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REGULAR ARTICLE

Synoptic analysis of Fabaceae in Jammu & Kashmir, India

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ABSTRACT

The present paper puts on record 61 genera representing 250 species 2 ssp. and 17 varieties of family Fabaceae inhabiting in the flora Jammu and Kashmir state. All the genera of this family have been distributed in 29 different tribes. Genus *Astragalus* has the highest respresentation of 58 species in the state.

Keywords: Flora of J & K state and Fabaceae.

INTRODUCTION

Fabaceae is one of the largest families of the flowering plants. The members of this family are characterized by highly modified papilionaceous corolla consisting of a petal standard, two lateral wings and a bilobed keel. This kind of corolla modification is specially adapted for insect pollination. The family is represented by 700 genera and over 1900 species all over the world and 179 genera and 1152species in India (Sanjappa 2000). In the present author has as many as 61 genera representing 250 species listed in Jammu and Kashmir. Nutritionally, the members of Fabaceae are chief source of proteins. The seeds of various species constitute a major component of our diet. All the species of this family have the unique ability to improve soil fertility by symbiosis with the help of nitrogen fixing bacteria (*Rhizobium leguminoserum*) which resides in the root nodules.

Keeping in view, the utility of legumes are used as a source of food, fodder, timber, fibers, dyes, gums, resin, oils and drugs. In addition to it, some species are grown as ornamentals, forage and for green manure.

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Perusal of literature of Singh and Kachroo (1976), Sharma and Kachroo (1981), Bhellum and Magotra (2007, 2012), Swami and Gupta (1998), Bhellum (2011) reveals the fragmentary and scattered information regarding the members of the family. No any consolidated accounts of this family are available from Jammu and Kashmir so far Fig.1.

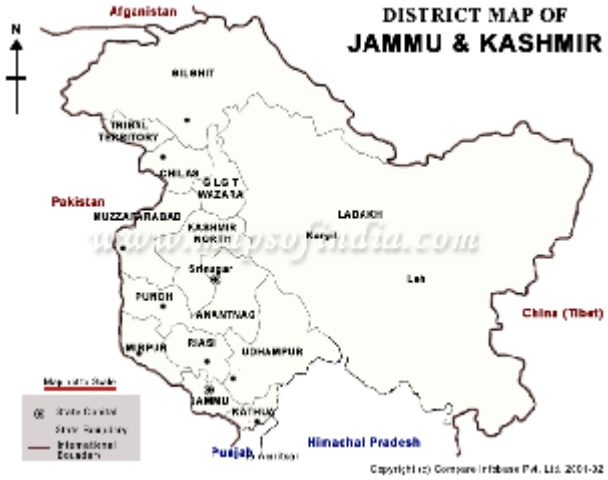

Fig. 1. District map of Jammu & Kashmir

TAXONOMIC CHARACTERISTICS

Trees, shrubs, climbers or herbs. Leaf rarely simple, mostly compound, unifoliolate, pinnately or palmately compound; stipules sometimes present. Inflorescence solitary, racemose, paniculate or umbellate, capitate or spicate. Flowers zygomorphic; Calyx gamosepalous; Corolla papilionaceous, polypetalous or sometimes united, vexillary imbricate, differentiated into the upper bigger outermost petal or vexillum, the two lateral wings, and the 2 innermost, sometimes united along the margin, forming the carina or keel. Stamens 10, diadelphous, rarely fewer,free or fused, mostly the adaxial stamen free or nearly so and the 9 united together, anthers uniform or dimorphic, basifixed or dorsifixed. Ovary unicarpellary, mostly unilocular, many-1 ovules on the adaxial suture. Fruit dehiscent by 2 or 1 sutures or indehiscent, or jointed and breaking up into 1-seeded parts. Seed sometimes arillate, with or without endosperm.

In the present paper, an attempt has been made to compile the family Fabaceae in Jammu and Kashmir state. This work has as many as 279 species representing 66 genera listed in Jammu and Kashmir state. The names or tribes, number of genera and number of species in each genus is given in the table I.

