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A taxonomic revision of genus *Desmodium desv.* (Fabaceae) from Maharashtra, India

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Abstract
The genus *Desmodium* Desv. (Fabaceae) is revised for Maharashtra State, India based intensive exploration and observation, literature survey and herbarium studies. Thirteen taxa are recognized and discussed about nomenclature, etymology and updated citation for each species with available type information. Detail description, notes and dichotomous taxonomic key for species are provided for easy identification.

Keywords: *Desmodium*, herbarium, literature survey, taxonomic key

Introduction

Linnaeus (1753 and 1763) [22] in his epic work described the genus *Hedysarum L*. Burman, f. (1768) [6] in his Flora indica and Roxburgh (1832) [32] In his Flora indica used to prefer genus *Hedysarum* respectively. Later on, *Desmodium* Desv. (Leguminosae. Papilionoideae, Desmodeae) was established by Desvaux, Nicaise Auguste (1813) [13] with four species namely *D. canescens, D. virgatum, D. scorpiurus, D. macrophyllum* of which rest three of it became the synonym of *D. scorpiurus.*

Review of Literature

Table 1: Shows the numbers of species earlier reported from India and Maharashtra by major taxonomic works.

Sr. no.	Name of authors	Year	Regions	Numbers of species
1	Wight & Arnott	(1834) [34]	Peninsular India	17
2	Baker	(1876) [3]	British India	49
3	Dalzell & Gibson	(1861) [8]	Bombay	8
4	Nairne	(1894) [23]	Western India	8
5	Sanjappa	(1991) [33]	India	47
6	Cooke	(1908 & 1958 Repr.) [7]	Presidency of Bombay	14
7	Almeida M.R.	(2000)	Maharashtra	18
8	Kothari	(2000) [19]	Maharashtra	20

Table.1: Chronological publications of Desmodium Desv. in India and Maharashtra.

Recently Ohashi (2021) [15] revised and found that *Desmodium* is the core genus of tribe *Desmodieae* of Fabaceae. which comprise of about 350-450 species (Ohashi 1973, Ohashi *et al*., 2018a) [29]. It is basically identified by its trifoliolate leaves pattern and some species exceptionally shows unifoliolate or to trifoliate leaves on same plant individual), presence of stipels, presence of straight to hooked or curved hairs on pods. The controversy surrounding the delimitation of *Desmodium* as a genus has been long-standing (Lima *et al*., 2014; Ohashi *et al*., 2018a) [21]. Recent progress in molecular phylogenetic studies has supported the polyphyly of *Desmodium* resulting in its reorganisation, including the segregation of previously synonymised genera and the description of new genera (Jabbour *et al*., 2018; Ohashi *et al*., 2018a, 2018b, 2019) [14, 28]. according to current classification, most of the Indian species of *Desmodium* are transferred into various segregated genera while the remaining species, i.e. *Desmodium* s.s., are restricted to the New World in their native distribution (Ohashi *et al*., 2018a, 2018b, 2019) [28]. while revising classification of *Desmodium*, Ohashi (2021) [15] Classified *Desmodium* and most of the species moved from *Desmodium* in to genus *Grona, Polhillides, Dendrolobium, Tadehagi, Alysicarpus, Huangtcia, Codariocalyx, Sohmaea, Pleurolobus* based on molecular sequence data with some morphological support, including from palynological characters (Ohashi & Ohashi, 2018a) and this classification was followed and nomenclature discussed in conclusion.

During the present investigation it is found that the almost all except 3 species of *Desmodium* species reported in Maharashtra transferred in various *Desmodium* groups. For the present investigation 13 species were collected out only three are treated in *Desmodium* proper, six in *Grona*, one in *Phyllodium*, one in *Dendrolobium*, one in *Tadehagi*, one in *Alysicarpus*, one in *Huangtcia*, one in *Codariocalyx*, one *Sohmaea* respectively for State of Maharashtra.

The taxonomic studies of *Desmodium* were under taken due to economic uses, endemism, nomenclatural anomalies and the herbarium based earlier work into consideration taxonomic studies on this genus for Maharashtra was undertaken. The taxonomic study of *Desmodium* includes

objectives like Survey, collection, morphology, and documentation of the *Desmodium* species in Maharashtra. The present work is based on the observation made in last five and half years with intensive and extensive field study and herbarium consultation in various Herbarium *viz*, BSI, BAMU, SUK, VH, Observations on the variations, distribution and rarity were recorded for every species. It is expected that the present study will be helpful for further investigations pollination and conservation of *Desmodium* groups and allied genera with its species in flora Maharashtra.

Desmodium Desv., J. Bot. Agric. 1(2):122, t. 5, 1813; Baker in Hook. f. Fl. Brit. India 2:161. 1876; T. Cooke Fl. Bombay Pres. 2: 134, 1958 (Repr.); Ohashi in Ginkgoana 1:1-318, 1973; Kambale & Pradhan Fl. Akola 62, 1988; Sanjappa, Legumes India 152. 1991; Almeida Fl. Maharashtra 60. 1998; Kothari & Moorthy Fl. Raigad 96. 1993; Karthik. and An. Kumar Fl. Yavatmal, 66. 1993; Kothari in N. P. Singh *et al*. Fl. Maharashtra St. Dicot. 1:669. 2000; Diwakar& Sharma Fl. Buldhana 107. 2000; Yadav & Sardesai in Fl. Kolhapur 147. 2003

Type species: *D. scorpiurus*

Desmodium Desv., J. Bot. Agric. 1(2):122, t. 5, 1813; Baker in Hook. f. Fl. Brit. India 2:161. 1876; T. Cooke Fl. Bombay Pres. 2: 134, 1958 (Repr.); Ohashi in Ginkgoana 1:1-318, 1973; Kambale & Pradhan Fl. Akola 62, 1988; Sanjappa, Legumes India 152. 1991; Kothari & Moorthy Fl. Raigad 96. 1993; Karthik. and An. Kumar Fl. Yavatmal, 66. 1993; Kothari in N. P. Singh *et al*. Fl. Maharashtra St. Dicot. 1:669. 2000; Diwakar& Sharma Fl. Buldhana 107. 2000; Yadav & Sardesai in Fl. Kolhapur 147. 2003; Kshirsagar and Patil, Flora of Jalgaon District 106. 2008.

