

TAXONOMIC EVALUATION OF GENUS *TRIFOLIUM* LINN. (FABACEAE) IN JAMMU AND KASHMIR (INDIA)

H.S. KIRN and B.K. KAPAHI*

* Department of Botany, G.G.M. Science College, Jammu-180001, India.

* Regional Research Laboratory, Canal Road, Jammu Tawi - 180 001 India.

Based upon extensive field collections, critical examination of available specimens in herbaria and scrutiny of literature, the genus *Trifolium* Linn. of family Fabaceae is evaluated. Three taxa namely *T. campestre* Schreb., *T. dubium* Sibth. and *T. tomentosum* Linn. have established recently. *T. tomentosum* Linn. is reported as a new distributional record for Jammu and Kashmir State.

Keywords : Fabaceae; Herbaria and misidentification; Taxonomic evaluation; *Trifolium*.

Introduction

Genus *Trifolium* Linn., Sp. Pl. 764. 1753 of family Fabaceae is distinguished from its two closely allied genera viz. *Medicago* Linn., Sp. Pl. 778. 1753 and *Trigonella* Linn., Sp. Pl. 776. 1753 by its digitately 3-foliolate leaflets, flowers in distinct heads and pods concealed or scarcely exceeding the calyx against the pinnately 3-foliolate leaflets, flowers in racemes and distinctly exserted pods.

Trifolium is represented by about 300 species chiefly distributed in temperate and subtropical regions of the world with main distribution centres in the Mediterranean region, Ethiopia, California and Chile¹. It is represented by 12 species in India. Hooker² recorded only 3 species from India, the rest therefore, have made ground in the present century. Of the 12 species found in India at present as many as 9 are recorded from Jammu and Kashmir State.

Materials and Methods

The present taxonomic evaluation of genus *Trifolium* in Jammu and Kashmir State is based upon extensive study of the genus during innumerable botanical forays in various parts of this state in the last more than 15 years, critical examination of herbarium specimens located at Dehra Dun, Jammu and Srinagar, and the scrutiny of available literature. The voucher specimens are deposited in the herbarium of R.R.L. Jammu.

The specimens examined from different herbaria are mentioned and the herbarium name is abbreviated viz. Herbarium of Forest Research Institute Dehra Dun as (DD), Herbarium of Botanical Survey of India Dehra Dun as (BSD), Herbarium of the Dept. of Bio-Sciences, University of Jammu (JU), Herbarium of Kashmir (KU) and Herbarium of Regional Research Laboratory, Jammu as (RRLJ). As most of these taxa are new entrants in our country and not described in the monumental Hooker's "Flora of British India", detailed description of each of these taxa is appended herewith the latest nomenclature, critical notes wherever required to remove misconcepts, flowering and fruiting period, occurrence and distribution. A dichotomous key to the identification of various species of *Trifolium* found in Jammu and Kashmir is provided which would be practically useful to the students of Botany in identifying these taxa in Jammu and Kashmir, the neighbouring states and in the herbaria as well.

Key to the identification of species of *Trifolium* found in Jammu and Kashmir.

For the present key Geesing³ and Polhill⁴ have been followed to a greater extent.

1. Annual herbs.....2
- Perennial herbs.....6
2. Fruiting calyx inflated.....3

- Fruiting calyx not inflated.....4
3. Peduncles exceeding the subtending leaves; heads starshaped; inflated calyx in fruit pyriform, with exserted divergent upper teeth..... *T. resupinatum*
 Peduncles shorter than the subtending leaves; heads globose; inflated calyx in fruit globose, with recurved upper teeth..... *T. tomentosum*
4. Erect herbs; flowers dirty white..... *T. alexandrianum*
 Prostrate or decumbent herbs flowers yellow.....5
5. Leaves sessile or subsessile, the leaflets oblanceolate, subobtusate, serrate; heads 5-6 mm or less in diam; flowers pale yellow..... *T. dubium*
 Leaves petiolate, the leaflets obovate, truncate or emarginate, dentate; heads 10-12 mm or more in diam.; flowers orange or bright yellow..... *T. campestre*
6. Flowers white, occasionally changing to pink..... *T. repens*
 Flowers reddish purple or pink.....7
7. Fruiting calyx inflated..... *T. fragiferum*
 Fruiting calyx not inflated.....8
8. Densely hairy herbs; heads sessile or sub sessile, ovoid, subtended by an involucre of leafy bracts; flowers 12-15mm long; pods 1-seeded..... *T. pretense*
 Glabrous herbs; heads on long stalks, globular, without involucre; flowers 8-10mm long, ebracteate; pods 2-4 seeded..... *T. hybridum*

