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## An enumeration of Fabaceae Lindl. Members in Pantnagar, Uttarakhand, India

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### Abstract

Fabaceae Lindl. is commonly called bean or legume family. Pantnagar is a small Tarai land area of ca. 51 km<sup>2</sup> near Himalayan foot hills in Kumaun region of Uttarakhand. Plant specimens of family Fabaceae were collected from different localities of the study area. Results show that in Pantnagar, Fabaceae is represented by 130 species and 3 subspecies under 69 genera, 21 tribes and 4 subfamilies. Papilionoideae DC. is the most dominant subfamily with 47 genera, 90 species, followed by Caesalpinioideae DC. (19 genera, 32 species) and 3 subspecies, Detarioideae Burmeist. (2 genera, 2 species), and Cercidoideae Azani *et al.* (1 genus, 6 species). Most of the species are herbs followed by shrubs, trees, climbers. Among the tribes, Phaseoleae Bronn ex DC. is the largest followed by Desmodieae, Mimoseae and Caesalpinieae. Large number of wild relatives of crop plants (54 species) also occurs in the area while many are alien species which include 13 invasive species.

**Keywords:** detarioideae, cercidoideae, caesalpinioideae, papilionoideae, legume

### Introduction

Today, angiosperms are the largest plant group in the world with 341,393 species under 15,990 genera, 462 families and 65 orders (Banki *et al.*, 2022) <sup>[5]</sup>. Fabaceae Lindl. is one among the three largest families of the angiosperms and represented by 22,353 species of 778 genera under 36 tribes and 6 subfamilies (Takhtajan, 2009; LPWG, 2017; Legume Data Portal, 2022) <sup>[43, 19, 20]</sup>. The family Fabaceae (Leguminosae Juss.) is commonly known as the legume, bean or pea family and contains largest number of edible species, thus ranked as second only to Poaceae Barnhart (Gramineae Juss.) in economic importance (Singh *et al.*, 2007) <sup>[40, 46]</sup>. Ecologically legumes have specific ability to fix atmospheric nitrogen (Rivas *et al.*, 2009). Bentham (1865) placed all legumes in the order Rosales under the family Leguminosae and further divided it into three subfamilies i.e., Papilionaceae Giseke, Caesalpinieae Rchb. and Mimoseae Bronn. On the other hands Hutchinson (1973) <sup>[12]</sup> and Cronquist (1988) <sup>[7]</sup> recognized these subfamilies as three different families under the order Leguminales or Fabales. In the Angiosperm Phylogeny Group classification (APGIV, 2016) all legumes are clubbed under single family Fabaceae which is placed in the order Fabales. The most recent classification of legumes by The Legume Phylogeny Working Group (LPWG, 2017) <sup>[19]</sup> have placed all the legumes in family Fabaceae, but unlike previous classifications, divided the family into 6 subfamilies i.e., Caesalpinioideae DC., Cercidoideae Azani *et al.*, Duparquetioideae Azani *et al.*, Detarioideae Burmeist., Dialioideae Azani *et al.* and Papilionoideae DC. with earlier Mimosoideae DC. embedded in the Caesalpinioideae.

In India the legumes were reported to have 199 genera, 1252 species, 23 subspecies, and 109 varieties (Sanjappa, 2001) <sup>[42]</sup>, though recent checklist of flowering plants of India (Sanjappa, 2020) <sup>[42]</sup> lists 176 genera and 1292 species. In Uttarakhand the family is represented by 98 genera and 421 species (Uniyal *et al.*, 2007) <sup>[46]</sup>. Pusalkar and Srivastava (2018) <sup>[30]</sup> mentioned presence of 80 genera and 351 species in Uttarakhand. In the adjacent state Uttar Pradesh Fabaceae is represented by 95 genera and 327 species (Shukla *et al.*, 2016) <sup>[41]</sup>, while in Himachal Pradesh legumes 70 genera and 230 species 2 subspecies and 8 varieties are listed in Chowdhery (1984) <sup>[6]</sup>.

Species wise legumes are among the dominant groups in Pantnagar area (Nisha *et al.*, 2015) <sup>[25]</sup>. In earlier works Rao *et al.* (2003) <sup>[35]</sup> reported 43 species in 24 genera (28 species wild). Joshi (2009) <sup>[16]</sup> reported 39 genera, 71 species of legume (34 species wild); Nisha *et al.* (2015) <sup>[25]</sup> listed 71 species in 38 genera of 17 tribe (all wild species). More recently in some unpublished sources Rana (2019) <sup>[38]</sup> reported 19 cultivated species in 15 genera. Kamboj (2021) <sup>[17]</sup> reported 20 cultivated species under 16 genera and Verma (2022) <sup>[47]</sup> reported 45

genera, 82 species of wild legumes in Pantnagar. However, a complete list of legume species (cultivated and wild) with updated nomenclature and recent classification is yet to be published for Pantnagar area and therefore, this is attempted in present communication.

### Materials and Methods

Pantnagar is situated in between the latitudes N 28° 59' 36" – 29° 02' 34" and longitude E 79° 28' 33" – 79°31' 12" with an altitude range of 213-238 m above mean sea level (Google Earth, 2022). The university has spread into an area of 51.24 km<sup>2</sup> and considered as the second-largest university (area wise) in the world (Annon. 2006) <sup>[1]</sup>. The type of soil varies from place to place in Pantnagar, amongst most productive, well drained, coarse-loamy or fine loamy and mildly alkaline soil present in Pantnagar (Pareek *et al.*, 2019) <sup>[31]</sup> which makes the land suitable for cultivated and wild flora. The area has a humid-subtropical climate. Plant specimens of the family Fabaceae were collected from different localities of the study area Pantnagar including agricultural fields, gardens, research centres, roadsides and residential areas of the university during different seasons for further study. The specimens were collected with the information about date, locality, date of collection, locality, habit and habitat, flower colour, and these are processed to prepare herbarium specimens following standard taxonomic procedures as suggested by Jain and Rao (1976) <sup>[15]</sup>, Rao and Sharma (1990) <sup>[34]</sup>. The collected and prepared specimens were submitted in the Herbarium, Department of Biological Sciences, CBSH, Pantnagar. The plant specimens were identified with the help of regional floras (Duthie, 1903; Osmaston, 1927; Babu, 1977; Gaur, 1999; Singh *et al.*, 2016) <sup>[9, 26, 4, 11, 40, 46]</sup> and taxonomic literature available on the web. Identification is further confirmed by comparing collected plant specimens with authentic herbarium sheets housed in the herbaria of Botanical Survey of India Dehradun (BSD) and Forest Research Institute, Dehradun (DD). Wherever required, images of herbarium specimens available in Indian Virtual Herbarium (<https://ivh.bsi.gov.in/index.html>) were also consulted. Nomenclature of identified species was mainly checked in taxonomic databases (POWO, 2022; Legume Data Portal, 2022; IPNI, Tropicos) <sup>[32, 20]</sup> to make it up to date. The classification proposed by LPWG (2017) <sup>[19]</sup> is followed here for subfamilies while the tribal classification given in Lewis (2005) <sup>[18]</sup> is followed.