Artificial Key to *Desmodium* of Maharashtra.

1a, The Leaf with triquetrous petiole……*D. triquetrum*
1b. The Leaf without triquetrus petiole…….2
2a. Leaves one or unifoliolate ……3
2b. Leaves trifoliolate……5
3a. Plant herbaceous, flowers included or slightly exerted……*D. ritchiei*
3b. Plant shrubby or under shrubs……4
4a. Stem angled, Flowers pinkish or purplish pod jointed ……*D velutinum*
4b. Stem not angled, Flowers bluish-violet, pods 4-6 jointed...……*D. gangeticum*
5a. Leaves 3-foliolate ……6
5b. Leaves 3 foliolate and intermixed…….*D.alysicarpoides*
6a. Raceme with densely axillary and umbellate clustered flowers ……7
6b. Raceme short to long, terminal, elongated ……8
7a. Flowersin dense axillary peduncled umbels ……*D. triangulare*
7b. Flowers paired fascicled cluster on each node of rachis……*D. pulchellum*
8a. Plants herbaceous……9
8b. Plant shrub or under shrubs……10
9a. Pods deeply indented sutured……*D.procumbens var. neomexicanum*
9b. Pods not as above ……11
10a Plant prostrate to creeping, hairy ……*D. triflorum*
10b. Plant stargling, viscid……*D.dichotomum*
11a. Plant trailing, flowers pink……... *D.scorpiurus*
11b. Plant erect, flowers pale bluish or purple…… 12
12a. Raceme densely flowered, Pods 3-8 jointed, Leaves 1-5 to 6.5 cm long ……..... *D. heterocarpon*
12b. Raceme lax flowered, Pod 5-11 jointed, Leaves 10-30 cm long….*D. laxiflorum*

1. *Desmodium alysicarpoides* Van Meeuwen in Reinwardtia 6:246. 1962; B. G. Kulk. Fl. Sindhudurg 118. 1988; Sanjappa, Legumes India 149. 1991; Almeida Fl. Maharashtra. 60. 1998; Kothari in N. P. Singh *et al*. Fl. Maharashtra St. Dicot. 1:669. 2000; Yadav &Sardesai in Fl. Kolhapur 147. 2003. Kshirsagar and Patil, Flora of Jalgaon District 107. 2008. *Desmodiastrum racemosum* (Bth.) Pramanik & Thoth. var. *parviflorum* (Dalz.) Pramanik & Thoth. In J. Ind. Bot. Soc. 65: 377. 1986.(Fig-1- A)

   Type: Dalzell, #s.n., Bombay, India (India), K000845226 (Bombay Herbarium of the late N. A. Dalzell, presented by Mrs. Dalzell, April 1878; In Kew Journal iii: 211 (1851) Herbaceous, stem erect to diffused, 1 to 2 feet or 30-60 cm long, smaller, much branched, clothed with short spreading grey hairs or pubescent, glabrous at base. Leaves 1 to 3 foliolate intermixed, Leaflets membranous, mostly simple, oblong, or sub-acute, sub cordate with appressed pubescent beneath, terminal one much longer up to 4 cm long, lateral ones up to 7.5-12 mm long, apiculate, petiole 0.5 to 2 cm; stipule 1 cm long, ovate, reduced to long apiculate point. Flowers bright red and tuning purplish to bluish when dries. few Flowers in lax, Raceme usually terminal, simple, 4-8 inches long, terminal racemes up to 40 cm long, lower flowers in distant pairs; pedicels capillary, 1 to 2 cm long, finely downy; bracts 6 mm long, lanceolate-cuspidate. Calyx 4mm, much longer than first joints of pod, clothed with short bristly hairs; teethsubulate, setaceous pilose, very long, divided almost to the base. Corolla 6.5-7.5 mm long, slightly exerted. Pods 9-10 cm long, 1 cm broad, sessile, much exerted, falcate, both sutures indented, joints 4-6. glabrescent with prominent reticulations, joints small.

   Fls. & Frts: October- December

   Distribution: In hilly and dry slopes, regions of deciduous and Wesrern Ghats forest of *Maharashtra*. Ahmednagar, Aurangabad, Kolhapur, Pune, Ratnagiri, Satara, Sindhudurg, Thane.

