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Floristic Diversity at Asola Bhatti Wildlife Sanctuary, Delhi, India

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ABSTRACT

The work has been carried out from April 2012 to March 2016 with the main aim to document the floristic diversity of Angiosperms at the Asola Bhatti Wildlife Sanctuary, Delhi in a view to conserve native flora of the Aravalli biodiversity. The vegetation is dry deciduous consisting of *Prosopis juliflora* as dominant exotic species and *Diospyros montana* as dominant native species in the sanctuary. In the present study we documented 82 genera and 100 species from the trails selected in the sanctuary and analyzed over three seasons. We geo-tagged all the species encountered and frequency of species in disturbed trails was also assessed. Diagnostic features of all the documented species have been included, along with their protologue information.

Key words: Biodiversity, conservation, ecology, native flora

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Introduction

Asola Bhatti Wild life Sanctuary (Protected area since 1986) situated just at the outskirts of Delhi (National Capital Territory of India). This protected area is the last remnant of Delhi ridge hilly range, as the remaining forests with some exceptions, have been destroyed due to massive urbanization. The sanctuary serves as major center for conservation and protection of native flora and fauna in collaboration with the Bombay Natural History Society (BNHS), Mumbai and for running Environmental awareness programmes.

Vegetation is an important part of the ecosystem that reflects the effects of the entire environment (Billings, 1952). Vegetation complex fluctuates from season to season in a cyclic way, and over the years in a successional manner; these fluctuations suggest a response by each species population to the prevailing heat, moisture, and light as modified by the vegetation itself (Heady, 1958). The development and death or decay of plant species alters the pattern of the species distribution in a community (Watt, 1964). Vegetation ecology includes the investigation of species composition and the sociological interaction of species in communities (Mueller-Dombois & Ellenberg, 1974). It puts emphasis on the study of composition, development, geographic distribution and environmental relationships of plant communities (Legendre & Fortin, 1989; Kolasa & Rollo, 1991). A detailed vegetation analysis provides information about species diversity, community organization, niche resources

apportionment and turnover rate of species in a forest ecosystem.

Population structure is expressed in terms of number of individuals present in each of the definite girth class distribution of tree species. Saxena and Singh (1984) reported that regeneration behaviour of tree species in a forest can be revealed from the population structure. A successful regeneration is indicated by presence of sufficient number of seedlings, saplings and young trees in a given population (Pokhriyal et al., 2010) and the number of seedlings of any species can be considered as the regeneration potential of that species (Negi & Nautiyal, 2005). Natural regeneration is a central component for tropical forest ecosystem dynamics (Getachew et al., 2010) and is essential for preservation and maintenance of biodiversity (Rahman et al., 2011). It is important to understand the growth status of a species in the ecosystem and is one of the key parameter to determine ecosystem stability (Kadavul & Parthasarathy, 2001; Deb & Sundriyal, 2011). Several types of disturbances like deforestation, landslides, herbivory, etc. can affect the potential regenerative status of species composing the forest stand spatially and temporally (Guariguata, 1990; Welden et al., 1991; Barik et al., 1996a, b; Boerner & Brinkman, 1996; Liang & Seagle, 2002; Ganesan & Davidar, 2003; Khumbongmayum et al., 2005, 2006; Ceccon et al., 2006; Ward et al., 2006; Guarino & Scariot, 2012).

The Ridge and Aravalli Hill range are storehouse of rich biodiversity which includes variety of plant and animal species and it is considered as one of the richest biodiversity centres of the Delhi-NCR with rich species density and diversity. Therefore, the present study was undertaken to analyse the plant diversity and population dynamics of the study site with special focus on the shrubby and herbaceous flora of the sanctuary. The findings of the study add records on quantitative data on plant species diversity of the sanctuary.

Material and Methods

Study area

Asola Bhatti Wildlife Sanctuary (28°28' 34" N and 77°13' 48" E) is situated in far southern edge of the city of Delhi at Asola near Tughlaquabad. It has got established in 1986. The area is situated amidst Southern ridge and the northern terminal of Aravalli Hill Range. It covers an area of 6,874 acres and the sanctuary has been divided into two compartments, viz. Asola and Bhatti regions. The area receives an average annual rainfall of 711 mm. The soil is sandy clay loam in texture, slightly acidic in nature having pH 5.1 and soil organic carbon content records 2.03%. The weather in the area may be classified as semi-arid hot, wet monsoon periods (May-August) and cool dry winter (September to February). Winter rains are also not uncommon and the average temperature varies from -1°C (min) to 43°C (max).

Methods

The study for the assessment of diversity of herbs, shrubs and tree diversity was conducted during April 2012 to March 2016 using random sampling method on the trails. Extensive field survey in the Asola region i.e., the first compartment was carried out in the sanctuary. Quadrat method was followed to record the herbs, shrubs and tree species diversity and other quantitative features. One hundred quadrats of 1×1 m for the study of herbs, one hundred quadrats of 5 x 5 m for shrubs and one hundred quadrats of 10 x 10 m for trees were laid down randomly in the study

site, covering an area of one ha. All the species and individuals encountered in each quadrat were counted and the girth was measured in the case of trees. The number of individual species encountered in each quadrat were used for further quantitative analysis. Community quantitative parameters such as frequency, density, abundance, basal area (BA), relative frequency, relative density, relative dominance and Importance Value Index (IVI) were calculated (Cottam & Curtis, 1956). Identification of plants was done by referring to taxonomic literature (Maheshwari, 1963; Krishen, 2006) and by consulting plant specimens at Delhi University Herbarium (DUH). Herbarium specimens are deposited and preserved in the DUH, University of Delhi. We characterized and classified the species based on exclusive morphological characters.

Results

During our survey, it has been observed that angiospermic flora in the four trails is represented by 100 species belonging to 82 genera and 34 families. The finding of the present study reveals that *Ziziphus nummularia* (Rhamnaceae) is dominant shrub followed by an invasive species, *Lantana camara* (Verbenaceae) which is co-dominant species in the flora (Table 1). On the other hand, quadrat analysis has shown that *Stellaria media* (Caryophyllaceae) is dominant herb while *Setaria italica* (Poaceae) is co-dominant species (Table 2). The present study also confirms that the disturbed trails have more frequency/ distribution of invasive weeds like *Lantana camara* and *Parthenium hysterophorus* as compared to the native flora (Tables 1 & 2).

During our investigation we also saw trespassing in the sanctuary by people searching for fire wood, recreation centre and fertile soil, grazing by goats and cattle. The presence of very few park officials increases these incursions. Four trails in Asola Bhatti area were mapped using GPS data (Figs. 1, 2). These trails have been mapped for the first time and the data may be used for further plantations in the area.