### Results

In this enumeration currently accepted name, basionym (where required), name used in the checklist of Indian plants (Sanjappa, 2020) <sup>[42]</sup> if different from currently accepted name, its publication details and voucher specimen number of submitted specimen in Herbarium (abbreviated as GBPUH) are given. In case of cultivated species, purpose of cultivation is also mentioned. All the legumes collected from Pantnagar area are enumerated under tribes and subfamilies recognized by Lewis *et al.* (2005) <sup>[18]</sup> and LPWG (2017) <sup>[19]</sup>.

#### Subfamily: Cercidoideae Azani *et al.*

Tribe: Cercideae Bronn

*Bauhinia acuminata* L., Sp. Pl. 1: 376. 1753. Cultivated as an ornamental shrub [GBPUH- 1244]

*Bauhinia blakeana* Dunn, J. Bot. 46: 325. 1908. Cultivated as an ornamental tree [GBPUH-1289]

*Bauhinia purpurea* L., Sp. Pl. 1: 375. 1753. Cultivated as avenue tree [GBPUH-931]

*Bauhinia racemosa* Lam., Encycl. 1(2): 390. 1785. [GBPUH-1440]

*Bauhinia tomentosa* L., Sp. Pl. 1: 375. 1753. Cultivated as ornamental shrub [GBPUH- 1277]

*Bauhinia variegata* L., Sp. Pl. 1: 375. 1753. [GBPUH- 1321]

#### Subfamily: Detarioideae Burmeist.

Tribe: Detarieae DC.

*Saraca asoca* (Roxb.) W.J.de Wilde, Blumea 15(2): 393. 1968. *Jonesia asoca* Roxb., Asiat. Res. 4: 355. 1795. Cultivated as ornamental and medicinal tree. [GBPUH- 1236]

*Tamarindus indica* L., Sp. Pl. 1: 34. 1753. [GBPUH- 1238]

#### Subfamily: Caesalpinioideae DC.

Tribe: Acacieae Dumort.

*Acacia auriculiformis* A. Cunn. ex Benth., London J. Bot. 1: 377. 1842. Cultivated as avenue tree along road sides [GBPUH- 1240]

*Acacia dealbata* Link, Enum. Hort. Berol. Alt. 2: 445. 1822. A small tree cultivated as an ornamental along road sides [GBPUH- 1215]

*Senegalia catechu* (L.f.) P.J.H. Hurter & Mabb., Mabblerley's Pl.-Book 1021. 2008. *Mimosa catechu* L.f., Suppl. Pl. 439. 1782. [GBPUH-1292]

*Senegalia rugata* (Lam.) Britton & Rose, N. Amer. Fl. 23(2): 120. 1928. *Mimosa rugata* Lam., Encycl. 1(1): 20. 1783. cultivated as timber tree [GBPUH-1314]

*Vachellia farnesiana* (L.) Wight & Arn., Prodr. Fl. Ind. Orient. 1: 272. 1834. *Mimosa farnesiana* L., Sp. Pl. 1: 521. 1753. [GBPUH- 1282]

*Vachellia nilotica* subsp. Indica (Benth.) Kyal. & Boatwr., Bot. J. Linn. Soc. 172(4): 515. 2013. *Acacia arabica* var. *indica* Benth., London J. Bot. 1: 500. 1842. [GBPUH- 1326]

Tribe: Cassieae Bronn

*Cassia fistula* L., Sp. Pl. 1: 377. 1753. [GBPUH-1232]

*Cassia javanica* L. subsp. *renigera* (Wall. ex Benth.) K.Larsen, Nordic J. Bot. 13(4): 404. 1993. *Cassia renigera* Wall. ex Benth., Trans. Linn. Soc. London 27(4): 518. 1871. Cultivated as ornamental or avenue tree [GBPUH- 1285]

*Senna alata* (L.) Roxb., Fl. Ind. 2: 349. 1832. *Cassia alata* L., Sp. Pl. 1: 378. 1753. [GBPUH- 1286]

***Senna alexandrina*** Mill. Gard. Dict., ed. 8 n. 1. 1768. Cultivated as ornamental shrub [GBPUH- 192]

***Senna occidentalis*** (L.) Link, Handbuch 2: 140. 1831. *Cassia occidentalis* L., Sp. Pl. 1: 377. 1753. [GBPUH- 1245]

***Senna polyphylla*** (Jacq.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 517. 1982. *Cassia polyphylla* Jacq., Collectanea 4: 104. 1791. Cultivated as ornamental shrub [GBPUH- 1288]

***Senna siamea*** (Lam.) H.S. Irwin & Barneby, Mem. New York Bot. Gard. 35(1): 98. 1982. *Cassia siamea* Lam., Encycl. 1(2): 648. 1785. Cultivated as ornamental tree [GBPUH- 1311]

***Senna sophera*** (L.) Roxb., Fl. Ind. ii. 347. 1832. *Cassia sophera* L., Sp. Pl. 1: 379. 1753. [GBPUH- 1248]

***Senna sulfurea*** (Collad.) H.S.Irwin & Barneby, Mem. New York Bot. Gard. 35: 78. 1982. *Cassia sulfurea* Collad., Hist. Nat. Med. Casses 84. 1816. Cultivated as ornamental shrub or small tree [GBPUH- 1239]

***Senna tora*** (L.) Roxb., Fl. Ind. 2: 340. 1832. *Cassia tora* L., Sp. Pl. 1: 376. 1753. [GBPUH- 1274]  
Tribe: Caesalpinieae Rchb.

