mm across ; receptacle sparsely hairy. Involucre bracts glabrous. Floral bracts spathulate, pubescent, acuminate. Corolla - lobes of male flowers with apical gland. Two sepals of female flowers winged ; one wingless petals hairy and gland - tipped. Ovary sessile ; style 3. Seeds 3, glabrous, shining, dark - brown.

*Fl. & Fr.* : September - October.

Rare, in moist and shady habitats.

*Selected specimen* : Sirohi : Mt. Abu, *Mehta* 88 (JAC).



4. *Eriocaulon margaretae* Fyson in Journ. Ind. Bot. 2 : 316. 1921 ; Fischer in Gamble, Fl. Madras 3 : 1619. 1931 ; Moldenke in Phytologia Mem. 2 : 261. 1980.

Erect herbs. Leaves 3 - 5 cm long, narrowly linear or setaceous. Peduncles many, 5 - 10 cm long, slender, striate. Sheaths shorter than the leaves, acute. Heads conic - sub globose, whitish. Involucre bracts obovate - oblong, rounded or sub - acute. Floral bracts narrowly obovate, acute, hyaline, glabrous or sub - pubescent. Receptacles shortly columnar, villous. Calyx of male flowers spathaceous, split down one side, 3 - lobed, silvery grey ; corolla - lobes small, with an apical black gland. Sepals of female flowers 3, narrowly boat - shaped, acute, hyaline, glabrous, with spongy wing in the middle of the back ; petals 3, linear, eglandular. Seeds oblong - subglobose, brown.

*Fl. & Fr.* : August - December.

Rare, in moist or marshy places on the Aravalli hills.

*Selected specimen* : Sirohi : Mt. Abu, Jain 48165 (BSI).

5. *Eriocaulon minutum* Hook. f. Fl. Brit. India 6 : 579. 1893 ; Cooke, Fl. Bombay 2 : 846. 1908 ; Fischer in Gamble, Fl. Madras 3 : 1619. 1931 ; Moldenke in Phytologia Mem. 2 : 262. 1980.

Small, densely tufted herbs. Leaves 1.2 to 1.8 cm long, narrowly linear or filiform, acute or obtuse, base dilated and sparsely woolly within. Peduncles numerous, 2.5 - 6.5 cm high, capillary, striate, slightly twisted ; sheaths shorter than the leaves, lax, obsolete ribbed, slender. Heads campanulate, 2.5 mm in diam., white, shining. Involucre bracts erect, ovate - lanceolate, acute or acuminate. Floral bracts shorter, oblanceolate, acute or cuspidate. Receptacles glabrous or sparsely villous. Calyx of male flowers spathaceous, split down one side, irregularly 3 - toothed, pale, glabrous. Sepals of female flowers 2, free, boat - shaped, falcately curved, spinulose, winged or keeled on the back, glabrous. Petals absent. Seeds oblong.

*Fl. & Fr.* : August - November.

Rare, in moist habitats on the hills.

*Selected specimens* : Sirohi : Mt. Abu, Duthie 6715 (DD), Mehta 117 (JAC), McCann 2792 (BLAT).

6. *Eriocaulon polycephalum* Hook. f. Fl. Brit. India 6 : 573. 1893 ; Moldenke in Phytologia 19 : 351. 1970 ; Singh, Fl. Banskara 233. 1983. *E. longispis* Hook. f. var. *polycephalum* (Hook. f.) Fyson in Journ. Ind. Bot. 2 : 309. 1921.

Stemless herbs, more than 25 cm high. Leaves c.  $20 \times 0.8$  cm, linear - ensiform. Peduncles one to many, upto 50 cm long, glabrous or pubescent. Heads 8 mm in diam. Receptacles villous. Involucre bracts obovate, sparsely hairy. Floral bracts obovate, caudate. Sepals of male flowers 3, free; stamens 6. Sepals of female flowers long, narrow, petals narrowly oblanceolate, ciliate with long soft hairs. Ovary sub-sessile.

*Fl. & Fr.* : October - March.

Rare, in marshy habitats in southern parts of the state.

*Selected specimen* : Banswara · *Majumdar* 10271 B (BSA).

7. *Eriocaulon quinquangulare* L. Sp. Pl. 87. 1753; Hook. f. Fl. Brit. India 6 : 582. 1893; Parker in Duthie, Fl. Gangetic Plain 3 : 319. 1929.

Stemless, annual herbs. Leaves radical,  $3 - 10 \times 0.3 - 0.6$  cm, linear - lanceolate, often red - tinged when dry. Scapes numerous, 7.5 - 20.0 cm high. Heads 3.0 - 4.5 mm in diam., globose or somewhat ovoid, densely white villous. Receptacles villous. Involucre bracts obovate or cuneate, obtuse, glabrous, pale straw - coloured. Floral bracts very much similar to involucre bracts but narrower and long acuminate, light or dark - brown, white hairy on the back. Calyx of male flowers spathaceous, oblong - spatulate, obtuse, tip penicillate; petals stipitate, minute, pilose. Sepals of female flowers narrowly oblanceolate - spatulate, hairy. Seeds sub - globose, smooth.

*Fl. & Fr.* : October - February.

Common in wet and marshy places in south and south - eastern parts of the state.

*Selected specimens* : Banswara : Punapathar forest block, *Singh* 3659 (BSJO); Bhilwara : Bijolia, *Singh* 5706 (BSJO); Kota : Atru, *Singh* 83924, 90963 (LWG). Also reported from Bundi district (*Maheshwari & Singh*, 1974).