Enumeration

1. *Trifolium alexandrianum* Linn., Cent. Pl. 1:25. 1755; Amoen. Acad. 4:286. 1759; Hossain in Notes Roy. Bot. Gard. Edinb. 23 : 425. 1961; D.E. Coombe in Tutin *et al.*, Fl. Europea 2 : 171. 1968; Zohare in Davis, Fl. Turk, 3 : 438. 1970; Babu⁵, Herb. Fl. D. Dun,

165. 1977; Ali, Nasir & Ali's Fl. W. Pak. No. 100. 288 (Fig. 38 B) 1977; Vajravelu in Fl. Tamil Nadu 1 : 124. 1983; Naithani⁶, Fl. Pl. Ind. Nep. and Bhut. 127. 1990.

An erect or ascending, sparsely pubescent, annual herb; stipules oblong-lanceolate, ciliated, acuminate, 7-12 mm long; leaves shortly petioled; leaflets 15-30 x 7-15 mm, broadly elliptic or oblong-lanceolate, mucronate; inflorescence a peduncled ovoid or oblong-conical, 10-20 mm long head, often with a small involucre of few bracts; peduncle 2-3 cm long; calyx pubescent, teeth unequal, hardly longer than the tube, spinescent; corolla dirty white or creamish, vexillum 8-12 mm long; pod 1-2 seeded.

Flowering and fruiting : May to September.

Occurrence : Cultivated, sometime found as an escape along the edges of fields and in waste lands.

Distribution : Turkey, Iran, Syria, Lebanon, Egypt, Caucasus, Pakistan and India.

Specimens examined :

H.S. Kirm :- 3658, 20.4.1988 from Chandak; 3684, 18.5.1988. Poonch township; 3776, 24.5.1989, Mangnar; (All from district Poonch); 7001, 15.4.1998, Uphampur township (All deposited in RRLJ) and 539, 8.6.1975 Gulpur, (Poonch) J.U.

2. *Trifolium campestre* Schreb. in Sturm, Deutschl. Fl. Helf. 16 : 13. (1804); Kirm & Naithani⁷ in J. Econ. Tax. Bot. 5(5) : 1169. 1984; Naithani loc. cit; *T. procumbens* β *campestre* (Schreb.) DC. Prodr. 2:205. 1825.

An erect or decumbent, annual herb; branches appressedly pubescent; stipules asymmetrically ovate, acuminate, obscurely veined, ciliate, shorter than the leaves; leaves shortly petioled; leaflets 6-13mm long, obovate-cuneate, obtuse-subretuse, slightly dentate in upper half, with 6-10 pairs of parallel veins, each ending in a tooth, the terminal leaflet borne on 3-6mm long

petiolule, longer than the lateral ones; heads yellow, 12-18mm long, oval-globular, on axillary, pubescent peduncles. Calyx glabrous, scarious 2-3mm long, teeth unequal, the lower ones twice as long as the upper ones; corolla yellowish brown in fruit, vexillum 4-6mm long, inflated in fruit, obscurely toothed-fringed towards the margin, wings much smaller; pods ovaoid-ellipsoid 1 or rarely 2-seeded; seeds ovoid, shining, yellow.

Flowering and Fruiting : March to June.

Occurrence : A weed in wheat fields, roadsides, waste lands and hilly slopes.

Distribution : Central and Atlantic Europe, Scandinavia, Mediterranean (including N. Africa), Balkan peninsula to Asia minor, Armenia-Kurdistan, Iran, Afghanistan and India.

Critical note : It closely resembles *T. aureum* Poll. in its heads of yellow flowers but in the later petiolules of all the leaflets are equal in size.

Specimens examined :

H.S. Kirn 1163. Chhote Shah Ziarat (Poonch) J.U; 3683, 10.5.1988, Gadigar (Jammu); 3782 25.5.1988, Sakhimaidan (Poonch); 3997, 28.5.89. Balakote (Poonch); 7004, 24.4.98, Dhargaloon (Poonch); 7005, 24.4.98, Potha, Tehsil Mendhar (Poonch); 7006, 24.4.98, Chhote Shah Ziarat (Poonch). All deposited in RRLJ.

