

Volume 15, Number 4, 2009

ISSN 1815-1094

Pakistan Journal
of
WEED SCIENCE RESEARCH

A quarterly research journal of weeds and medicinal herbs



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TAXONOMY OF NODULATED LEGUMINOUS FLORA OF DERA ISMAIL KHAN NORTH-WESTERN PAKISTAN

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ABSTRACT

An extensive survey was carried out during 2005-2007 to investigate nodulated leguminous weed species, which grow in agricultural and non-agricultural fields of North Western Part (Dera Ismail Khan) of Pakistan. Studies revealed that 18 such weed species belonging to 10 genera are commonly found in the research area. The genera with number of species are: Alhaji (1 sp.), Argyrolobium (1 sp.), Astragalus (2 spp.), Cajanus (1 sp.), Lathyrus (2 spp.), Lotus (1 sp.), Medicago (5 spp.), Melilotus (3 spp.), Sesbania (1 sp.) and Vicia (1 sp.). Key to the species of the area was developed for easy and correct identification & differentiation. Results were systematically arranged by alphabetic order of botanical names, followed by synonym (if any), description of the plant, flowering and fruiting period, type, local and general distribution. Nodulated leguminous plant specimens were collected, identified, preserved, mounted and deposited as voucher specimens in the Department of Plant Sciences, Quaid-i-University, Islamabad, for future references.

Key words: Nodulated Leguminous Weeds, Dera Ismail Khan, Pakistan

INTRODUCTION

Dera Ismail Khan (D.I.Khan) district (7326 Km²; 31°.15' to 32°.32'N and 70°.11' to 71°.20' E) is located in the extreme south of the North West Frontier Province (NWFP), Pakistan. Most of the area of the district consists of flat dry alluvial plain, commonly known as *Daman* which makes up more than 80 percent of the area where a large number of streams and hill torrents discharge 850,000 cusecs of water during peak flow. This unique irrigation system is termed as *Rod Kohi* (irrigation from streams originating from hills). The area is gifted with diverse and unique flora, as it is adjacent to the South Waziristan Agency and Sulaiman Range in the West, Koh Sheikh Buddin in the North and Indus River in the East. The summer season is dry and hot. June is the hottest month during which the mean maximum and

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minimum temperature is recorded around 42°C and 27°C, respectively. December, January and February are the coldest months. In January the mean maximum and minimum temperature is around 20 °C and 40 °C, respectively (Anonymous, 1998).

Weeds in simpler terms are the plants that interfere with the healthy or normal growth and development of our crops. They are now known to limit the production of crops causing serious losses in the output of grains, seeds and fruits etc. (Chaudhri, 1992). They belong to practically all plant families, but certain families particularly Compositae (Asteraceae), Graminae (Poaceae), Cruciferae (Brassicaceae) and Leguminosae (Fabaceae) constitute the major weed flora throughout the world.

The plants of family Leguminosae bear nodules on their root system, but not all legumes are nodulated and it is known that certain tree forms do not possess them at all. Hardly 16% of Leguminosae have so far been examined for nodulation of which 95% of the sub-family Mimosoideae, 26% of Ceasalpinioideae and 90% of Papilionoideae possess root nodules (Anonymous, 2008).

In root nodules the leguminous plants host bacteria. These bacteria, known as rhizobia, have the ability to take nitrogen gas (N₂) out of the air and convert it to a NO₃⁻ or NH₃, which is usable by the host plant. This process is called nitrogen fixation. The legume, acting as a host, and rhizobia, acting as a provider of usable nitrate, form a symbiotic relationship. The ability of legumes to fix atmospheric nitrogen reduces fertilizer costs for farmers and gardeners who grow legumes, and means that legumes can be used in a crop rotation to replenish soil that has been depleted of nitrogen. Legume seed and foliage has comparatively higher protein content than non-legume material, due to the additional nitrogen that legumes receive through the process (Anonymous, 2008a).

The leguminous plants are not bad weeds as a group, although there are certain exceptions. Under favourable conditions many species usually considered as harmless may turn into pests difficult to eradicate. But most of them have a beneficial effect rather than injurious, due to the presence of nitrogen fixing root nodules (Athar and Sandhu, 1992). Unfortunately no research regarding the taxonomic studies of leguminous species has been carried out so far in D.I. Khan District. In the present investigation, nodulated leguminous weeds have been explored, examined and described.