8. *Eriocaulon sollyanum* Royle, Illus. 409. t. 97. f. 1. 1839. *E. trilobum* Buch. - Ham. ex Koern. in Linnaea 27 : 645. 1856; Hook. f. Fl. Brit. India 6 : 583. 1893; Parker in Duthie, Fl. Gangetic Plain 3 : 319. 1929.

Scapigerous herbs. Leaves  $4.0 - 11.0 \times 0.25 - 0.6$  cm, caespitose, linear, narrowed towards an acute or sub-obtuse apex, flat, 9 to 11 - nerved. Peduncles numerous, twisted, glabrous. Heads 3.0 - 4.5 mm in diam., sub - globose. Involucre bracts  $3 \times 1$  mm, linear - oblong, obtuse, at first radiating beyond the head, afterwards reflexed, pale - shining. Floral

bracts 2 mm long, ciliate at the apex, concave. Receptacles villous. Male flowers shortly stipitate ; sepals 3, oblong, obtuse, connate into spathes. Female flowers sub-sessile ; sepals 3, oblanceolate, boat - shaped, hairy on the back. Seeds ellipsoid, transversely ridged, pale - yellow.

*Fl. & Fr.* : October - December.

Rare, in wet and marshy habitats in the south - eastern parts of the state.

*Selected specimens* : Kota : Kair - Khari river, *Majumdar* 10456 (BSA) ; Shahabad, *Majumdar* 13132 A (BSA).

### 153. CYPERACEAE

(P.J. Parmar)

#### 1a. Flowers bisexual :

2a. Style jointed with the ovary, style - base dilated or spongy - thickened, clearly demarcated :

3a. Hypogynous bristles present. ... 5. *Eleocharis*

3b. Hypogynous bristles absent :

4a. Style - base caducous *i. e.* falling apart from achene. ... 7. *Fimbristylis*

4b. Style - base persistent on the mature achene, hence, achenes crowned by a bulbous style base. ... 2. *Bulbosotylis*

2b. Style continuing with the ovary, without demarcated border, hence, achenes neither crowned by nor jointed with the style - base :

5a. Spikelets many - flowered :

6a. Hypogynous bristles and/or scales present. Glumes spirally imbricated :

7a. Hypogynous scales 3, often alternate with 3 - bristles. Glumes pilose outside. ... 8. *Fuirena*

7b. Hypogynous bristles present, scales absent. Glumes glabrous or pubescent outside :

8a. Leaves absent or reduced to sheath or at - most mucros. Hypogynous bristles needle - like. ... 14. *Schoenoglectus*

- 8b. Leaves with distinct lamina.  
Hypogynous bristles not needle like :
- 9a. Hypogynous bristles 3 - 6, undivided, retrorsely scabrid, upto as long as the nut. Styles 2, rarely 3. Nuts obovate. ... 1. *Bolboschoenus*
- 9b. Hypogynous bristles 6, divided almost to the base into numerous hairs, exerted, much longer than the nut. Styles 3. Nuts ellipsoid. ... 6. *Eriophorum*
- 6b. Hypogynous bristles and scales absent. Glumes spirally imbricated or 2 - ranked :
- 10a. Glumes spirally imbricate. ... 14. *Schoenoplectus*
- 10b. Glumes 2 - ranked *i.e.* distichous :
- 11a. Rhachilla articulated ; spikelets falling entirely :
- 12a. Nuts triangular with one side facing rhachilla ... 11. *Mariscus*
- 12b. Nuts bilaterally flattened with one angle facing rhachilla. ... 9. *Kyllinga*
- 11b. Rhachilla not articulated, persistent ; glume falling apart from rhachilla :
- 13a. Nuts triangular or dorsiventrally flattened with one side facing rhachilla. ... 4. *Cyperus*
- 13b. Nuts bilaterally flattened with one angle facing rhachilla. ... 12. *Pycreus*
- 5b. Spikelets one - flowered :
- 14a. Glumes 2, dorsiventral. ... 10. *Lipocarpa*
- 14b. Glumes absent. Spikelets represented only by an achlamydeous flower subtended directly by a bracteole of spike. ... 13. *Rikliella*
- 1b. Flowers unisexual :
- 15a. Pistillate flowers enclosed in an utricle. Nuts not bony, without hypogynous disk. ... 3. *Carex*
- 15b. Pistillate flowers not enclosed in an utricle. Nuts bony, borne on a discoid or cupule - like hypogynous disk. ... 15. *Scleria*

## 1. BOLBOSCHOENUS (Ascherson) Palla

- |  |     |   |
|--|-----|---|
| Glumes brown or golden - brown. Style 3 - fid. | ... | 1. <i>B. maritimus</i><br>var. <i>maritimus</i> |
| Glumes straw - coloured. Style 2 - fid.        | ... | 2. <i>B. maritimus</i><br>var. <i>affinis</i>   |

1. *Bolboschoenus maritimus* (L.) Palla in Koch. Syn. Deutsch. Fl. ed. 3. 3532. 1904 ; Hooper in Saldanha & Nicolson, Fl. Hassan 658. 1978. *Scirpus maritimus* L. Sp. Pl. 51. 1753 ; Clarke in Hook. f. Fl. Brit. India 6 : 658. 1893 ; Duthie, Fl. Gangetic Plain 3 : 363. 1929.

var. *maritimus*

Erect, perennial sedge, with horizontally creeping rhizomes forming ovoid tubers at the nodes. Leaves 3 - 8 mm wide, often as long as the stem, flat, linear. Involucre - bracts 1 - 3, leaf - like. Inflorescence anthelate, terminal, loose ; rays 5 - 8, slender. Spikelets 1.5 - 3.0 cm long, oblong - ovoid. Glumes 5 - 7 mm long, broadly ovate, puberulous, bifid at apex, strongly keeled, mucro antrorsely scabrid. Hypogynous bristles 6, retrorsely scabrid. Nuts sessile, narrowly obovoid, lenticular or trigonous, beaked, smooth, brown to greyish - black.