3. *Trifolium dubium* Sibth., Fl. Oxon. 231. 1794; Prain in J. As. Soc. Beng. 66 : 354, 1897; Gamble, Fl. Pres. Madras 1:302. 1918; Singh in Bull. Bot. Surv.Ind. 12(1-4): 268, 1970 ; Ali in Fl. w. Pak. 100 : 289. 1977; Naithani in Ind. J. For. 5 : 146. 1982; Grierson & Long, Fl. Bhutan 1(3) : 730, 1987. *T. minus* Sm. in Relham, Fl. Cantabr. ed. 2 : 86. 1876; Collett, Fl. Siml. 116, 1922.

A procumbent, slender annual herb; stem branching usually from the base, pubescent or subglabrous; leaflets 6-12mm long, obovate-obcordate, finely toothed, the terminal leaflets petiolulate; stipules 4-5mm

long, broadly lanceolate-ovate; petiole 5-10mm long; flowers in compact, hemispherical, 8-10mm long racemes on axillary peduncles; calyx 0.2mm long, with narrow acute teeth; corolla 3-5mm long, yellow changing to yellowish brown; pods obovoid, single seeded; seeds yellowish brown.

Flowering and Fruiting : May to August

Occurrence : Rare, on grassy slopes and in beds of nallahs.

Distribution : Europe, extending to Caucasus and North Western Himalaya in India and Pakistan.

Specimens examined :

G. H. Dar - 5431, 5.6.1983, Ganderbal, 1650 (KU); Gurcharan Singh - 1841, 5.6.1970 and 378, 25.5.69, Harwan, 2000m (All KU); G.L. Fuller - 6140, 7.12.1913, (Univ. of Kashmir Accession No. 8520, 13.10.79 (KU) is a case of misidentification. Specimen referred here infact is *Medicago lupulina* Linn.; J.N. Vohra and B.D. Naithani-89520, August 1986, Synthen area 3,500m (BSD); B.M. Wadhwa 69097, 15.9.1979, Dachigam (BSD); H.S. Kirn - 1129, Loran, district Poonch, 2000m (J.U.).

4. *Trifolium fragiferum* Linn. Sp. Pl. 772. 1753; Baker in Hook. f., Fl. Brit Ind. 2 : 86. 1876; Singh & Kachroo⁸ in For. Fl. Sgr. 141. 1976. Ali, Fl. W. Pak. 100 : 286. 1977.

A procumbent, perennial herb, often rooting from the lower nodes; stipules 5-10 mm long, lanceolate, membranous, long pointed; leaves petiolate; leaflets 5-20 x 4-10mm, shortly petiolulate, ovate, acute, dentate; petiole 25-60 mm long; inflorescence a compact head, 12-15mm long, hemispherical-ellipsoid, involucred; peduncles 7-20 cm long, longer than the petiole of subtending leaves; bracts 2-5mm long; calyx subglabrous, inflated in fruit, the teeth as long as the tube; corolla white, soon changing to pink; vexillum 5-7mm long; pod 1-2 seeded, included in inflated calyx.

Flowering and fruiting : July to November

Occurrence : Scare, in river beds and wet places.

Distribution : Europe, caucasus, Egypt, Arabia, N. Africa, Turkey, Iraq, Syria, Iran, Afghanistan and N. W. Himalaya.

Specimens examined :

R. L. Badwar - 3480, 17.7.1935, Baramulla (RRLJ); A.K. Dutt - 7413, 19.7.1962. Barzalla nursery, Srinagar (RRLJ); H.S. Kirn - 2202 Saikloo, dist. Poonch 1300 m (JU).

5. *Trifolium hybridum* Linn., Sp. Pl. 766. 1753; Hossain in Notes Roy. Bot. Gard. Edinb. 23 : 451, 1961; Babu, Herb Fl. Dehra Dun 166. 1977.

No specimen seen. Believed to be cultivated in Srinagar. It is a native of Europe and Continental Asia.

6. *Trifolium pratense* Linn., sp. Pl. 768. 1753; Baker in Hook. f., Fl. Brit. Ind. 2 : 86, 1876; Collect, Fl. Siml. rep.ed. 116. 1922; Singh & Kachroo, For. Fl. Sgr. 142. 1976.