Table 1. Frequency, density (D=individuals ha⁻¹) and abundance of shrubs species of Asola Bhatti Wildlife Sanctuary. (– specimen found in the sanctuary but was not present in the laid quadrat)

Taxon	Family	Frequency	Density	Abundance
<i>Lantana camara</i> L.	Verbenaceae	18	0.76	4.2
<i>Lantana montevidensis</i> (Spreng.) Briq	Verbenaceae	–	–	–
<i>Capparis decidua</i> (Forssk.) Edgew.	Capparaceae	–	–	–
<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn.	Rhamnaceae	28	5.92	21.14

Table 2. Frequency, density (D=individuals ha⁻¹) and abundance of herb species of Asola Bhatti Wildlife Sanctuary. (– specimen found in the sanctuary but was not present in the laid quadrat)

Taxon	Family	Frequency	Density	Abundance
<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	2	0.02	1
<i>Achyranthes aspera</i> L.	Amaranthaceae	2	0.04	2
<i>Aerva lanata</i> (L.) Juss. ex Schult.	Amaranthaceae	4	0.04	1
<i>Ageratum houstonianum</i> Mill.	Asteraceae	–	–	–
<i>Asparagus racemosus</i> Willd.	Asparagaceae	2	0.02	1
<i>Alysicarpus monilifer</i> (L.) DC.	Fabaceae	–	–	–
<i>Blepharis maderaspatensis</i> (L.) B. Heyne ex Roth	Acanthaceae	6	0.34	5.6
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	12	0.4	3.3
<i>Bothriochloa pertusa</i> (L.) A.Camus	Poaceae	–	–	–
<i>Bromus hordeaceus</i> L.	Poaceae	–	–	–
<i>Senna occidentalis</i> (L.) Link	Fabaceae	2	0.44	11
<i>Cenchrus ciliaris</i> L.	Poaceae	–	–	–
<i>Cenchrus setigerus</i> Vahl	Poaceae	–	–	–
<i>Chrysopogon fulvus</i> (Spreng.) Chiov.	Poaceae	–	–	–
<i>Commelina benghalensis</i> L.	Commelinaceae	–	–	–
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	72	12.24	17
<i>Datura innoxia</i> Mill.	Solanaceae	–	–	–
<i>Desmodium gangeticum</i> (L.) DC.	Fabaceae	–	–	–
<i>Desmostachya bipinnata</i> (L.) Stapf.	Poaceae	–	–	–
<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	–	–	–

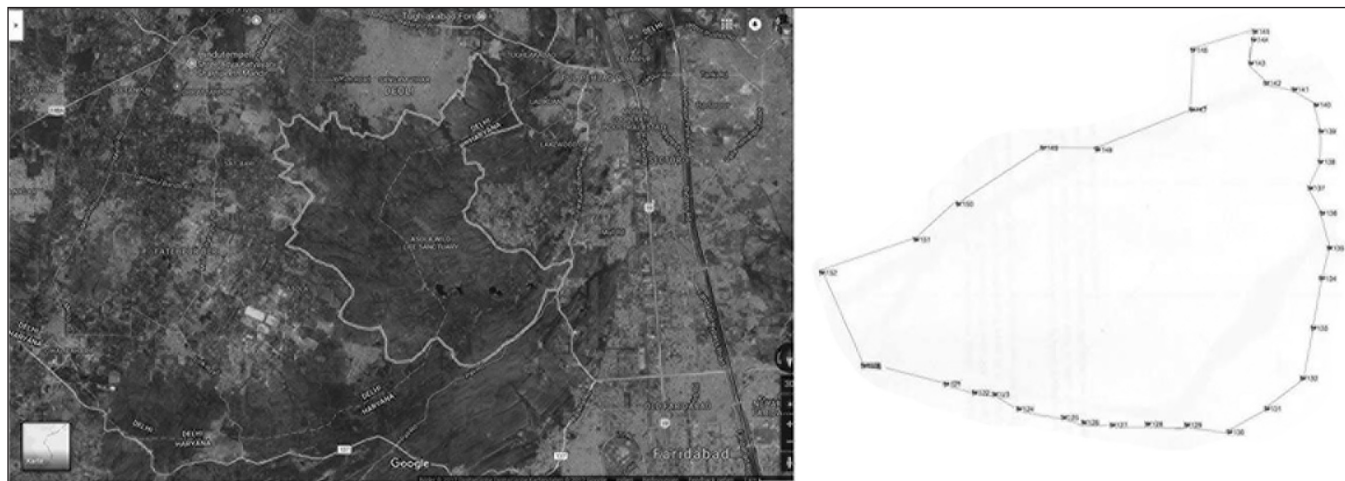


Figure 1. Map showing a trail in Bhatti area (Asola Bhatti Wildlife Sanctuary) based on GPS data; flags showing intersect of latitude and longitude. (Map data: Google, DigitalGlobe 2017).

Systematic Enumeration

The systematic list of taxa has been provided with information on basionyms, photographs of some taxa (Fig. 3) and relevant synonyms retrieved from online databases like IPNI (last accessed on 5 May, 2018) and TROPICOS (last accessed on 5 May, 2018).

ACANTHACAEAE

Andrographis paniculata (Burm.f.) Wall., Pl. Asiat. Rar. (Wallich) 3 (pt. 12):116 (1832); *Justicia paniculata* Burm. f., Fl. Ind. (N.L. Burman) 9. (1768).

Erect, branched, annual herbs. Branches quadrangular, glabrous. Flowers white with purple

throat, solitary, distant, in lax, terminal and axillary racemes, pubescent. Fruit capsules, acute at ends, smooth. Seeds many, pitted, glabrous ABWS, 14 May 2014, AK Pandey & DS Meena 2035.

Blepharis maderaspatensis (L.) B. Heyne ex Roth, Nov. Pl. Sp. 320 (1821); Maheshw. Fl. Delhi 266 (1963); *Acanthus maderaspatensis* L., Sp. Pl. 2: 639 (1753).

Prostrate, spreading or erect, pubescent much branched herbs. Leaves ternate, obovate, elliptic, trichomes on both surfaces. Flowers yellow or white with pink or purple nerves. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2019.

Elytraria acaulis (L.f.) Lindau in Nat. Pflanzenfam. Nachtr. [Engler & Prantl] 1: 304 (1897); Maheshw. Fl. Delhi 265 (1963); *Justicia acaulis* L.f., Suppl. Pl. 84 (1782).

Acaulescent herbs. Leaves elliptic to obovate, arranged in a basal rosette, flowers in one-several spikes, corolla white, flowers usually closed, capsule 5.5-6.5 mm long, hairless. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2027.

Rostellularia crinita (Nees) Nees, Prodr. [A. P. de Candolle] 11: 373. (1847).

Erect, much branched, annual herbs with slender hairy stem. Leaves simple, opposite, ovate, pubescent. Flowers in axillary and terminal short dense spikes. Corolla pink, bi-lipped. Capsules elliptic, shortly stalked, mucronate, minutely puberulous. Seeds finely rugose. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2103.