Table 1: Break up of the different tribes, number of the genera and number of species, subspecies and varieties in each tribe.

Serial no	Name of the tribe	Number of genera	Number of species
1.	Sophoreae	***Sophora* L.**	*Sophora alopecuroides* L. *S. mollis* (Royle) Baker
2.	Podalyrieae	***Thermopsis* R. Br. ex Ait & Ait. f.**	*Thermopsis barbata* Royle *T. inflata* Camb.
3.	Genisteae	***Spartium* L.**	*Spartium junceum* L.
4.	Lupineae	***Argyrolobium* Eckl. & Zey** ***Lupinus* L.**	*Argyrolobium flaccidum* Royle ex Jaub. & Spach *A. indica* L. *A. roseum* (Camb.) Jaub. & Spach *Lupinus polyphyllus* Lindl.
5.	Crotalarieae	***Crotalaria* L.**	*Crotalaria albida* Heyne ex Roth *C. barbata* Grah. ex Wight *C. ferruginea* Grah. ex Benth. *C. juncea* L. *C. longipes* Wight & Arn. *C. madurensis* Wight & Arn. *C. medicagenia* Lam. var. *medicaginea* *C. medicagiea* Lam. *var. neglecta* Baker *C. pallida* Ait. *C. prostrata* Rottl.

			C. retusa L. *C. spectabilis* Roth. *C. tetragona* Andr. *C. verrucosa* L.
6.	Robinieae	***Robinia* L.**	*Robinia pseudoacacia* L.
7.	Millettieae	***Mellettia* Wight & Arn.** ***Wisteria* Nutt.**	*Mellettia extensa* (Benth.) Baker *Wisteria chinensis* (Sweet) DC.
8.	Lonchocarpeae	***Pongamia* Vent.**	*Pongamia pinnata* (L.) Pierre
9.	Dalbergieae	***Dalbergia* L. f.**	*Dalbergia lanceolaria* L. f. *D. sissoo* Roxb.
10.	Tephrosieae	***Tephrosia* Pers.**	*Tephrosia pumila* (Lam.) Pers. *T. purpurea* (L.) Pers.
11.	Indigofereae	***Cyamopsis* DC. *Indigofera* L.**	*Cyamopsis tetragonaloba* (L.) Taub. *Indigofera astragalina* DC. *I atropurpurea* Buch.- Ham. ex Horn. *I. cassioides* Rottler ex DC. *I. cedorum* Dunn *I. cordifolia* Heyne ex Roth. *I. hebepetala* Benth. ex Baker *I. trifoliata* L. *I. himalayensis* Ali *I. linifolia* (L. f.) Retz. *I. linnaei* Ali *I. oblongifolia* Forssk. *I. tinctoria* L. *I. heterantha* Wall. ex Brandi
12.	Sesbanieae	***Sesbania* Scop.**	*Sesbania bispinosa* (Jacq.) W. F. Wight *S. sesban* (L.) Merr. *S. gradiflora* (L.) Poir.
13.	Coluteae	***Colutea* L.**	*Colutea paulsenii* Freyn ssp. *paulsenii C. paulsenii* Freyn ssp. *mesantha* (Shap. ex Ali) Ali
14.	Astragaleae	***Astragalus* L.**	*Astragalus alitschuri* O. Fedtsch. *A. amhertia* Royle ex Benth. *A. arnoldii*

