BULL. BOT. SURV. INDIA
Vol. 18, Nos. 1-4 : pp. 85-101, 1976

A TAXONOMIC STUDY OF THE GENUS *CASSIA* LINN. IN RAJASTHAN

VIJENDRA SINGH

Botanical Survey of India, Jodhpur

ABSTRACT

Twenty one species of the genus *Cassia* Linn. (Caesalpiniaceae) occur in Rajasthan. The present paper deals with the correct identity, nomenclature and taxonomic status of the taxa. Short diagnostic description of each species has been given along with the ecological notes, local name, flowering and fruiting period, local uses and geographical distribution. More emphasis has been laid on the extra-floral nectaries, number and shape of anthers and on the areole of the seeds. A key for the identification of the taxa is given along with the figures of important plant organs of taxonomic value.

INTRODUCTION

The genus *Cassia* Linn., which originated in south-east Asia, comprises of about 600 species distributed in tropical and subtropical parts of the World (Hutchinson, 1964). The relationship of the taxa in the genus *Cassia* Linn. was first outlined by Breyne (1678, 1689). Subsequent workers like Miller (1754), Gaertner (1791), Moench (1794), Persoon (1805), Roxburgh (1832) etc. have proposed a narrow delimitation of the genus *Cassia* Linn. De Candolle (1825) in his monograph on the genus *Cassia* Linn. adopted a wider generic delimitation which was followed with certain amendments by majority of botanists like Vogel (1837), Miquel (1855), Bentham (1871), Baker (1878), Prain (1897), Greene (1897), Ridley (1922), Corner (1935), Amshoff (1939) etc. Britton and Rose (1930), Steyaert (1950, 1952), de Wit (1955), Brenan (1958, 1967), Chatterjee (1960), Irwin (1964), Irwin and Rogers (1967), Ali and Quraishi (1967), Ali (1973), Ohashi (1975) and Irwin and Barneby (1976) have also made significant contributions towards the classification of the genus *Cassia* Linn. Recently, Panday (1971) has made an attempt towards the taxonomic revision of the Indian species of *Cassia* Linn., but this work is of little taxonomic value.

Considering the importance of the group, the present study was undertaken with a view to provide information on correct identity, nomenclature and taxonomic status of the species of *Cassia* Linn. found in Rajasthan. Besides short diagnostic features, which are generally not available in the existing Indian floras but are of considerable taxonomic value, notes on ecology, local name, flowering and fruiting time, local uses and geographical distribution have been given. The recommendations of Holmgren and Keuken (1974) have been followed regarding the abbreviations for the names of herberia, with the following additions:

1. Botanical Survey of India, Jodhpur (BSJO).
2. Central Arid Zone Research Institute, Jodhpur (CAZRI).

The Flora of British India (Hooker *et al.*, 1878) and the Flora of the Upper Gangetic plain and of adjacent Siwalik and Sub-Himalayan tracts (Duthie, 1903-29) have been abbreviated as FBI and FUGP respectively.

Date of receipt : 6. 1. 77. Date of acceptance : 7. 12. 77

KEY TO THE SPECIES

1. Foliar glands present:
   2. Glands on the petiole always present (glands between the leaflets may or may not be present):
      3. Glands distinctly stalked, peltate ... *C. pumila*
      3. Glands always sessile :
         4. Stamens 4 or 5 ... *C. hochstetteri*
         4. Stamens 7 to 10 :
            5. Rachis winged or serrate. Leaflets 30-60 pairs, not exceeding 10 mm in length. Stamens 10, all fertile ... *C. mimosoides*
            5. Rachis entire. Leaflets not more than 20 pairs, always more than 10 mm long. Fertile stamens 7, three reduced to staminodes:
               6. Leaflets distinctly lanceolate, always acute, never more than 17 mm broad. Bracts obtuse. Pods turgid. Hilum-end of the seeds slightly curved on one side... *C. sophera*
               6. Leaflets ovate-lanceolate, acute or acuminate, always more than 18 mm broad. Bracts very acute. Pods less turgid, comparatively more flattened. Hilum-end of the seeds straight ... *C. occidentalis*
   2. Glands always between the pairs of leaflets (no glands on the petiole) :
      7. Fertile stamens 10 :
         8. Glands between the lowest pair of leaflets only. Leaflets narrowly linear to almost acicular, not more than 2 mm wide ... *C. artemisioides*
         8. Glands between the lower 3 or 4 pairs of leaflets. Leaflets ovate, lanceolate or oblong, always more than 10 mm wide :
            9. Leaflets 4-6 pairs, lanceolate or ovate-lanceolate, 4.5-7 × 2-3 cm. Bracts broadly ovate, acuminate or acute, reflexed. Petals subequal, 2-3 cm long. Pods 10-15 × 1-2 cm, 15 to 30-seeded. Seeds narrowly oblong, 6-7 × 2.5-3 mm. Cotyledons slightly wrinkled. Areole of seeds reticulately veined, without tarnsverse septa ... *C. surattensis*
            9. Leaflets 8-9 pairs, oblong or obovate-oblong, 2-4 × 1.3-2 cm. Bracts narrowly ovate-lanceolate, not reflexed. Petals unequal, 1.5-2 cm long. Pods 5-9 × 1-1.5 cm, 6 to 12-seeded. Seeds obovate, 4-5.5 × 1.5-2 mm. Cotyledons not wrinkled. Areole longitudinally straited, with transverse septa ... *C. suffruticosa*
      7. Fertile stamens 5 or 7, the remaining reduced to staminodes :
         10. Leaflets 2 pairs only ... *C. absus*
         10. Leaflets always more than 2 pairs :
            11. Stipules foliaceous, auricled. Glands between all the pairs of leaflets ... *C. auriculata*
            11. Stipules linear-lanceolate, small. Glands between the lower one or two pairs of leaflets :
               12. Plants glabrous, not foetid. Anthers distinctly margined at the corners. Cultivated shrubs ... *C. pectabilis*
               12. Plants pubescent or hairy, foetid. Anthers not margined at the corners. Indigenous herbs :
                  13. Three large anthers distinctly necked at the apex, the remaining 4 anthers rounded at the apex. Seed-areole slit-like, narrow, not morethan 1 mm wide, never extending upto hilum. Testa slightly muricate, not distinctly veined ... *C. obtusifolia*
                  13. All the 7 anthers rounded at the apex. Seed-areole broad, 1.5-2 mm wide, always extending upto hilum. Testa not muricate, but distinctly veined... *C. tora*

1. Foliar glands on the petiole or rachis absent :
   14. Leaves simple, phyllodineous, often with sessile glands on the margins of lamina ... *C. phyllodinea*
   14. Leaves pinnately compound; leaflets not phyllodineous and are without glands :
      15. Pods with crests or wings on the valves :
         16. Indigenous herbs or undershrubs. Leaflets obovate, not exceeding 4 cm in length. Valves of the pods with crests over the seeds ... *C. italica*
         16. Planted shrubs or small trees. Leaflets oblong, always more than 4 cm long. Valves of the pods with broad wings down the middle of each valve ... *C. alata*
      15. Pods without crests or wings, almost smooth :
         17. Pods cylindric:
            18. Three long filaments with globular swellings in the middle ... *C. nodosa*
            18. Filaments without swellings :
               19. Flowers yellow, in pendulous racemes ... *C. fistula*
               19. Flowers pink, rose-coloured or whitish-pink, in corymbs ... *C. roxburghii*
         17. Pods strap-shaped :
            20. Trees. Bracts 3-lobed. Flowers in panicles. Pods 15-30 cm long, indehiscent. Testa of seeds smooth ... *C. siamea*
            20. Herbs or undershrubs. Bracts linear, entire. Flowers in racemes. Pods 3.5-6 cm long. Testa of seeds transversely wrinkled ... *C. senna*

ENUMERATION

Cassia pumila Lamk. Encycl. Meth. 1: 651. 1785; FBI 2: 266; FUGP 1: 295; de Wit in Webbia 11: 288. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 9. 1967; Ali in Fl. W. Pak. 54: 20. 1973. *C. prostrata* Roxb. Hort. Beng. 32. 1814 nom. nud. (non Humb. & Bonpl. ex Willd. 1809). *Senna prostrata* Roxb. Fl. Ind. 2: 353. 1832.

Plants erect, suberect or prostrate, upto 50 cm high or long. Leaves upto 10 cm long. Leaflets upto 30 pairs, upto 18 × 3.5 mm in size. Glands of the petioles persistant; those on the rachis deciduous or absent. Anthers unequal. Pods upto 4.5 cm long, straight or slightly curved.

Field notes: Common in open wastelands, forests and in grasslands. Good soil binder and useful for soil conservation in the desert. Resembles closely *C. mimosoides* Linn., *C. hochstetteri* Ghesq. and *C. kleinii* Wt. & Arn. in habit. Seeds are used as purgative.

Local name: Karelia.

Flowering and *Fruiting*: August-November.

Distribution: Africa to India, Malay Islands and Australia.