2. *Desmodium dichotomum* (Willd.) DC. Prodr. 2:336. 1825; Meeuwen in Reinwardtia 6:248. 1962; Sanjappa, Legumes India 152. 1991; Almeida Fl. Maharashtra 61. 1998; Kothari & Moorthy Fl. Raigad 96. 1993; Karthik. and An. Kumar Fl. Yavatmal, 66. 1993; Kothari in N. P. Singh *et al*. Fl. Maharashtra St. Dicot. 1:670. 2000.Yadav & Sardesai in Fl. Kolhapur 148. 2003; Kshirsagar and Patil, Flora of Jalgaon District 107. 2008. Gadpayale *et al*., in ijrbat sp. issue-1: 25. 2015. *Hedysarum dichotomum*Willd. Sp. Pl. 3:1180. 1802. (Fig-2 - B) Diffused herb or some times straggling,30-120 cm high; stem somewhat angled, or deeply grooved, hairy, viscidly pubescent or with long spreading hairs.
   Leaves 3-foliolate; petiole 2-4 cm long; stipules large, oblong, auricled to folioceous-amplexicaul and cuspidate; Leaflets 1.8-17.5 x 0.7-4.6 cm, ovate-obovate, elliptic or obovate, rounded on both ends,

slightly hispidulous and sparsely hairy above, thinly sericeous and pubescent beneath, secondary nerves strong, parallel, ca 8-15, conspicous beneath; petiolule 1 cm long, stipels large exceeding the hairy petiolules, linear lanceolate, 3-4 mm long. Flowers pink to bluish, very small, in terminal panicle raceme with lanceolate small bracts; pedicel filiform, 3-5 mm long; bracts 2-3 mm long, lanceolate, acute, ciliate. Calyx 2.5 cm long, hairy; teeths about as long as tube, linear, acute, ciliate. Corolla 3-4 mm long. Pod straight,0.8.-1.8 cm long and up to 3-4 mm broad, indented on both suture; joints 5-6, rounded, with minute hooked hairs with faintly reticulations.

Fls. & Frts.: September to December

Distribution: Common throughout in open situation as well as forest undergrowth. In all district of Maharashtra.

3. *Desmodium gangeticum* (L.) Dc. Prodr. 2: 327. 1825; Baker in Hook. f. Fl. Brit. India 2:168. (incl. var. *maculatum* (L.) Baker: 1876; T. Cooke, Fl. Pres. Bombay 1: 379. 1958 (Repr.); Meeuwen in Reinwardtia 6:249. 1962; B. G. Kulk. Fl. Sindhudurg 118. 1988; Kambale & Pradhan Fl. Akola 62. 1988; Sanjappa, Legumes India 153. 1991; Karthik. and An. Kumar Fl. Yavatmal, 66. 1993; Almeida Fl. Maharashtra 62. 1998; Kothari and Moorthy Fl. Raigad 95. 1993; Kothari in N. P. Singh *et al*. Fl. Maharashtra St. Dicot. 1:670. 2000; Diwakar & Sharma Fl. Buldhana 107. 2000; Yadav &Sardesai in Fl. Kolhapur 148. 2000; Gadpayale*et al*., in ijrbat sp. issue-1: 26. 2015.Kshirsagar and Patil, Flora of Jalgaon District 108. 2008. *Hedysarum gangeticum* L Sp. Pl. 746. 1753. (Fig-3 - C)

   Holotype: Ind. Orient., Herb. Linn.921.13 (LINN). Herbaceous or Under-shrub or Shrub, stem somewhat angled, suberect, glabrescent, 60-120 cm high, woody, clothed with short grey hairs. Stipule 7-10 mm long scarious, linear-subulate; Leaves 1 foliolate, 2-14.5 x 1.1.-7.6 cm, lanceolate, ovate or narrowly ovate - oblong, glabrous above, appressed pubescent, grey, silky or nearly glabrous to glaucous beneath, apex acute to pointed and rounded at base, margin somewhat waved; petiole 1-3 cm long; petiolule 1 mm long, hairy; stipel 3 mm long, subulate. Raceme copious, ascending lateral and terminal, sometimes later sub-lax, 6-12-inch-long, simple or with a few short ascending branches in the lower part; pedicle 4-5 mm long, ascending to filiform, bracts 1-3 mm, subulate, setaceous; bracteole minute. Flowers usually 2, rachis very slender, very small, bluish-violet. In terminal and axillary racemes. Calyx 4 lobed, long triangular, twice as long as tube, 2-2.5 mm, finely downy; teeths lanceolate. Corolla 4 cm long, white to violet with black tinged; standard 3 mm broad, ovate, cuneate at base. Stamens 9+1. Pods reddish-brown, 1/3 to 3/4-inch-long, 1/12 to 1/8 in broad, sub-falcate or curved, hairy, 4 to 8 jointed indented about half-way down on the lower suture, upper suture slightly indented, usually with minute hooked hairs on the surface and reticulately veined.

   Fls. & Frts: March- November

   Distribution: Common throughout in dry and moist deciduous forest and also in open situation.

   Etymology: From the ‘Ganga’ sacred river of India.

4. *Desmodium heterocarpon* (L) Dc. Prodr. 2. 337. 1825; Meeuwen in Reinwardtia 6:251. 1962; H. Ohashi in Ginkgoana 1: 210. 1973; B. G. Kulk. Fl. Sindhudurg 118. 1988; Sanjappa, Legumes India 154. 1991; Kothari and Moorthy Fl. Raigad 94. 1993; Almeida Fl. Maharashtra 63. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1:670. 2000; Gadpayale *et al*., in ijrbat sp. issue-1: 26. 2015. *Hedysarum heterocarpon* L. Sp. Pl. 747. 1753. *Desmodium polycarpon* (Poir.) DC. Prodr. 2:334. 1825; Baker in Hook. f. Fl. Brit. India 2:171. 1876; T. Cooke, Fl. Pres. Bombay 1:377. 1958 (Repr.) (Fig-10 - J) Erect or suberect undershrub and sometimes ascending or trailing shrub, branches grey hairy, 60-160 cm high; root stock creeping and with short root hairs. Leaves 3 foliolate; petiole as long or shorter than the lateral side leaflets, angled, hairy; stipules subulate to narrowly ovate, lanceolate, setaceous, 4-8 mm long; leaflets; Leaflets 2.5- 7.5 x 1-3.2 cm, obovate-oblong to elliptic-oblong, side ones half to three-fourth as long as the end one, hairy beneath, rounded to acute at apex and obtuse to cuneate at base rarely rounded to somewhat retuse, mucronate, membranous or sub-coriaceous, pale and thinly silky beneath, secondary nerves 5-7, straight fine, curving at the margin.Flower 2-3 on fascicled on rachis, bluish-purple, 5-6 mm long, arranged in lax terminal and often panicle raceme. Racemes 2-10 cm long, covered with appressed straight to curved hairs; pedicles slender or filiform, 3-6 mm long, bracts imbricating, concave to lanceolate, 2-3 mm long, striate to sub-striate. Calyx 2-2.5 mm, 2 upper teeth connate except at tip, 3- lower narrower, acuminate, longer than the tube. Corolla 4 mm long, purple. Standard petal obovate-orbicular; wings and keel petals slightly curved upwards or straight. Stamen 9+1. Pods 1-2x 0.3-0.3 cm long, densely hooked hairy on dorsal side, closed or packed somewhat, linear-oblong, flat, pubescent, 3-8 jointed, joints not much longer than broad, lower suture indented, joints about as broad as long.