			A. bakeri Ali *A. bicuspis* Fischer *A. candolleana* Royle ex Benth. *A. breviscapus* B. Fedtsch. *A. breviscapus* B. Fedtsch. *A. candolleana* Royle ex Benth. *A. cashmirensis* Bunge var. *cashmirensis* *A. cashmirensis* Bunge var. *falconeri* Baker *A. chlorostachys* Lindl. *A. coluteocarpus* Boiss. var. *coluteocarpus* *A. coluteocarpus* Boiss. var.glaber Ali *A. concretus* Benth. *A. confertus* Benth. ex Bunge *A. densiflorus* Kar & Kir *A. falconeri* Bunge *A. frigidus* (L.) A. Gray *A. gilgitensis* Ali *A. gracilipes* Benth. ex Bunge *A. grahamianus* Royle ex Benth. *A. graveolens* Buch. – Ham. *A. hendersonii* Baker *A. heydei* Baker *A. himalayanus* Klotz. *A. hoffmeisteri* (Klotz.) Ali var. *hoffmeisteri* *A. hoffmeisteri* (Klotz.) Ali var. *pilosa* Ali *A. imitenssis* Ali *A. kashmirensis* Bunge *A. ladakensis* Balakr. *A. leucocephalus* Grah. ex Benth. *A. macropterus* DC. *A. maddenianus* Benth. ex Baker *A. malcophyllus* Benth. ex Bunge *A. maxwellii* Royle ex Benth. *A. malanostachys* Benth. ex Bunge *A. multiceps* Wall. ex Benth. *A. munroi* Benth. ex Bunge *A. nivalis* Kar & Kir *A. ophiocarpus* Benth. ex Bunge *A. oplites* Benth. ex Parker *A. oxyodon* Baker *A. peduncularis* Royle ex Benth.

			A. pindreensis (Benth. ex Baker) Ali
			A. polyacanthus Royle ex Benth.
			A. pseudochlorostachys Ali
			A. psilocentros Fisch. var. *psilocentros*
			A. rhizanthus Royle ex Benth.
			A. scorpiurus Bunge
			A. staintonianus Ali
			A. stewartii Baker
			A. strobiliferus Royle ex Benth.
			A. subuliformis DC.
			A. subumbellatus Klotz.
			A. tibetanus Benth. ex Bunge
			A. tribulifolius Benth ex Bunge
			A. trichocarpus Grah. ex Benth.
			A. webbinus Grah. ex Benth.
			A. zanskarensis Benth. ex Bunge
			Caragana brevifolia Kamarov.
			C. brevispina Royle
			C. conferta Benth. ex Baker
			C. cuneata Baker
			C. gerardiana Royle
		***Caragana* Fabr.**	*C. ploycantha* Royle
			C. tetracanthoides Poir var. *himalaica* Kom.
			C. versicolor Benth.
			Chesneya cuneata (Benth.) Ali
			C. depressa (Oliver) Pop.
			Gueldenstaedtia verna (Georgi) Boiss.
			Oxytropis cachemirica Camb.
			O. chiliophylla Royle ex Benth.
		***Chesneya* Lindl. ex Endl.**	*O. densa* Benth. ex Bunge
		***Gueldenstaedtia* Fisher**	*O. glabra* DC.
		***Oxytropis* DC.**	*O. humifusa* Kar & Kir
			O. tatarica Camb. ex Bunge
			O. microphylla (Pall.) DC.
			O. mollis Royle ex Benth.
			O. savellanica Bunge ex Boiss
			O. lapponica (Wahl.) Gay
15.	Psoralieae	***Amorpha* L.**	*Amorpha fruticosa* L.
		***Psoralea* L.**	*Psoralia pinnata* L.
16.	Cajaneae	***Atylosia* Wight & Arn.**	*Atylosia rostrata* Baker