Specimen examined: JODHPUR: *Sharma* 1938 (CAZRI), *Jain* 321, *Purohit* 622, *Chhota Ram* 833 (JAC); Palsana, *Saxena* 3711 (CAZRI); Kailana, *Narayan* 1208 (CAZRI); Balsamand, *Blatter* 7247 (BLAT); Bariganga, *Shetty* 144 (BSJO); PALI: Sojat, *Gour* 1659 (CAZRI); Ramnagar, *Kanodia* 1975 (CAZRI); Takhatgarh, *Narayan* 963 (CAZRI); Chang Chittar, *Shetty* 1800 (BSJO); Merwara, *Duthie* 4644, 4645 under *C. kleinii* Wt. & Arn. (DD); JAISALMER: *Saxena* 4451 (CAZRI); BHARATPUR: Bayana, *Umashankar* 46075 (LWG); KOTA: Darah, *Singh* 83739 (LWG); Puraniya, *Verma* 747 (BSA); TONK: Deoli, *Shetty* 1221 (BSJO), *Maheshwari* 52942 (LWG); JHALAWAR: Bijliya Bhadak, *Wadhwa* 7414 (BSA); Misroli, *Wadhwa* 7660 (BSA); Sarhod, *Wadhwa* 3542 (BSA); UDAIPUR: *Majumdar* 11676 (BSA); BANSWARA: Puna pathar forest block, *Singh* 2930 (BSJO).

Critical notes: Typical *C. pumila* Lamk. has been considered to possess 6 to 25 pairs of leaflets of maximum 13 × 3 mm size and a single stalked, peltate gland on the petiole below the lowest pair of leaflets. An examination of the specimens from Rajasthan shows that the number of leaflets may be more than 25 pairs (upto 30 pairs) of maximum 18 × 3.5 mm size, and in addition to the solitary gland on the petiole, there are similar glands between each pair of leaflets in the young leaves. The older leaves are devoid of such glands. The stalks of the rachis-glands, unlike those found on the petioles, are very weak and hence soon fall off (*Shetty* 1800; *Kanodia* 1975; *Singh* 2930). This led the author to examine more plants from the adjoining regions and it was observed that there are many intermediate forms with regard to the number and the size of leaflets. The presence of rachis-glands is also quite a common phenomenon in this species, but as they soon fall down, it was not noted by earlier workers. Further, Deflers (1889) had recognised a variety *yemensis* Defl., endemic to Wasil, under *C. pumila* Lamk. (Blatter, 1919-36). The original material and description of var. *yemensis* Defl. are not in the hand of the present author; hence, it is not possible to comment upon it. But, in the light of present observations, an amendment in the diagnosis of *C. pumila* Lamk. seems essential and it is presented above.

C. hochstetteri Ghesq. in Bull. Jard. Bot. Brux. 9: 155. 1932; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 9. 1967; Brenan in Fl. Trop. East Afr. (Leguminosae) Part 2: 96. 1967; Ali in Fl. W. Pak. 54: 21. 1973. *C. dimidiata* Roxb. Hort. Beng. 32. 1814 nom. nud. (non Ham. ex D. Don, 1825); FUGP 1: 295. *C. nic-*

titans Hochst. ex Oliv. Fl. Trop. Afr. 2: 28. 1771 (non Linn. 1753). *Senna dimidiata* Ham. ex Roxb. Fl. Ind. 2: 352. 1832 (non *C. dimidiata* Ham. ex D. Don, 1825). *C. mimosoides* L. var. *dimidiata* (Ham. ex Roxb.) Baker in Hook. f. Fl. Brit. Ind. 2: 266. 1878. *C. sparsa* Steyaert in Bull. Jard. Bot. Brux. 21: 359. 1951 pro parte.

Plants covered with long, white, spreading hairs. Leaflets 20-30 pairs, oblong-lanceolate, ciliolate, apiculate, oblique-based. Glands sessile, oblong, just beneath the lowest pair of leaflets on the petioles. Flowers yellow, 1-4 in the axils of leaves; anthers dehiscing by apical pores. Pods flat, straight, hairy, 4-6 mm wide, 4 to 15-seeded. Seeds rhomboid, 2-3 × 1.5-2.5 mm, smooth; areole absent; testa dotted.

Field notes: Common on the gravelly soils among grasses, particularly in hilly tracts; poorly represented in the desert area. The species is outstanding in having only half the number of usual number of stamens; otherwise it resembles closely the other members of *C. mimosoides* L. group.

Local name: Ikrar.

Flowering and *Fruiting*: August-November.

Distribution: Africa, Pakistan, India, Burma, China, Japan, Abyssinia.

Specimen examined: JODHPUR: *Sharma* 28 (JAC); SIROHI: Mt. Abu, *Blatter* 12013, 12370, 12315, 12346, 12324 (BLAT); Turumal, *Blatter* 12560 (BLAT).

C. mimosoides Linn. Sp. Pl. 1: 379. 1753; FBI 2: 266; FUGP 1: 296; de Wit in Webbia 11: 283. 1955; Brenan in Fl. Trop. East Afr. (Leguminosae) Part 2: 100. 1967. *C. sensitiva* Roxb. Hort. Beng. 32. 1814 nom. nud. *C. tenella* Roxb. Hort. Beng. 32. 1814 nom. nud. *C. roxburghiana* Grah. in Wall. Cat. 5323. 1831-32. *C. amoena* Ham. in Wall. Cat. 5321. 1831-32. *Senna sensitiva* Roxb. Fl. Ind. 2: 353. 1832. *S. tenella* Roxb. Fl. Ind. 2: 354. 1832.

Leaves 8-10 cm long. Rachis winged between the pairs of leaflets. Glands sessile, disc-shaped, situated near the top of petioles. Four stamens longer than the remaining six, all dehiscing by terminal pores. Stigma truncate. Pods 2.5-5 cm long, 18 to 25-seeded.

Field notes: Occasionally found in the forests among grasses, prefers wet habitats in the eastern half of the State. Most of the specimens reported under *C. mimosoides* L. from Rajasthan actually belong to *C. hochstetteri* Ghesq. The Japanese cultivate this species for making a tea from its leaves.

Local name: Ikrar.

Flowering and *Fruiting*: August-November.

Distribution: Tropics of Old world, chiefly in India, Ceylon and Malay peninsula. Reported from America also, but not included by Britton and Killip in Ann. N. Y. Acad. Sci. 35: 187. 1936.

Specimen examined: KOTA: Shahabad, *Majumdar* 13122 (BSA); CHITTOR: Bansi, *Majumdar* 12340 (BSA).

Critical notes: Baker (1878) distinguished three varieties under *C. mimosoides* Linn. *viz.*, var. *dimidiata* (Ham. ex Roxb.) Baker, var. *wallichiana* (DC.) Baker and var. *auricoma* (Grah. ex Benth.) Baker. He considered *C. leschenaultiana* DC. as a synonym of his variety *wallichiana*. Prain (1897) pointed out that variety *wallichiana* (DC.) Baker consists of two distinct elements, one is var. *wallichiana* (DC.) Baker and the other is *C. leschenaultiana*. He advocated the separation of latter as a species. Recently Ghesque (1932) described the species *C. hochstetteri* Ghesq., which is the same as var. *dimidiata* (Ham. ex Roxb.) Baker. Steyaert (1950) raised vars. *wallichiana* and *auricoma* to the rank of species *C. wallichiana* DC. and *C. auricoma* (Grah. ex Benth.) Stey. respectively. Subsequently, de Wit

(1955) reduced *C. auricoma* (Grah. ex Benth.) Stey. to the status of a variety and transferred it to *C. leschenaultiana* DC. Ali and Quraishi (1967) transferred *C. auricoma* (Grah. ex Benth.) Stey. to *C. wallichiana* DC. as its variety. Ohashi (1975) considered *C. wallichiana* DC. as conspecific with *C. mimosoides* Linn., and *C. leschenaultiana* DC. as a subspecies of the latter and *C. auricoma* (Grah. ex Benth.) Stey. as a variety under *C. mimosoides* Linn. subsp. *leschenaultiana* (DC.) Ohashi.

The treatment given by Ali & Quraishi (1967) is satisfactory and may be used for classifying the Indian material of *C. mimosoides* L. group.

C. sophera Linn. Sp. Pl. 1: 379. 1753; FBI 2: 262-63; FUGP 1: 293; de Wit in Webbia 11: 265. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 11. 1967; Brenan in Fl. Trop. East Afr. (Legum.) Part 2: 78. 1967; Ali in Fl. W. Pak. 54: 27. 1973. *C. frutescens* Mill. Gard. Dict. ed 8. no. 2. 1768. *C. esculenta* Roxb. Hort. Beng. 31. 1814 nom. nud. *Senna esculenta* Roxb. Fl. Ind. 2: 346. 1832. *S. sophera* (L.) Roxb. Fl. Ind. 2: 347. 1832. *Cassia atropurpurea* Span. ex Benth. in Trans. Linn. Soc. 27: 533. 1871. (err. pro. *C. atroviridis* Span.).