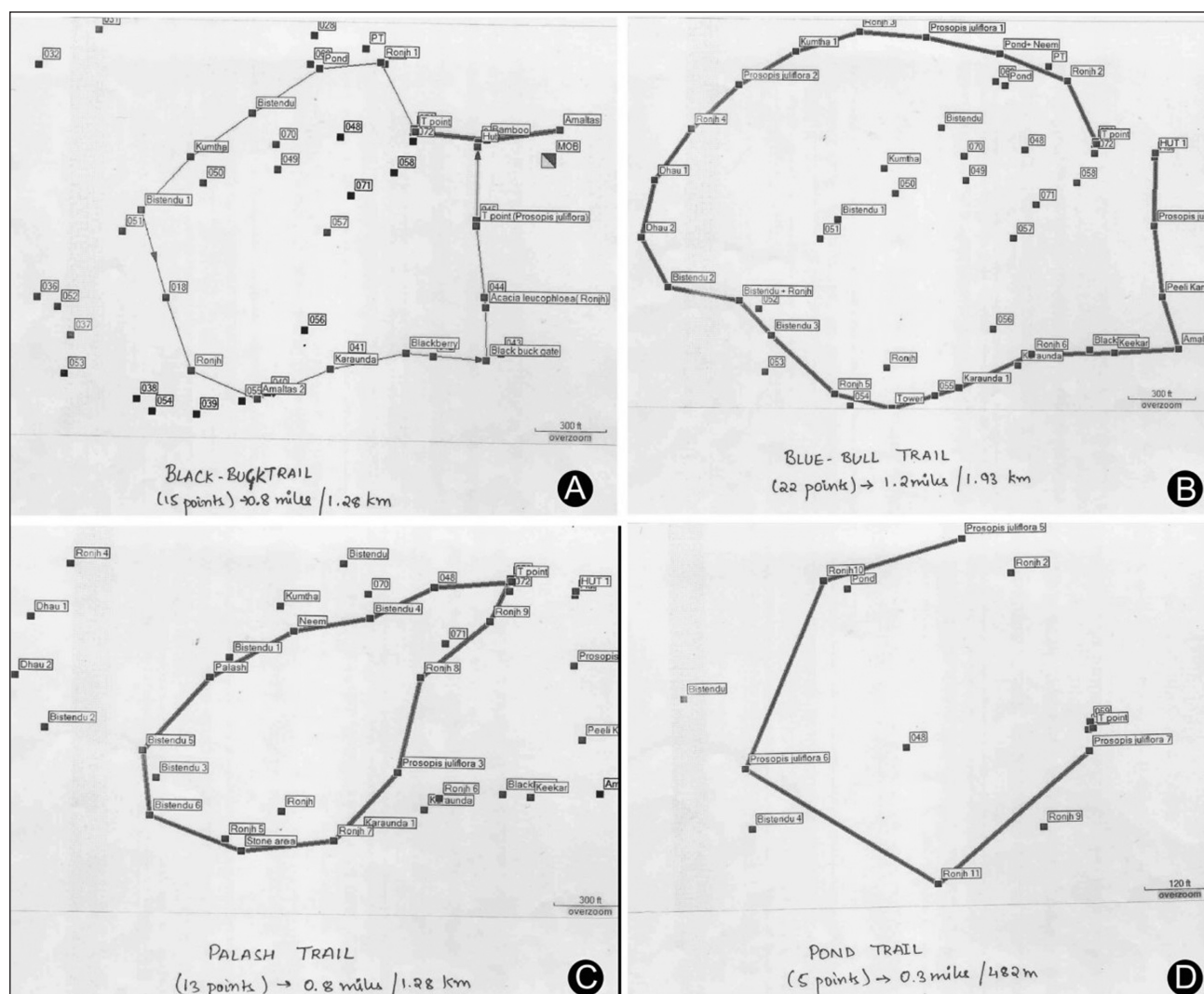


Figure 2. (A-D). Trail maps of the study area constructed using GPS data (Garmin ETREX 10) (A) Black Buck Trail, 0.8 miles/1.28 km. (B) Blue Bull trail, 1.2 miles/1.93 km. (C) Palash trail 0.8 miles/1.28 km. (D) Pond trail, 0.3 miles/0.482 km.

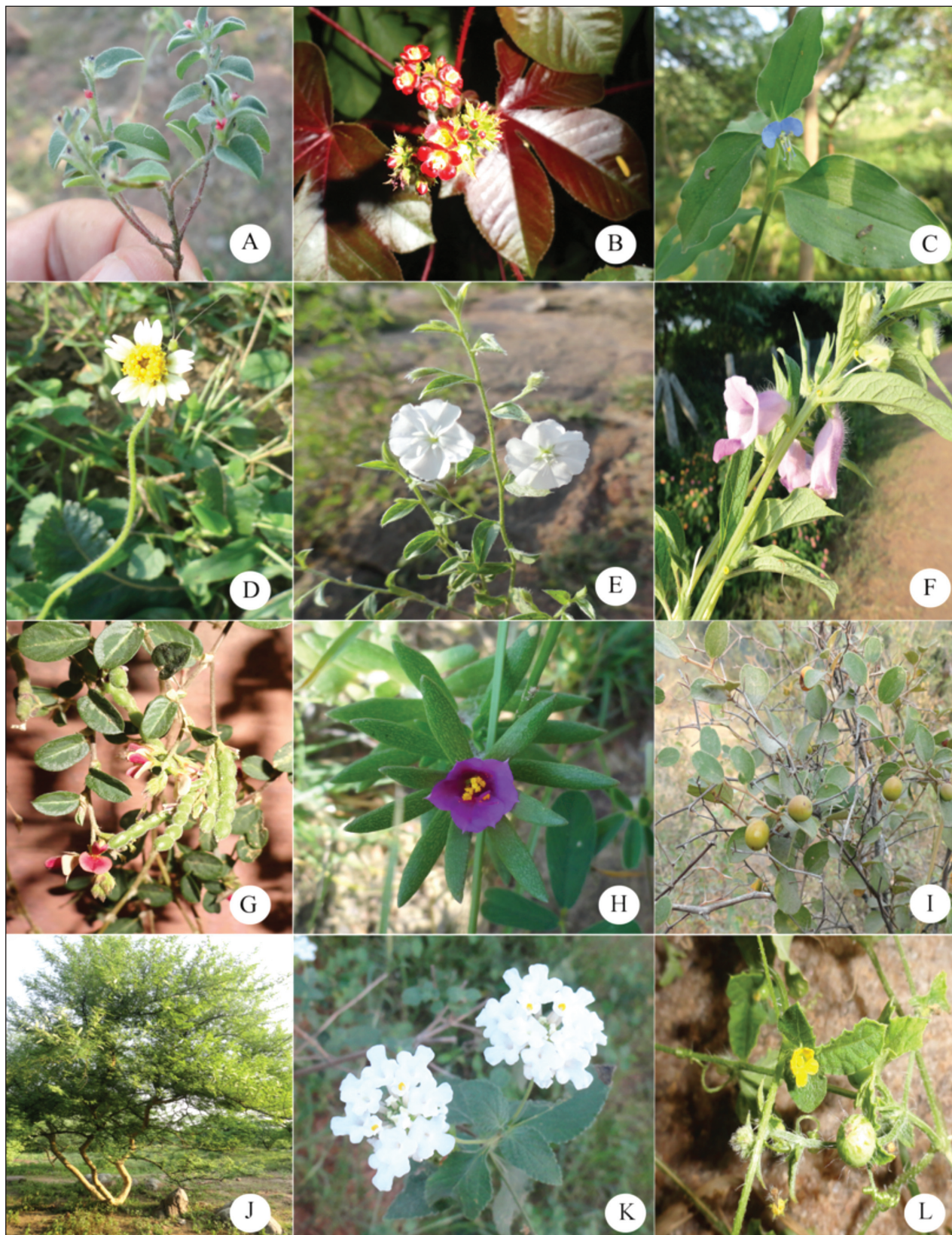


Figure 3. Habit of some taxa from the Asola Bhatti Wildlife Sanctuary. (A) *Indigofera linifolia*. (B) *Jatropha gossypifolia*. (C) *Commelina benghalensis*. (D) *Tridax procumbens*. (E) *Evolvulus alsinoides*. (F) *Sesamum indicum*. (G) *Alysicarpus monilifer*. (H) *Portulaca pilosa*. (I) *Ziziphus nummularia*. (J) *Acacia ferruginea*. (K) *Lantana montevidensis*. (L) *Cucumis maderaspatanus*.

Ruellia prostrata Poir., Encycl. [J. Lamarck & al.] 6(1): 349. (1804).

Prostrate, perennial herbs. Stem terete, sparsely pubescent. Leaves ovate or elliptic, acute at base, sparsely pubescent entire, acute-acuminate apex. Flowers bluish-purple, subsessile, axillary, solitary bracteoles elliptic, foliaceous. Calyx 5, linear, pubescent, acute. Corolla pubescent, tube infundibuliform. Capsules club-shaped, densely covered with fine hairs; seeds orbicular glabrous. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2101.

AMARANTHACEAE

Achyranthes aspera L., Sp. Pl. 1: 204. (1753); Roxb. Fl. Indica. 1: 225 (1832).

Erect annual or perennial herbs. Stem pubescent. Leaves opposite, ovate to orbiculate, wavy along margins. Inflorescence spike of raceme with white flowers. Seeds solitary. ABWS, 18 October 2014, AK Pandey, MD Dwivedi & DS Meena 2084.