   Fls. & Frts: August- December.

   Distribution: Common and frequent in forest and open places of forest, plateaus and in deciduous forest. Chandrapur, Kolhapur. Nashik, Pune, Raigad, Ratnagiri, Solapur, Thane.
   Ethymology: Greek, hetero- = differing, -carpon = fruit; alluding to the pods on the lower part being one-seeded (articles probably having fallen off with age or as a result of insufficient pollination) while the upper ones are many-seeded.

5. *Desmodium laxiflorum* DC. In ann. Sci. Nat. Paris1, 4:100. 1825; Baker in Hook. f. Fl. Brit. India 2:164. 1876; T. Cooke, Fl. Pres. Bombay 1: 376. 1958 (Repr.); Meeuwen in Reinwardtia 6:252. 1962; B. G. Kulk. Fl. Sindhudurg 119. 1988; H. Ohashi in Ginkgoana 1: 101. 1973. Sanjappa. Legumes India 156. 1991; Kothari and Moorthy Fl. Raigad 94. 1993; Almeida Fl. Maharashtra

64. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1:671. 2000; Diwakar & Sharma Fl. Buldhana 107. 2000; Kshirsagar and Patil, Flora of Jalgaon District 108. 2008. Gadpayale *et al*., in ijrbat sp. issue-1: 27. 2015. (Fig-4 - D)

Holotype: Nepal, Wallich. An erect under shrub, 3-5 ft in high, with obtusely angled branches, clothed with dense short hairs. Petiole 3-5 mm long. stipules persistent, lanceolate, staceous 7.5 mm long; Leaves trifoliate, Leaflets 3.5-15.0 x 1.5-8.0 cm, ovate-elliptic or lanceolate, membranous or sub-cariaceous, glabrous above, appressed-pubescent beneath, terminal one 8-17 cm x 3-8 cm, lateral one about half as long, acute or scarsely acuminate, appressed hairy beneath, scabrid-puberlous above, secondary nerves 9-11, strong, parallel joining a marginal one. Flower white or bluish-violet, in lax racermes; racemes copious, axillary and terminal, 15-30 cm long; pedicles 3-4 mm long; bracts minute, linear subulate. Calyx under 2-3 mm long, densely hairy or strigose; teeths lanceolate, longer than tube. Standard 5 mm diam., keels 5 mm long. Pods 1 to 1 1/2 (one and half), rarely 2 inches, by 1/12 inches. Clothed with minute hooked hairs, flat, not all or slightly or rarely constricted between seeds, hairy to tubercle- based hairy, 6-10 jointed, joints longer than broad.

Fls. & Frts.: Aug to Dec.

Distribution: common under forest. Aurangabad, Ahmednagar, Satara, Pune, Kolhapur, Sindhudurg, Ratnagiri, Thane.

6. *Desmodium procumbens* (Mill.*)* Hitchc. *var. neomexicanum* (A. Gray) H.Ohashi, J. Jap. Bot. 88(3): 174. 2013. *Desmodium neomexicanum* A. Gray, Smithsonian Contr. Knowl. 3(art. 5): 53 (1852). Almeida Fl. Maharashtra 64. 1998. (Fig-5 - E)
   A straggling Herb ca. 1 m high, Erect, branching from base; stem and branches slender, slightly hairy to pubescent. Leavestrifoliolate, 1.7-4.3 x 0.5-1.8 cm, ovate or lanceolate, apex obtuse, both the surfaces uncinate-puberulent. Flowers in axillary, terminal panicle to lax panicle with white bluish tinge; bracts minute setaceous, persistent; pedicle filiform. Pods 1.5 - 2 cm long with deeply indented sutures, 4-6 jointed, reticulately veined, slightly sharply twisted, subsessile or stipitate; stipe up to 2 mm long