*Fl. & Fr.* : October - March.

Common in marshy places, on the bank of tanks, ponds, ditches etc.

*Selected specimens* : Ajmer : Tiagi 24 (DD) ; Banswara : Kanodia 51110 (BSI) ; Barmer : Sheo, Rao 67037 (BSI) ; Bharatpur : Khatipura village, Parmar 8653 (BSJO) ; Ganganagar : Rampura, Roy 5055 (BSJO) ; Sirohi : Abu Road, McCann 1389, 1390 (BLAT).

*Notes* . Many workers consider *Scirpus maritimus* L. as an European element following Beetle (1942) and *S. tuberosus* Desf. as an Asian element. Recently *S. maritimus* L. has been reported from many parts of Asia including India. Detailed study to confirm the taxonomic status and distribution pattern of these taxa is necessary.

2. var. *affinis* (Roth) Parmar, P.J. *comb. nov. Scirpus affinis* Roth in Reem. & Schult. Syst. Veg. 2 : 140. 1817. *S. maritimus* L. var. *affinis* (Roth) Clarke in Hook. f. Fl. Brit. India 6 : 659. 1893 ; Duthie, Fl. Gangetic Plain 3 : 366. 1929.

Very similar to type variety, but can be easily distinguished by its usually 3 - 1 spikelets, entire, straw - coloured glumes and 2 - fid style.

*Fl. & Fr.* : January - May.

Common particularly in the eastern parts of the state in marshy places.

*Selected specimens* : Alwar : Baranviar, *Parmar* 9716 (BSJO); Banswara : *Majumdar* 10270 (BSA), *Karodiu* 51110 A (BSI); Barmcr : *Sheo* (behind Mansar tank), *Rao* 67037A (BSA) ; Jaipur : Shahapura - kanwat, *Kaul* 41941 (LWG) ; Kota : Amar Niwas, *Singh* 74763 (LWG) ; Tonk : Near Frazer bridge, *Pandey* 4769 (BSJO).

## 2. *BULBOSTYLIS* Kunth *nom. cons.*

- 1a. Spikelets in an almost prickly head. Glumes densely pubescent. ... 3. *B. subspinescens*
- 1b. Spikelets in capitate or anthelate heads without prickles. Glumes almost glabrous :
- 2a. Inflorescence anthelate. Spikelets and glumes chestnut - brown. Glumes mucronate. Achenes undulate - corrugate. ... 2. *B. densa*
- 2b. Inflorescence capitate. Spikelets and glumes yellowish or rusty - brown. Glumes with recurved awns. Achenes smooth. ... 1. *B. barbata*

1. *Bulbostylis barbata* (Rottb.) Clarke in Hook. f. *Fl. Brit. India* 6 : 651. 1893 ; Duthie, *Fl. Gangetic Plain* 3 : 358. 1929. *Scirpus barbata* Rottb. *Descr. Pl. Rar. Prcg.* 27. 1772 *et* *lc. Rar. Nov. Pl.* 52. t. 17. f. 4. 1773.

Annual, tufted, glabrous herbs. Leaves 40 - 100 × 0.5 - 0.8 mm, as long as or shorter than the stem, filiform, acute, glabrous or sparsely pilose on lower surface. Inflorescence of 10 - 25 spikelets. Spikelets sessile, 2 - 9 × 1.0 - 1.3 mm, linear, polygonal. Glumes 1.5 - 2.2 mm long, ovate, membranous, keeled. Stamens 1 - 3. Achenes obovate - orbicular, trigonous, pale, obscurely trabeculate with transversely rectangular cells, rounded at apex.

*Fl. & Fr.* : August - November.

Common in wet grounds in wastelands and cultivated fields, particularly in the eastern parts of the Aravalli range.

*Selected specimens* : Ajmer : *Lourie* 199/11 (DD) ; Banswara : Near Paloda village, *Singh* 2819 (BSJO) ; Jodhpur : Malar, *Singh* 3238

(BSJO) ; Kota : Atru, *Singh* 74475 (LWG) ; Nagaur : Roopasar well, *H. Lal* 34923 (LWG) ; Sirohi : Rohi to Chitrasani, *Allen* 1054 (BLAT).

2. *Bulbostylis densa* (Wall.) Hand. - Mazz. in Karsten & Schenk, *Vegetationsb.* 20(7) : 16. 1930 ; Raizada, *Suppl. Duthie, Fl. Gangetic Plain* 290. 1976. *Scirpus densus* Wall. in Roxb. *Fl. Ind.* 1 : 231. 1820. *Isolepis trifida* Nees in Wight, *Contrib. Bot. Ind.* 108. 1834. *Bulbostylis capillaris* (L.) Kunth var. *trifida* (Nees) Clarke in Hook. f. *Fl. Brit. India* 6 : 652. 1893.

Annual, tufted, slender, glabrous herbs. Leaves narrowly linear, 20 - 100 × 0.4 - 0.5 mm, gradually acute at apex. Inflorescence simple to subcompound, bearing 1 - 8 spikelets. Spikelets solitary or in clusters, 3 - 6 × 1.5 mm, oblong - ovate to ovate, subacute at apex. Glumes 1.5 - 2.0 mm long, ovate, acute, mucicous, strongly keeled on back, membranous. Stamens 2. Achenes obovate - orbicular, trigonous, densely granular - punctulate.

*Fl. & Fr.* : August - November.

Rare, found along the dry sandy river - beds.