***Acrocarpus fraxinifolius*** Arn., Mag. Zool. Bot. 2(12): 547. 1839. Cultivated as avenue tree [GBPUH- 1329]

***Caesalpinia pulcherrima*** (L.) Sw., Observ. Bot. 166. 1791. *Poinciana pulcherrima* L., Sp. Pl. 1: 380. 753. Cultivated as ornamental shrub [GBPUH- 988]

***Delonix regia*** (Bojer) Raf., Fl. Tellur. 2: 92. 1837. *Poinciana regia* Bojer, Bot. Mag. 56: t. 2884. 1829. Cultivated as ornamental tree [GBPUH- 929]

***Parkinsonia aculeata*** L., Sp. Pl. 1: 375. 1753. Cultivated as ornamental tree [GBPUH- 1235]

***Peltophorum pterocarpum*** (DC.) Backer ex K.Heyne. Nutt. Pl. Ned.-Ind., ed. 2, 2: 755. 1927. *Inga pterocarpa* DC., Prodr. 2: 441. 1825. Cultivated as ornamental tree [GBPUH- 1234]

**Tribe:** Ingeae Benth. & Hook. f.

***Albizia chinensis*** (Osbeck.) Merr., Amer. J. Bot. 3: 575. 1916. *Mimosa chinensis* Osbeck., Dagb. Ostind. Resa, 233. 1757; *Albizia stipulata* (DC.) Boivin, Encycl. 2: 33. 1837. [GBPUH- 1317]

***Albizia lebbek*** (L.) Benth., Hooker's London J. Bot. 3. 87. 1844. *Mimosa lebbek* L., Sp. Pl. 1: 516. 1753. [GBPUH- 1214]

***Albizia procera*** (Roxb.) Benth., London J. Bot. 3: 89. 1844. *Mimosa procera* Roxb., Pl. Coromandel 2(1): 12, t. 121. 1799. [GBPUH- 1316]

***Calliandra haematocephala*** Hassk., Retzia 1: 216. 1855.

Cultivated as ornamental shrub or small tree [GBPUH- 1291]  
***Calliandra tergemina*** (L.) Benth., London J. Bot. 3: 96. 1844. *Mimosa tergemina* L., Sp. Pl. 1: 517. 1753. Cultivated as ornamental shrub or small tree [GBPUH-1436]

***Falcataria falcate*** (L.) Greuter & R.Rankin, Espermat. Cuba Invent. Prelim. XII. 2016. *Adenanthera falcata* L., Herb. Amboin. 14. 1754. Cultivated in tree collection [GBPUH- 1330]

***Pithecellobium dulce*** (Roxb.) Benth., London J. Bot. 3: 199. 1844. *Mimosa dulcis* Roxb., Pl. Coromandel 1(4): 67, t. 99. 1798. Cultivated as ornamental tree [GBPUH- 1237]

**Tribe:** Mimoseae Bronn

***Adenanthera microsperma*** Teijsm. & Binn., Natuurk. Tijdschr. Ned.-Indle xxvii. 58. 1864. Cultivated as avenue tree [GBPUH- 1281]

***Dichrostachys cinerea*** (L.) Wight & Arn., Prodr. Fl. Ind. Orient. 1: 271. 1834. *Mimosa cinerea* L., Sp. Pl. 1: 520. 1753. Cultivated as ornamental tree [GBPUH- 1233]

***Leucaena leucocephala*** (Lam.) de Wit, Taxon 10: 54. 1961. *Mimosa leucocephala* Lam., Encycl. 1(1): 12. 1783. [GBPUH- 1293]

***Mimosa pudica*** L., Sp. Pl. 1: 518. 1753. [GBPUH- 1241]

***Mimosa rubicaulis*** subsp. himalayana (Gamble) H.Ohashi, Enum. Fl. Pl. Nepal. 2: 126. 1979. *Mimosa himalayana* Gamble, Bull. Misc. Inform. Kew 1: 4. 1920. [GBPUH- 1290]

***Prosopis juliflora*** (Sw.) DC., Prodr. 2: 447. 1825. *Mimosa juliflora* Sw., Prodr. 85. 1788. [GBPUH- 1315]

**Subfamily:** Papilionoideae DC.

**Tribe:** Abreae Hutch.

***Abrus precatorius*** L., Syst. Nat., ed. 12. 2: 472. 1767. [GBPUH- 960]

**Tribe:** Cicereae Alef.

***Cicer arietinum*** L., Sp. Pl. 2: 738. 1753. Many cultivars are cultivated as pulse crop [GBPUH- 1243]

**Tribe:** Crotalariae Hutch.

***Crotalaria alata*** Buch.-Ham., Prodr. Fl. Nepal. 241. 1825. [GBPUH- 1296]

***Crotalaria juncea*** L., Sp. Pl. 2: 714. 1753. Cultivated for fiber, edible shoots and flowers. [GBPUH- 1220]

***Crotalaria medicaginea*** Lam., Encycl. 2(1): 201. 1786. [GBPUH- 1253]

***Crotalaria mysorensis*** Roth, Nov. Pl. Sp. 338. 1821. [GBPUH- 1217]



***Crotalaria pallida*** Aiton, Hort. Kew. 3: 20. 1789. *Crotalaria striata* DC., Prodr. 2: 131. 1825. [GBPUH- 1310]

***Crotalaria prostrata*** Rottler, in Willd., Enum. Pl. 2: 747. 1809. *Crotalaria prostrata* Roxb., Fl. Indica 3: 270. 1832. [GBPUH- 1300]

***Crotalaria spectabilis*** Roth, Nov. Pl. Sp. 341. 1821. *Crotalaria sericea* Retz., Observ. Bot. 5: 26. 1788, nom. illeg. [GBPUH- 1219]