Leaflets 4-10 pairs, lanceolate or oblong-lanceolate, acute. Glands linear-clavate, near the base of petioles. Racemes almost umbellate. Pods turgid, linear, 5-10.5 × 0.6-1.3 cm, septate. Seeds laterally compressed, lying at right angle of the long axis of pod, 4-4.5 × 3-3.5 mm; areole 1.5-2 × 1 mm, reticulately veined like testa.

Field notes: Rare; found in wastelands, often forming a dense community. Resembles closely *C. occidentalis* Linn. The bark, leaves and seeds are used in skin diseases, particularly in the treatment of ringworm.

Local name: Kasunda, Kasundi.

Flowering and *Fruiting*: August-January.

Distribution: Native of Tropical Asia or America; naturalized in India, Malaysia, Ceylon, Philippines, Pakistan, Africa etc., and cultivated in many countries.

Specimen examined: KOTA: Baran, *Singh* 90494 (LWG); UDAIPUR: *Kaul* 8579 (LWG), *Verma* 5 (BSA), *Majumdar* 10381 (BSA); BARMER: *Tiwari* 969 (BSJO); SIKAR: *Bhardwaja* 29721 (LWG); JHALAWAR: Asnawar, *Wadhwa* 6912 (BSA).

Critical notes: *C. sophera* L. is very similar and closely related to *C. occidentalis* L. The difficulty in distinguishing the two was discussed long ago by Bentham (1871). The narrow and more raised petiolar glands and more numerous pairs of leaflets have been chiefly used for distinguishing *C. sophera* L. from *C. occidentalis* L. But the present study revealed that there are many intermediate forms which break up these distinguishing characters. Brenan (1967) has also reported such forms from East tropical Africa. This group needs further study on world basis. I have followed the earlier workers as regards the taxonomic status of these two species and characters considered best to the knowledge of the author have been used for distinguishing these two species in the key.

C. occidentalis Linn. Sp. Pl. 1: 377. 1753; FBI 2: 262; FUGP 1: 292; de Wit in Webbia 11: 256. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 7. 1967; Brenan in Fl. Trop. East. Afr. (Legum.) Part 2: 78. 1967; Ali in Fl. W. Pak. 54: 17. 1973. *C. planisiliqua* Linn. Sp. Pl. 1: 377. 1753 nom. conf. *C. foetida* Pers. Syn. Pl. 2: 457. 1805. *Senna occidentalis* (L.) Link, Handb. 2: 140. 1831. *S. occidentalis* (L.) Roxb. Fl. Ind. 2: 343. 1832 (non Link, 1831). *Cassia sophera* Wall. Cat. 5317. 1831-32 in part (non Linn. 1753). *C. occidentalis* L. var. *aristata* Hassk. Pl. Jav. Rar. 405. 1848 (non DC. 1825).

Leaflets 3-6 pairs, usually acuminate. Glands ovoid or subglobose, at the base of

petioles and rarely between the lowest pair of leaflets also. Smaller 4 or 5 anthers straight, with small basal appendages. Stigma plumose on one lateral side. Seeds ovoid or obovoid, 3-5 × 2-4 mm, laterally compressed; areole 2.5 × 1.5 mm, transversely veined.

Field notes: Common in wastelands, particularly near habitations. The plants are very foetid, often strongly tinged with purple, varying in number and size of leaflets and in pubescence. The colour of flower is wrongly given as 'pale-lilac' in Fl. Brit. Ind. 2: 262. 1878. It is always yellow. Leaves are used in foot and mouth disease of cattle. Roots and seeds are purgative, but useful in whooping cough. Roasted seeds are used as a substitute for coffee in Africa and Arabia.

Local name: Talka, Chakundra.

Flowering and *Fruiting*: August-November.

Distribution: Native of South America; introduced into India long before 1824. Also naturalized in Africa, Arabia, Pakistan, Burma and Malaysian Peninsula.

Specimen examined: KOTA: *Singh* 90514 (LWG); JODHPUR: *Bhandari* 544 (JAC); PALI: *Bhandari* 23 (JAC), *Shetty* 1905 (BSJO); BARMER: *Bhandari* 232 (JAC); UDAIPUR: *Ramchandra* 53183 (LWG); SIROHI: Pachali, *Narayan* 341 (CAZRI); Abu Rd., Kaul 9390 (LWG).

Critical notes: Bailey (1949), Grisebach (1864) and Britton and Rose (1930) considered *C. planisiliqua* Linn. as a valid name for the present *C. surattensis* Burm. f. The specimen representing *C. planisiliqua* L. in Linnaean herbarium is the present *C. siamea* Lamk., which is not certainly the specimen on which Linnaeus based his diagnosis of *C. planisiliqua*. The Linnaean diagnosis given in Species plantarum refers best to *C. occidentalis* Linn. (Chatterjee, 1960).

C. artemisioides Gaudich. ex DC. Prodr. 2: 495. 1825; Townsend in Fl. Iraq 3: 20. 1974.

Shrubs, upto 2 m high, clothed with white pubescence. Leaflets 3-4 pairs, narrowly linear to almost acicular, grooved above, 20-40 × 1-2 mm. Glands club-shaped. Flowers yellow, in axillary corymbs. Sepals obtuse, hairy outside. Pods flat, glabrous.

Field notes: Rarely planted in the gardens for ornamental purposes. The plants thrive well in dry sandy soils of the desert area.

Flowering and *Fruiting*: January-April.

Distribution: Native of Australia. Planted in many countries.

Specimen examined: JODHPUR: Central Arid Zone Research Institute, *Singh* 2248, 2464 (BSJO).

C. surattensis Burm. f. Fl. Ind. 97. 1768; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 11-12. 1967; Ali in Fl. W. Pak. 54: 29. 1973. *C. glauca* Lamk. Encycl. Meth. 1: 645. 1785; FBI 2: 262; FUGP 1: 292. *C. arborescens* Vahl, Symb. Bot. 3: 56. 1794 (non Mill. 1768). *C. discolor* Desv. Journ. Bot. 3: 73. 1814. *C. sulphurea* DC. Prodr. 2: 495. 1825. *Senna arborescens* Roxb. Fl. Ind. 2: 345. 1832.

Rachis terete. Leaflets obtuse or retuse. All anthers identical in shape, slightly margined laterally; tips of anthers straight or slightly reflexed. Pods flat, pale green at maturity, irregularly constricted between the seeds. Seeds blackish-brown, narrowed towards base.

Field notes: Occasionally planted in the gardens for ornamental purposes. It is a quick growing tree, thrives well in comparatively fertile soils and produces flowers when about 1 m high.

Flowering and *Fruiting*: October-January.

Distribution: Native of South-East Asia, chiefly of Malay Peninsula, Sumatra, Java, Australia etc. Planted in many countries.

Specimen examined: JODHPUR: Central Arid Zone Research Institute, *Singh* 2453 (BSJO).

C. suffruticosa Koen. ex Roth, Nov. Pl. Sp. 213. 1821 ; in DC. Prodr. 2: 496. 1825. *Senna speciosa* Roxb. Fl. Ind. 2: 347. 1832. *Cassia horsfieldii* Miq. Fl. Ind. Bot. 1: 99. 1855. *C. acclinis* F. Muell. Fragm. 4: 13. 1864. *C. glauca* Lamk. var. *suffruticosa* (Koen. ex Roth) Baker in Hook. f. Fl. Brit. Ind. 2: 265. 1878 ; FUGP 1: 292. *Psilorhegma suffruticosa* (Koen. ex Roth) Britton in North Am. Fl. 23: 255. 1930. *Cassia surattensis* Burm. f. var. *suffruticosa* (Koen. ex Roth) Chatterjee in Journ. Bomb. nat. Hist. Soc. 57 (3): 695-698. 1960; Ali in Fl. W. Pak. 54: 29. 1973.

Uppermost pair of leaflets largest, gradually smaller downwards. Glands oblong or slender. Flowers 1.5-2.5 cm in diameter. Large anthers not more than 4.5 mm in length. Tips of all anthers reflexed outwards. Pods black at maturity.

Field notes: Commonly planted in the gardens for ornamental purposes. Plants thrive well in the fertile soils. Plantations in the desert area are not successful. Flowers are produced when about 2 m high. Wadhwa collected it from the bank of Aklera river where it was apparently indigenous.

Flowering and *Fruiting*: September-February.

Distribution: Indigenous throughout tropics, particularly in south-east Asia. Planted in many countries.

Specimen examined: KOTA: *Singh* 90175, 90288 (LWG); BHARATPUR: *Singh* 2461 (BSJO); JHALAWAR: Aklera river bank, *Wadhwa* 7610 (BSA).