MATERIALS AND METHODS

Frequent field trips of the area were arranged to various parts of D.I.Khan District to collect the live specimens. A Collection of the nodulated leguminous weeds was made and herbarium specimens

were prepared. Plants were identified with the help of available literature (Jafri, 1966; Stewart, 1972; Qurashi and Khan, 1972; Ali, 1977) and by comparing with the already identified plant specimens of the herbarium, Quaid-i-Azam University, Islamabad. After correct identification, the plants were deposited in Department of Plant Sciences, Quaid-i-Azam University, Islamabad for future references. Only positive reports of nodulated plants were presented. Detailed morphological features of each species were compiled. Taxonomic key was developed to differentiate closely related taxa. Leguminous weed species having nodulated roots were listed in the Table.

RESULTS AND DISCUSSION

Studies revealed that 18 nodulated legume weed species were common in agricultural and non-agricultural fields. The plants examined included: *Alhagi maurorum* Medic., *Argyrolobium roseum* (Camb.) Jaub. & Sapach, *Astragalus amherstianus* Royle ex Benth., *A. bakaliensis* Bunge, *Cajanus cajan* (L.) Millsp. *Lathyrus aphaca* L., *L. sativus* L., *Lotus corniculatus* L., *Medicago laciniata* (L.) Mill., *M. lupulina* L., *M. minima* (L.) Grufb. *M. polymorpha* L., *M. sativa* L. *Melilotus alba* Desr. *M. indica* (L.) All. *M. officinalis* (L.) Pall. *Sesbania sesban* (L.) Merrill and *Vicia sativa* L., herbs, climbers and undershrubs. *Sesbania sp.* and *Cajanus cajan* grown as crops, also grow as weeds in some other crops. Results were systematically arranged by alphabetic order of botanical names, followed by synonym (if any), description of the plant, flowering and fruiting period, type, local and general distribution.

Legume plants only grow vigorously if they have functioning nodules, and this depends upon their roots encountering the appropriate bacteria strains in the soil. Bacteria involved in nodule formation and symbiotic N-fixation belongs to the genera *Rhizobium* and *Bradyrhizobium*. *Rhizobium* species are fast-growing, acid-producing N-fixing bacteria. *Bradyrhizobium* species are slower-growing, alkaline-producing bacteria (Adjei, *et al.* 2008).

A. maurorum species has a symbiotic relationship with certain soil bacteria. These bacteria form nodules on the roots fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby (Anonymous, 2008b). *C. cajan* is nodulated with *Rhizobium* of the cowpea type and is an effective green manure crop (Anonymous, 1988). Being a legume, *L. aphaca* enriches soil through symbiotic nitrogen fixation. *L. sativus* has an extensive root system and fixes atmospheric nitrogen through bacteria that live on the roots. It makes a good soil-enriching green manure crop or can be planted for erosion control (Anonymous, 2008a).

The genus *L. carnicultus* can fix nitrogen from the air through root nodules, making it useful as a cover crop. The nodulating symbionts are *Bradyrhizobium* bacteria. *M. laciniata* forms a symbiotic relationship with the bacterium *Sinorhizobium meliloti* which is capable of nitrogen fixation. *M. lupulina* is a summer annual/perennial plant sometimes considered a weed. As with other legumes, nitrogen-fixing bacteria, known as *rhizobia*, are found in nodules on the roots. *M. minima* form a symbiotic relationship with the bacterium *Sinorhizobium meliloti*, which is capable of nitrogen fixation. *M. polymorpha* forms a symbiotic relationship with the bacterium *Sinorhizobium medicae*, which is capable of nitrogen fixation. The root nodules of *M. sativa*, contain bacteria, *Sinorhizobium meliloti*, with the ability to fix nitrogen, producing high-protein forage regardless of available nitrogen in the soil. Its nitrogen-fixing abilities (which increases soil nitrogen) and use as animal fodder greatly improves the agricultural efficiency. *Melilotus albus* is a major source of nectar. It is nonetheless favoured for honey production and for its nitrogen fixing ability in preparing agricultural soil for future crops. Other *Melilotus* spp. has also moderate nodulation. *S. sesban* is cultivated nitrogen fixing leguminous plant which has abundant nodulation. However, it is considered as a weed when found growing in cultivated crop fields. *Vicia sativa* L. is also nitrogen fixing leguminous plant. Although considered a weed when found growing in a cultivated grain fields, this hardy plant is often grown as green manure or livestock fodder (Anonymous, 2008a).