   Fls. & Frts: September- October

   Distribution: Rare in deciduous forest. Dhule, Pune, Ahemadnagar

7. *Desmodium pulchellum* (L.) Benth. In fl. Hongk. 83. 1862; Baker in hook. f. Fl. Brit. India 2:162. 1876; T. Cooke, Fl. Pres. Bombay 1: 376. 1958 (Repr.); Meeuwen in Reinwadtia6:256. 1962; B. G. Kulk. Fl. Sindhudurg 119. 1988; Sanjappa, Legumes India 160. 1991; Almeida Fl. Maharashtra 65. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1: 673. 2000; Gadpayale *et al*., in ijrbat sp. issue-1: 28. 2015. *Hedysarum pulchellum* L. Sp. Pl. 747. 1753. (Fig-12 - L) Under-shrub, up to 1 m tall; branches terets, grey-downy. Leaves 3 foliolate; petiole 1-1.5 cm long. Channelled above, densely downy; stipule ovate, 5 mm long, acuminate; leaflets 4.5-10 x 2.4-5.0 cm, elliptic-ovate, ovate to oblong, downy tomentose beneath, apex obtuse or subacute, often sinuate, base rounded or subcordate, coriaceous, glabrescent and subrugose above, secondary nerves 7-10 with parallel tertiaries, terminal one 7.5-14 cm long, lateral one about half as long; petiolules 2.5-3mm; stipels subulate. Flowers white or yellow, in axillary or terminal racemes, 7.5-12 cm long, composed of solitary, fascicled or umbellate flowers in the axile of 10-40 compound leafy bracts; bracts 12-40; bracts 2 foliolate, stipellate, orbicular, 1 cm across, glabrous on upper side, finely downy on the inner side, strongly nerved, coriaceous. Calyx 2 mm long, puberlous, teeth lanceolate. Corolla white or yellow, 6 mm long. Pods 4-5 mm long, indented on both suture; joints usually 2, slightly longer than broad, indented, pubescent.

   Fls. & Frts.: Common as undergrowth in moist deciduous forest.

   Distribution: Chandrapur, Pune, Ratnagiri, cultivated in Sindhudurg (Ornamental).

8. *Desmodium ritchiei* Sanjappa.Bot. Surv. India 22: 229. (1980) 1982 & legumes of India 161. 1991; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1: 670. 2000; Yadav &Sardesai Fl. Kolhapur 148. 2003; Gadpayale *et al*., in ijrbat sp. issue-1: 28. 2015.*D. rotundifolium* Baker in Hook. f. Fl. Brit. India 2:172. 1876; T. Cooke, Fl. Pres. Bombay 1: 381. 1958 (Repr.); Kambale& Pradhan Fl. Akola 62. 1988. *Desmodiastrum racemosum* (Bth.) Pramanik & Thoth. var. *rotundifolium* (Dalz. Ex. Prain) Pramanik& Thoth in J. Ind. Bot. Soc. 65:378. 1987.
   (Fig-6 - F) Erect herb, 15-45 cm high; stem, slender, terete, finely spreading hairy. Leaves 1-foliolate; petiole 5-6 mm, filiform; stipule lanceolate, tip, setaceous, 3 mm long, leaflets 1.2-2.5 x 1.2-2.5 cm, orbicular, obtuse or cuspidate, glabrous above, appressed pubescent beneath., nerves inconspicuous, base slightly cordate; petiole 1.5 mm long; stipel subulate. Flowers pink, in terminal and axillary lax raceme, at first short, after mature 7 to 12 cm; lower flower in distant pairs, upper solitary along a slender rachis; pedicels pubescent, filiform, ascending 6-15 mm long; bracts ovate, acuminate, striate, caducous. Calyx 4-5 mm long, hairy, teeth subulate, much longer than tube, ciliate. Corolla pink, exerted, 5 mm long. Pods 6-12 mm long, lower suture slightly indented, as broad as long, falcate, joints 3-6, reticulately veined, glabrescent when mature in the month of Nov-Dec.

   Fls. & Frts: September-December

   Distribution: As an undergrowth in deciduous forest, Common. Satara, Pune, Bhandara

9. *Desmodium scorpiurus* (Sw) Poir. Dict. Nat., ed. 2 [F. Cuvier] 13: 110. 1819; Nawale *et al*., Bioinfolet 17(3A) 395. 2020. *Hedysarum scorpiurus Sw. Prodr. 107.*

1788.Desmodium scorpiurus Desv. J. Bot. 1: 122. 1813. Vartak & Kumbhojkar in J. Bombay Nat. Hist. Soc. 81: 224. 1984; Tandyekkal and Mathew, Rheedea 5(2): 177. 1995; Almeida Fl. Maharashtra 66. 1998; Kothari in Singh *et al* Fl. Maharashtra St. Dicot. 1: 675. 2000. Yadav &Sardesai Fl. Kolhapur 148. 2003. *Desmodium scorpiurus* (Sw.) Desv. ex DC., Prodr. [A. P. de Candolle] 2: 333. 1825. *Desmodium scorpiurus* (Sw.) Desv. Mem. Soc. Linn. Paris 4: 306. 1826.
(Fig-7 - G)

Type: Jamaica, Swartz s.n. (lectotype S [S-R-2774], first step designated by Schubert (1980: 656), second step designated here; isolectotypes B [W 13825 -01 0], LD [LD1263645], S [S13-17668]
Herb, stem straggling to prostate, 10-40 cm long tall, wiry grooved, hairy. Leaves 3 foliolate, alternate, stipule auricular or leafy, 3-4 mm long some amplexicaul to stem, attenuate at apex; petiole 1-3 cm long, hairy; stipel 1-2 mm long; Terminal leaflets 3.0-7.0 x 1.5-4.0 cm, ovate-oblong or elliptic-oblong, apex obtuse, base rounded, hairy on both surfaces, lateral leaflets smaller than terminal, 1-2.5 cm long, obtuse at both end, Inflorescence terminal and axillary, 1-3 flowered; pedicel 2-5 mm long, hairy. Flowers white-purplish. Calyx 4, boat shaped, 2-2.5 mm long. Corolla 3-4 mm long, Standard obovate, wings oblong, keels obvate. Pods linear-moniliform, 4-6 cm long, 6-8 jointed, hairy. Seeds yellow to pale brown, rhomboidal.

Fls. & Frts.: Ocober-March

Distribution: Common near riversides. Aurangabad, Satara, Sangli, Bombay, Pune, Kolhapur, Sindhudurg

Etymology: Latin, scorpi- = scorpion, -urus = tail; pod is similar to tail like structure of scorpion.