Aerva lanata (L.) Juss. ex Schult., Syst. Veg., ed. 15 bis [Roemer & Schultes] 5: 564 (1819); Maheshw. Fl. Delhi 294 (1963); *Achyranthes lanata* L., Sp. Pl. 1: 204 (1753).

Pubescent herbs. Leaves alternate, obovate. Flowers minute, greenish white, sessile, bisexual. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2005.

Chenopodium album L., Sp. Pl. 1: 219 (1753).

Erect pubescent herbs. Stem ribbed. Leaves opposite, waxy coated, deltoid-ovate or rhombic-oblong, entire. Flowers radially symmetrical and grow on a dense branched spike. Seeds numerous, black. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2094.

APOCYNACEAE

Alstonia scholaris (L.) R.Br., Mem. Wern. Nat. Hist. Soc. 1: 75 (1811); Maheshw. Fl. Delhi 215 (1963); *Echites scholaris* L., Mant. Pl. 53 (1767).

Evergreen laticiferous trees. Leaves 4-7, lanceolate or obovate. Flowers greenish white, corolla tubular, seeds elongated-oblong. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2041.

Carissa carandas L., Mant. Pl. 1: 52 (1767); Maheshw. Fl. Delhi 213 (1963); *Arduina carandas* (L.) Baill., Hist. Pl. (Baillon) 10 (Gentin. & Apocyn.): 170. (1889).

Shrubs or small trees. Stem spiny. Leaves ovate.

Flowers white or pinkish, in terminal, corymbose cyme, pubescent. Berries ellipsoid, purple. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2024.

Cascabela thevetia (L.) Lippold, Feddes Repert. 91 (1-2): 52 (1980); *Cerbera thevetia* L., Sp. Pl. 1:209 (1753); *Thevetia peruviana* (Pers.) Merr., in Philipp. J. Sci. (Bot) 9: 130 (1914).

Evergreen leafy shrubs or small trees. Leaves simple, elongated elliptical to lanceolate, laticiferous, spirally arranged. Flowers orange, yellow or white. Drupes angular, 2 seeded. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2006.

Catharanthus roseus (L.) G.Don, Gen. Hist. 4 (1): 95 (1837); *Vinca rosea* L., Syst. Nat., ed. 10. 2: 944 (1759).

Evergreen herbs. Leaves ovate to oblong, glossy green, smooth, unicostate, petiolate, opposite. Flowers are white to dark pink with a deep red centre, tube 2.5–3 cm long, corolla lobes 2–5 cm diameter., The fruit is a pair of follicles, 2–4 cm x 3 mm. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2096.

ARECACEAE

Caryota urens L., Sp. Pl. 2: 1189 (1753); Maheshw. Fl. Delhi 342 (1963).

Tall, evergreen palms. Leaves bipinnate, leaflets shiny. Spadix large. Fruits dark purple, pericarp thin. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2042.

ASPARAGACEAE

Asparagus racemosus Willd., Sp. Pl., ed. 4. [Willdenow] 2 (1): 152 (1799).

Extensive, armed, scandent shrubs, growing up to 1-2 m in height. Stem and branches angled. Leaves linear-subulate, straight. Cladodes slender, spinous. Flowers numerous, white, axillary racemes. Fruits fleshy, globose, turns red at maturity. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2102.

ASTERACEAE

Ageratum houstonianum Mill., Gard. Dict., ed. 8. n. 2 (1768).

Densely hirsute herbs. Leaves ovate, opposite, pubescent. Flowers in discoid heads, florets ranges from pale lavender to pale blue. Cypsela up to 2 mm long, brown to black. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2036.

Parthenium hysterophorus L., Sp. Pl. 2: 988 (1753).

Profusely branched herbs. Leaves alternate, pinnately dissected. Male florets developed in pairs, along with five ray florets. Cypsela obovate, black. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2043.

Senecio vulgaris L., Sp. Pl. 2: 867 (1753).

Erect herbs. Leaves alternate, pubescent, pinnately lobed. Flowers yellow, Inflorescences devoid of ray florets, disc florets yellow, pappus barbellate. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2001.

Sonchus oleraceus L., Sp. Pl. 2: 794 (1753).

Annual erect herbs. Stem glaucous, striate. Leaves sessile, oblong or obovate, entire to pinnatifid, semi amplexicaul. Capitula irregular arranged in umbellate cymes, pedicels glandular. Flowers yellow. ABWS, 15 February 2015, AK Pandey, MD Dwivedi & DS Meena 2117.

Tridax procumbens L., Sp. Pl. 2: 900 (1753); Maheshw. Fl. Delhi 199 (1963).

Erect hispid herbs. Leaves ovate to lanceolate, dentate along margins. Capitula heterogamous; corolla yellow. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2031.

Vernonia cinerea (L.) Less., Linnaea 4: 291 (1829); Maheshw. Fl. Delhi 190 (1963); *Conyza cinerea* L., Sp. Pl. 2: 862 (1753).

Erect, annuals or perennial pubescent herbs. Leaves ovate to lanceolate. Capitula purple or lilac, cypselas 1.5 mm long, terete, pappus white. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2011.

BALANITACEAE

Balanites aegyptiaca (L.) Delile, Descr. Egypte, Hist. Nat. 221, t. 28, f. 1. (1813); *Ximenia aegyptiaca* L., Sp. Pl. 2: 1194 (1953).

Spiny shrubs. stem pubescent when young, spines long, straight, axillary. Leaves bifoliate, elliptic or obovate, rarely mucronate. Flowers in few flowered cymes, greenish white. Calyx pubescent; corolla glabrous. Fruit drupe. ABWS, 15 February 2015, AK Pandey, MD Dwivedi & DS Meena 2116.

BIGNONIACEAE

Tecomella undulata (Sm.) Seem., J. Bot. 1: 18.

(1863); *Bignonia undulata* Sm., Exot. Bot. 1:35, t. 19. (1805).

Medium sized trees, branches drooping, smooth. Leaves simple, sub-opposite, oblong, obtuse at apex, cuneate at base. Flowers in cymes on lateral branches, yellow to orange. Corolla campanulate. Capsules curved to linear, oblong, smooth. Seeds winged. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2121.

CAPPARACEAE

Capparis decidua (Forssek.) Edgew., J. Proc. Linn. Soc., Bot. 6: 184 (1862); Maheshw. Fl. Delhi 65 (1963); *Capparis aphylla* Roth, Nov. Pl. Sp. 238 (1821).

Shrubs or small trees, highly branched often leafless, spines paired, short, oppositely arranged. Flowers red or scarlet. Fruits globose to ovoid berries red when ripe. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2030.

CARYOPHYLLACEAE

Stellaria media (L.) Vill., Hist. Pl. Dauphiné (Villars) 3 (2): 615 (1789); *Alsine media* L., Sp. Pl. 1: 272 (1753).

Annual decumbent herbs. Leaves opposite decussate, spatulate. Inflorescence cyme. Flowers white and axillary. Fruit capsule, 2-4 seeded. ABWS, 21 September 2014, AK Pandey, MD Dwivedi & DS Meena 2081.

CLEOMACEAE

Cleome viscosa L., Sp. Pl. 2: 672. (1753).

Annual erect herbs, branched, pubescent. Leaves digitately compound, leaflets are obovate to elliptic-oblong. Flowers few, yellow, pedicellate. Siliqua glandular-pubescent, obliquely striated, tapering at both ends. Seeds many, reniform, subglobose, glabrous. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2104.

CONVOLVULACEAE

Evolvulus alsinoides (L.) L., Sp. Pl., ed. 2. 1: 392 (1762); Maheshw. Fl. Delhi 230 (1963); *Convolvulus alsinoides* L., Sp. Pl. 1: 157 (1753).

Much branched pubescent herbs. Leaves alternate, distichous, elliptic, oblong-lanceolate. Flowers blue with white throat. Note: Flowering throughout the year. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2004.