*Selected specimens* : Pali : Luni river bed, *Shetty* 1810 (BSJO) ; Sirohi : Mt. Abu, *Mchta* 298, 1476 (JAC). Also reported by Raizada (1954) & Chavan & Sabnis (1960) from Mt. Abu.

3. *Bulbostylis subsperescens* Clarke in Hook. f. *Fl. Brit. India* 6 : 652. 1893 ; Haines, *Bot. Bihar & Orissa* 5 : 924. 1924 ; Vyas in *Indian For.* 92 : 582. 1966 *et Journ. Bombay Nat. Hist. Soc.* 64 : 226. 1967.

Caespitose, pubescent, annual herbs. Stem rigid, curved. Leaves 5.0 - 7.5 cm long, numerous, curved, acicular, striate, pubescent, with very broad striated sheath. Spikelets about 10, in a dense, almost prickly stellately spreading terminal head. Bracts about as long as the head. Glumes scarcely keeled, densely pubescent. Style 3 - fid. Achenes pale - brown.

*Fl. & Fr.* : August - November.

Rare, included on the authority of Vyas (1966 & 1967) from Alwar district.

### 3. CAREX L.

1a. Spikes many, in panicles :

2a. Panicles simple ; secondary panicles reduced to solitary spikes, at least in the upper part of inflorescence. Stigmas 3.

... 3. *C. myosurus*

- 2b. Panicles compound ; secondary panicles not reduced to solitary spikes. Stigmas 2. ... 1. *C. cruciata*
- 1b. Spikes 3 - 5, in simple racemes. ... 2. *C. heterostachya*

1. *Carex cruciata* Wahlenb. in Vet. - Akad. Nya. Handl Stockholm 24 : 149. 1803 ; Clarke in Hook. f. Fl. Brit. India 6 : 715. 1894 ; Babu, Herb. Fl. Dehradun 550. 1977 ; Singh in Journ. Bombay Nat. Hist. Soc. 74 : 48. 1977 *C. condensata* Nees in Wight, Contrib. Bot. Ind. 123. 1834 ; Clarke in Hook. f. *l.c.* 6 : 176. 1894 ; Duthie, Fl. Gangetic Plain 3 : 371. 1929.

Perennials, with a short, stout, woody rhizome covered with fibrous sheaths. Stems many, erect, 3 - gonous, glabrous. Leaves linear, sub-basal, as long or longer than the stem, upper one passing into bracts. Sheaths trigonous. Panicles 10 - 30 cm long, with 8 - 10, 3 - 8 cm long secondary panicles. Spikes monoecious. Spikelets cylindrical, linear-oblong, upto 1.5 cm long. Female florets 4 - 5 ; glumes ovate - oblong, aristate, reddish - brown. Utricle sub - inflated, ellipsoid, faintly 3 - gonous, abruptly narrowed into a 2 - fid beak. Male florets above the female ones ; glumes ovate - lanceolate, shortly aristate.

*Fl. & Fr.* : September - January.

Occasionally found in low - lying areas in the south - eastern parts of the state.

*Selected specimen* : Bundi : Near Hindoli, Singh 74091 (LWG).

2. *Carex heterostachya* Bunge, Enum. Pl. Chin. Bor. 69. 1832 ; Singh in Journ. Bombay Nat. Hist. Soc. 74 : 48. 1977. *C. songorica* Kar. & Kir. in Bull. Soc. Nat. Mosc. 3 : 525. 1842 ; Clarke in Hook. f. Fl. Brit. India 6 : 739. 1894.

Perennial herbs, with horizontal rhizomes. Stem 30 - 50 cm high, 3 - gonous. Leaves flat, rigid, overtopping the stem, sheathing at base. Spikes 3 - 5, distant, erect, upper one or two narrow, 1.5 - 4.0 cm long, male ; lower ones cylindrical, female. Female glumes ovate, shorter than utricles. Utricles ovoid - ellipsoid, 4 × 2 mm, inflated, narrowed into a beak, with 2, curved arms.

*Fl. & Fr.* : October - April.

Occasionally found along the bank of rivers and ponds in the south - eastern parts of the state.

*Selected specimen* : Kota : Sitabari (Kelwara), Singh 91075 (LWG).

3. *Carex myosurus* Nees in Wight, Contrib. Bot. Ind. 122. 1834 ; Clarke in Hook. f. Fl. Brit. India 6 : 723. 1894 ; Duthie, Fl. Gangetic Plain 3 : 370. 1929.



Perennial, glabrous, tall herbs, with short and stout woody rhizomes clothed with persistent, fibrous remains of leaf - sheaths. Stem erect, obtusely 3 - angled. Leaves sub - basal, as long as or shorter than the stem. Panicles 15 - 60 cm long. Spikelets oblong - cylindric. Female flowers pale brown, aristate, glabrous or shortly hairy at the top. Utricles obliquely ellipsoid - obovoid, 3 - gonous, shortly stalked, abruptly narrowed into a short hairy, 2 - fid beak, hairy in the upper part. Male flowers with ovate, cuspidate, reddish - brown glumes.

*Fl. & Fr.* : August - December.

Rare, in wastelands and open forests. Included on the authority of Sutaria (1941), Raizada (1954) and Chavan & Sabnis (1960) from Mt. Abu (Sirohi district).