Key to the genera

- 1+Stamen monadelphous-----2. *Argyrobium*
 - Stamens diadelphous -----2
- 2+Plants armed with thorns -----1. *Alhagi*
 - Plants unarmed -----3
- 3+Plants usually climbing or trailing-----4
 - Plants erect or suberect or spreading (not climbing) -----5
- 4+Style tapering apically, glabrous or bearded at apex, all round or on lower surface only; staminal sheath oblique at the apex-----10. *Vicia*
 - Style flattened or dorsally compressed towards apex, glabrous or bearded along the upper surface; staminal sheath truncate at the apex-----5. *Lathyrus*
- 5+Pods spirally coiled (twisted) -----7. *Medicago*
 - Pods not spirally coiled-----6
- 6+Shrubs (or tree); pods up to 25 cm long -----7
 - Herbs, pods usually small, up to 6 cm long-----8
- 7+Leaflets 18-30; pod long, 20-30 seeded-----9. *Sesbania*
 - Leaflets 3; pod short, 3-7 seeded -----4. *Cajanus*

8+Flowers axillary solitary (rarely 2-3 at one place),
 sessile-----6. *Lotus*
 - Flowers in raceme or spike, usually many-----9
 9+Leaflets more or less toothed; pods glabrous,
 wrinkled (ovoid)-----8. *Melilotus*
 -Leaflets entire; pods hairy, not wrinkled -----3. *Astragalus*
Alhagi maurorum Medic. in Vorles, Churpf, Phys. Oek. Ges. 2: 397
 (1787).

Synonym: *A. camelorum* Fisch. ex DC., Prodr. 2: 352 (1825).

An undershrub armed with sharp thorns up to 120 cm high, glabrous or pubescent. Leaves simple, very variable, up to 2.5 cm long, entire, apiculate, glabrous or pubescent; petiole c. 2 mm; stipules minute. Inflorescence lateral axillary raceme, 1-5 cm long, ending in spine. Flowers pink or reddish-violet, 1-8, on the thorns; pedicels 1-3 mm long; calyx glabrous, teeth triangular; corolla twice or thrice as long as the calyx. Pod glabrous up to 3.5 cm long, more or less constricted between the seeds, 1-9 seeded.

Flowering and Fruiting Period: April-September.

Type: S.E. Russia, north of Caspian Sea, Herb. Linn. 921. 1 (LINN).

Local Distribution: Common in the area.

General Distribution: Pakistan; Kashmir; Iran; Afghanistan; Russia; Turkey; Iraq; Syria Palestine; Cyprus; N. Africa.

Argyrobium roseum (Camb.) Jaub. & Sapach, Illustr. i. 116 (1842).

Syn: *Cytisus roseus* Camb. in Jacq., Voy. Bot. 4: 35. t. 40. 1835.

A small diffuse annual about 3-6 in. high, sub erect to spreading, usually silky hairy. Leaves 3-foliolate, petioled; leaflets obovate. Flowers yellowish rose; peduncle 1-4 flowered. Calyx glabrous. Pod 2-3 cm long, silky hairy. Seeds 8-15.s

Flowering and Fruiting Period: April-October.

Holotype: Mirpour, Jacquemont (P-not).

Local Distribution: Dara Zinda, Sheikh Maila, Bilot Sharif

General Distribution: Pakistan; Kashmir; India; Persia; Afghanistan; Arabia.

Astragalus L.

Key to the species

+ Legume rostrate; seeds 10-12 ----- *A. amherstianus*

- Legume not rostrate; seeds more than 20 ----- *A. bakaliensis*

A. amherstianus Royle ex Benth. in Royle, Illustr. Bot. Himal. Mount. 199 (1835).

An annual with woody root-stock, stem densely caespitose, 20-40 cm long, clothed with dense appressed whitish hairs. Leaves imparipinnately compound, petiole short, 0.3-1.7 cm long; leaflets 11-19, narrow, oblong, obtuse, 3-10 x 1.5-4.5 mm. densely hairy. Flowers 4-10, in distinctly closed racemes; pedicels very short; bracts minute,

pilose, hairs spreading white. Calyx hairy, toothed, as long as the tube. Corolla primrose-yellow. Pod linear, turgid, 0.8-1.2 cm long, about 0.3 cm broad, much recurved, rostrate, thinly pubescent, 10-12 seeded.