		***Cajanus* DC.**	*Cajanu cajan* (L.) Millsp.
		***Flemingia* Roxb. Ex Ait. & Ait f.**	*Flemingia macrophylla (Willd.) O. Kuntze ex Merr.* *F. stribilifera* (L.) Ait & Ait f.
		***Rhynchosia* Lour.**	*Rhynchosia capitata* (Heyne ex Roth) DC. *R. minima* (L.) DC.
17.	Erythrineae	***Butea* Roxb. ex Willd.**	*Butea monosperma* (Lam.) Taub.
		***Mucuna* Adans.**	*Mucuna pruriens* (L.) DC.
		***Erythrina* L.**	*Erythrina suberosa* Roxb.
18.	Phaseoleae	***Phaseolus* L.**	*Phaseolus coccineus* L. *P. multiflorus* Lam.
		***Vigna* Savi**	*Vigna triloba* (L.) Verdc. *V. vexillata* (L.) A. Rich.
19.	Glycineae	***Clitoria* L.**	*Clitoria ternata* L.
		***Dumasia* DC.**	*Dumasia villosa* DC.
		***Glycine* Willd.**	*Glycine max* (L.) Merr.
		***Shuteria* Wight & Arn.**	*Shuteria involucrata* (Wall.) Wight & Arn. *S. vestita* (Wall.) Wight & Arn.
20.	Abreae	***Abrus* Adans.**	*Abrus precatorius* L.
21.	Vicieae	***Cicer* L.**	*Cicer macranthum* M. Popov
		***Lathyrus* L.**	*C. microphyllum* Benth.
		***Lens* Mill.**	*Lathyrus aphaca* L.
		***Vicia* L.**	*L. emodi* (Wall. ex Fritsch) Ali *L. erecta* Lagasca *L. hirsutum* L. *L. humilis* (Seringe) Fischer ex Spreng. *L. inconspicus* L. *L. laevigatus* (Waldst. & Kit) Grenier *L. odoratus* L. *L. pratensis* L. *L. sativa* L. *L. sphaericus* *Lens culinaris* Medic. *Vicia angustifolia* L. *V. bakeri* Ali *V. benthamiana* Ali *V. bithynica* L. *V. cracca* L. *V. faba* L. *V. hirsuta* (L.) Gray *V. lathyroides* L.

			V. monantha Retz.
			V. narbonensis L.
			V. pallida Turcz.
			V. rigidula Royle
			V. sativa L.
			V. sepium L.
			V. tenuifolia Roth
			V. tetrasperma (L.) Schreber
22.	Ononideae	***Ononis* L.**	*Ononis antiquorum* L.
			O. arvensis L.
23.	Trifolieae	***Medicago* L.**	*Medicago falcata* L.
			M. lupulina L.
			M. minima (L.) Grufb.
			M. orbicularis (L.) Bart.
			M. polymorpha L.
			M. sativa L.
		***Melilotus* Mill.**	*Melilotus alba* Medic. ex Desr.
			M. indica (L.) All.
			M. officinalis (L.) Pall.
		***Trifolium* L.**	*Trifolium campestre* Schreb.
			T. dubium Sibth.
			T. fragiferum L.
			T. hybridum L.
			T. pretense L.
			T. repens L.
			T. tomentosa L.
		***Trigonella* L.**	*Trigonella cachemiriense* Camb.
			T. emodi Benth.
			T. corniculata (L.) L
			T. fimbriata Royle ex Benth.
			T. foenum-graecum L.
			T. gracilis Benth.
			T. incisa Benth.
			T. podperae (Sirj.) Vass.
			T. pubescens Edgew. ex Baker
24.	Loteae	***Lotus* L.**	*Lotus corniculata* L.
			L. tenuifolia (L.) Hartm.
25.	Hedysareae	***Alhagi* Gangneb**	*Alhagi maurorum* Medic.
			A. nepalensis (L.) Shaparenko
		***Ebanus* L.**	*Ebenus stellata* Boiss.
		***Hedysarum* L.**	*Hedysarum alpinum* L.