Critical notes: It would have been unnecessary to discuss the nomenclatural problem of *C. glauca* Lamk. and *C. surattensis* Burm. f., as there is unaminity of opinion regarding accepting the validly published name *C. surattensis* Burm. f. for *C. glauca* Lamk. But, unfortunately, a quite distinct taxon named *C. suffruticosa* Koen. ex Roth has been wrongly interpreted as conspecific with *C. surattensis* Burm. f. (Bentham, 1871 ; Ali and Quraishi, 1967 etc.) or as its variety (Baker, 1878 ; Chatterjee, 1960 ; Ali, 1973). Britton and Rose (1930) placed it under their newly created genus *Psilorhegma* and named it *P. suffruticosa* (Koen. ex Roth) Britton. Fischer (Kew Bull. 1932: 56) examined Koenig's specimens from India, now kept at Lund Herbarium, but did not find any specimen of *C. suffruticosa, C. glauca* or *C. surattensis*. A close study reveals that these two taxa should be considered as two distinct species rather than reducing *C. suffruticosa* Koen. ex Roth as the variety of *C. surattensis* Burm. f.

Further, *C. fastigiata* Vahl (Symb. Bot. 3: 57. 1794) excl. descr. 'glandulis inter ominia paria' probably belongs here as indicated by Wight and Arnott (Prodr. 290. 1834) and Prain (J. As. Soc. Beng. 66: 477. 1897). The original material has not been available to the author and hence, it is not possible to consider *C. fastigiata* Vahl as a valid name for this taxon.

The varietal name *C. glauca* Lamk. var. *suffruticosa* (Koen. ex Roth) Baker has been wrongly ascribed to Prain in Gamble's Fl. Madras (403. 1919) instead of to Baker. Similarly, Ali (1973) has wrongly transferred this variety to *C. surattensis* Burm. f. in 'Flora of West Pakistan' without consulting Chatterjee (1960).

C. absus Linn. Sp. Pl. 1: 376. 1753; FBI 2: 265-66; FUGP 1: 294; de Wit in Webbia 11: 279. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 8. 1967; Brenan in Fl. Trop. East Afr. (Legum.) Part 2: 81. 1967; Ali in Fl.W. Pak. 54: 20. 1973. *C. exigua* Roxb. Hort. Beng. 31. 1814 nom. nud. *Senna absus* (L.) Roxb. Fl. Ind. 2: 340. 1832. *S. exigua* Roxb. Fl. Ind. 2: 340. 1832.

Plants covered with glandular-based viscous hairs. Rachis grooved Leaflets obliquely elliptic or obovate, 2-5 × 1-3 cm. Glands lin-

ear, between both the pairs of leaflets. Flowers yellow or red, in terminal or leaf-opposed, few-flowered racemes. Bracts broadly ovate, acute or acuminate. Bracteoles linear-lanceolate, persistent. Fertile stamens 5 or 7. Ovary silky hairy. Pods 3-5.5 × 0.7-0.8 cm, flat, hairy. Seeds 4-6, compressed, broadly ovoid; areole absent; testa black, pitted.

Field notes: Common from plains to the hills, prefering wet and shady localities. The plants vary in habit, size of leaflets and indumentum. Red and yellow flowers were noted on the same plant. Leaves are used in cough and asthma. Seed are used in eye diseases.

Local name: Chimar, Chiksi.

Flowering and *Fruiting*: August-November.

Distribution: Tropics of old World.

Specimen examined: JAIPUR: Sambhar lake, *Hiralal* 34824 (LWG); KOTA: *Verma* 411 (BSA); Darah, *Singh* 74830, 74867 (LWG); PALI: *Shetty* 1971 (BSJO); JODHPUR: *Singh* 10 (JAC); SIROHI: Mt. Abu, *Blatter* 12343, 13319, 10335, 12057, 12019, 12002 (BLAT); TONK: *Maheshwari* 52996 (LWG); JHALAWAR: Bijliya Bhadak, *Wadhwa* 5329, 7465 (BSA).

Critical notes: *Cassia absus* Linn. has small appendages on the leaf-rachis between the pairs of leaflets which have been considered as g'ands (de Wit, 1955) or eglandular acicular organs (Steyaert, 1950). Brenan (1967) was also confused about the morphology of these appendages. The present study revealed that there are linear, narrow appendages between both the pairs of leaflets. The upper one is persistent, hairy, 1-1.5 mm long, purple or white with purple acute tip; it appears like a mucro of the rachis. The lower one is about 1 mm long, glabrous, with a tuft of hairs at the base on the rachis, soon falls down leaving a small point on the rachis which sometimes takes the shape of a fringed white structure which has been wrongly figured by Brenan (1967) as a gland.

C. auriculata Linn. Sp. Pl. 1: 319. 1753; FBI 2: 263; FUGP 1: 294; de Wit in Webbia 11: 234. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 11. 1967; Brenan in Fl. Trop. East Afr. (Legum.) Part 2: 76. 1967; Ali in Fl. W. Pak. 54: 27. 1973. *Senna auriculata* (L.) Roxb. Fl. Ind. 2: 349. 1832. *Cassia densistipulata* Taub. in P.O.A.C. 200. 1895; Ghesq. in Rev. Bot. Appliq. 14: 244. 1934.

Glands linear, needle-like, pink in upper half. Base of stipules produced into filiform appendages. Bracts ovate, apiculate or acuminate, persistent, with a pair of similar glands in their axils. Veins of petals dichotomously branched. Fertile stamens 7. Seeds ovate-oblong, 5-7 × 4-5 mm, light brown; testa irregularly wrinkled; areole about 3 × 1 mm, transversely veined; cotyledons deeply wrinkled.

Field notes: Comparatively gregarious and abundant on dry sandy soils of the desert than the gravelly soils in the east of Aravallis; often planted in the gardens or in hedges. Bark is a good tanning material and also provides fibre for ropes. Seeds are used in cough and asthma.

Local name: Anwal.

Flowering and *Fruiting*: August-November.

Distribution: Africa to India, Burma, Ceylon and Malay Peninsula. Cultivated in tropics.

Specimen examined: JODHPUR: *Panwar* 66, *Chunila!* 11 (JAC); Central Arid Zone Research Institute, *Singh* 2444 (BSJO); Jaswant College, *Vyas* 13, *Malik* 6 (JAC); Kailana, *Shetty* 417 (BSJO), *Saxena* 2793 (CAZRI); Baringanga, Shetty 129 (BSJO), *Narayan* 324 (CAZRI); UDAIPUR: *Kaul* 8564 (LWG), *Verma* 21 (BSA); JHUNJHUNU: *Puri* 39993 (LWG); SIROHI: Pachali, *Narayan* 341 (CAZRI); Abu Rd., *Kaul* 938 (LWG);

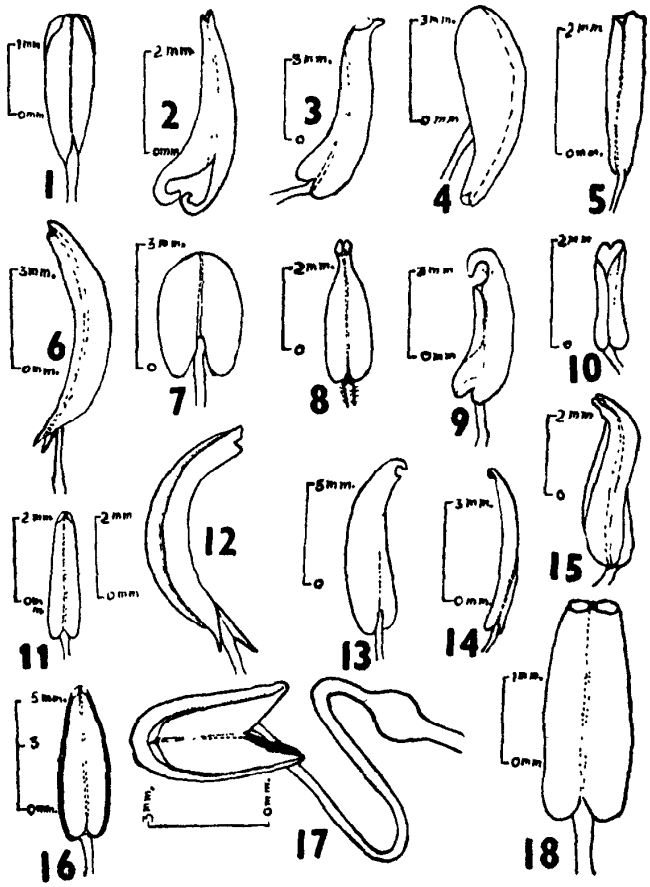

Figure : 1. *Anthers* (Large)
1. *Cassia absus* L. 2. *C. artemisioides* Gaud. ex DC. 3. *C. auriculata* L. 4. *C. fistula* L. 5. *C. hochstetteri* Ghesq. 6. *C. italica* (Mill.) Lam. ex Andrews 7. *C. roxburghii* DC. 8. *C. obtusifolia* L. 9. *C. occidentalis* L. 10. *C. pumila* Lamk. 11. *C. phyllodinea* R. Br. 12. *C. senna* L. 13. *C. siamea* Lamk. 14. *C. spectabilis* DC. 15. *C. suffruticosa* Koen. ex Roth 16. *C. surattensis* Burm. f. 17. *C. nodosa* Buch.-Ham. ex Roxb. 18. *C. tora* L.