Flowering and Fruiting Period: April–June.

Holotype: Simla, Sara Amherst (K).

Local Distribution: Common in Hathala, paroa and Paniala circle

General Distribution: Pakistan; Kashmir; India (Kumaun Tehri, Garwal, N. Punjab), 6000-13000 ft.

A. bakaliensis Bunge in Arb. Naturf. Vir. Riga. 1: 249 (1847).

An erect annual covered with appressed white hairs, dwarf or little elongated, up to 10 cm long. Leaves imparipinnately compound, petiole up to 2 mm long. Inflorescence an axillary peduncled raceme, peduncle 2.5 – 7 cm long; peduncle exceeding the leaves. Calyx c. 4.0 mm long, pilose, teeth equaling tube. Standard broadly oval, retuse; keel longer than wings. Pod erect, sickle-shaped, pubescent, not rostrate, ventral suture obtuse. Seeds 20-30.

Flowering and Fruiting Period: March-April.

Holotype: Bei Bakali, 28.4.1842, Lehman 378 (LE-not seen)

Local Distribution: Common in Hathala and Paniala circle

General Distribution: Pakistan; Kashmir; Persia; Afghanistan; Russia.

This species resembles *A. amherstianus* in general appearance but differs from it in possessing stem up to 10 cm long and rostrate pod having 20-30 seeds. In *A. amherstianus* the stem is 20-40 cm long; pod is not rostrate and contains 10-12 seeds.

Cajanus cajan (L.) Millsp. In Publ. Field Mus. Nat. Hist. Bot. Ser. 2: 53 (1900).

Syn: *Cajanus indicus* Spreng., Syst. Veg. 3: 248 (1826)

An erect pubescent shrub, 1.5-4 m tall. Leaves 3-foliolate, entire; stipules minute; leaflets 2.5-10 x 1.5-3.5 cm, minutely stipellate, elliptic to lanceolate, soft pubescent on both surfaces; petiole 1-5 cm long. Inflorescence a terminal panicle; peduncle 2-7 cm long. Pedicel 1-1.7 cm long, pubescent. Calyx velvety pubescent. Corolla bright yellow with reddish brown or crimson lines. Pod 4.5-10 cm long, 4-14 mm broad, long beaked, pubescent and glandular. Seeds 3-7, orbicular with one edge flattened, compressed.

Flowering and Fruiting Period: July-August.

Syntype: Ceylon, hermann 2.76 & 3.30 (BM).

Local Distribution: Tehsils Paharpur and D.I.Khan

General Distribution: Native of Tropical Africa, widely cultivated.

Lathyrus Linn.

Key to the species

- + Leaflets absent; flowers yellow ----- *L. aphaca*
- Leaflets present; flowers white, red or bluish ----- *L. sativus*

L. aphaca Linn., Sp. Pl. 729 (175).

An annual trailing or scrambling herb. Stem without wings, branched, glabrous. Leaves reduced to tendrils; leaflets absent. Stipules in pair, foliaceous, oppressed to the stem, 5-30 mm long, broadly ovate, hastate. Inflorescence 1-2 flowered, axillary raceme. Peduncle long, 1-4 times as long as the stipules. Calyx teeth equal to 3 times as long as the tube. Corolla twice the calyx, bright to pale yellow. Pod linear-oblong, wingless, glabrous, 4-6 seeded.

Flowering and Fruiting Period: February-April.

Lectotype: Herb.Linn.905/1 (LINN)

Local Distribution: Commonly found in the area.

General Distribution: Pakistan; Kashmir; India; Europe; N. Africa; S.W. & C. Asia; Afghanistan; Arabia.

L. sativus Linn., Sp. Pl. 730 (1753).

Annual with glabrous winged stem, nearly erect or so. Leaves pinnately compound, leaflets 2, 5-100 mm long, 1.5-11 mm broad, narrowly lanceolate to linear, median and upper leaves with mostly 3-sect tendrils, stipules lanceolate, semisagittate. Peduncle 1-flowered, 3-6 cm. long. Calyx tube much longer than teeth. Corolla bluish, white or red. Pod 2.5-3.5 cm long, flat, glabrous, 4-5 seeded.