10. *Desmodium trangulare* (Retz.) Merr. In J. Arnold Arb. 23:170. 1942; Meeuwen in Reinwadtia 6:261. 1962; B. G. Kulk. Fl. Sindhudurg 120. 1988; Sanjappa, Legumes India 162. 1991; Kothari and Moorthy Fl. Raigad 95. 1993; Almeida Fl. Maharashtra 67. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1: 677. 2000; Yadav &Sardesai Fl. Kolhapur 149. 2003; Kshirsagar and Patil, Flora of Jalgaon District 109. 2008. Hedysarum Retz. Obs. Bot. 3:40. 1753. *Desmodium congestum* Wall ex Wight &Arn. Prodr. 224.1834. *Desmodium cephalotes* (Roxb) Wall ex Wight &Arn. Prodr. 224. 1834; Baker in Hook. f. Fl. Brit. India 2:161. 1876; *Desmodium congestum* var. *congestum* (Wall ex Wight &Arn.) Prain in J. As. Soc. Bengal 66: 389. 1897; T. Cooke, Fl. Pres. Bombay 1: 375. 1958 (Repr.).*Desmodium triangulare* (Retz.) Merr. var. *congestum* (Prain) Sant. In Kew Bull. 276. 1948. (Fig-13 - M)

Type: Thunberg's specimen (LD).
Perennial, Shrub, 60-150 cm high; branches subterete or triquetrous, hairy or young appressed silky. Leaves 3 foliolate; petiole 1-5 cm long; stipules lanceolate,5-6 mm long, striate, with a fine setaceous tip; leaflets 3.5-15 x 2.0-4.5 cm, elliptic-oblong, ovate-oblong or oblong-lanceolate, silky pubescent beneath, apex acuminate, base subacute, secondary veins 7-20; lateral leaflets smaller than terminal one, petiolules, 1.5-2.5 mm; stipels filiform. Flowers white or red or yellow, in dense axillary peduncled umbels; bracts linear-oblong, acute or acuminate 2.5-3 mm long; bracteoles linear or staceous 3 mm long. calyx tube 3-3.5 mm; standard 7-7.5 mm long. Pods 1.5-2.5 cm, deeply indented; joints 4-6, slightly silky or glabrous, 2.5-3 mm broad, brown, slightly falcate, pubescent.

Fls. & Frts: August-December

Distribution: in deciduous forest, common in Kolhapur, Nashik, Pune, Raigad, Ratnagiri, Satara, Thane.

11. *Desmodium triflorum* (L.) DC. Prodr. 2:334. 1825; Baker in Hook. f. Fl. Brit. India 2:173. 1876; T. Cooke, Fl. Pres. Bombay 1: 378. 1958 (Repr.). Meeuwen in Reinwadtia 6:261. 1962; H. Ohashi in Ginkgoana 1: 245. 1973; B. G. Kulk. Fl. Sindhudurg 120. 1988; Sanjappa, Legumes India 163. 1991; Karthik. and An. Kumar Fl. Yavatmal, 67. 1993; Kothari and Moorthy Fl. Raigad 96. 1993; Almeida Fl. Maharashtra 68. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1: 677. 2000; Yadav & Sardesai Fl. Kolhapur 149. 2003; Kshirsagar and Patil, Flora of Jalgaon District 109. 2008. Gadpayale *et al*., in ijrbat sp. issue-1: 28. 2015. *Hedysarumtriflorum* L. Sp. Pl. 749. 1753. (Fig-8 - H)

Syntypes: Herb.Linn.921.45 (LINN); Herb. Hermann fol. 4, 20, 21/297 (BM). Perennial trailing or prostrate herb, stem caespitose, very slender, trailing 1/2 to 1 1/2 (one and half) ft.
Or up to 45 cm long, copiously branched, clothed with fine and long spreading hairs. Stipules lanceolate, persistent; petiole1/8 to 1/4. Leaves usually trifoliate, leaflets 0.3-1.5 x 0.2-0.8 cm, obovate, membranous, truncate to emarginate, glabrous above, cuneate at base with minute hairs to hairy beneath. Pedicel 1/4 to 1/8 inch.
Flower purple, pinkish and sometimes white, 1-4 in axillary fascicles on axils of leaves of small lateral branches; pedicle 6-7 mm long, bracts ovate, acute, ciliate; bracteoles minute. Calyx pubescent, 2.5-3 mm long, covered with long silky hairs, teeth very long, setaceous. Pods falcate to curved, 1 to 2 cm and 1/8 in broad, compressed, hairy; 3-5 jointed; upper suture straight and lower slightly indented, joints hairy or nearly glabrous, reticulate-veined, rather longer than broad.

Fls. & Frts.: June-January

Distribution: Common throughout the state in moist and dry situations. It is one cosmopolitan species (Hooker, 1879) [12]

Etymology: Latin, tri- = three, -flora = flowers; alluding to the flowers in fascicles of threes, although it varies from one to four (Ho *et al*. 2021).