**Tribe:** Dalbergieae Bronn ex DC.

***Aeschynomene indica*** L., Sp. Pl. 2: 713. 1753. [GBPUH- 1254]

***Arachis hypogaea*** L., Sp. Pl. 2: 714. 1753. Cultivated for edible seeds [GBPUH- 1312]

***Dalbergia sissoo*** Roxb. ex DC., Prodr. 2: 416. 1825. [GBPUH- 949]

**Tribe:** Desmodieae Hutch.

***Alysicarpus bupleurifolius*** (L.) DC., Prodr. 2: 352. 1825. *Hedysarum bupleurifolium* L., Sp. Pl. 2: 745. 1753. [GBPUH- 342]

***Alysicarpus glumaceus*** (Vahl) DC., Prodr. 2: 353. 1825. *Hedysarum glumaceum* Vahl, Symb. Bot. 2: 106. 1791. [GBPUH- 1260]

***Alysicarpus hamosus*** Edgew., J. Asiat. Soc. Bengal 21(2): 171. 1852. [GBPUH- 1319]

***Alysicarpus monilifer*** (L.) DC., Prodr. 2: 353. 1825. *Hedysarum moniliferum* L., Mant. Pl. 102. 1767. [GBPUH- 1259]

***Alysicarpus rugosus*** (Willd.) DC., Prodr. 2: 353. 1825. *Hedysarum rugosum* Willd., Sp. Pl., ed. 4. 3(2): 1172. 1802. [GBPUH- 1318]

***Alysicarpus vaginalis*** (L.) DC., Prodr. 2: 353. 1825. *Hedysarum vaginae* L., Sp. Pl. 2: 746. 1753. [GBPUH- 1265]

***Bouffordia dichotoma*** (Willd.) H. Ohashi & K. Ohashi, J. Jap. Bot. 93(3): 180. 2018. *Hedysarum dichotomum* Willd., Sp. Pl., ed. 4. 3(2): 1180. 1802; *Desmodium dichotomum* (Willd.) DC., Prodr. 2: 336. 1825; *Desmodium diffusum* (Willd.) DC., Prodr. 2: 336. non 335. 1825. [GBPUH- 1320]

***Dendrolobium triangulare*** (Retz.) Schindl., Repert. Spec. Nov. Regni Veg. 20: 279. 1924. *Hedysarum triangulare* Retz., Observ. Bot. iii. 40. 1783; *Desmodium cephalotes* (Roxb.) Wight & Arn., Prodr. Fl. Ind. Orient. 224. 1834; *Desmodium triangulare* (Retz.) Merr., J. Arnold Arbor. 23: 170. 1942. [GBPUH- 1322]

***Desmodium tortuosum*** (Sw.) DC., Prodr. 2: 332. 1825. *Hedysarum tortuosum* Sw., Prodr. 107. 1788. [GBPUH- 1306]

***Grona triflora*** (L.) H. Ohashi & K. Ohashi, J. Jap. Bot. 93(2): 117. 2018. *Hedysarum triflorum* L., Sp. Pl. 2: 749. 1753; *Desmodium triflorum* (L.) DC., Prodr. 2: 334. 1825. [GBPUH- 1299]

***Lespedeza juncea*** (L.f.) Pers., Syn. Pl. 2(2): 318. 1807. *Hedysarum junceum* L. f., Dec. Pl. Hort. Upsal. 1: 7. 1762. [GBPUH- 1267]

***Ougeinia oojeinensis*** (Roxb.) Hochr. Bull. Soc. Bot. Geneve xiii. & xiv. 51. 1909; *Dalbergia oojeinense* Roxb., Fl. Indica 3: 220. 1832. *Desmodium oojeinense* (Roxb.) H. Ohashi, Ginkgoana 1: 117. 1973. [GBPUH- 1270]

***Phylloidium pulchellum*** (L.) Desv., J. Bot. 1: 124, t. 5, f. 24. 1813. *Hedysarum pulchellum* L., Sp. Pl. 2: 747. 1753. [GBPUH- 1284]

***Pleurolobus gangeticus*** (L.) J. St.-Hil. ex H. Ohashi & K. Ohashi, J. Jap. Bot. 93(3): 184. 2018. *Hedysarum gangeticum* L., Sp. Pl. 2: 746. 1753. [GBPUH- 1280]

***Uria lagopus*** DC., Ann. Sci. Nat. 4: 100. 1825. [GBPUH- 1272]

***Uria picta*** (Jacq.) DC., Prodr. 2: 324. 1825. *Hedysarum pictum* Jacq., Collectanea 2: 262. 1789. [GBPUH- 440]

***Uria rufescens*** (DC) Schindl., Repert. Spec. Nov. Regni Veg. 21: 14. 1925. *Desmodium rufescens* DC., Ann. Sci. Nat. (Paris) 4: 101. 1825. [GBPUH- 1325]

**Tribe:** Fabaeae Rchb.

***Lathyrus aphaca*** L., Sp. Pl. 2: 729. 1753. [GBPUH- 1268]

***Lathyrus odoratus*** L., Sp. Pl. 2: 732. 1753. Cultivated as ornamental herb [GBPUH- 1297]

***Lathyrus oleraceus*** Lam., Fl. Franc. 2: 580. 1779. *Pisum sativum* L., Sp. Pl. 2: 727. 1753. Cultivated as vegetable crop. [GBPUH- 1250] Many cultivars present.