Flowering and Fruiting Period: March-August.

Types: 'Habitat in Hispania, Gallia', Herb.Linn.905/6 (LINN); Hort. Cliff. (BM).

Local Distribution: Common in the area.

General Distribution: Pakistan; Kashmir; India; Europe; N. Africa; S.W. Asia; Russia.

This is a very distinct species differing from *L. aphaca* by possessing winged stem; median and upper leaves with mostly 3-sect tendrils and bluish, white or red corolla. While, *L. aphaca* the stem is without wings; each leaf is reduced to tendril and corolla is bright to pale yellow.

Lotus corniculatus Linn., Sp. Pl. 775 (1753).

Extremely variable perennial herb, prostrate, ascending or decumbent; branches glabrous to densely pilose. Leaf rachis up to 6 mm long, leaflets 3-20 x 2-10 mm. Inflorescence a 3-6-flowered axillary, pedunculate umbel; peduncle 3-12 cm long. Bracts sessile, leaf-like. Calyx c. 6 cm long, teeth unequal. Corolla yellow. Pod 12-30 x 2-3 mm cylindrical, straight.

Flowering and Fruiting Period: April-August.

Type: Described from Europe, Herb. Linn. 931. 23 (LINN).

Local Distribution: Tehsils Paharpur, D.I.Khan and Paroa.

General Distribution: Pakistan; India; Nepal; Afghanistan; Iran; Syria; Lebanon; Iraq; Turkey; Palestine; Arabia. Egypt; Cyprus; Russia; Europe; Japan; Korea; China; Mongolia; Australia.

Medicago Linn.**Key to the species**

1. +Pod prickly -----2
- Pod not prickly -----4
2. +The spines of the pod oriented almost parallel to the surface of the disc-----*M. polymorpha*
- The spines of the pod oriented almost at right angle to the surface of the disc ----- 3
3. +Stipules laciniate; corolla scarcely exerted from the calyx tube-----*M. laciniata*
- Stipules sub entire to entire; corolla distinctly exerted from the calyx tube-----*M. minima*
4. +Flowers yellow; pod 1-seeded -----*M. lupulina*
- Flowers bluish-violet; pod many seeded -----*M. sativa*

M. laciniata (L.) Mill., Gard. Dict. Ed. 8, no. 5 (1768)

Syn: *M. polymorpha* var. *laciniata* L., Sp. Pl.781 (1753).

Annual, spreading, stem glabrous. Leaves pinnately 3-foliolate; stipules laciniate; petiole equal to or exceeding leaflets; leaflets obovate-cuneate, 6-12 x 2-5 mm. Truncate or retuse, usually pubescent on lower side only, dentate. Inflorescence a 1-2 flowered peduncle raceme, peduncle longer than the petiole. Calyx narrowly turbinate, teeth as long as the tube. Corolla 4-5 mm long, yellow. Pod spherical or ovoid with 5-7 sharply spinous coils, 8-10 seeded.

Flowering and Fruiting Period: March-April.

Type: plate 34 in Breyne, Exoticarum aliarumque minus cognitarum plantarum, 1678 (Heyn l.c.).

Local Distribution: near Darya Khan-D.I.Khan Bridge, Paharpur.

General Distribution: Pakistan; Orient; Algeria; Tunisia; Kenya; Somalia Republic; Socotra; S. Europe.

M. lupulina L., Sp. Pl. 779 (1753)

Annual or perennial procumbent herb with up to 60 cm long, pubescent or glandular stem. Leaves pinnately 3-foliolate; petiole up to 2.5 cm long; stipules entire or faintly toothed with long acuminate tips; leaflets 5-20 x 4-8 mm. Obovate, cunneate, base deltoid, entire. Inflorescence an axillary, pedunculate raceme, peduncle longer than the leaves. Flowers yellow; calyx teeth almost equal to slightly longer than the tube; corolla slightly exerted. Pod 2-3 mm curved, 1-seeded

Flowering and Fruiting Period: March–June.

Type: Described from Europe, Herb. Linn. 933/10. (LINN).

Local Distribution: near Darya Khan-D.I.Khan Bridge, Paharpur.

General Distribution: Pakistan; India; Russia; Afghanistan; Iran; Syria; Turkey; Europe; Eritrea; Ethiopia; Somali Republic; Tanganyika and Kenya.