12. *Desmodium triquetrum* (L.) DC. Prodr. 2. 326. 1821; Baker in Hook. f. Fl. Brit. India 2:163. 1876 p.p.;T. Cooke, Fl. Pres. Bombay 1: 378. 1958 (Repr.);

Meeuwen in Reinwadtia 6:262. 1962; B. G. Kulk. Fl. Sindhudurg 121. 1988; Sanjappa, Legumes India 163. 1991; Kothari and Moorthy Fl. Raigad 94. 1993; Almeida Fl. Maharashtra 68. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1: 677. 2000; Yadav & Sardesai Fl. Kolhapur 149. 2003; Kshirsagar and Patil, Flora of Jalgaon District 110. 2008. *Hedysarum triquetrum* L. Sp. Pl. 746. 1753. (Fig-8 - H)

Undershrub, up to 1 m tall; branches triquetrous, grooved, glabrescent when older. Leaves unifoliolate; petiole winged, 1.5-3.5 cm long, 2010 mm broad, 2 cuspidate at apex; stipule 1-1.2 cm long, lanceolate; leaflets 4-18 x 2-9 cm, ovate-oblong or lanceolate, rigidly sub-coriaceous, glabrous above, sparsely hairy on nerve beneath, acute at apex, slightly hairy on nerves beneath, rounded or subcordate at base; petiolule very short; stipel acute, adnate to the top of petiolar wing. Flowers small, red, bluish or purplish, in axillary and terminal raceme, 1-3 in axillary, and terminal position, panicle raceme, panicle 10-22 cm long; pedicels ascending5-6 mm long. Calyx 1/8-inch campanulate; upper teeth deltoid, broad, acute.

Pods 1-5-4 cm long, linear-oblong, compressed, flat, beaked, glabrous or grey-pubescent, 4-8 jointed, appressed hairy, dehiscent, joints nearly square, lower suture faintly indented, Seeds compressed, 1.5-1.7 mm, white or yellow.

Fls. & Frts.: August-December

Distribution: in Plains, ghats or as forest under growth. Common in Ahmednagar, Kolhapur, Nashik, Pune, Raigad, Ratnagiri, Satara, Thane.

13. *Desmodium velutinum* (Willd.) DC. Prodr. 2: 328. 1825; Meeuwen in Reinwadtia 6:264. 1962; Kambale & Pradhan Fl. Akola 62. 1988; Sanjappa, Legumes India 165. 1991; Karthik. and An. Kumar Fl. Yavatmal, 67. 1993; Kothari and Moorthy Fl. Raigad 95. 1993; Almeida Fl. Maharashtra 69. 1998; Kothari in Singh *et al*. Fl. Maharashtra St. Dicot. 1: 677. 2000. *Hedysarum velutinum* Willd. Sp. Pl. 3: 117. 1803. *Desmodium laticifolium* (Roxb) DC. Prodr. 2: 327. 1825; Baker in Hook. f. Fl. Brit. India 2:168. 1876; T. Cooke, Fl. Pres. Bombay 1: 380. 1958 (Repr.). (Fig-9 - J) Erect Undershrub, 60-150 cm high; branches densely to fulvous-pubescent, terete.
14. Leaves 1-foliolate; petiole 1-1.5 cm long; stipules lanceolate with setaceous tip, hairy; leaflets 7-13 x 4-10 cm, broadly ovate or suborbicular, obtuse or subacute; sometimes repand, membranous or coriaceous, softly hairy, secondary nerves 6-8, base cordate, scabridly sparsely hairy above, densely so beneath. Flowers pinkish or purplish, 4-5 mm long, fascicled in terminal and axillary raceme, very narrow, 5-18 cm long, sometimes panicle up to 40 cm long.
15. Calyx 3-4.5 mm long, densely hairy, teeth triangular. Pods straight, 1.5-2.0 cm long, densely hairy, 3-6jointed, joints slightly longer than broad, ca. 3 mm long, pubescent or villose.

Fls. &Frts.: July-December

Distribution: In hilly region. Aurangabad, Pune,

Result and Discussion

Desmodium alysicarpoides Snap Van Meeuwen is bridging species between *Alysicarpus* Neck ex Desv. and *Desmodium* Desv. With some common characters. Meeuwen (1962) keep this species in *Desmodium* where as Thothari and Pramanik (1978) created a new genus *Desmodiastrum* Thot. & Pramanik to accommodate this together *Alysicarpus racemosus* Benth. and *Desmodium rotundifolium* Baker (Almeida *et al*. 2003) [1]. After that Ohashi treated it as *Alysicarpus parviflorus* Dalzell, however author feels, Ohashi (2018) [27] broad concept and present investigation is fit for acceptance of *Desmodium alysicarrpoides* Meeuwen even at the species level of under *Alysicarpus* Neck ex Desv. because it carries similar pod morphology like chain in Alysicarpus.

Desmodium benthamii is nomenclature novum for *D. brachystachym* Grahm. ex Benth in Miq. Pl. Jungh. 223, 1852. (Non Schlecht. 1838). *Desmodium brachystachym* same epithets used by two authors like *D. brachystachym* Benth. and *D. brachystacym* Schltdl. As well as *Desmodium benthamii* this epithet used by two authors *viz*., *Desmodium benthamii* Balakr. and *D. benthamii* Ohashi.

Desmodium brachystachym is first time reported by Malhotra S. K. and Moorthy S, (1976). After Herbarium consultation at BSI, it is fount one of sheet of *D. brachystachym* has a notation 'Chota Nagpur, Ranchi and upper Bengal'. These two localities were mentioned. It is might be Malhotra and Moorthy (1976) feels Nagpur is district of Maharashtra and included in Tadoba Wild life Sanctuary, but during field trips in Chandrapur, Nagpur districts, it was tried to trace the live specimens as well as herbarium specimens from Western Regional circle Pune (*BSI*), but could not found any specimen. So, it is opinioned that the occurrence of this species from Maharashtra is uncertain.

The name *Desmodium diffusum* published by De Candolle in Ann. Sci. Nat. 4: 100, (Jan) 1825 and which is coated in his Prodromus 2: 335. 1825 is *D. laxiflorum* (Roxb.) DC. That me, therefore appearing our India floras is nom. illegitimate being later homonym. The next valid name is then *D. dichotomum* based on *H. dichotomum* Willd. (G. L. Shah, 1969), due to avoid confusion I omitted from citation of species.