***Lathyrus sativus*** L., Sp. Pl. 2: 730. 1753. [GBPUH- 1269]

***Lathyrus sphaericus*** Retz., Observ. Bot. iii. 39. 1783. [GBPUH- 1224]

***Vicia faba*** L., Sp. Pl. 2: 737. 1753. Cultivated for edible pods as vegetable [GBPUH- 1229]

***Vicia hirsuta*** (L.) Gray, Nat. Arr. Brit. Pl. 2: 614. 1822. *Ervum hirsutum* L., Sp. Pl. 2: 738. 1753. [GBPUH- 1222]

***Vicia lens*** (L) Coss. & Germ., Fl. Descr. Anal. Paris 143. 1845. *Ervum lens* L., Sp. Pl. 2: 738. 1753; *Lens culinaris* Medik., Vorles. Churpfalz. Phys.-Oecon. Ges. 2: 361. 1787. Many cultivars are cultivated as pulse crop [GBPUH- 1301]

***Vicia sativa*** L., Sp. Pl. 2: 736. 1753. [GBPUH- 1279]

***Vicia tenera*** Benth., Ill. Bot. Himal. Mts. 200. 1835. [GBPUH- 1327]

***Vicia tenuifolia*** Roth, Tent. Fl. Germ. 1: 309. 1788. [GBPUH- 1328]

***Vicia tetrasperma*** (L.) Schreb., Spic. Fl. Lips. 26. 1771. *Ervum tetraspermum* L., Sp. Pl. 2: 738. 1753. [GBPUH- 1223]

**Tribe:** Galegeae Dumort.

***Glycyrrhiza glabra*** L., Sp. Pl. 2: 742. 1753. Cultivated as medicinal herb [GBPUH- 187]

Tribe: Genisteae Dumort.

***Lupinus polyphyllus*** Lindl., Bot. Reg. 13: t. 1096. 1827. Cultivated as ornamental [GBPUH- 1294]

Tribe: Indigofereae Benth.

***Cyamopsis tetragonoloba*** (L.) Taub. in Engler & Prantl, Nat. Pflanzenfam. 3, 3: 259. 1894. *Psoralea tetragonoloba* L., Mant. Pl. 104. 1767; Cultivated for edible shoots and edible pods [GBPUH- 1231]

***Indigofera astragalina*** DC., Prodr. 2: 228. 1825. [GBPUH- 1228]

***Indigofera linifolia*** (L.f.) Retz., Observ. Bot. 4: 29. 1786. *Hedysarum linifolium* L.f., Suppl. Pl. 331. 1782. [GBPUH- 1278]

***Indigofera linnaei*** Ali, Bot. Not. 111. 549. 1958. *Indigofera enneaphylla* L., Mant. Pl. Altera 272. 1771. [GBPUH- 1242]

***Indigofera tinctoria*** L., Sp. Pl. 2: 751. 1753. [GBPUH- 1307]

***Indigofera trifoliata*** L., Cent. Pl. II. 29. 1756. [GBPUH- 1247]

Tribe: Millettieae Miq.

***Millettia peguensis*** Ali, Kew Bull. 21(3): 489. 1968. *Millettia ovalifolia* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 68. 1873. Cultivated as ornamental tree [GBPUH- 1275]

***Pongamia pinnata*** (L.) Pierre, Fl. Forest. Cochinch. Sub t. 385. 1899. *Cytisus pinnatus* L., Sp. Pl. 2: 741. 1753. Cultivated as ornamental tree [GBPUH- 1273]

***Tephrosia pumila*** (Lam.) Pers. Syn. Pl. 2(2): 330. 1807. *Galega pumila* Lam., Encycl. 2(2): 599. 1788. [GBPUH- 1324]

***Tephrosia purpurea*** (L.) Pers., Syn. Pl. 2(2): 329. 1807. *Cracca purpurea* L., Sp. Pl. 2: 753. 1753. [GBPUH- 1218]

***Wisteria chinensis*** (Sims) DC., Prodr. 2: 390. 1825. *Glycine sinensis* Sims, Bot. Mag. 46: t. 2083. 1819. Cultivated as an ornamental climber [GBPUH- 1012]

**Tribe:** Phaseoleae Bronn ex DC.

***Butea monosperma*** (Lam.) Taub., in Engler & Prantl, Nat. Pflanzenfam. 3(3): 366. 1894. *Erythrina monosperma* Lam.,

**Encycl. 1(2):** 391. 1785; *Butea frondosa* Roxb., Pl. Coromandel 1(1): 21. 1795. [GBPUH- 1227]

***Cajanus cajan*** (L.) Millsp., Publ. Field Columb. Mus., Bot. Ser. 2(1): 53. 1900. *Cytisus cajan* L., Sp. Pl. 2: 739. 1753. Many cultivars are cultivated as pulse crop [GBPUH- 1276]

***Cajanus scarabaeoides*** (L.) Thouars, Dict. Sci. Nat. 6: 167. 1806. *Dolichos scarabaeoides* L., Sp. Pl. 2: 726. 1753; *Atylosia scarabaeoides* Benth. in Miq., Pl. Jungh. 2: 242. 1852. [GBPUH- 1262]

***Canavalia gladiata*** (Jacq.) DC., Prodr. 2: 404. 1825. *Dolichos gladiatus* Jacq., Collectanea 2: 276. 1789. Cultivated for edible pods [GBPUH- 1255]

***Clitoria ternatea*** L., Sp. Pl. 2: 753. 1753. Cultivated as ornamental and medicinal climber [GBPUH- 1257]

***Dunbaria glandulosa*** (Dalzell & A.Gibson) Prain J. Asiat. Soc. Bengal, Pt. 2, Nat. His. 66: 433. 1897; *Cajanus glandulosus* Dalzell & A.Gibson, Bombay Fl. 73: 1861. [GBPUH- 1304]

***Erythrina variegata*** L., Herb. Amboin. 10. 1754. *Erythrina indica* Lam., Encycl. 2(1): 391. 1786. [GBPUH- 919]

***Flemingia lineata*** (L.) W.T.Aiton, Hort. Kew., ed. 2. 4: 350. 1812. *Hedysarum lineatum* L., Syst. Nat., ed. 10. 2: 1170. 1759. [GBPUH- 1283]

***Flemingia procumbens*** Roxb., Hort. Bengal. 56: Fl. Ind. iii. 338. 1832. *Flemingia vestita* Benth. ex Baker, Fl. Brit. India 2(4): 230. 1876; *Moghania vestita* (Benth. ex Baker) Kuntze, Revis. Gen. Pl. 1: 199. 1891. [GBPUH- 1303]

***Flemingia semialata*** Roxb. ex W.T.Aiton, Hort. Kew., ed. 2, 4: 349. 1812. *Flemingia congesta* Roxb., Hort. Beng. 56: Fl. India 3. 340. [GBPUH- 1258]