Evolvulus sericeus Sw., Prodr. [O. P. Swartz] 55. (1788).

Annual, highly branched, pubescent herbs. Leaves alternate, distichous, elliptic, oblong-lanceolate. Flowers white. Note: Flowering throughout the year. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2097.

COMMELINACEAE

Commelina benghalensis L., Sp. Pl. 1: 41 (1753); *C. kilimandscharica* K. Schum. Pflanzenw. Ost-Afrikas C: 134 (1895).

Annual diffuse herbs. Stem hairy. Leaves ovate to elliptic, apex pointed or blunt, velvet, pubescent with frilly margin. Spathe funnel shaped, flat at apex. Stamens 3, staminoides 2, capsule 5 seeded. Note: Also known as Bengal dayflower. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2074.

CUCURBITACEAE

Coccinia grandis (L.) Voigt, Hort. Suburb. Calcutt. 59 (1845); *Coccinia indica* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 347 (1834); *Bryonia grandis* L., Mant. Pl. 126 (1767).

Herbaceous twiners. Leaves tri to penta lobed, cordate at base, glabrous. Flowers white. Fruit ovoid to oblong, fleshy, turns red on maturity. Seeds embedded in pulp. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2085.

Cucumis maderaspatanus L., Sp. Pl. 2: 1012 (1753).

Annual, scabrous climbers, Leaves simple, tri to penta lobed. Flowers yellow; male flowers distinct in clusters. Fruit globose, bright red with small white patches when mature. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2075.

Diplocyclos palmatus (L.) C. Jeffrey, Kew Bull. 15(3): 352 (1962); *Bryonia palmata* L., Sp. Pl. 2:1012 (1753).

Climbing herbs with bifurcate tendrils. Leaves simple, tri lobed, lobes obtuse, margin entire. Flowers monoecious. Fruit baccate, globose or ovoid Seeds numerous. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2073.

EBENACEAE

Diospyros montana Roxb., Pl. Coromandel 1 (2): 37, t. 48. (1795); Maheshw. Fl. Delhi 206 (1963); *Diospyros*

bracteata Roxb., Fl. Ind. ed 2. 539 (1814).

Shrubs or small trees. Leaves alternate, ovate-oblong, pubescent. Male flowers pale yellow. Fruits pendulous, globose. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2020.

EUPHORBIACEAE

Euphorbia hirta L., Sp. Pl. 1: 454 (1753).

Annual erect, hispid herbs. Leaves elliptic to oblong, dark green to brownish above, white-villous beneath. Cyathia axillary and terminal. Capsule 3 seeded. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2100.

Jatropha gossypifolia L., Sp. Pl. 2: 1006 (1753); Maheshw. Fl. Delhi 314 (1963); *Jatropha elegans* Klotzsch, Bot. Voy. Herald [Seemann] 3: 102. (1853).

Much branched shrubs. Leaves alternate, tri-lobed, spirally arranged. Flowers, unisexual; male flowers dark red. Fruits green. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2018.

FABACEAE

Abrus precatorius L., Syst. Nat., ed. 12. 2: 472 (1767).

Perennial, twinning shrubs. Leaves pinnately compound, oblong, mucronate at apex, pubescent. Flowers pink in axillary racemes. Seeds ovate-elliptic, scarlet red with black spot at the hilum, shining, smooth. ABWS, 15 February 2015, AK Pandey, MD Dwivedi & DS Meena 2118.

Acacia ferruginea DC., Prodr. [A. P. de Candolle] 2: 458. (1825); Maheshw. Fl. Delhi 150 (1963).

Perennial, deciduous, branched with thorns. Leaves compound, leaflets 15-30, alternate. Flowers pale yellow in lax axillary spikes, spikes up to 14 cm long, often in panicle, at the end of the branches Pods flat, smooth, dark brown, 3-7 seeded. ABWS, 21 September 2014, AK Pandey, MD Dwivedi & DS Meena 2079.

Acacia leucophloea (Roxb.) Willd., Sp. Pl., ed. 4 [Willdenow] 4 (2): 1083. (1806); *Mimosa leucophloea* Roxb., Pl. Coromandel 2(2): 27, t. 150 (1800).

Large thorny trees, profusely branched., canopy umbrella-like. Bark white to yellowish gray, smooth. Leaves compound, bipinnate, 4-13 pairs of pinnae, each with 5-30 pairs of leaflets, spines at the base of leaves. Flowers in large terminal, tomentose panicles, light-yellow to cream. Pods yellow, green or brown,

flat, slightly curved. Seeds 10-20. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2105.

Acacia senegal (L.) Willd., Sp. Pl., ed. 4 [Willdenow], 4(2):1077 (1806); *Mimosa senegal* L., Sp. Pl. 1: 521 (1753).

Small deciduous trees, up to 10-20 ft. high. Stem prickly, branches flexuous. Leaves bipinnate, with stipular spines, main rachis pubescent, pinnae 3-5 pairs, short stalked, leaflets small, linear to elliptic-oblong. Flowers in axillary dense spikes, whitish, fragrant. Calyx campanulate, divided. Corolla twice the length of calyx, lanceolate, acute. Pod straight or slightly curved, thin, light brown or gray. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2107.

Alysicarpus monilifer (L.) DC., Prodr. [A. P. de Candolle] 2: 353. (1825); *Hedysarum moniliferum* L., Mant. Pl. 102 (1767).

Diffuse or prostrate herbs; branches spreading, covered with long adpressed hairs. Leaves unifoliolate, obovate or elliptic-oblong, subcordate base, obtuse to mucronate at apex, glabrous or sparsely hairy, petiolate, stipulate. Flowers in 4-10 flowered dense axillary racemes; corolla pink to violet. Pods 3-7-jointed, moniliform, turgid, with hooked hairs. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2106.

Butea monosperma (Lam.) Taub., Nat. Pflanzenfam. [Engler & Prantl] 3 (3): 366 (1894); Maheshw. Fl. Delhi 130 (1963); *Erythrina monosperma* Lam., Encycl. [J. Lamarck & al.] 1(2): 391 (1785).

Trees. Leaves trifoliolate, leaflets coriaceous, terminal. Flowers bright orange-red, hysteranthous. Pods pendulous, pubescent. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2044.

Cassia fistula L., Sp. Pl. 1: 377. (1753); Maheshw. Fl. Delhi 142 (1963).

Medium sized trees, hysteranthous. Leaves paripinnate. Flowers yellow. Pods long, cylindrical, dark brown or blackish, indehiscent, pendulous. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2039.

Desmodium gangeticum (L.) DC., Prodr. [A. P. de Candolle] 2: 327 (1825); *Hedysarum gangeticum* L., Sp. Pl. 2: 746. (1753).

Erect recumbent, undershrubs. Leaves elliptic to oblong. Inflorescence raceme; flowers lavender. Pods indehiscent, dented on lower suture, pubescent. ABWS,

20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2071.

Indigofera cordifolia B. Heyne ex Roth, Nov. Pl. Sp. 357. (1821).

Diffuse copiously branched, annual pubescent herbs. Leaves simple, broadly ovate, cordate, obtuse at apex. Flowers in dense, sessile 4-8 flowered heads. Corolla bright red, standard spatulate. Pods oblong, densely pubescent, 2-seeded, rarely 1-seeded. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2108.

Indigofera linifolia (L.f.) Retz., Observ. Bot. (Retzius) 4: 29. (1786); *Hedysarum linifolium* L.f., Suppl. Pl. 331 (1782).

Prostrate or erect annual branched herbs. Leaves simple, linear to oblong-lanceolate, acute apex. Flowers in dense, axillary, racemes. Calyx linear. Corolla bright-red, longer than calyx. Pods globular, apiculate, appressed white tomentose, 1-seeded. Seeds globular. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2110.