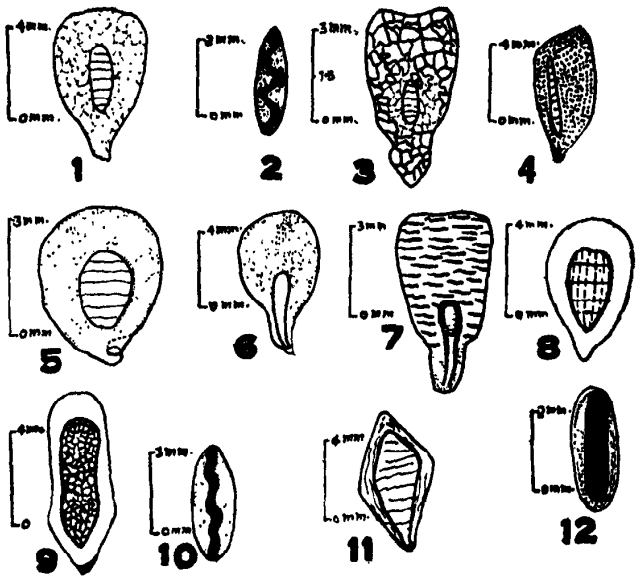

Figure : 2. *Seeds*
1. *Cassia auriculata* L. 2. *C. auriculata* L. (T.S.) 3. *C. italica* (Mill.) Lam. ex Andrews 4. *C. obtusifolia* L. 5. *C. occidentalis* L. 6. *C. phyllodinea* R. Br. 7. *C. senna* L. 8. *C. suffruticosa* Koen. ex Roth 9. *C. surattensis* Burm f.; 10. *C. surattensis* Burm. f. (T.S.) 11. *C. tora* L. 12. *C. suffruticosa* Koen. ex Roth (T.S.).

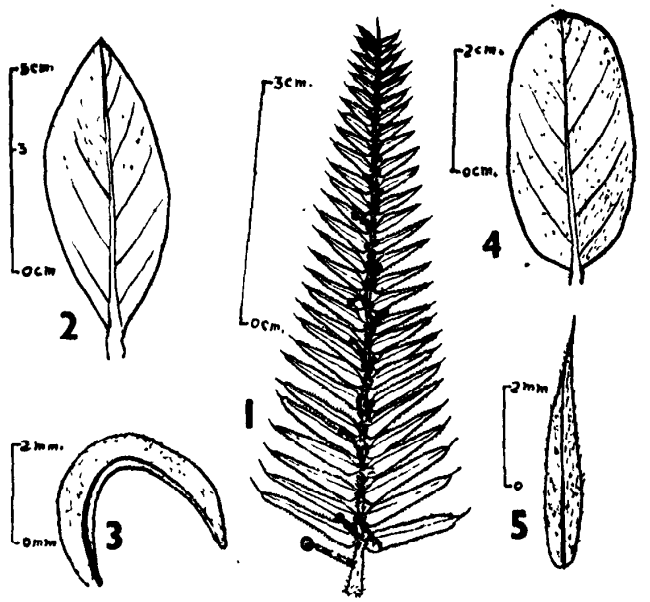

Figure : 3. *Leaves*
1. *Cassia pumila* Lamk. (Leaf showing petiolar and rachis glands) 2. *C. surattensis* Burm. f. (Leaflet) 3. *C. surattensis* Burm. f. (Stipule) 4. *C. suffruticosa* Koen. ex Roth (Leaflet) 5. *C. suffruticosa* Koen. ex Roth (Stipule).

Mt. Abu, *Blatter* 12377 (BLAT); TONK: *Shetty* 550 (BSJO); KOTA: Chhabra, *Singh* 90384 (LWG); BUNDI: *Verma* 1857 (BSA); BANSWARA: *Majumdar* 10238 (BSA).

C. spectabilis DC. Cat. Pl. Hort. Monsp. 90. 1813.

Large shrubs or small trees. Rachis grooved. Leaflets 3 pairs, obovate or rounded, 7-25 × 5-17 mm, glabrous. Glands linear. Flowers yellow, in corymbs. Fertile stamens 7; anthers slightly margined laterally. Ovary glabrous.

Field notes: Occasionally planted in the gardens for ornamental purposes. The plants thrive well in dry sandy soils in the desert area. Flowers usually dry up and soon fall down without producing fruits. Resembles closely *C. tora* Linn. and *C. obtusifolia* Linn. in vegetative phase.

Flowering and *Fruiting*: Most part of the year.

Distribution: Native of Tropical America; cultivated in many countries.

Specimen examined: JODHPUR: Central Arid Zone Research Institute, *Singh* 2450 (BSJO).

C. obtusifolia Linn. Sp. Pl. 1: 377. 1753; FUGP 1: 293; de Wit in Webbia 11: 259. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 7-8. 1967; Brenan in Kew Bull. 13: 248. 1958; Fl. Trop. East Afr. (Legum.) Part 2: 77. 1967; Ali in Fl. W. Pak. 54: 17-19. 1973. *C. toroides* Roxb. Hort. Beng. 31. 1814 nom. nud. *Senna toroides* Roxb. Fl. Ind. 2: 341. 1832. *Cassia tora* Linn. var. *β*. Wt. & Arn. Prodr. Fl. Pen. Ind. Or. 291. 1834. *C. tora* sensu Baker in Hook. f. Fl. Brit. Ind. 2: 263. 1878 (non Linn. 1753). *C. tora* Linn. var. *obtusifolia* (L.) Haines, Bot. Bihar & Orissa 304. 1922.

Glands cylindrical, between one or two lowest pairs of leaflets. Sepals densely hirsute on both the sides. Petals hairy on the veins. Seeds somewhat rhomboid, 5-6·5 × 2·5-3 mm.

Field notes: Common from plains to the hills and often dominates the undergrowth of deciduous forests on the Aravallis and in the east of it. The character of hairiness is much variable. The leaves, twigs and young fruits are cooked as vegetable. Seeds are used in cough, asthma and skin diseases.

Local name: Pumaria, Puadia.

Flowering and *Fruiting*: August-November.

Distribution: Native of tropical America; naturalized in tropical regions of the World except Polynesia and Australia.

Specimen examined: BARMER: Hatma village, *Tiwari* 946 (BSJO); JODHPUR: Bariganga, *Shetty* 166 (BSJO); PALI: Kantalia, *Shetty* 1812 (BSJO); TONK: Bilaspura, *Shetty* 1083A (BSJO); SIROHI: *Arun Kumar* 31, Khichi 1 (JAC); Mt. Abu, *Shiv Ram* 2 (JAC); JAISALMER: *Blatter* 11985 (BLAT); ALWAR: *Kaul* 18652 (LWG); JHALAWAR: Bijliya Bhadak, *Wadhwa* 7461 (BSA); CHITTORGARH: *Majumdar* 12298 (BSA); KOTA: *Majumdar* 12431 (BSA); Shahabad, *Wadhwa* 9264 (BSA).

C. tora Linn. Sp. Pl. 1: 376. 1753; FBI 2: 263 in part; de Wit in Webbia 11: 276. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 8. 1967; Ali in Fl. W. Pak. 54: 19. 1973. *C. sunsub* Forsk. Fl. Aegypt.-Arab. 86. 1775. *C. tala* Desv. in Journ. Bot. 3: 73. t. 73. 1814. *C. gallinaria* Collad. Hist. Cass. 96. 1816. *C. humilis* Collad. Hist. Cass. 96. 1816. *Senna tora* (L.) Roxb. Fl. Ind. 2: 340. 1832. *Cassia regeonii* Ghesq. in Rev. Bot. Appliq. 14: 238. 1934.

Glands linear-cylindrical, usually between the two lowest pairs of leaflets. Flowers white or yellow. Bracts fugaceous. Sepals and petals hairy or glabrous. Seeds rhomboid, 3-5 × 3 mm.

Field notes: Sparsely distributed from plains to the hills; often found in association with *C. obtusifolia* L. The plants vary in hairiness and shape and size of leaflets.

Plants are used as a substitute for soap. Seeds are used in earache. Leaves are used in ringworm. Unripe fruits are cooked as vegetable. Seeds are used as a substitute for coffee in England, Arabia, Abyssinia, Assam and Bombay.

Local name: Puadia, Pumaria.

Flowering and *Fruiting*: August-November.

Distribution: Native of America; naturalized from Africa to India and eastwards to Polynesia.

Specimen examined: TONK: Mayola Forest, *Shetty* 1083B (BSJO); KOTA: *Wadhwa* 1987 (BSA); Atru, *Singh* 90192 (LWG); JHALAWAR: Barpatti, *Wadhwa & Prasad* 9560 (BSA); Bhawanimandi, *Verma* 3512 (BSA).