#### 4. CYPERUS L.

- |  |     |                            |
|--|-----|----------------------------|
| 1a. Style undivided at the apex. Stigma entire.  | ... | 22. <i>C. meeboldii</i>    |
| 1b. Style divided at the apex. Stigmas as many as style - arms :                                     |     |                            |
| 2a. Stigmas 2. Nuts dorsally compressed :  |     |                            |
| 3a. Spikelets in a decompound umbel.   | ... | 1. <i>C. alopecuroides</i> |
| 3b. Spikelets in lobed heads :   |     |                            |
| 4a. Perennial, rhizomatous herbs. Spikelets in pseudolateral heads.                                  | ... | 21. <i>C. laevigatus</i>   |
| 4b. Annual herbs, with fibrous roots. Spikelets in terminal heads.                                   | ... | 29. <i>C. pygmaeus</i>     |
| 2b. Stigmas 3. Nuts trigonous or triquetrous :   |     |                            |
| 5a. Spikelets digitately or stellately arranged :  |     |                            |
| 6a. Annuals, with fibrous roots. Stamen 1, rarely 2 :  |     |                            |
| 7a. Glumes with recurved cuspidate apex.   | ... | 10. <i>C. cuspidatus</i>   |
| 7b. Glumes obtuse :  |     |                            |
| 8a. Spikelets few, digitate, in twice compound umbels. Rachilla flexuous. Nuts minutely verruculose. | ... | 32. <i>C. tenuispica</i>   |

- 8b. Spikelets many, in compact heads Rachilla slender. Nuts punctate. ... 11. *C. difformis*
- 6b. Perennials, with a woody root - stock. Stamens usually 3, rarely 1 :
- 9a. Angle of nut much thickened by corky tissue. Style fimbriate. ... 27. *C. platystylis*
- 9b. Angle of nut not corky thickened. Style simple :
- 10a. Inflorescence a lax umbel. ... 17. *C. haspan*
- 10b. Inflorescence a more or less globose, terminal head or in contracted umbels :
- 11a. Rootlets woolly. ... 8. *C. conglomeratus*
- 11b. Rootlets not woolly :
- 12a. Rhizomes very short ; rootlets wiry :
- 13a. Stem slender, close - set, nodose at the base. Glumes c. 5 mm long. Stamens 3. ... 23. *C. niveus*
- 13b. Stem caespitose. Glumes c. 2 mm long. Stamen 1. ... 28. *C. pulchellus*
- 12b. Rhizomes creeping ; rootlets thick :
- 14a. Spikelets in contracted umbels. ... 5. *C. atkinsonii*
- 14b. Spikelets in one head. ... 3. *C. arenarius*
- 5b. Spikelets distinctly spicately or rarely sub - racemosely arranged :
- 15a. Rachilla of spikelets distinctly winged, with decurrent base of glumes :
- 16a. Leaves short, rarely half the length of stem or absent :

- 17a. Culms more or less articulated when dry :
- 18a. Culms weakly trigonous. Bracts distinct, foliaceous. Glumes 1.8 - 2.2 mm long. Anthers upto 1 mm long. ... 9. *C. corymbosus*
- 18b. Culms terete. Bracts very small, papery. Glumes 2.2 - 3.5 mm long. Anthers 1.0 - 1.5 mm long. ... 4. *C. articulatus*
- 17b. Culms not articulated when dry. ... 26. *C. pangorei*
- 16b. Leaves long, more than half the length of stem or longer :
- 19a. Rhizomes stoloniferous :
- 20a. Stolons soon disappearing, terminating into tunicated bulbils. Leaves arising from the stem at some distance, above the base and below the middle. ... 6. *C. bulbosus*
- 20b. Stolons persistent, bearing ovoid black tubers. Leaves radical :
- 21a. Leaves flaccid, flat. Umbels usually compound. Glumes usually 3.0 - 3.5 mm long :
- 22a. Stem not closely thickened at base. Bracts 3. Glumes apiculate, 5 to 7 - nerved :
- 23a. Stolons bearing hard, black, fragrant tubers. Nuts oblong.

- Glumes frequently slightly recurved at apex, slenderly 5 - nerved. ... 30. *C. rotundus*
- 23b. Stolons not or scarcely tuberiferous. Nuts oblong - obovate. Glumes with straight apex, conspicuously 7 - nerved. ... 33. *C. tuberosus*
- 22b Stem not nodosely thickened at base. Bracts 3 - 6. Glumes obtuse, 3 - nerved. ... 14. *C. esculentus*
- 21b. Leaves rigid. Umbels simple, usually compact. Glumes less than 2.5 mm long. ... 31. *C. stoloniferus*
- 19b. Rhizomes not stoloniferous :
- 24a. Wings of rachilla deciduous. Spikelets hardly flattened. ... 12. *C. digitatus*
- 24b. Wings of rachilla persistent. Spikelets conspicuously flattened :
- 25a. Spikelets densely arranged. Rachis invisible. Anthers longer than the filaments. ... 18. *C. imbricatus*
- 25b. Spikelets laxly arranged, exposing rachis. Anthers as long as or longer than the filaments :
- 26a. Ripe spikelets ascending. ... 15. *C. exaltatus* var. *exaltatus*
- 26b. Ripe spikelets rigidly patent. ... 16. *C. exaltatus* var. *dives*
- 15b. Rachilla of spikelets not or hardly winged. Glumes without decurrent base :
- 27a. Annuals, with tufted stems. Roots fibrous only :
- 28a. Slender herbs. Spikelets 1.0 - 2.5 cm long. Glumes acute at the apex. ... 7. *C. compressus*