			H. falconeri Baker var. falconeri
			H. falconeri Baker var. *cacherimiana* (Benth. ex Baker) Pramanik.
			H. microcalyx Baker
		***Onobrachis* Mill.**	*Onobrachis laxiflora* Baker var. *laxiflora*
			O. laxiflora Baker var.*schugnanica* (B. Feditsch.) Ali
		***Stracheya* Benth.**	*Stracheya tibetica* Benth.
26.	Aeschynomeniae	***Aeschynomene* L.**	*Aeschynomene aspera* L.
			A. indica L.
			Smithia sennitiva Dalz.
		***Smithia* Ait.**	*Smithia ciliata* Royle
			S. conferta J. E. Sm.
27.	Desmodieae	***Alysicarpus* Neck. ex Desv.**	*Alysicarpus heyneanus* Wight & Arn.
			var. *meeboldii* (Schind.) Pramanik & Thoth.
		***Desmodium* Desv.**	*Desmodium concinum* DC.
			D. elegans (G. Don) DC.
			D. gangeticum (D. Don) G. Don
			D. heterocarpon (L.) DC. var. *strigossum* Van Meeuwen
			D. microphyllum (Thunb.) DC.
			D. motorium (Houtt.) Merr.
			D. multiflorum DC.
			D. podocarpum (Thunb.) DC.
			D. triflorum (L.) DC.
			Uraria picta (Jacq.) Desv. ex DC.
		***Ougeinia* Benth.**	*U. rufescens* (DC) Schindler
			Ougenia
		***Uraria* Desv.**	*Uraria picta*
28.	Stylosantheae	***Zornia* Gmel**	*Zornia diphylla* (L.) Pers.
			Z. gibbosa Span.
29.	Lespedezeae	***Campylotropis* Bunge**	*Campylotripis meeboldii* (Schindler) Schlinder
			C. stenocarpa (Klotz.) Schindler
			Lespedeza elegans Camb.
		***Lespedeza* Mich.**	*L. floribunda* Wall. ex Maxim.
			L. juncea (L. f.) Pers. var. juncea
			L. juncea (L. f.) Pers. var.*sericea* (Thunb.) Lace & Hemsl.
			L. juncea (L. f.) Pers. var. *variegata* (Camb.) Ali
			L. tomentosa (Thunb.) Sieb. ex maxim.
Total	**29**	**61**	**250**

MATERIAL AND METHODS

Plant explorations were carried out in different seasons of the year at some selected sites in Jammu and Kashmir. This paper is based on the collection of angiosperm flora in general and family Fabaceae in particular between 1999 and 2005. The forays of two different types were undertaken round the year, the collection trips to distant places were of the duration of 3- 7 days. In between, brief trips of 1- 2 days durations were executed along or in the company of one or more helpers. In this way, it was possible to raise the collections from the different parts of the state. In the first year the collections were massive and in the subsequent years they reduced to solitary specimen. While collecting the plant specimens field numbers were allotted and relevant data about the plant was recorded in the field book. The specimens were carried to the Laboratory in the polythene bags, ruck-sacks or in plant press depending upon the length of trip and distance of the place of collection. The plants collected were pressed in the in wooden press wrapped in blotters. These specimens are changed frequently to reduce the discoloration of foliage and flowers and to avoid rotting. The dried specimens were mounted on the Herbarium sheets. Printed labels were pasted and relevant data was entered. These specimens were identified with the help of taxonomic literature.

RESULTS

The finding of the present investigation and its comparison to adjacent counterparts are shown in Fig. 2.

The flora of Jammu and Kashmir is still in the state of compilation; however some regional floras such as Floras of Srinagar, Jammu and Udhampur (Singh and Kachroo, 1976; Sharma and Kachroo, 1981; Swami and Gupta, 1998) respectively have been published. The authors have compiled Fabaceae of Jammu and Kashmir State.

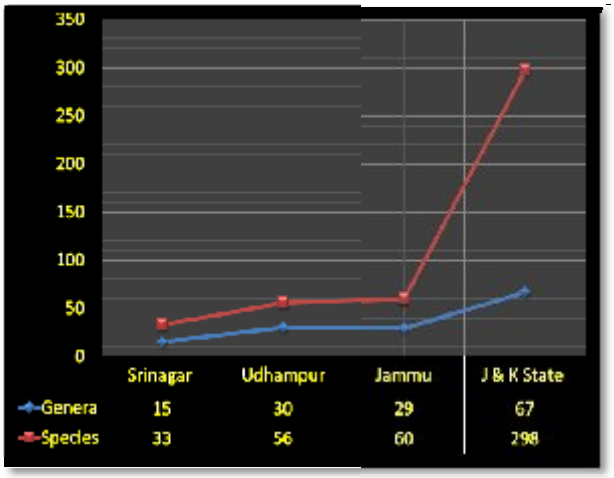

Fig. 2: Line -graph showing numerical size of taxa in Jammu and Kashmir and its comparison to taxa reported from Srinagar, Jammu and Udhampur.