***Flemingia strobilifera*** (L.) W.T.Aiton, Hort. Kew., ed. 2, 4: 350. 1812. *Hedysarum strobiliferum* L., Sp. Pl. 2: 746. 1753. [GBPUH- 1261]

***Glycine max*** (L.) Merr., Interpr. Herb. Amboin. 274. 1917. *Phaseolus max* L., Sp. Pl. 2: 725. 1753. Many cultivars are cultivated as pulse crop [GBPUH- 1230]

***Lablab purpureus*** (L.) Sweet, Hort. Brit. 481. 1826. *Dolichos purpureus* L., Sp. Pl., ed. 2. 2: 1021. 1763. Cultivated for edible pods as vegetable. [GBPUH- 1131]

***Mucuna interrupta*** Gagnep., Notul. Syst. (Paris) 3: 26. 1914. [GBUH- 1323]

***Mucuna pruriens*** (L.) DC., Prodr. 2: 405. 1825. *Dolichos pruriens* L., Herb. Amboin. 23. 1754. [GBPUH- 1256]

***Neustanthus phaseoloides*** Benth. in Miq., Pl. Jungh. 2: 235. 1852. *Pueraria phaseoloides* (Roxb.) Benth., J. Linn. Soc., Bot. 9: 125. 1865. [GBPUH- 1266]

**Phaseolus vulgaris** L., Sp. Pl. 2: 723. 1753. Cultivated as vegetable crop [GBPUH- 920] Many cultivar present as green vegetable

**Phaseolus trilobus** (L.) Aiton, Hort. Kew. 3: 30. 1789. *Dolichos trilobus* L., Sp. Pl. 2: 726. 1753. Cultivated as pulse crop [GBPUH- 59]

**Rhynchosia minima** (L.) DC., Prodr. 2: 385. 1825. *Dolichos minimus* L., Sp. Pl. 2: 726. 1753. [GBPUH- 1263]

**Teramnus labialis** Spreng., Syst. Veg., ed. 16, 3: 235. 1826. [GBPUH- 1264]

**Vigna mungo** (L.) Hepper, Kew Bull. 11(1): 128. 1956. *Phaseolus mungo* L., Mant. Pl. 101. 1767. Many cultivars are cultivated as pulse crop [GBPUH- 1226]

**Vigna radiata** (L.) R.Wilczek, Fl. Congo Belge 6: 386. 1954. *Phaseolus radiatus* L., Sp. Pl. 2: 725. 1753. Many cultivars are cultivated as pulse crop [GBPUH- 964]

**Vigna unguiculata** (L.) Walp., Repert. Bot. Syst. 1(5): 779. 1842. *Dolichos unguiculatus* L., Sp. Pl. 2: 725. 1753. Cultivated as vegetable and pulse crop [GBPUH- 993]

**Tribe:** Psoraleeae Benth.

**Cullen corylifolium** (L.) Medik., Vorles. Churpfalz. Phys.-Ocon. Ges. ii. 381. 1787. *Psoralea corylifolia* L., Sp. Pl. 2: 764. 1753. [GBPUH- 1287]

**Tribe:** Sesbanieae Hutch.

**Sesbania bispinosa** (Jacq.) W.Wight, Bull. Bur. Pl. Industr. U.S.D.A. 137. 1909. *Aeschynomene bispinosa* Jacq., Icon. Pl. Rar. 3(8): t. 564. 1792. [GBPUH- 1225]

**Sesbania sesban** (L.) Merr., Philipp. J. Sci. 7: 235. 1912. *Aeschynomene sesban* L., Sp. Pl. 2: 714. 1753. [GBPUH- 1302]

**Tribe:** Trifolieae Endl.

**Medicago lupulina** L., Sp. Pl. 2: 779. 1753. [GBPUH- 1221]

**Medicago polymorpha** L., Sp. Pl. 2: 779. 1753.[GBPUH- 1298]

**Melilotus albus** Medik., Vorles. Churpfalz. Phys.-Ocon. Ges. 2: 382. 1787. [GBPUH- 1246]

**Melilotus indicus** (L.) All., Fl. Pedem. 1: 308. 1785. *Trifolium indicum* L., Sp. Pl. 2: 765. 1753[GBPUH- 1251]

**Trifolium alexandrinum** L., Cent. Pl. 1. 25. 1755. [GBPUH- 1313]

**Trifolium dubium** Sibth., Fl. Oxon. 231. 1794. [GBPUH- 969]

**Trifolium repens** L., Sp. Pl. 2: 767. 1753. [GBPUH- 1309]

**Trifolium resupinatum** L., Sp. Pl. 2: 771. 1753. [GBPUH-

1252]

**Trifolium tomentosum** L. Sp. Pl. 2: 771. 1753. [GBPUH- 1305]

**Trigonella balansae** Boiss. & Reut., Diagn. Pl. Orient. Ser. 2, 5: 79. 1856. *Trigonella corniculata* (L.) L., Syst. Nat., ed. 10. 2: 1180. 1759; *Trifolium corniculatum* L., Sp. Pl. 2: 766. 1753. Cultivated as leaf vegetable and spice [GBPUH- 948]