Desmodium gangeticum (L.) DC is highly variable, diffuse or sub erect in habit due to that the varieties considered as variation among the vegetative parts.

Desmodium heterocarpon (L) DC is highly variable in degree of pubescence with straight and hooked hairs on rachis of inflorescence (Baker, 1878; Cooke, 1958 Repr.; Ohashi, 2021) [7, 15].

Isely (1998) [13] and Ohashi (2013) [10] treated *Desmodium procumbens* has twisted loment and on the basis of it segregated and recognized two variety as *D. procumbens* var. *procumbens* and *D. procumbens* var. *neomaxicanum* (A. Gray) H. Ohashi. After studying all collected specimens from Ahmednagar and Pune shows leaves mostly three foliolate, stipe 2 mm long and pod subsessile, so it is attributing to *D. procumbens* var. *neomexicanum* (A. Gray) H. Ohashi.

Almeida (1998) [2] and Kothari (2000) [19] shown *Desmodium scorpiurus* Sw. Desv. is correct name but this new combination was published by Desvaux (1826) and by Poiret (1819) [31], It means according to Shenzhen Code (2018), Poiret (1819) [31] has priority over name published

by Desvaux in 1826. *Desmodium scorpiurus* Desv. is nom. nudum and published without basionym and it is often confused with *D. laxiflorum* DC. but easily distinguished as shown in key.

According to Bin Ye and H. Ohashi (2007) [5], Bin Ye *et al*., (2011) [4], H. Ohashi (2013) [10], H. Ohashi *et al*., (2017) [18] segregated *Desmodium* based on Morphology, phylogenetic studies, pollen studies respectively and its analysis shows following are the list of species earlier recorded under *Desmodium* for Flora of Maharashtra (Kothari, 2000; Almeida 1998) [19, 2] is now altered with botanical name and they are now recognized as depicted in conclusion.

Photo plate 1: A-D. Alysicarpoides. B-D. Dichotomum. C-D. Gangeticum. D-D. Laxiflorum. E-D. Procumbens, F- D. Ritchici. G-D. Scorpiurus. H-D. Triflorum, I-D Velutinum. J-D. Haterocarpon. K-D. triquctrum. L-D. Pulchellum. M-D. Triangulare

Conclusion

The taxonomic studies of *Desmodium* were under taken due to economic uses, endemism, nomenclatural anomalies and the herbarium based earlier work into consideration taxonomic studies on this genus for Maharashtra was undertaken.

This taxonomic revision studies of *Desmodium* shows 13 species are found in Maharashtra. After field trips and field observations and consultation of reputed herbaria it is found that *D. benthamii* N. P. Balakr., *D. heterophyllum* (Willd.) DC., *D. motorium* (Houtt.) Merr., *D. renifolium* (L.) Schindle and *D. repandum* (Vahl) Poir shows uncertain distribution for Maharashtra. Distribution and rarity recorded for every species will be helpful to study the IUCN status for Maharashtra. It is expected that the present study and observations will be helpful for further investigations in pollination study and conservation of *Desmodium* groups and allied genera with its species for Maharashtra.

List of species of earlier considered as species of *Desmodium* Desv. for Maharashtra with its accepted names.

D. alysicarpoides Meeuwen synonym of *Alysicarpus parviflorus* Dalzell

D. benthamii N. P. Balakr. Synonym of *Grona brachystachya* (Graham ex Benth.) H. Ohashi & K. Ohashi

D. benthamii Ohashi synonym of *Grona brachystachya* (Graham ex Benth.) H. Ohashi & K. Ohashi

D. dichotomum (Willd.) DC is synonym of *Bouffordia dichotoma* (Willd.) H. Ohashi & K. Ohashi

D. gangeticum (L.) DC is synonym of *Pleurolobus gangeticus* (L.) J.St.-Hil. ex H. Ohashi & K. Ohashi

D. heterocarpon (L.) DC is synonym of *Grona heterocarpos* (L.) H. Ohashi & K. Ohashi

D. heterophyllum (Willd.)DC is synonym of *Grona heterophylla* (Willd.) H. Ohashi & K. Ohashi

D. laxiflorum DC. is synonym of *Sohmaea laxiflora* (DC.) H. Ohashi & K. Ohashi

D. motorium (Houtt.) Merr.is synonym of *Codariocalyx motorius* (Houtt.) H. Ohashi

D. pulchellum (L.) Benth.is synonym of *Phyllodium pulchellum* (L.) Desv.

Desmodium neomexicanum A.Gray is synonym of *Desmodium procumbens* var. *neomexicanum* (A.Gray) H.Ohashi.

D. renifolium (L.)Schindle is synonym of *Huangtcia renifolia* (L.) H. Ohashi & K. Ohashi

D. ritchiei Sanjappa is synonym of *Alysicarpus racemosus* Benth.

D. triangulare (Retz.) Merr. is synonym of *Dendrolobium triangulare* (Retz.) Schindl.

D. triflorum (L.) DC is synonym of *Grona triflora* (L.) H.Ohashi & K. Ohashi

D. triquetrum (L.) DC is synonym of *Tadehagi triquetrum* (L.) H.Ohashi

D. umbellatum (L.) DC is synonym of *Dendrolobium umbellatum* (L.) Benth.

D. velutinum (Willd.)DC is synonym of *Polhillides velutina* (Willd.) H. Ohashi & K. Ohashi

D. repandum (Vahl) Poir is synonym of *Hylodesmum repandum* (Vahl) H. Ohashi & R.R. Mill

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