- 28b. Stout herbs. Spikelets 0.3 - 1.0 cm long. Glumes obtuse, emarginate or minutely mucronate at the apex :
- 29a. Glumes dorsally 3 to 5 - nerved, back smooth :
- 30a. Spikes drawn out into a linear raceme. ... 20. *C. iria* var. *paniciformis*
- 30b. Spikes not drawn into a linear - raceme. ... 19. *C. iria* var. *iria*
- 29b. Glumes dorsally 5 to 7 - nerved, back spinulose - ciliate. ... 2. *C. alulatus*
- 27b. Perennials, with woody rhizomes and often with long stolons :
- 31a. Plants without true stolons. Spikelets in cylindrical spikes. ... 25. *C. nutans* subsp. *eleusinoides*
- 31b. Plants stoloniferous. Spikelets in spicate - racemes :
- 32a. Mature spikelets acicular, patent. Glumes obtuse. Nuts as long as the glumes. ... 13. *C. distans*
- 32b. Mature spikelets linear, suberect. Glumes minutely mucronulate. Nuts shorter than the glume. ... 24. *C. nutans* subsp. *nutans*

1. *Cyperus alopecuroides* Rottb. Descr. Pl. Rar. Progr. 20. 1772 et Icon. Rar. Nov. Pl. 38. t. 8. f. 2. 1773 ; Mahesh. Illus. Fl. Delhi f. 212. 1966. *Juncellus alopecuroides* (Rottb.) Clarke in Hook. f. Fl. Brit. India 6 : 595. 1893 ; Duthie, Fl. Gangetic Plain 3 : 340. 1929.

Robust, perennial, tufted sedge, with short rhizomes. Culms stout, trigonous, 60 - 140 cm tall, glabrous. Leaves 3 to 5, as long as or shorter than the culms, 5 - 7 × 0.6 - 1.7 cm. coriaceous. Inflorescence terminal, lax, often with a central spike. Spikes digitate, patent, 2 - 4 × 0.8 - 1.5 cm, cylindrical to oblong - cylindrical, very dense, the rachis hidden by the crowded spikelets. Spikelets 4 - 7 × 2.0 - 2.5 mm, 10 to 30 - flowered, ovate to lanceolate - oblong, slightly turgid, acute. Rachilla straight, flattened. Glumes

1.5 - 2.2 × 1.0 - 1.3 mm, ovate - elliptic to ovate, 5 or 7 - nerved. Nuts broadly elliptic to obovate, c. 1 mm long, apiculate at apex, light - brown.

*Fl. & Fr.* : August - November.

Common in the aquatic and marshy places, particularly in the eastern regions of the state.

*Selected specimens* : Ajmer : *Lourie* 4911 (DD) ; Alwar : On the way to Talvarksh. *Parmar* 9579 (BSJO) ; Banswara : On Ghatol road, *Singh* 2945 (BSJO) ; Ganganagar : Hanumangarh, *Roy* 5037 (BSJO) ; Jodhpur : Bilara, *Singh* 3513 (BSJO) ; Udaipur : Jaisamand, *Verma* 63 A (BSA).

2. *Cyperus alulatus* Kern in Reinwardtia 1 : 643. f. 1. 1952 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 293. 1976. *C. iria* L. var. *rectangularis* Kukenth. in Engl. Pflanzenr. 101 : 152. 1935.

Erect, tufted, annual sedge. Leaves 5 - 40 cm long. basal. longer than the stem. Involucre bracts 3 - 5. foliaceous, unequal. Inflorescence a terminal, lax, compound umbel. Spikes 1 - 3 × 1.0 - 1.8 cm. Spikelets 3 - 10 × 2.0 - 2.2 mm, patent, compressed, ovate to oblong - linear, 5 to 15 - flowered, golden - brown or yellowish - brown. Rachis flexuous, hispid on the angles. Glumes 1.5 - 2.0 × 1.2 - 1.3 mm, ovate or suborbicular, imbricate, emarginate, membranous, 7 - nerved, keel narrowly winged, spinosely ciliate on the back. Nuts c. 1.7 × 1.0 mm, obovate - ellipsoid, triquetrous with concave smooth sides, broadly stipitate, apiculate, brown to dark - brown.

*Fl. & Fr.* : September - November.

Common in moist, sandy and marshy places, particularly in the eastern parts of the state.

*Selected specimens* : Alwar : Umrai forest block, *Parmar* 9599 (BSJO) ; Banswara : Ghatol, *Singh* 2903 (BSJO) ; Bhilwara : Bhimar village, *Singh* 5991 (BSJO) ; Jaisalmer : 40 km south - west of Jaisalmer, *Shetty* 3403 (BSJO) ; Pali : Sarandhana village, *Shetty* 1807 (BSJO) ; Udaipur : Khamblighat, *Kanodia* 82394 (BSI).

3. *Cyperus arenarius* Retz. Obs. Bot. 4 : 9. 1786 ; Clarke in Hook. f. Fl. Brit. India 6 : 602. 1893 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 294. 1976 ; Bhandari, Fl. Ind. Desert 364. 1978.

Perennial, rhizomatous sedge. Rhizomes horizontally long - creeping. Culms one to few arising from the apices of the branches of rhizomes,

obtusely trigonous, smooth. Leaves 4 - 8, lower few reduced to subphyllous sheaths, 5 - 20 × 1 - 3 mm, shorter or slightly overtopping the culm, subcoriaceous. Sheaths membranous, straw - coloured. Inflorescence head - like, bearing 5 - 30 spikelets. Spikelets 6 - 13 × 2 - 5 mm, lanceolate - ovate, subacute, 8 to 17 - flowered, turgid, with obtuse angles. Rachilla straight. Glumes imbricated, 4 - 5 × 2 - 3 mm, ovate, obtuse or slightly emarginate at mucronulate apex, 9 or 11 - nerved. Nuts broadly obovate, rounded at apex, triquetrous, black.

*Fl. & Fr.* : June - December.

Common in sandy grounds, particularly in the western parts of the state.