**Trigonella foenum-graecum** L., Sp. Pl. 2: 777. 1753. Cultivated as leaf vegetable and spice [GBPUH-

## Discussion

### Legume diversity in Pantnagar

In the present study a total of 130 species, 3 subspecies under 69 genera of family Fabaceae (Leguminosae) have been recorded in Pantnagar area. Six subfamilies of legumes are known in the world and four of them are represented in present study area. Papilionoideae is the largest subfamily (species wise) represented by 14 tribes, 47 genera (68%) and 90 species (69%) followed by Caesalpinioideae 5 tribes, 19 genera (28%) and 35 species (25%), Detarioideae (1 tribe, 2 genera (3%) and 2 species (1%) and Cercidoideae 1 tribe, 1 genus (1%) and 5 species (5%). Lewis *et al.* (2005) <sup>[18]</sup> have classified world legumes in 36 tribes and the results of present study indicate that 21 tribes (58.33% of total) have their representation in Pantnagar. Phaseoleae is the largest tribe with 15 genera and 23 species, followed by Desmodieae with 10 genera and 17 species, Mimoseae with 5 genera, 5 species and 1 subspecies, Caesalpinieae with 5 genera and 5 species. Trifolieae, Ingeae and Millettieae are represented by 4 genera each and 11 spp., 7 spp., and 5 spp. respectively. Dalbergieae and Acacieae are represented by 3 genera and 3 spp, 5 spp., and 1 subspp. respectively. Fabeae, Cassieae, Indigofereae and Detarieae by 2 genera each and 12 spp., 10 spp, and 1 subspp., 6 spp. and 2 spp. respectively. Rest of the 8 tribes Cercideae, Abreae, Cicereae, Crotalarieae, Galegeae, Genisteae, Psoraleeae and Sesbanieae are represented by single genus (Figure-1). At generic level *Senna* is the largest genus represented by 8 species, followed by *Crotalaria* and *Vicia* (7 species each), *Alysicarpus* and *Bauhinia* (6 species each), *Lathyrus*, *Indigofera* and *Trifolium* (5 species each), *Flemingia* (4 species), *Albizia*, *Uraria* and *Vigna* (3 species each), *Acacia*, *Senegalia*, *Calliandra*, *Tephrosia*, *Cajanus*, *Mucuna*, *Phaseolus*, *Sesbania*, *Medicago*, *Melilotus*, and *Trigonella* are represented by 2 species each. Cassia, Vachallia and Mimosa have 1 species and 1 subspecies each. Rest of the 43 genera are represented by solitary species.

Present study shows that herbs are the most dominant species in wild 61% (53 species) followed by trees 20% (17 species), shrub 10% (9 species), and climbers 9% (8 species) (Figure-2). While in case of cultivated legume flora tree species are dominant 16 species followed by herbs 15 species, shrubs 9 species and climbers 6 species. Wild flora results are almost similar to Nisha *et al.* (2015) <sup>[25]</sup> who reported dominance of annual and perennial herbs in wild species followed by trees species, climbers and shrubs species, little difference in number of shrubs and climbers. The comparison of species indicates that 16 additional species (*Aeschynomene indica*, *Alysicarpus glumaceus*, *Alysicarpus monilifer*, *Alysicarpus rugosus*, *Crotalaria mysorensis*, *Crotalaria spectabilis*, *Indigofera astragalina*, *Indigofera linifolia*, *Indigofera*

*linnaei*, *Lespedeza juncea*, *Trifolium tomentosum*, *Vicia tenera*, *Tephrosia purpurea*, *Senegalia catechu*, *Sesbania sesban* and *Senna sophora*,) of wild legumes are reported in present work which is due to more intensive plant survey in the area. Legume flora of Pantnagar (130 species, 3 subspecies and 69 genera) is considerably more diverse than Rajaji National Park having (23 genera, 47 species; Uniyal and Rao, 1993), Mussoorie (39 genera, 92 species; Raizada and Saxena, 1978), Delhi (60 genera, 123 species; Maheshwari, 1963), Corbett National Park (30 genera, 73 wild species; Pant, 1986), Naini Tal (29 genera, 69 wild species; Gupta, 1968), though less diverse than Chamoli district (56 genera and 150 species; Naithani, 1984), Pithoragarh district (58 genera, 168 species; Pangtey *et al.*, 1988) and district Pauri Garhwal (72 genera and 229 species; Gaur, 1999) [11].

### Invasive Alien Species, weeds and wild relatives of cultivated plants

Invasive alien species are the subset of naturalized plant that produces reproductive offsprings, often in a very large number at considerable distance (Mooney and Hobbs, 2000). These 13 species (10% of total legume flora) are *Acacia dealbata*, *Crotalaria pallida*, *Indigofera astragalina*, *Indigofera linifolia*, *Indigofera linnaei*, *Leucaena leucocephala*, *Melilotus albus*, *Mimosa pudica*, *Prosopis juliflora*, *Sesbania bispinosa*, *Senna alata*, *Senna occidentalis*, and *Senna tora*. All these are considered as a threat for native

species (Reddy, 2009; Chandra Sekar *et al.*, 2012).

Each crop has undoubtedly had its wild biological relatives that are typically too close but occasionally noticeably distant. The term wild relations denotes ancestors and species that are somewhat related to cultivated plants (Pradheep *et al.*, 2014). Wild relatives (of taxon group 4 level; Maxted *et al.*, 2006) [23] of *Lathyrus oleraceus* and *L. sativus* in the area are *L. aphaca* and *L. sphaericus*. Similarly, wild relatives of cultivated *Abrus* (*A. precatorius*); *Albizia* species (*A. chinensis*, *A. lebbeck*, *A. procera*); cultivated *Alysicarpus* (*A. monilifer*, *A. rugosus*, *A. vaginalis*.); *Bauhinia* (*B. purpurea*, *B. variegata*); *Cajanus* (*Cajanus scarabaeoides*); *Cassia* (*C. fistula*); *Crotalaria* (*C. alata*, *C. medicaginea*, *C. mysorensis*, *C. pallid*, *C. prostrate*, *C. spectabilis*); *Dalbergia* (*D. sissoo*); *Erythrina* (*E. variegata*); *Flemingia* (*F. procumbens*); *Grona* (*G. triflora*); *Indigofera* (*I. tinctoria*); *Lespedeza* (*L. juncea*); *Lupinus* (*Lupinus polyphyllus*); cultivated *Melilotus* (*M. albus*, *M. indicus*); cultivated *Mimosa* (*M. pudica*); *Medicago* (*M. lupulina*, *M. polymorpha*); *Melilotus* (*M. albus*, *M. indicus*); *Mucuna* (*M. pruriens*); *Neustanthus* (*N. phaseoloides*); *Pithecellobium* (*Pithecellobium dulce*); *Prosopis* (*P. juliflora*); *Senegalia* (*S. catechu*); cultivated *Senna* (*S. alata*, *S. alexandrina*, *S. occidentalis*, *S. tora*); *Sesbania* (*S. bispinosa*, *S. sesban*), *Tephrosia* (*T. purpurea*); *Teramnus* (*T. labialis*); *Trifolium* (*T. alexandrinum*, *T. repens*, *T. resupinatum*); *Uraria picta* (*U. lagopus*); *Vachellia* (*Vachellia farnesiana*, *V. nilotica* subsp. *indica*); cultivated *Vicia* (*V. sativa*).