Indigofera linnaei Ali, Bot. Not. 111: 549. (1958).

Annual or perennial herbs, trailing, branched, slender, pubescent. Leaves imparipinnate; leaflets 5-9, sub-sessile, oblong-obovate, appressed pubescent. Flower axillary, racemes subcapitate. Corolla exerted, red; standard obovate. Pod 2 seeded. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2066.

Leucaena leucocephala (Lam.) de Wit, Taxon 10: 54 (1961); Maheshw. Fl. Delhi 146 (1963); *Mimosa leucocephala* Lam., Encycl. [J. Lamarck & al.] 1(1): 12 (1783).

Moderate sized trees. Leaves bi-pinnate, leaflets 10-20 pairs, opposite. Flowers whitish-creamy. Pods flat, brown, shining. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2047.

Pithecellobium dulce (Roxb.) Benth., London J. Bot. 3: 199 (1844); Baker in Hook.f. Fl. Brit. India [J.D.Hoker] 2:302 (1878); Maheshw. Fl. Delhi 152 (1963); *Mimosa dulcis* Roxb., Pl. Coromandel 1(4): 67. t. 99 (1798).

Large thorny trees. Leaves bi-pinnate, leaflets 2. Flowers yellow or white, in globose, axillary heads. Pod spirally twisted, reddish brown. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2023.

Pongamia pinnata (L.) Pierre, Fl. Forest Cochinch. sub t. 385 (1899); Maheshw. Fl. Delhi 135 (1963); *Cytisus pinnatus* L., Sp. Pl. 2: 741 (1753).

Moderate sized trees. imparipinnate leaves, a solitary terminal leaflet. Flowers small, fragrant, lilac-rose, or white-creamish. Pods woody. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2045.

Prosopis juliflora (Sw.) DC., Prodr. [A. P. de Candolle] 2: 447 (1825); Maheshw. Fl. Delhi 145 (1963); *Mimosa juliflora* Sw., Prodr. [O. P. Swartz] 85 (1788).

Medium sized deciduous trees. Leaves bi-pinnate, spines in pairs, straight, strong, arise from leaf axils. Flowers pale yellow. Pods flat, pendulous. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2046.

Senna occidentalis (L.) Link, Handbuch [Link] 2: 140 (1829); *Cassia occidentalis* L., Sp. Pl. 1: 377 (1753).

Erect branched, undershrub. Leaves paripinnate, ovate to lanceolate. Flowers yellow. Pods pubescent. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2025.

Tephrosia purpurea (L.) Pers., Syn. Pl. [Persoon] 2 (2): 329 (1807); Maheshw. Fl. Delhi 121 (1963); *Cracca purpurea* L., Sp. Pl. 2: 753 (1753).

Suberect woody herbs. Leaves bi-pinnate, obovate, pubescent. Flowers purple. Pods curved at tips. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2014.

Tephrosia villosa (L.) Pers., Syn. Pl. [Persoon] 2 (2): 329 (1807); *Cracca villosa* L., Sp. Pl. 2: 752 (1753).

Annual or perennial bushy herbs. Leaves imparipinnately compound with 7-19 leaflets, stipules tomentose, caducous, lanceolate. Flowers in a terminal or axillary pseudoracemes. Pods curved. Seeds 12-16, rectangular, black, smooth. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2065.

LAMIACEAE

Hyptis suaveolens (L.) Poit., Ann. Mus. Natl. Hist. Nat. 7: 472. t. 29. f. 2. (1806); *Ballota suaveolens* L., Syst. Nat., ed. 10. 2: 1100 (1759).

Erect, strongly aromatic, viscid pubescent herbs. Leaves opposite, ovate, rounded to subcordate at base, acute at apex. Flowers bluish violet, inflorescence verticillaster. Nutlets 2, oblong, pubescent. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2125.

Leucas cephalotes (Roth) Spreng., Syst. Veg., ed. 16 [Sprengel] 2: 743 (1825); *Phlomis cephalotes* Roth., Nov. Pl. 262 (1821).

Annual, erect, pubescent herbs. Stem erect, branched. Leaves ovate to elliptic-lanceolate, cuneate, crenate – serrate, acute at apex. Flowers white, sessile, in globose many flowered, dense whorls. Calyx tubular, straight, hairy above nutlets, Corolla annulate. Nutlets obovoid, smooth, brown. ABWS, 06 December 2015, AK Pandey & DS Meena 2111.

Ocimum sanctum L., Mant. Pl. 1: 85 (1767).

Erect much branched undershrubs, pubescent. Leaves elliptic oblong, obtuse or acute at apex, pubescent. Flowers purplish-white, dorsal lip pubescent from dorsal surface. Nutlets broadly ellipsoid, yellow with black margins, glabrous. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2126.

MALVACEAE

Abutilon indicum (L.) Sweet, Hort. Brit. [Sweet] 1: 54 (1826); *Sida indica* L., Cent. Pl. 2: 26 (1756).

Erect under shrubs. Leaves ovate to sub-orbicular, acute at apex, dentate, densely pubescent. Flowers yellow, axillary, solitary. Fruit schizocarp, globular, mericarp reniforms. Seeds 2-3 per mericarp. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2127.

Malvastrum coromandelianum (L.) Garcke, Bonplandia (Hannover) 5(18): 295 (1857); Maheshw. Fl. Delhi 73 (1963); *Malva coromandeliana* L., Sp. Pl. 2: 687 (1753).

Branched stout herbs. Leaves ovate-lanceolate, crenate-serrate. Flowers yellow. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2009.

Pavonia zeylanica (L.) Cav., Diss. 3, Tertia Diss. Bot. 134. (1787); *Hibiscus zeylanicus* L., Sp. Pl. 2: 697 (1753).

Erect pubescent, highly branched herbs. Leaves variable, upper leaves generally lanceolate, lower ones lobed, lobes oblong or obovate. Flowers solitary, pink. Fruit is velvety, spherical. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2112.

Sida acuta Burm.f., Fl. Ind. (N. L. Burman) 147 (1768).

Annual herbs or undershrubs. Stem pubescent. Leaves simple, lanceolate to linear, elliptic or ovate-oblong, serrate, acute at apex, stellately hairy. Flowers yellow, axillary, solitary or in clusters. Calyx campanulate. Corolla obovate-cuneate, obliquely truncate at apex. Fruits schizocarp, tetrahedral; seeds dark brown. ABWS,

05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2109.

Sida cordifolia L., Sp. Pl. 2: 684 (1753); Maheshw. Fl. Delhi 75 (1963).

Herbs or small diffuse branched shrubs. Leaves ovate, cordate, crenate-serrate. Flowers bisexual, pale yellow. Fruit a sub-globose schizocarp. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2013.

Urena sinuata L., Sp. Pl. 2:692 (1753).

Erect subshrubs. Stem and branches densely pubescent. Leaves palmate, deeply lobed, nerves prominent, glandular, with stellate trichomes. Flowers pink, clustered. Carpels armed with hooked bristles. Fruit is schizocarp, globose. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2113.

MORACEAE

Ficus benjamina L. var. *nuda* (Miq.) Barrett, Amer. Midl. Naturalist 45 (1): 128 (1951). *Ficus benjamina* var. *comosa* King, Ann. Roy. Bot. Gard. (Calcutta) 1: 44 (1888); Maheshw. Fl. Delhi 324 (1963).

Small to medium sized evergreen trees. Leaves coriaceous, smooth, shining, elliptic-ovate. Receptacles orange yellow; male, female and gall flowers in the same receptacle. Achenes ovoid-reniform. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2049.

Morus alba L., Sp. Pl. 2: 986 (1753); Hook.f. Fl. Brit. India [J.D.Hooker] 5: 492 (1888); Maheshw. Fl. Delhi 328 (1963).