*Selected specimens* : Ajmer : *Tiagi* 9 (DD) ; Barmer ; Near Kujra village, *Shetty* 2282 (BSJO) ; Churu : *Sharma* Acc. No. 18039 (BSI) ; Ganganagar : Lakuwali, *Roy* 6424 (BSJO) ; Jaipur : Durgapura, *Sharma* 1206 (RUBL) ; Jaisalmer : Rann near Ramgarh, *Tiwari* 822 (BSJO) ; Nagaur : Merta road station, *H. Lal* 34859 (LWG).

4. *Cyperus articulatus* L. Sp. Pl. 44. 1753 ; Clarke in Hook. f. Fl. Brit. India 6 : 611. 1893 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 294. 1976.

Subphyllous perennial sedge. Rhizomes long - creeping. Culms trigonous, smooth, glabrous, distinctly transversely septate when dry, clothed at base with 3 - 4 sheaths. Leaves reduced to long sheaths, at times sheath with a short blade. Sheaths membranous to herbaceous, reddish - brown. Inflorescence terminal or pseudolateral, compound umbel ; primary rays 6 - 10, unequal, upto 15 cm long, secondary rays in corymbs. Spikes ovoid, with 5 - 10 mm long rachis, densely bearing 10 - 15 spikelets. Spikelets 5 - 18 × 1.0 - 1.5 mm, suberect to spreading, linear. Rachilla straight, winged. Glumes ovate - oblong to lanceolate - oblong, obtuse. Nuts trigonous, brown to grey brown.

*Fl. & Fr.* : August - November.

Occasionally found in the stagnated water of ponds in the south western parts of the state.

*Selected specimens* : Jalore Baragaon, *Shetty* 6692 (BSJO) Udaipur : Jaisamand lake, *Verma* 64 (BSI).

5. *Cyperus atkinsonii* Clarke in Journ. Linn. Soc. 21 : 109. 1884 et Hook. f. Fl. Brit. India 6 : 603. 1893 ; Raizada, Suppl. Duthie, Fl. Gangetic Plain 295. 1976 ; Bhandari, Fl. Ind. Desert 365. 1978.

Perennial, tufted sedge, with woody rhizomes. Culms trigonous, with numerous brown sheaths at the base. Leaves basal, shorter than the stem, c.  $40 \times 0.4$  cm, lanceolate, rigid. Sheaths persistent, at length disintegrating into fibers. Inflorescence a simple umbel, often contracted into a head. Spikes c.  $14 \times 4$  mm, compressed, narrowly linear, acute, brown. Spikelets 10 - 15 in a head,  $1 - 2 \times 0.3 - 0.4$  cm. 20 to 30-flowered, compressed, narrowly linear, sub-acute. Rachilla persistent, slender. Glumes 3.0 - 3.5 cm long, ovate, cymbiform, with a strong, sharp mucro beyond the obtuse tip. Nuts c. 1.2 mm long, trigonous, obovate, yellowish - brown.

*Fl. & Fr.* : March - September.

Rare, grows sporadically in large tufts on sand, usually in the north - western region of the state.

*Selected specimens* : Barmer : *Bhandari* 1871 (JAC) ; Bikaner : Vallabh garden, *Roy* 1750 (BSJO) ; Churu : Bhaleri village, *Roy* 2587 (BSJO) ; Jaipur : Bassi plantation, *Raizada* Acc. No. 130149 (DD) ; Jodhpur : Kailana, *Moorthy* 41 (BSJO) ; Tonk : Barni plantation, *Sen* Acc. No. 148964 (DD).

6. *Cyperus bulbosus* Vahl, Enum. Pl. 2 : 342. 1805 ; Clarke in Hook. f. Fl. Brit. India 6 : 611. 1893 ; Duthie, Fl. Gangetic Plain 3 : 336. 1929.

Perennial sedge, with ovoid - globose or ovoid - fusiform tubers. Culm solitary, triquetrous, smooth. Leaves 7 - 18, equalling or slightly longer than the culm,  $8 - 25 \times 0.2 - 0.4$  cm, narrowly linear, gradually acuminate, scabrid on upper margins. Sheaths 2 - 6 cm long, broader than the blade, membranous, dark brown. Inflorescence a sub-umbellate, interrupted or reduced to a capitate head. Spikelets  $1.0 - 2.2 \times 0.15 - 0.2$  cm, patent, linear, acute, 8 to 25-flowered, reddish - brown. Rachilla with ovate, persistent wings. Glumes 3 - 4  $\times 1.5 - 2.0$  mm, boat-shaped, 9 to 11-nerved, reddish, margins hyaline in lower part, obtuse or mid-rib produced into a short arista. Nuts 1.5 - 1.7 mm long, ellipsoid to obovoid, trigonous, apiculate or obtuse at apex, black.

*Fl. & Fr.* : August - November.

Common in moist - waste places, particularly in the north - western part of the state.

*Selected specimens* : Bhilwara : *Badnor*, *Singh* 6470 (BSJO) ; Churu : Bhaleri village, *Roy* 2741 (BSJO) ; Jaipur : Durgapura, *Sharma* 1208 (RUBL) ; Jaisalmer : On Pokaran road, *Raizada* 45/55 (DD) ; Jodhpur : Kailana, *Shetty* 95 (BSJO).



7. *Cyperus compressus* L. Sp. Pl. 46. 1753 ; Clarke in Hook. f. Fl. Brit. India 6 : 605. 1893 ; Duthie, Fl. Gangetic Plain 3 : 326. 1929 ; Mahesh. Illus. Fl. Delhi f. 217. 1966.