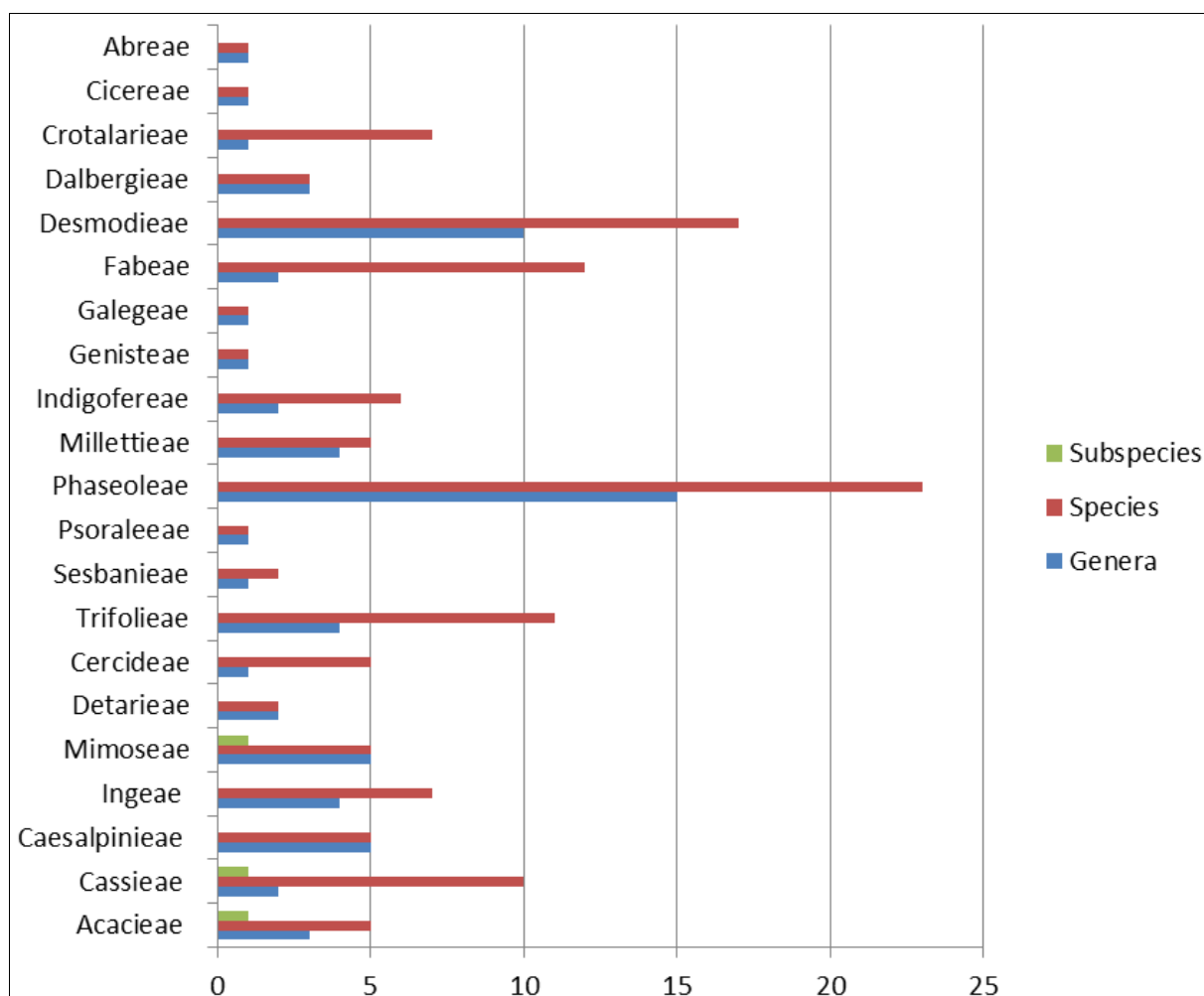
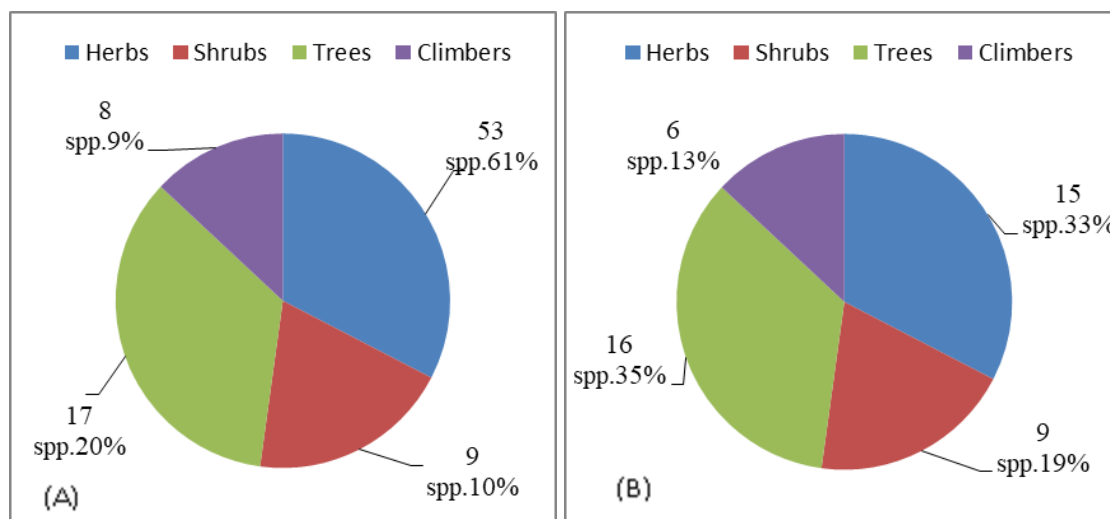


Fig 1: Diversity of species, subspecies and genera in different tribes of family





**Fig 2:** Life forms of Legumes in Pantnagar (A- Wild species, B- Cultivated species)

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