Critical notes: *C. tora* Linn. resembles closely *C. obtusifolia* Linn. and hence, they have been greatly mixed up in most of our Indian herbaria and floras. Bentham (1871) treated the latter under *C. tora* Linn. and this concept was followed by many workers like Fewcett & Rendle (1910-36), Baker (1878), Maheshwari (1963) etc. Prain (1897) separated *C. obtusifolia* Linn. from *C. tora* Linn. on the basis of single gland between the lowest pair of leaflets, as the latter species bears glands between the two lowest pairs of leaflets. This concept was followed by de Wit (1955) and Backer (Fl. Java Fam. 118. 1941). Recently, Brenan (1958) pointed out that some African and American specimens of *C. obtusifolia* Linn. have two glands on the rachis and this leads to confusion. He relied, therefore, on two other characters namely the shape of large anther and size of seed-areole to distinguish these two species. The present study revealed that the character of glands is not constant. Both the species may have one or two glands and resemble closely in most of the morphological characters. The characters used in the present key are best suited to distinguish these two species.

C. phyllodinea R. Br. in App. Sturt. Centr. Aust. 15. 1850; Bentham in Fl. Aust. 2: 287. 1864.

Shrubs, 1-2 m high, clothed with white, silky tomentum. Leaves 1.5-5 × 0.2-0.4 cm. Flowers yellow, in axillary racemes or corymbs. Fertile stamens 10. Pods flat, constricted irregularly. Seeds obovate-oblong, blackish-brown, produced at the hilum end; testa pitted; areole narrow, extending upto hilum.

Field notes: Occasionally planted in the gardens for ornamental purposes. Very successful in arid regions of the State.

Flowering and *Fruiting*: December-April.

Distribution: Native of South Australia; cultivated in many countries.

Specimen examined: JODHPUR: Central Arid Zone Research Institute, *Singh* 2451 (BSJO), *Maheshwari* 74176 (LWG).

C. italica (Mill.) Lamk. ex Andrews, Fl. Pl. Anglo-Egypt. Sudan 2: 117. 1952; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 6. 1967; Brenan in Kew Bull. 13: 239. 1958; Fl. Trop. East Afr. (Legum.) Part 2: 65. 1967; Ali in Fl. W. Pak. 54: 16. 1973. *Senna italica* Mill. Gard. Dict. ed. 8. no. 2. 1768. *Cassia senna* Burm. f. Fl. Ind. t. 33. f. 2. 1768 (non Linn. 1753). *C. aschrek* Forsk. Fl. Aegypt.-Arab. 86. 1775. *C. obtusa* Roxb. Hort. Beng. 31. 1814 nom. nud.; FUGP 1: 294. *C. obovata* Collad. Hist. Cass. 92. t. 15A. 1816 nom. illegit.; FBI 2: 264. *C. obtusata* Heyne in Araneyk. Gewachse 9: t. 43. 1825. *Senna obtusa* Roxb. Fl. Ind. 2: 344. 1832. *Cassia obovata* Collad. var. *obtusata* (Heyne) Bischoff. in Bot. Zeit. 8: 883. 1850. *Senna obovata* (Collad.) Batka var. *genuina* Batka in Monogr. Cassien Gruppe Senna 46. 1866. *S. obovata* (Collad.) Batka var. *pilosa* Batka in Monogr. Cassien Gruppe Senna 33, 49. 1866.

Leaflets 4-6 pairs. Petioles 1-4 cm long. Racemes 4-23 cm long, smaller, equal or

longer than the leaves. Sepals 5-13 mm long. Petals 8-20 mm long. Fertile stamens 7; anther-lobes sagittate, appendaged at the base. Pods septate between the seeds. Seeds obovoid-oblong, 4-6 × 2.5-3.5 mm, emarginate at the broader end; testa irregularly wrinkled, grey; areole about 1.5 × 0.5 mm, transversely veined.

Field notes: Rather common in the arid regions, often found on sand-dunes. Good soil binder. Very rarely found in the east of Aravallis in gravelly soils. Pods and leaves are purgative.

Local name: Goral, Gharawal.

Flowering and *Fruiting*: August-February.

Distribution: Africa to India.

Specimen examined: BARMER: Balotra, *Tiwari* 979, *Shetty* 2242 (BSJO); BIKANER: Nayagaon, *Roy* 2032 (BSJO); Near Gollri, *Roy* 1708 (BSJO); PALI: *Shetty* 1861, 1400 (BSJO); JAIPUR: Sambhar lake, *Hiralal* 34824 (LWG); JAISALMER: *Wadhwa* 5103 (BSA), *Tiwari* 825 (BSJO); Ramgarh, *Wadhwa* 5170 (BSA).

Critical notes: Brenan (1958) has recognised three subspecies under this taxon *i.e.* subsp. *italica, micrantha* and *arachioides,* and mentioned that most of the Indian material belongs to subsp. *micrantha* Brenan. Most of the Indian workers have blindly followed Brenan (1958) without making critical study of the Indian material. It is evident from the diagnostic features used by Brenan (*l.c.*) that they are greatly overlapping. One of the characters considered for distinguishing subsp. *micrantha* from the other two subspecies is that "the racemes are shorter than the subtending leaves" The present study revealed that this character does not hold good as there are different degrees of relationship between the length of racemes and their subtending leaves. The length of flowering and fruiting racemes is also variable even in the same plant, The length of leaves, racemes, sepals, petals, anthers etc. varies greatly in different regions of the same plant at different times. The Indian plants also vary in indumentum, shape of leaves and in general appearance. Brenan (*l.c.*) has himself admitted that there is a great variation in the vegetative and floral parts in subsp. *italica.* There seems no reason to recognise the existence of subsp. *micrantha,* at least in India. Almost all the Indian material belongs to the species proper.

C. alata Linn. Sp. Pl. 1: 378. 1753; FBI 2: 264; de Wit in Webbia 11: 231. 1955; Brenan in Fl. Trop. East Afr. (Legum.) Part 2: 64. 1967; Ali in Fl. W. Pak. 54: 25. 1973. *C. herpetica* Jacq. Obs. 2: 24. t. 45. f. 2. 1767. *C. alata* Linn. var. *rumphiana* DC. Prodr. 2: 349. 1825. *Senna alata* (L.) Roxb. Fl. Ind. 2: 349. 1832.

Leaves 30-75 cm long. Leaflets 5-14 pairs, oblong-elliptic to obovate-elliptic, retuse, apiculate. Racemes 20-30 cm long. Bracts orange-coloured, 2-2.8 cm. long. Petals yellow, 1.7-2.2 × 0.9-1.2 cm. Fertile stamens 10. Pods 12-17 × 1.3-3 cm, transversely septate, dehiscing along the ventral suture. Seeds compressed at right angle of the axis of pod, deltoid-rhombic, 6-8 × 4-6 mm, produced at hilum end.

Field notes: Rarely planted in the gardens for ornamental purposes. Plants thrive well in comparatively fertile soils and produce flowers when about 1 m high. Number of leaflets does not reach upto 24 pairs as mentioned by de Wit (1955). Leaves are used in the treatment of ringworm.

Local name: Dadmardoma.

Flowering and *Fruiting*: October-December.

Distribution: Native of West Indies and South America; naturalized in East Africa, South India, Burma and Malaysia. Cultivated in many countries.

Specimen examined: KOTA: Baran, *Singh* 90484 (LWG).

C. nodosa Buch.-Ham. ex Roxb. Fl. Ind. 2: 334. 1832; FBI 2: 261; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 11. 1967; Ali in Fl. W. Pak. 54: 21-23. 1973.

Medium-sized trees. Leaflets 8-20 pairs, 2.5-5 × 1.7-2.8 cm, oblong. Stipules foliaceous, auricled, reniform. Stamens 10, yellow, 4 longer ones with globular swellings in the middle and soon falling. Anthers dorsifixed or versatile, 1-3 × 1-1.5 mm, narrowed towards base, dehiscing by basal pores. Ovary hairy; stigma inconspicuous.

Field notes: Planted in the gardens and along the roads for shade and ornamental flowers. Flower-colour fades from pink to white with the age of the flower.

Flowering and *Fruiting*: February-September.

Distribution: Native of tropical Asia. Planted in many countries.

Specimen examined: JODHPUR: Central Arid Zone Research Institute, *Singh* 2455, 2650 (BSJO).

Critical notes: This species resembles closely *C. javanica* Linn. Baker (1878) suggested that the latter may be reduced to a variety of *C. nodosa* Buch.-Ham. ex Roxb. This concept, however, has not been followed by recent workers like de Wit (1955), Ali & Quraishi (1967), Brenan (1967) etc., but they have also failed to observe some constant characters of taxonomic value. The present study revealed that the globular swellings in the middle of long filaments distinguish *C. nodosa* Buch.-Ham. ex Roxb. from other related taxa.

C. fistula Linn. Sp. Pl. 1: 377. 1753; FBI 2: 261; FUGP 1: 291; de Wit in Webbia 11: 207. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 5. 1967; Ali in Fl. W. Pak. 54: 12. 1973. *Cathoetocarpus fistula* (L.) Pers. Syn. Pl. 1: 459. 1805. *Cassia fistula* Linn. var. *obovata* DC. Prodr. 2: 490. 1825. *C. rhombifolia* Roxb. Hort. Beng. 31. 1814 nom. nud.; Fl. Ind. 2: 335. 1832.