DISCUSSION

The study area shows Jammu plains, lesser Himalayan, and high altitude mountains of Kashmir region with sharp steep peaks and some wide valleys. Most of the terrains including ravines and mounts are of considerable hight. Climate of the state in Kashmir is mostly temperate with well defined seasons; mild wet summer, dry autumn, cold and snowy winter.

The representatives of the family Fabaceae reach the various altitudinal zones. Some of the species are confined to alpine zones such as species of *Astragalus, Cicer*, *Lathyrus, Lupinus, Onobrachis, Ononis, Oxytropus, Thermopsis,Trifolium, Vicia* etc. The ten largest tribes with in Family Fabaceae are Astragaleae (81 species), Vicieae (30 species) and Trifolieae (25 species), Desmodieae and Hedysareae (15 species each), Crotalarieae and Indigofereae (14 species each), Lespedezeae (8 species), Cajaneae (6 species) and Aeschynomeneae (5 species).

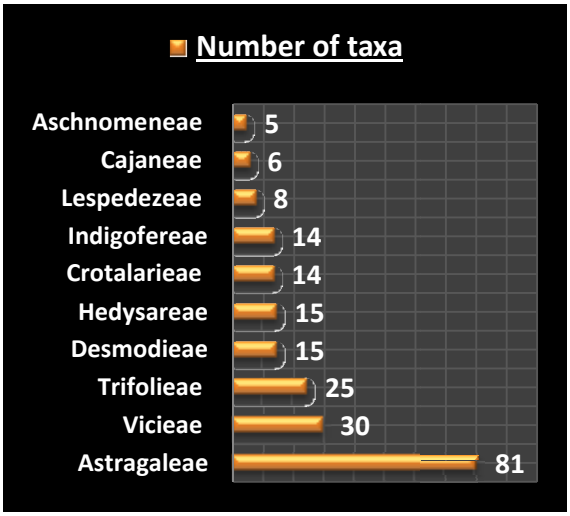

Fig. 3. Bar graph showing ten tribes and break up of number of species in each tribe.

Ten genera with maximum number of species are *Astragalus* (60 species), *Vicia* (16 species), *Crotalaria* (14 species), *Indigofera* (13 species), *Lathyrus* (11 species), *Oxytropis* (10 species), *Trigonella* (9 species), *Desmodium* (9 species), *Caragana* (8 species), and *Trigonella* (7 species). Genus *Astragalus* L. is the largest with 60 species in the family most of the species are confined to Kashmir Himalayas.

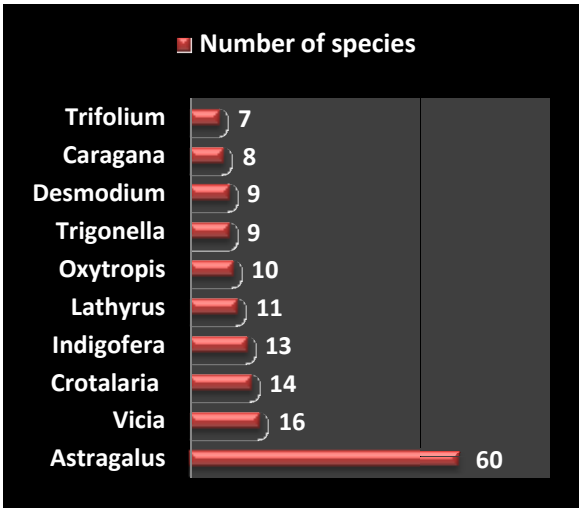

Fig. 4 Bar graph showing ten genera and break up of species in each genus

Dhar and Kachroo (1983) reported 91 species of legumes from the alpine region of Kashmir Himalaya which constitutes 39.6% of the present investigation. During the present investigation of family Fabaceae from the state of Jammu and Kashmir, one new record for the flora of India (Bhellum, 2011), one new record for the flora of Jammu and Kashmir (Bhellum and Magotra, 2000) have been already published.

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