Tufted, erect or diffuse, glabrous sedge. Culms patent, stout, trigonous, smooth. Leaves few, basal, 8 - 20 × 0.1 - 0.4 cm, linear, shorter than or slightly longer than the culm. Sheaths membranous, striate, pale - brown. Inflorescence anthelate or congested. Bracts 2 - 5, foliaceous, unequal. Spikes 2 - 5 cm long, oval or somewhat flabelliform. Spikelets 10 - 25 × 2.5 - 4.0 mm, compressed, 15 to 40 - flowered, greenish, turning to straw colour when mature. Rachilla flexuose, with caducous wings. Glumes 3 - 4 × 2.0 - 2.5 mm, broadly ovate, strongly folded with acute keel, 3 - nerved on both sides, acute at apex with a straight mucro. Nuts 1.0 - 1.5 × 0.7 - 1.0 mm, broadly - ovate, triquetrous, minutely puncticulate, dark - brown.

*Fl. & Fr.* : August - November.

Common weed in open, dry waste places and in cultivated fields after rains.

*Selected specimens* : Alwar : Naldeshwar forest block, Parmar 9538 (BSJO) ; Banswara : Near Paloda village, Singh 2810 (BSJO) ; Jaipur : Durgapura, Sharma 1215 (RUBL) ; Kota : Shahabad, Verma 698 (BSA) ; Sirohi : Abu road, Allen 1052 (BLAT).

8. *Cyperus conglomeratus* Rottb. Descr. et Ic. Rar. Nov. Pl. 21. t. 15. f. 7. 1773 ; Clarke in Hook. f. Fl. Brit. India 6 : 602. 1893 ; Bhandari, Fl. Ind. Desert 367. 1978.

Perennial, tufted, glabrous sedge, with more or less woody rhizomes. Culms stout, terete below, trigonous above, thickened and clothed with brown, ovate, acuminate scales. Leaves as long as or shorter than the culm, 2.0 - 2.5 cm wide, coriaceous, margins inrolled when dry, shortly cuspidate at apex. Sheath pale, with oblique mouth. Inflorescence a simple umbel of a few, densely crowded spikes, often contracted into a head. Bracts 3 - 5. Spikelets 1.2 - 2.5 × 0.3 - 0.4 cm, oblong - lanceolate, compressed, 8 to 20 - flowered, straw - coloured or pale brown. Rachilla stout, not winged. Glumes c. 8 × 1.5 mm, oblong - lanceolate or ovate, with a minute mucro, many - nerved, tightly imbricating but not placed very close to rachilla. Nuts obovoid, unequally trigonous, pale brown.

*Fl. & Fr.* : August - November.

Common in moist or dry sandy soils throughout the desertic zones.

*Selected specimens* : Barmer : Near Munabao, Pandey 7910 (BSJO) ; Bikaner : Near Ranjitpura, Roy 2389 (BSJO) ; Churu : Adsisar, Roy 4024

(BSJO); Jaisalmer : West of Nachana, *Shetty* 3338 (BSJO); Jodhpur : CAZRI, *Rao* 67199 (BSI).

9. *Cyperus corymbosus* Rottb. Descr. et Ic. Rar. Nov. Pl. 42. t. 7. f. 4. 1773; Clarke in Hook. f. Fl. Brit. India 6 : 612. 1893; Duthie, Fl. Gangetic Plain 3 : 336. 1929.

Perennial, glabrous, glaucous - green sedge, with long creeping rhizomes. Culms subterete or weakly trigonous, scarcely septate when dry. Sheaths membranous, reddish - brown. Inflorescence a compound umbel. Bracts 2 - 4, lanceolate, erect - patent; primary rays 6 - 15, unequal. Spikes ovoid; rachis 5 - 10 mm long, densely bearing 10 - 15 spikelets. Spikelets 5 - 18 × 1.0 - 1.5 mm, sub - erect or spreading. Rachilla straight, with oblanceolate, white - hyaline or red - brown wings. Glumes 1.8 - 2.2 × 0.8 - 1.0 mm, ovate - oblong to lanceolate - oblong, obtuse, membranous, with 2 or 3 parallel veins on both sides of strong costa. Nuts 1.0 - 1.2 mm, oblong, trigonous, brown.

*Fl. & Fr.* : August - November.

Occasionally found in the eastern parts of the Aravalli in marshy places.

*Selected specimens* : Ajmer : *Raizada* 3/56 (DD); Alwar : *Siliserh*, *H. Lal* 34544 (LWG); Jhalawar : *Eklera*, *Majumdar* 10022 (BSA); Sirohi : Mt. Abu, *Mehta* 1041 (JAC).

10. *Cyperus cuspidatus* Kunth in H.B.K. Nov. Gen. et Sp. Pl. 1 : 204. 1815; Clarke in Hook. f. Fl. Brit. India 6 : 598. 1893. *C. uncinatus* auct. plur. non Poir. 1806; Duthie, Fl. Gangetic Plain 3 : 325. 1929.

Slender, tufted, annual sedge, with fibrous roots. Culms slender, triquetrous, smooth, 1 to 3 - leaved at base. Leaves upto 2/3 as long as the culm; blades nearly setaceous, 0.4 - 1.0 mm wide, narrowly linear. Inflorescence a single, terminal, compact, nearly globose head. Bracts 3 - 6, foliaceous, but usually longer. Spikelets linear, strongly flattened, 5 - 15 × 2 - 3 mm. Glumes patent, narrowly elliptic, mucronate, 1.0 - 1.5 × 0.6 - 1.0 mm, emarginate at apex, strongly 3 - nerved on keel. Nuts obovate, 0.5 - 0.75 × 0.3 - 0.4 mm, trigonous and with 3 - flat faces, puncticulate, brown.

*Fl. & Fr.* : August - October.

Frequent in sandy soils, low - lying areas, river - beds, ponds etc., particularly in the eastern parts of the state.