A decumbent, hairy, perennial herb; stipules ovate-lanceolate, abruptly mucronate; leaflets 15-25 x 10-20 mm, obovate-broadly elliptic, obscurely toothed; inflorescence globose-ovoid, 10-20mm wide head; heads sessile or sometime peduncled, usually with an involucre of reduced bracts; calyx 8-10mm long, teeth almost twice the length of cup, unequal, the lowest longer than the others, cup 2-3mm long; corolla reddish purple or pink; vexillum 10-18mm long; pod 1-seeded, opening by a lid.

Flowering and Fruiting : May to October.

Occurrence : Common in pastures, waste lands, roadsides and as a weed in fields between 1300-3200m.

Distribution : Europe, N. Africa, Central and South Western Asia, Afghanistan and U.S.S.R.

Critical note : A very variable taxon with respect to size of parts and hairyness.

Specimens examined :

L.D. Kapoor - 217, 10.9.1945, Near Chandanwari; B.K. Abrol - 3761, 27.8.1958, Dachigam; No 3707, 13.6.1956, Yarikah near Tangmarg; No 4270, 1.7.1955 Krimchi, district Udhampur. All housed in RRLJ.

7. *Trifolium repens* Linn., Sp. Pl. 768. 1753; Baker in Hook.f., Fl. Brit. Ind. 2:86. 1876; Collect, Fl. Siml. rep. ed. 116. 1922; Nair, Fl. Bashr. Himal. 89. 1977.

A glabrous, trailing, perennial herb; stem often rooting from the nodes; leaves long petioled; leaflets obovate or emarginate, 10-40 x 6-15mm, the terminal leaflet sessile; stipules narrowly oblong-ovate, sheathing at the base, subulate at the apex, shorter than the petioles; heads of flowers globose, peduncled, peduncles 4-10 cm long; flowers white, sometime tinged with pink; calyx teeth unequal, lanceolate, shorter than the tube, 10 nerved; vexillum 7-10mm long; pods linear, 3-4 seeded.

Flowering and Fruiting : April to October.

Occurrence : Common, throughout ascending to Ca. 4500m.

Distribution : USSR, Central and Eastern Asia, Australia, North & South Africa, Afghanistan and eastward to India.

Specimens examined :

D.R. Sharma - 15162, 17.7.1989, Dawar, Gurez (A case of misidentification. The specimen is referable to *T. pratense* Linn.); K.S. Ahulawalia 1721, 20.4.1951, Dhagger Jammu; B.K. Abrol - 3701, 1.6.1956 Srinagar and No 3713, 17.6.1956, Yarikah; L.D. Kapoor-1271, 14.5.1951, Yarikah; Y.K. Sarin 11101, 26.6.1966, Batote; RRL Acession No 2186, 17.5.1956, Jamiangali (Poonch); B.K. Abrol - 5349, 30.6.1956, Thannamandi dist. Rajouri; Y. K. Sarin - 6207, 10.6.60, Bhaderwah (All housed in RRLJ). H.S. Kirn - 387 and 4351 from Mendhar and Poonch township in district Poonch (J.U.).

8. *Trifolium resupinatum* Linn, Sp. Pl. 771. 1753; Baker in Hook. f., Fl. Brit. Ind. 2 : 86.

1876; Hossain in Notes Roy. Bot. Gard. Edinb. 23 : 451. 1961; Ali, Fl. W. Pak. 100 : 298. 1977; Babu, Herb. Fl. Dehra Dun 166. 1977.

An ascending or erect, glabrous, annual herb; stipules ovate; leaves petiolate; leaflets 8-30 x 10-18mm, obovate-cuneate, usually rounded or truncate - emarginate at the apex; inflorescence a many flowered, peduncled 10-18 mm long head; heads subglobose, without any involucre; peduncles little longer than the subtending leaves; calyx 5-10mm long, inflated in fruit, densely hairy, teeth as long as or little longer than the tube; corolla pinkish purple, resupinate; vexillum 5-10 mm long; pod shortly ovoid, enclosed within the inflated calyx, 1-2 seeded.

Flowering and Fruiting : April to August.

Occurrence : Often found as an escape from cultivation. Cultivated as green fodder.

Distribution : Probably native of S. Europe; distributed in Southern U.S.S.R., Egypt, Turkey, Iraq, Syria, Afghanistan and eastward to India, N. Africa.