Trees. Leaves crisped hairy, broadly ovate, serrate-dentate or lobed. Flowers monoecious; male spikes catkin and longer than female. Fruits white or dark purple. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2048.

NYCTAGINACEAE

Boerhavia diffusa L., Sp. Pl. 1: 3 (1753).

Diffuse branched herbs. Leaves ovate or elliptic-lanceolate, acute or obtuse at apex, undulate along margins. Flowers pink, sessile or very short pedicellate. Fruit obovoid or sub-ellipsoid, rounded above, slightly cuneate, below, broadly and bluntly 5-ribbed, glandular. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2128.

Bougainvillea glabra Choisy, Prodr. [A. P. de Candolle] 13(2): 437 (1849).

Evergreen, climbing shrubs with thorny stems. Leaves dark green, alternate, simple, ovate, acuminate at apex. Flowers white, bracts pink, papery. Achenes narrow, five-lobed. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2122.

OXALIDACEAE

Oxalis corniculata L., Sp. Pl. 1: 435 (1753).

Prostrate, procumbent, pubescent herbs. Leaves trifoliate, cuneate-obovate, glabrous. Flowers axillary, solitary. Calyx pubescent. Capsule linear-oblong, shortly beaked, tomentose. Seeds brown, ovoid numerous. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2111.

PEDALIACEAE

Sesamum indicum L., Sp. Pl. 2: 634 (1753).

Aerial, erect, robust and pubescent herbs. Leaves compound, lobed, broadly ovate to linear-oblong. Flowers pink, drooping, solitary. Capsule erect, 4 locules with many seeds. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2067.

PLUMBAGINACEAE

Plumbago zeylanica L., Sp. Pl. 1: 151 (1753).

Sprawling shrubs with striate stem. Leaves thin, ovate. Flowers in spiciform racemes, white; calyx densely glandular. Capsules oblong. ABWS, 18 October 2014, AK Pandey, MD Dwivedi & DS Meena 2083.

POACEAE

Bambusa bambos (L.) Voss., Vilm. Blumengärtn., ed. 3. 1: 1189 (1895); *Arundo bambos* L., Sp. Pl. 1:81 (753).

Shrubby or arborescent plants with stout rootstocks. Leaves flat, lanceolate, with parallel venation. Flower once in 80-100 yrs. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2037.

Bothriochloa pertusa (L.) A. Camus, Ann. Soc. Linn. Lyon, sér. 2, 76 (1930): 164 (1931); Maheshw. Fl. Delhi 394 (1963); *Holcus pertusus* L., Mant. Pl. Altera 301 (1771).

Perennial herbs. Leaves linear. Racemes sub-digitately fasciculate, silky, whitish or dull, sessile spikelets pedicelled, not awned. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2058.

Bromus hordeaceus L., Sp. Pl. 1: 77 (1753).

Annual or biennial grass, grow in tufts, sometimes singly. Leaves grey-green, linear, velvet-hairy on both surfaces, ligules are flat and toothed, panicles are grey-green to purple. The spikelets awned. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2086.

Cenchrus ciliaris L., Mant. Pl. Altera 2: 302 (1771); Maheshw. Fl. Delhi 377 (1963).

Tufted, decumbent, much-branched perennial grass. Leaves linear. Racemes purplish, spikelets oblong-lanceolate. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2051.

Cenchrus setigerus Vahl., Enum. Pl. [Vahl] 2: 395 (1805); Maheshw. Fl. Delhi 377 (1963).

Annual tufted grass with erect stems, nodes knotted. Leaves linear-lanceolate. Racemes solitary, cylindric. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2052.

Chrysopogon fulvus (Spreng.) Chiov., Fl. Somalia 1: 327 (1929); Maheshw. Fl. Delhi 401 (1963); *Pollinia fulva* Spreng., Neue Entdeck. Pflanzenk. 2: 93 (1821).

Perennial grass. Raceme solitary, oblique at tip, creamish to brownish. Awns small, unequal, hairy. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2015.

Cynodon dactylon (L.) Pers., Syn. Pl. [Persoon] 1: 85 (1805); Maheshw. Fl. Delhi 390 (1963); *Panicum dactylon* L., Sp. Pl. 1: 58 (1753).

Perennial grass. Leaves linear, acuminate. Spikelets laterally compressed, glumes boat shaped. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2050.

Desmostachya bipinnata (L.) Stapf, Fl. Cap. (Harvey) 7 (4): 632 (1900); Maheshw. Fl. Delhi 395 (1963); *Briza bipinnata* L., Syst. Nat., ed. 10. 2: 875 (1759).

Perennial tall grass. Leaves linear to linear-lanceolate. Panicles narrowly pyramidal or columnar reddish-brown or brown, spikelets sessile. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2056.

Eleusine indica (L.) Gaertn., Fruct. Sem. Pl. 1: 8 (1788); *Cynosurus indicus* L., Sp. Pl. 1: 72 (1753).

Annual tufted grass branched from the base. Leaf blades flat or sometimes folded. Spikes mostly 2-6, florets closely imbricate, dark green, disarticulating at maturity, glumes in 2 rows, on one side of the flattened

rachis. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2090.

Imperata cylindrica (L.) P. Beauv., Ess. Agrostogr. 165, 166, t. 5, f. 1 (1812); Maheshw. Fl. Delhi 381 (1963); *Lagurus cylindricus* L., Syst. Syst. Nat., ed. 10. 2: 878 (1759).

Erect, slender grass, with creeping, stoloniferous, rootstocks. Leaves linear, flat, acuminate, fruiting panicles silvery white, spikelets lanceolate. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2057.

Paspalum distichum L., Syst. Nat., ed. 10. 2: 855 (1759).

Perennial, rhizomatous herbs, stolons forming mat, culms erect. Leaves linear. Racemes 2, terminal; spikelets solitary. Caryopsis elliptic. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2098.

Setaria intermedia Roem. & Schult., Syst. Veg., ed. 15 bis [Roemer & Schultes] 2: 489 (1817); Maheshw. Fl. Delhi 379 (1963).

Annual tufted grass. Leaf ligulate, ciliate linear-lanceolate. Spikelets broadly ovate. Caryopsis ellipsoid. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2053.

Setaria pumila (Poir.) Roem. & Schult., Syst. Veg., ed. 15 bis [Roemer & Schultes] 2: 891 (1817); *Panicum pumilum* Poir., Encycl. [J. Lamarck & al.] Suppl. 4. 273 (1816).

Annual tufted grass. Leaf sheaths 2-5 cm, ligule, linear lanceolate. Panicles spiciform, cylindric, densely flowered, spikelets, 2 mm, ovoid. Caryopsis ovoid-ellipsoid. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2054.

Setaria verticillata (L.) P. Beauv., Ess. Agrostogr. 51, 171, 178 (1812); Maheshw. Fl. Delhi 378 (1963); *Panicum verticillatum* L., Sp. Pl., ed. 2. 1: 82 (1762).

Annual grass. Leaves linear or linear lanceolate. Lower floret sterile, upper one bisexual, elliptic-oblong, plano-convex, coriaceous, stigma purple. ABWS, 28 June 2014, AK Pandey, MD Dwivedi & DS Meena 2055.

PORTULACACEAE

Portulaca grandiflora Hook., Bot. Mag. 56: t. 2885 (1829); Maheshw. Fl. Delhi 71 (1963).

Prostrate herbs. Leaves linear-lanceolate. Flowers rose-purple or pink. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2033.

Portulaca oleracea L., Sp. Pl. 1: 445 (1753).

Prostrate, glabrous, succulent herbs. Leaves oblong to obovate, linear, spatulate. Flowers yellow. Seeds muriculate. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2072.