Medicago minima (L.) Grufb. In Linn. Amoen. 4: 105 (1759).

Syn: *M. Polymorpha* Linn. var. *minima* Linn., Sp. Pl. 780 (1753).

Annual, pubescent; petiole up to 8 mm long, leaflets 6-12 x 2-7 mm distinctly toothed, obovate, pubescent on both surfaces. Inflorescence a 2-6 flowered peduncled raceme, peduncle generally longer than the petiole. Flower 2-5; calyx teeth linear, as long as the tube; corolla distinctly exserted. Pod of 3-5 coils, spines variable.

Flowering and Fruiting Period: April–July.

Lectotype: 'the illustration accompanying *Medica achinata minima*' J. Bauhin & Cherler, Hist.Pl.Un.2:386.1651 (Heyn, l.c.).

Local Distribution: near Darya Khan-D.I. Khan Bridge, Paharpur

General Distribution: Pakistan; Kashmir; Europe; N. Africa and Cape; Asia (except the desert areas); introduced in North and South America.

M. polymorpha Linn., Sp. Pl. 779. (1753).

Syn: *M. denticulata* Willd., Sp. Pl. 3: 1414 (1802).

Annual, glabrous or subglabrous prostrate, up to 60 cm long. Leaves pinnately 3-foliolate compound; stipule laciniate; petiole 1.2-4 cm long; leaflets 10-20 x 7-15 mm. Obovate to cuneate, obtuse, truncate to retuse faintly toothed. Inflorescence a 2-8 flowered peduncled raceme, peduncle 5-15 mm long. Flowers yellow; calyx teeth lanceolate, as long as the tube; corolla twice as long as calyx. Pod flattened to rather subglobose, of 2-4 spirals; margin with double row of spines.

Flowering and Fruiting Period: March-May.

Lectotype: Hort. Cliff. No. 118 (BM).

Local Distribution: Commonly found in the area.

General Distribution: Pakistan; widely distributed throughout the world, except for tropical regions and desert.

M. sativa Linn., Sp. Pl. 778 (1753)

A glabrous branched, erect to suberect annual or perennial herb, up to 90 cm tall; leaflets 5-20 x 3-10 mm. Obovate to sublinear, dentate at apex, appressed pubescent. Inflorescence a peduncled raceme, peduncle much longer than petiole. Flowers violet or bluish; calyx teeth as long as the tube; corolla exserted. Pod slightly pubescent with 2-3 spiral coils, 10-20 seeded.

Flowering and Fruiting Period: March-June.

Type: Described from Spain and France, Herb.Linn.933/6 (LINN); Herb. Cliff. (BM).

Local Distribution: near Darya Khan-D.I. Khan Bridge, Paharpur, Paroa

General Distribution: Pakistan; India; Central Asia to Europe, Orient and N. Africa; widely cultivated.

Melilotus Mill.**Key to the species**

1. +Flowers white -----*M. alba*
 - Flowers yellow -----2
2. +Corolla 2-3 mm long; pod turgid, coarsely reticulate----*M. indica*
 - Corolla 5-7 mm long; pod not turgid, only slightly
 reticulate -----*M. officinalis*

M. alba Desr. in Lam., Encycl. Meth. 4: 63. 1796

Annual, erect, glabrous or finely pubescent above, 30-150 cm high. Leaflets narrowly or broadly oblong, denticulate, obtuse or emarginated. Flowers in 4-10 cm long raceme, white, honey sweet; pedicel short. Calyx teeth lanceolate, shorter than the tube. Corolla exceeding calyx. Pod small, usually 2-seeded, slightly reticulate.

Flowering and Fruiting Period: March-June.

Type: Described from Europe and Siberia.

Local Distribution: Tehsil Paharpur, D.I. Khan and near Darya Khan-D, I. Khan Bridge

General Distribution: Pakistan; India; Tibet; Persia; Afghanistan; Central Asia; Turkey; Arabia; Europe; introduced in America and Australia.

This species is easily distinguished from the *M. indica* and *M. officinalis* by possessing white flowers. In the *M. indica* and *M. officinalis*, the flowers are yellow.

M. indica (L.) All. Fl. Pedem. 1: 308 (1785).

Syn: *Melilotus parviflora* Desf. Fl. Alt. 2: 192 (799).