Pedicels jointed just beneath the calyx. Fertile stamens 10; 4 small filaments with large, versatile anthers dehiscing by basal pores; 3 long filaments with medium-sized, basi-fixed anthers dehiscing by longitudinal slits; 3 small filaments with small, basifixed anthers dehiscing by longitudinal slits. Seeds obovate, 6-8 × 4-6 mm; areole absent.

Field notes: Commonly planted in the gardens and along the roads for shade and showy flowers; apparently indigenous on the Aravallis. Flowers slightly fragrant and come out before the leaves. The fruits remain on the tree for most part of the year. The wood is used for agricultural implements. Bark is a good tanning material. Seeds are emetic. Fruits are used in snakebite.

Local name: Amaltas, Karmala.

Flowering and *Fruiting*: February-May.

Distribution: Native of tropical Asia. Cultivated in many countries.

Specimen examined: UDAIPUR: Kaul 53182 (LWG); KOTA: *Singh* 90896 (LWG); Shahabad, *Singh* 91041 (LWG); PALI: *Tandon* 418 (JAC); JODHPUR: Mandor, *Shetty* 593 (BSJO); TONK: Toda Rai Singh, *Shetty* 555 (BSJO); JHALAWAR: *Wadhwa* 7587, 3587 (BSA); CHITTORGARH: Pratapgarh, *Verma* 262 (BSA).

C. roxburghii DC. Prodr. 2: 489. 1825; de Wit in Webbia 11: 226. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 11. 1967; Ali in Fl. W. Pak. 54: 23. 1973. *C. marginata* Roxb. Hort. Beng. 31. 1814 nom. nud.; Fl. Ind. 2: 339. 1832; FBI 2: 262.

Medium-sized trees. Leaflets oblong, 2-5 × 1-2 cm, emarginate or retuse, oblique-based. Sepals and petals densely hairy. Fertile stamen 10; anthers dehiscing by basal pores. Pods 20-30 cm long, pendulous; pulp spongy.

Field notes: Planted in the gardens and

along the roads for shade and showy flowers. It is a rapid growing but short lived tree. Plant thrive well in comparatively fertile soils. Resembles closely *C. nodosa* Buch.-Ham. ex Roxb. and *C. javanica* Linn. Flowers are made into garlands.

Flowering and *Fruiting*: November-August.

Distribution: India, Burma, Ceylon and Malaysia. Planted in many countries.

Specimen examined: JODHPUR: Central Arid Zone Research Institute, *Singh* 2446 (BSJO); KOTA: *Singh* 90511, 90871 (LWG).

C. siamea Lamk. Encycl. Meth. Bot. 1: 648. 1785; FBI 2: 264; de Wit in Webbia 11: 263. 1955; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 11. 1967; Ali in Fl. W. Pak. 54: 25. 1973. *C. sumatrana* Roxb. Hort. Beng. 31. 1814 nom. nud. *Senna sumatrana* Roxb. Fl. Ind. 2: 348. 1832. *Cassia florida* Vahl in Thw. Enum. Fl. Zeyl. 1: 16. 1858.

Rachis terete. Fertile stamens 7. Pods 15-30 × 1-2 cm, depressed between the seeds. Seeds compressed, broadly oblong, smooth; areole oblong, in the centre of the seeds.

Field notes: Planted along the roads and in the gardens for shade and its beautiful flowers. Flowering is more profuse in autumn in arid regions and in spring in the east of Aravallis. Half of the leaves usually fall down during April. Walking sticks and mallets are made from its wood.

Local name: Kassod.

Flowering and *Fruiting*: November-May.

Distribution: Native of south-east tropical Asia. Planted in many countries.

Specimen examined: UDAIPUR: *Majumdar* 11662 (BSA); Cheekhaghat, *Gomawat* 53181 (LWG); Jaipur: *Hiralal* 34615 (LWG), *Wadhwa* 8382 (BSA); KOTA: Shahabad, *Singh* 74789 (LWG); JODHPUR: *Singh* 2452, *Panday* 2441 (BSJO); Mandor, *Mathur* 52 (CAZRI), *Bhandari* 1506 (JAC); BANSWARA: *Majumdar* 10249 (BSA); JHALAWAR: Eklera, *Majumdar* 10183, *Wadhwa* 9607 (BSA).

C. senna Linn. Sp. Pl. 1: 377. 1753; Brenan in Fl. Trop. East Afr. (Legum.) Part 2: 65-66. 1967; Ali in Fl. W. Pak. 54: 12. 1973. *C. senna* Forsk. Pietri Flor. Arab. in Herb. Brit. Mus. 1772 (non Linn. 1753). *C. media* Forsk. Fl. Aegypt.-Arab. Bot. 271. 1775. *C. angustifolia* Vahl, Symb. Bot. 1: 28. 1790; Ali & Quraishi in Sind Univ. Sci. Res. Journ. 3: 5. 1967. *C. acutifolia* Del. Fl. Aegypt. *Ill.* 61. t. 27. 1813. *C. lanceolata* Collad. Hist. Cass. 93. 1816 (non Forsk. 1775). *C. lanceolata* Wall. Cat. 5318. 1831-32 (non Forsk. 1775). *Senna officinalis* Roxb. Fl. Ind. 2: 346. 1832. *S. acutifolia* Batka, Monogr. Senna 41. 1866. *S. angustifolia* Batka, Monogr. Senna 30, 40. 1866.

Shrubs, upto 1.5 m high. Leaflets 3-8 pairs, lanceolate, 1-5 × 0.4-2 cm, pubescent, acute. Stipules linear. Flowers yellow; racemes longer than leaves. Sepals yellow, obtuse. Fertile stamens 7; anthers dehiscing by terminal pores, hastate or sagittate at the base; anther-lobes produced beyond the connective at the apex. Pods flat, oblong, 3.5-6 × 1.2-2 cm, pubescent, brown. Seeds obovate-oblong, white, retuse at the apex, much produced at the hilum end; areole more towards base, situated on raised surface of the seed.

Field notes: Rarely cultivated in the gardens for medicinal purposes. The leaves and fruits are used as a laxative and purgative.

Local name: Senna.

Flowering and *Fruiting*: February-May.

Distribution: Native of Somaliland and Arabia; also naturalized in Africa and India.

Specimen examined: JODHPUR: University Botanical Garden, *Singh* 2463 (BSJO).

DOUBTFUL SPECIES

C. javanica Linn. Sp. Pl. 1: 379. 1753; FBI 2: 267; Ali & Quraishi in Sind Univ.

Sci. Res. Journ. 3: 11. 1967; Ali in Fl. W. Pak. 54: 23-25. 1973. *C. bacillus* Gaertn. Sem. 2: 313. 1791.

This species was reported by Sarup (1954) and Shankhla (1951) from Jodhpur. The specimens lodged in the Herbarium, University of Jodhpur (Jodhpur: Jaswant College, *Viswani* 473; Balsamand: *Murty* 711; Pali: *Tondon* 500) under the name *C. javanica* Linn. actually belong to *C. roxburghii* DC. The reports of Sarup (1954) and Shankhla (1951) of this species are said to be based on a tree which was growing in the campus of Jaswant College, Jodhpur. I could not find any tree there and it is said to have been destroyed a few years ago. *C. javanica* Linn. is a native of Java and Sumatra and has been planted in many countries. Seth *et al.* (1962) are of the opinion that it cannot survive in arid regions of India. Hence, the presence of this species at Jodhpur is very doubtful.

C. kleinii Wt. & Arn. Prodr. 293. 1834; FBI 2: 266; FUGP 1: 295.

This species was reported by Duthie (1903-29) from Merwara, Ratnam (1951) from Lohargal, Sarup (1954) from Jodhpur and Blatter and Hallberg (1918-21) from Balsamand. The specimens *Duthie* 4644, 4645 (DD) from Merwara and *Blatter* 7247 (BLAT) from Balsamand actually belong to *C. pumila* Lamk. I could not find any specimen of *C. kleinii* W. & A. from Rajasthan in any of the important Indian herbaria. Hence, Ratnam (1951) and Sarup's (1954) records of *C. kleinii* W. & A. are doubtful. It can be easily distinguished from *C. pumila* Lamk. by the presence of 10 fertile stamens and 10 to 15-seeded fruits. It is distributed from Africa to India and Java.

C. purpurea Roxb. ex Lindl. in Bot. Reg. t. 856. 1824; Ali in Fl. W. Pak. 54: 27. 1973. *Senna purpurea* Roxb. Fl. Ind. 2: 343. 1832. *Cassia sophera* L. var. *purpurea* (Roxb. ex Lindl.) Baker in Hook. f. Fl. Brit. Ind. 2: 263. 1878; FUGP 1: 293.