Critical note : A variable taxon with respect to size and shape of leaflets. It closely resembles *T. tomentosum* Linn. in its accrescent calyx but in the later taxon the peduncles are shorter than or equalling the petiole of subtending leaves. *T. tomentosum* Linn. is a recent and naturalized weed in Jammu.

Specimens examined :

J.N. Vohra and B.D. Naithani - 88836 Aug. 1988, Pul Doda-Baderwah (BSD); H.S. Kirn - 3801, 28.5.1988, Mishriwala in Jammu and 6702, 4.5.1977, from Poonch riverside (RRLJ), 2147 from Poonch township (JU).

9. *Trifolium tomentosum* Linn., Sp. Pl. 771. 1753; Hossain in Notes Roy. Bot. Gard. Edinb. 23 : 453. 1961; Babu, Ind. For. 95(2) : 102. 1969. Raizada⁹, Suppl. Fl. Upper Gang. Plain 60. 1976. Sharma¹⁰, Geobios new reports 5:53. 1986; Punj. plants 31, 1990. *T. fragiferum* sensu Sharma & Kachroo¹¹, Fl. Jammu 1:135. 1981 non Linn.

A diffuse, glabrous, annual herb; stem subterete, decumbent below, ascending upwards; lower leaves long petioled, leaflets digitately 3-foliolate, 1-2 x 1-1.5cm, obovate, rounded-truncate-emarginate, acutely denticulate-dentate; stipule 12-15mm long, with scarious lower halves and adnate to the petiole, ovate-lanceolate; heads axillary, pedunculate, globose, 5-8mm across; peduncles 1-2 cm long, shorter than their subtending leaves, recurved in fruiting; flowers subsessile; calyx 2-3mm long, densely hairy at the back, accrescent and globose in fruit, with 1 mm long inwardly bent and hidden upper calyx teeth; corolla purplish 4-5mm long, macroscent, the standard obovate, notched; style glabrous; pod ovoid-ellipsoid, 2-seeded, shorter than the inflated fruiting calyx.

Flowering and Fruiting : January to April.

Occurrence : Common in lawns, waste lands and along roadsides. Specimens collected from Jammu University Campus; Talab Tillo and Nagrota in Jammu district and Tariath in district Udhampur.

Distribution : Native of Europe, naturalised elsewhere.

Critical note : The occurrence of this taxon in India was first reported by Babu in 1969 from Dehra Dun (U.P.) and subsequently from upper Gangetic plains by Raizada⁹ and from Punjab by Sharma in 1986. On account of its appearance, flower colour and accrescent fruiting calyx it has often been mistaken for *T. fragiferum* L. and *T. resupinatum* L. by early workers. B.M. Sharma's specimen No 381, 3.3.1970 in RRLJ from Talab Tilo and Ajay Swami's No 86816, 31.3.86 from Udhampur city, both misidentified as *T. fragiferum* L. are referable here. *T. tomentosum* Linn. differs from *T. fragiferum* L. in its annual habit, peduncles shorter than the subtending leaves (1-2 cm in length), recurved in fruit, and globose heads against perennial habit, peduncles erect, exceeding the subtending leaves (10-15 cm long). It

differs from *T. resupinatum* Linn. in having peduncles shorter than the subtending leaves, globose heads and globose inflated fruiting calyx with inwardly recurved upper teeth against peduncles longer than the subtending leaves, starshaped heads and pyriform inflated fruiting calyx with distinctly exerted and divergent upper teeth.

Specimen examined :

H.S. Kirm - 3788, 28.5.1988, Mishriwala (Jammu); 3795, 28.5.1988, Jammu city; 3800, 28.5.1988 Talab Tillo, Jammu; 6813, 10.5.1998, University Campus, Jammu; 6907, 27.3.98, Hans Raj Park, Jammu city; 6951, 5.4.1998 Thariat, dist. Udhampur; 7002, 15.4.1998. Garhi, dist. Udhampur; 7003. 16.4.1998 Bakshinagar, Jammu. B.M. Sharma 381, 3.3.1970 from Talab Tillo, Jammu (misidentified as *T. fragiferum* L.) All deposited in RRLJ. Ajay Swami - 86816, 31.3.1986 from Udhampur city (misidentified as *T. fragiferum* L.) BSD.

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