Annual, erect herb, 15-90 cm high, stem pubescent. Stipules linear, acuminate; leaflets 1.5-2.5 cm long, 5-10 mm broad, oblong or lanceolate, dentate, retuse or emarginated. Inflorescence 10-16 flowered raceme. Peduncle up to 3 cm long. Flowers yellow; calyx c. 1.5 mm long; corolla 2-3 mm long. Pod small, nearly globose, turgid, irregularly reticulate, 1-seeded.

Flowering and Fruiting Period: March-August.

Type: Described from India, Herb.Linn.930/2 (LINN).

Local Distribution: commonly found in the area.

General Distribution: Pakistan; India; Orient; Europe; introduced in warm temperate regions.

M. officinalis (L.) Pall., Reise 537 (1776)

Annual to biennial, erect or decumbent plant, 30-250 cm tall, glabrous or slightly pubescent above. Leaves pinnately 3-foliate. Leaflets obovate or oblanceolate, 12-25 mm. long, rounded at apex, denticulate nearly all round. Inflorescence a 4-10 cm long raceme, longer than the subtending leaf. Flowers yellow; calyx teeth lanceolate, as long as the tube; corolla linear usually three times as

long as calyx, wings and vexillum equal, longer than the keel. Pod distinctly stipitate, usually 1-seeded.

Flowering and Fruiting Period: September.

Type: Described from Europe

General Distribution: Pakistan; Kashmir; India (N. Punjab) Tibet; Russia; China; Persia; Turkey; Middle and Southern Europe; introduced in America and Tropical Asia.

This species closely resembles *M. indica*, but differs from it in possessing corolla 5-7 mm long; pod not turgid, only slightly reticulate. In *M. indica* the corolla is 2-3 mm long; pod is turgid and coarsely reticulate.

Sesbania sesban (L.) Merrill in Philip. J. Sci., Bot. 7: 235 (1912).

Synonym: *S. aegyptiaca* Poir. In Lam., Encyc. Meth. 7: 128 (1806)

A small soft wooded, short-lived tree, 1-7 m tall. Leaves paripinnate, 7-15 cm long; leaflets 18-50, linear-oblong, obtuse, apiculate, glabrous. Inflorescence an axillary raceme, 3-20-flowered, upto 15 cm long. Pedicel up to 12 mm long. Calyx teeth deltoid, subequal, shorter than tube. Corolla yellow, tinged with or spotted purple. Pod 15-30 cm long, up to 5 mm wide, 20-40 seeded.

Flowering and Fruiting Period: August-February.

Holotype: Herb. Linn. 922.12 (LINN).

Local Distribution:

General Distribution: Cosmopolitan in tropics of the old world.

Vicia sativa Linn., Sp. Pl. 736 (1753).

Annual herb, 5-8 cm high, pubescent, climbing by tendrils. Leaves paripinnate; leaflets 4-18, the terminal represented by a tendril, linear to lanceolate to oblong, acute, obtuse or emarginated; stipules semisagittate, dentate; tendril generally branched. Flowers 1-2 rarely 3, axillary; pedicel short; calyx pubescent, subequal; corolla pale pink, purplish violet, rarely white. Pod 2.3-6.5 cm long, narrowly oblong, 6-12 seeded.

Flowering and Fruiting Period: July-August.

Type: Herb. Linn. 906/20 (LINN).

Local Distribution: near Darya Khan-D.I.Khan Bridge, Pharpur

General Distribution: Pakistan; India; Orient; Europe; Russia; Far East.

REFERENCES CITED

- Adjei, M.B., K.H. Quesenberry and C.G. Chambliss. 2008. Nitrogen Fixation and Inoculation of Forage Legumes SS-AGR-56-AG152 Nitrogen Fixation and Inoculation of Forage Legumes.
- Ali, S.I. 1977. Papilionaceae. In E. Nasir & S.I. Ali, Flora of Pakistan, Karachi. pp. 38-320.