This species was reported by Duthie (1903-29) from Merwara and Nair (1956) from Chirawa. It is said to differ from *C. sophera* L. in the presence of small leaflets not exceeding 2.5 cm in length and purple stem and branches. The present study revealed that these characters are not correlated with one-another. Some specimens of *C. occidentalis* Linn. also bear strongly purple stem and branches. I could not find any specimen from Rajasthan in the Herbarium of Forest Research Institute, Dehra Dun or elsewhere. This taxon needs further critical study.

Further, it also seems essential to mention that *C. renigera* Wall. ex Benth., a native of Burma, and *C. multijuga* Rich., a native of America, are under trial in Central Arid Zone Research Institute, Jodhpur. The data obtained from the said Institution shows that they can survive in the dry climate of Indian desert.

DISCUSSION

Out of about thirty species of *Cassia* L. found in India, twenty one have completely established in the soils of Rajasthan, two are under trial but showing good chances of survival and three have been recorded by earlier workers but the author considers them doubtful. Thus, Rajasthan alone contains more than 76 percent of the total species found in India. Of these, ten species are indigenous and they do not show any particular pattern of distribution in the east and west of the Aravallis except that *C. italica* (Mill.) Lamk. and *C. auriculata* Linn. are better represented in the sandy desert in the west of Aravallis, and *C. hochstetteri* Ghesq. and *C. mimosoides* Linn. are more common on the Aravallis and in the east of it. The remaining species are cultivated and have been introduced from various countries. It is interesting to mention that *C. phyllodinea* R. Br., *C. spectabilis* DC., *C. artimisioides* Gaudich. and *C. mul-*

tijuga Rich. have been introduced very recently into India.

ACKNOWLEDGEMENTS

The author wishes to express his sincere thanks to the Director, National Botanic Gardens, Lucknow, to the Director, Botanical Survey of India, Howrah and to the C.S.I.R., New Delhi for the facilities provided from time to time during the course of the present study. He is grateful to the Director, Central Arid Zone Research Institute, Jodhpur for permitting him to collect the specimens and for the facilities accorded for consulting the herbarium. He is also thankful to the Regional Botanist, Arid Zone Circle, Botanical Survey of India, Jodhpur for his valuable suggestions and encouragement and to the authorities of various Indian herbaria for their help.

REFERENCES

ALI, S. I. Caesalpiniaceae in NASIR, E. *et al.* Flora of West Pakistan. No. 54. Karachi. 1973.

——AND S. QURAISHI. A taxonomic study of the genus *Cassia* Linn. from West Pakistan. *Sind Univ. Sci. Res. J.* 3: 1-13. 1967.

AMSHOFF, G. J. H. On south American Papilionaceae. Utrecht. 1939.

BAILEY, L. H. Manuals of cultivated plants. New York. 1949.

BAKER (FIL.), E. C. The leguminosae of Tropical Africa. Ostend. 1930.

BAKER, J. G. Caesalpinieae in HOOKER, J. D. *et al.* The Flora of British India 2 : 254-285. 1878.

BANERJEE, M. L. AND G. SIRCAR. Minor venation pattern of Indian species of *Cassia* Linn. *Bull. bot. Soc. Beng.* 28 : 1-3. 1974.

BENTHAM, G. Revision of the genus *Cassia* Linn. *Trans. Linn. Soc.* 18 : 503-592. 1871.

BLATTER, E. Flora Arabica. *Rec. bot. Surv. India* 8 : 1-591. 1919-1930.

——AND F. HALLBERG. The Flora of Indian Desert. *J. Bombay. nat. Hist. Soc.* 26 and 27: on different pages. 1918-1921.

BRENAN, J. P. M. New and noteworthy *Cassias* from Tropical Africa. *Kew Bull.* 13 : 231-252. 1958.

——Flora of Tropical East Africa. London and Tonbridge. 1967.

BREYNE (BREYNIUS) J. Exoticarum aliarumque minus cognitarum plantarum centuria prima. Danzig. 1678.

——Prodromus fasciculi rariorum plantarum secundus. Gedani. 1689.

BRITTON, N. L. AND J. N. ROSE. North American Flora. Vol. 23. New York, 1930.

CHATTERJEE, D. The correct name of *Cassia glauca* and its varieties. *J. Bombay nat. Hist. Soc.* 57(3): 695-698. 1960.

COOKE, T. The Flora of Presidency of Bombay. Vol. 2. London. 1901-1908.

CORNER, M. A. H. A. Account of Malay peninsular species of *Cassia*. *Mag.* 5 : 37-50. 1935.

CANDOLLE, A. P. DE AND A. DE CANDOLLE. Prodromus systematis naturalis regni vegetabilis. Vol. 2. Paris. 1825.

DEFLERS, A. VOYAGE AU YEMEN. *Journ. d'une Excursion Bot. faite* 1887 *dans les Montagnes de'l Arabie Heureuse.* Paris. 1889.

DE WIT, H. C. D. A revision of the genus *Cassia* (Caesalpiniaceae) as occurring in Malaysia. *Webbia* 11 : 197-292. 1955.

DUTHIE, J. F. Flora of the Upper Gangetic Plain and Adjacent Siwalik and Sub-Himalayan tracts. Vol. 2. Calcutta. 1903-1929.

FAWCETT, W. AND A. B. RENDLE. Flora Jamaica. London. 1910-1936.

GAERTNER, J. De Fructibus et Seminibus Plantarum. Vol. 2. Stuttgart. 1791.

GAMBLE, J. S. AND C. E. C. FISCHER. The Flora of the Presidency of Madras. 11 parts. London. 1915-1936.

GHESQUE. J. Contribution a l'etude des Legumineuses principalement du Congo Belge 1. Les *Cassia* Africains de la section *Chamaecrista* Benth. *Bull. Jard. Bot. Brux.* 9 : 139-169. 1932.

GREENE, E. L. The genus *Chamaecrista*. *Pittonia* 3 : 238-243. 1897.

GRISEBACH, A. H. R. Flora of British West Indian. Islands. London. 1864.

HAINES, H. H. The Botany of Bihar and Orissa. London. 1921-1924.

HOLMGREN, P. K. AND W. KEUKEN (COMPILAR). Index Herbariorum Regnum Vegetabile. Vol. 92. Utrecht. 1974.

HUTCHINSON, J. The Genera of Flowering Plants. Vol. 1. Oxford. 1964.

IRWIN, H. S. Monographic studies in *Cassia* (Leguminosae-Caesalpinioideae). I. section *Xerocalyx*. *Mem. New York. Bot. Gard.* 12(1) : 1-114. 1964.

——AND D. J. ROGERS. Monographic studies in *Cassia* (Leguminosae-Caesalpinioideae) II. A taximetric study of section *Apoucouita*. *Ibid.* 16 : 71-120. 1967.

——AND R. C. BARNEBY. Notes on the generic status of *Chamaecrista* Moench (Leguminosae-Caesalpinioideae). *Brittonia* 28 : 28-36. 1976.

LINNAEUS, C. Species Plantarum. Vol. 1. Stockholm. 1753.

MAHESHWARI, J. K. Flora of Delhi. C. S. I. R., New Delhi. 1963.

MILLER, P. The Gardener's Dictionary. Ed. 4. London. 1754.

MIQUEL, F. A. W. Flora Indiae Batavae. Vol 1. Amsterdam. 1855.

MOENCH, K. Mathodus Plantas horti.....Marburgensis. Marburgi Cattorum, 1794.

NAIR, N. C. Flora of Chirawa. *Proc. Raj. Acad. Sci.* 6 : 49-64. 1956.

OHASHI, H. Nomenclatural changes in several Himalayan Leguminosae. *J. Jap. Bot.* 50(10) : 305-310. 1975.

PANDAY, Y. *Cassias* commonly occurring or cultivated in India. *J. Bombay nat. Hist. Soc.* 68(2): 311-318. 1971.

PERSOON, D. C. H. Synopsis Plantarum. Vol. 1. Paris. 1805.

PRAIN, D. Some additional Leguminosae. *J. Asiat. Soc. Beng.* 66(2) : 347-518. 1897.

RATNAM, B. V. The vegetation of Lohargal. *Proc. Raj. Acad. Sci.* 2 : 26-36. 1951.

RIDLEY, H. N. The Flora of Malay Penninsula. Vol. 1. London. 1922.

ROXBURGH, W. Flora Indica(edited by W. Carey). Vol. 2. Serampore. 1832.

SARUP, S. A list of some common plants of Jodhpur and its neighbourhood. *Univ. Raj. Studies (Biol. Sci.)* 1954 : 1-25. 1954.

SETH, S. K. *et al.* Trees of Vana Mahotsava. New Delhi. 1962.

SHANKHLA, K. S. Enumeration of the flowering plants of north-west Rajasthan. *Univ. Raj. Studies (Biol. Sci.)* 1951 : 43-56. 1951.

STEYAERT, R. L. Notes sur des *Cassia* Africains description de nouvelles especes. *Bull. Jard. Bot. Brux.* 20 : 233-268. 1950.

——Flora Congo Belge, Congo Belge. 1952.

VOGEL, TH. Synopsis generis Cassiae. Berlin. 1837.