Portulaca pilosa L., Sp. Pl. 1: 445 (1753).

Prostrate to erect herbs. Leaf blades are linear to oblong-lanceolate, terete to hemispheric, acute at apex. Flowers ranges from dark pinkish to purple. Capsules oval. Seeds black. ABWS, 21 September 2014, AK Pandey, MD Dwivedi & DS Meena 2076.

PUTRANJIVACEAE

Putranjiva roxburghii Wall., Tent. Fl. Nepal. 2: 61 (1826); Maheshw. Fl. Delhi 317 (1963).

Evergreen trees. Leaves alternate obliquely elliptic-oblong to ovate. Flowers unisexual. Drupes ellipsoid. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2038.

RHAMNACEAE

Ziziphus mauritiana Lam., Encycl. [J. Lamarck & al.] 3 (1): 319 (1789).

Shrubs or small trees. Branches tomentose. Flowers greenish yellow, axillary in many flowered, sub-umbellate cymes. Drupes yellow to orange. ABWS, 10 May 2014, AK Pandey, MD Dwivedi & DS Meena 2124.

Ziziphus nummularia (Burm.f.) Wight & Arn., Cat. Ind. Pl. 31 (1833); Maheshw. Fl. Delhi 102 (1963); *Rhamnus nummularia* Burm.f. Fl. Ind. (N.L. Burman) 61 (1768).

Thorny bushes or shrubs. Leaves ovate, elliptic or orbicular. Drupes globose, glabrous. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2012.

Ziziphus oenopolia (L.) Mill., Gard. Dict. ed. 8, [textus s.n.] Ziziphus no. 3 (1768); *Rhamnus oenopolia* L., Sp. Pl., ed. 2. 1: 282 (1762).

Straggling shrubs. Leaves simple, ovate to ovate-lanceolate, alternate, stipular spines paired, dimorphic. Flowers minute, green, in subsessile, pubescent, paniculate, axillary, dichotomous cymes. Drupes spherical, black, shining, 2 seeded. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2114.

RUTACEAE

Citrus limon (L.) Burm.f., Fl. Indica 173 (1768); *Citrus medica* L., Sp. Pl. 2: 782 (1753).

Small trees. Leaves ovate, acute at apex, serrulate, petiole winged. Flowers white, axillary, solitary. Fruits yellow when ripened, globose, depressed at apex. Seeds many and variable. Note: Often cultivated for their fruits. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2123.

SIMAROUBACEAE

Ailanthus excelsus Roxb., Pl. Coromandel 1 (1): 24. t. 23. (1795).

Large trees, trunk white. Leaves pinnately compound, leaflets alternate, coarsely and irregularly serrate. Flowers in lax, branched panicles, greenish yellow, glabrous, mostly dioecious. Fruit samara, lanceolate, acute at ends, single seeded. ABWS, 10 May 2015, AK Pandey, MD Dwivedi & DS Meena 2120.

SOLANACEAE

Datura innoxia Mill., Gard. Dict., ed. 8, Datura no. 5 (1768); Maheshw. Fl. Delhi 243 (1963).

Erect herbs. Leaves ovate-lanceolate to broad ovate, calyx persistent, reflexed. Capsule globose, covered with hairy spines. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2010.

Solanum nigrum L., Sp. Pl. 1: 186 (1753).

Erect branched herbs. Leaves sinuate, entire along margins, unequal at base. Flowers drooping, white, in extra axillary cymes. Berries many seeded, turns black on maturity. ABWS, 21 September 2014, AK Pandey, MD Dwivedi & DS Meena 2080.

Solanum surattense Burm.f., Fl. Ind. (N. L. Burman) 57 (1768).

Prickly, prostrate or erect, branched subshrubs. Stem with numerous prickles, large, creamish to yellowish. Leaves pinnately lobed, elliptic to ovate. Flowers in extra axillary cymes, bluish purple. Berries, globose, yellow. Seeds smooth. ABWS, 28 September 2014, AK Pandey, MD Dwivedi & DS Meena 2099.

Solanum virginianum L., Sp. Pl. 1: 187. (1753).

Branched diffuse herbs. Leaves lyrate, membranous. Flowers 2-4 together, globose. Berries smooth, green with white stripes and pitted, turns yellow on ripening. Note: Fruiting throughout the year. ABWS, 14 May 2014, AK Pandey, MD Dwivedi & DS Meena 2028.

ULMACEAE

Holoptelea integrifolia (Roxb.) Planch., Ann. Sci. Nat., Bot., sér. 3, 10: 259 (1848).; *Ulmus integrifolia* Roxb., Pl. Coromandel 1(3): 56. (1796).

Large deciduous trees, growing up to 18 m tall. Bark grey, covered with blisters, peeling in corky scales on old trees. Leaves alternate, elliptic-ovate, entire along margins. Flowers greenish-yellow to brown, small, pubescent, borne in short racemes or fascicles at the scars of fallen leaves. Samara, membranous, net-veined. Seeds flat. ABWS, 12 April 2015, AK Pandey, MD Dwivedi & DS Meena 2119.

VERBENACEAE

Lantana camara L., Sp. Pl. 2: 627 (1753).

Aromatic shrubs. Leaves ovate to ovate-lanceolate, margin serrate. Flowers variously coloured, generally orange, pink and yellow. Fruits drupeaceous. ABWS, 18 April 2014, AK Pandey, MD Dwivedi & DS Meena 2022.

Lantana montevidensis (Spreng.) Briq, Annuaire Conserv. Jard. Bot. Genève 7-8: 301 (1904); *Camara montevidensis* Kuntze, Revis. Gen. Pl. 3 [3]: 250 (1898).

Annual shrubs. Leaves lightly-hairy green, strongly-scented, ovate to lanceolate. Flowers white. Fruit drupe. ABWS, 20 September 2014, AK Pandey, MD Dwivedi & DS Meena 2062.

ZYGOPHYLLACEAE

Tribulus terrestris L., Sp. Pl. 1: 387. (1753).

Perennial herbs. Stem usually prostrate, form flat patches. Leaves pinnately compound, opposite. Flowers axillary, solitary, yellow, petals five. Fruits globose with 5 wooly mericarps. Spines lateral. Seeds many. ABWS, 05 April 2015, AK Pandey, MD Dwivedi & DS Meena 2115.

Conclusion

This is the first attempt to enumerate the shrubby and herbaceous taxa within the Asola Bhatti Wildlife sanctuary with the aim of helping to conserve the native flora of the sanctuary. We have provided information on basionyms, relevant synonyms and publication details for 100 taxa. During our investigation we saw people searching for fire wood, grazing by goats and cattle and presence of very few park officials.

Asola Bhatti Wildlife sanctuary is the only sanctuary situated in the Aravalli Hills in the Delhi region. The sanctuary serves as the green lungs of Delhi and acting as carbon sink for the national capital. The sanctuary has been in news for illegal mining of stones in the Bhatti regions and illegal encroachments within the

sanctuary (Mohan, 2005). The sanctuary houses a wide range of flora and fauna which are greatly affected by these activities and it is of prime concern to protect and conserve the wildlife and its environment.

Although these activities affect the flora of the region, the awareness and educational programme by Conservation Education Centre (CEC Delhi) and the officials of the sanctuary are creating new awareness and opportunities in ecotourism, educating college and school children. This effort will add to the educational potential of the park.

Acknowledgements

Partial local travel support by the Bombay Natural History Society is thankfully acknowledged. Authors are thankful to Prof. Arun. K. Pandey, Department of Botany, University of Delhi for critically going through the MS. SK is thankful to CSIR for JRF. Thanks are also due to two anonymous reviewers for their comments which helped in improving the manuscript. We thank Dr Ishtiyak Ahmad, Mr Sohail Madan, Chief Education Officers, and Mr Lakhan their help during the collection trips.

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