- Anonymous. 1988. NFTA 88-06, A quick guide to useful nitrogen fixing trees from around the world. Available at: <http://www.winrock.org/fnrm/factnet/factpub/FACTSH/Ccajanbckup.html> Accessed on 20.12.2008.
- Anonymous. 1998. District Census Report of Dera Ismail Khan. Census Publication No. 50. Population Census organization Statistic division Government of Pakistan Islamabad. pp.1-2
- Anonymous. 2008. Leguminous Plants. Available at: <http://www.microbiologyprocedure.com/rhizobium-andlegume-root-nodulation/leguminous-plants.html>. Accessed on 12. 12. 2008
- Anonymous. 2008a. Fabaceae from wikipedia, the free encyclopedia. Available at: <http://en.wikipedia.org/wiki/Fabaceae>. Accessed on 12.12.2008
- Anonymous. 2008b. Plants for a future-database search. Available at: http://www.ibiblio.org/pfaf/D_search.html. Accessed on 20.12.2008
- Athar, M. and G.R. Sandhu. 1992. Nodulating Leguminous Weeds of some Major Crops of Pakistan. *In* Identification and Control of Weeds Manual. National Training Course. Pakistan Agricultural Research Council, Islamabad. p. 29.
- Chaudhri, M.N. 1992. Weeds and their identification. *In*: Identification and Control of Weeds Manual. National Training Course. Pakistan Agricultural Research Council, Islamabad. p. 14.
- Jafri, S.M.H. 1966. The Flora of Karachi. The Book Corporation, Karachi. p. 9.
- Qurashi, M.A. and Khan, S.A. 1972. Flora of Peshawar District and Khyber Agency. Volume II Part I (A). Pak. J. Forestry 22(2): 153-220.
- Stewart, R.R. 1972. An Annotated Catalogue of the Vascular Plants of West Pakistan and Kashmir". *In* Flora of West Pakistan, Karachi. pp. 383-425.

Table-1. List of Nodulated Leguminous Weeds of D.I. Khan District, NWFP, Pakistan.

SN	Botanical Name	Voucher No.	English Name	Local Name	Habit	Nodulation	Occurrence
1.	<i>Alhaji maurorum</i>	70	Camel's Thorn	Janasa, Jawain	Under shrub	sparse	Non-Agr. & Agr. field
2.	<i>Argyrolobium roseum</i>	155	-----	-----	Annual herb	Sparse	Usually in non-agr. fields
3	<i>Astragalus amherstianus</i>	99	Milk-vetch	Ozhai	Annual herb	Sparse	Agri. & non-agri. field
4	<i>Astragalus bakaliensis</i>	95	Milk-vetch	Ozhai	Annual herb	Sparse	Agri. & non-agri. field
5	<i>Cajanus cajan</i>	251	Pigeon Pea	Arhar	Erect shrub	Moderate	Cultivated in grain crops
6	<i>Lathyrus aphaca</i>	289	Yellow pea	Jungli Matar,	Annual trailing or climbing herb	Moderate	Agri. & non-agri. field
7	<i>Lathyrus sativus</i>	288	Indian pea	Kesari dal	Annual herb	Moderate	Agri. & non-agri. field
8	<i>Lotus corniculatus</i>	66	Bird's-foot trefoil	----	Variable perennial herb	Moderate	Agri. & non-agri. field
9	<i>Medicago laciniata</i>	313	Cut-Leaf Medicago	----	Spreading annual herb	Moderate	Agri. & non-agri. field
10	<i>Medicago lupulina</i>	286	Black medicago	----	Annual or perennial herb	Abundant	Agri. & non-agri. field
11	<i>Medicago minima</i>	153	Small Medic-Grass	Maina	Annual herb	Moderate	Agri. & non-agri. field
12	<i>Medicago polymorpha</i>	14	California burclover	Maina	Annual spreading herb	Abundant	Agri. & non-agri. field
13	<i>Medicago sativa</i>	285	Lucerne or alfalfa	Vilayati Gawuth	Perennial herb	Sparse	Agri. & non-agri. field
14	<i>Melilotus alba</i>	23	White sweet clover	Senji	Annual erect herb	Moderate	Agri. & non-agri. field
15	<i>Melilotus indica</i>	15	Indian Sweet clover	Banmethi Senji	Erect annual herb	Moderate	Agri. & non-agri. field
16	<i>Melilotus officinalis</i>	314	Yellow Sweet clover	Senji	Annual to biennial herb	Moderate	Agri. & non-agri. field
17	<i>Sesbsnia sesban</i>	205	Indian sesbania	Jaith, Jantar	shrub or soft wooded tree	Abundant	Cultivated in crop fields
18	<i>Vicia sativa</i>	287	Spring Vetch	Rewari	Annual erect or climbing herb	Moderate	Cultivated fields