Identification of Annual Forage Legumes: A Simple Key

M. Amin Khatib Salkini

International Center for Agricultural Research in the Dry Areas (ICARDA)

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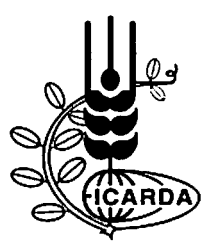

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Preface

Forage legumes (Leguminosae) are a major source of protein-rich feed for livestock. They occupy a special place in the cereal-based farming systems in the dry areas, because they improve soil fertility by biological nitrogen fixation and are useful in replacing fallow in cereal (barley and wheat)/fallow rotations common in the Central and West Asia and North Africa (CWANA) region.

Livestock play an important role in the farming economy of the rural communities of CWANA. Forage legumes, thus, are important for these communities as they help them sustain their flocks to generate income from meat and dairy products.

ICARDA has a regional responsibility in CWANA for the improvement of pasture and forage legumes. The Center is actively involved in research on pasture and forage legume species suitable for use in CWANA to replace fallow to alleviate feed shortage and promote livestock raising. The Center has also identified species suitable for rehabilitating degraded rangelands and thereby conserving vegetation and biodiversity. These species are palatable and provide nutritious grazing for livestock.

However, the need continues to identify new pasture and forage legume species suitable for use in the farming systems of CWANA.

This manual provides a simple key for identification of forage legumes. The key covers the description of root, stem, leaf, flower, pod and seed of the most common species found in CWANA.

It is hoped that the Manual will be useful for students, extension workers and others involved in pasture and forage legume research.

Table of Contents

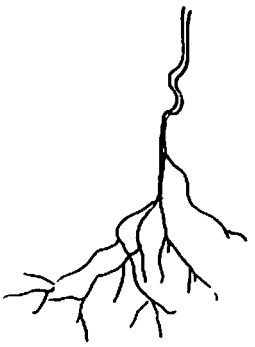
MORPHOLOGICAL CHARACTERS

1- ROOTS

Taproots, extreme or branching often not deep, thick or thin, nodules for n-fixation are found on the roots.

Extreme

most species

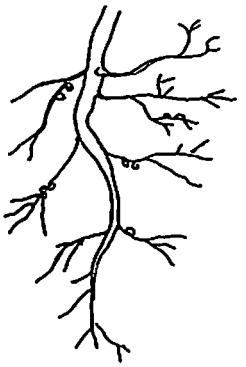


Branching

Trifolium micranthum

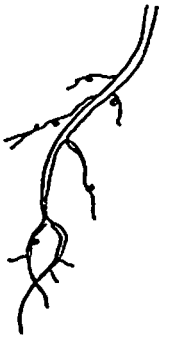
Thick and deep

most species of:
Lathyrus
Vicia
Pisum



Thin and surface

most species of:
Trifolium
Medicago



2- STEM

Type of growth

- **Erect** — *Trifolium (purpureum, angustifolium)*, *Medicago scutellata*, *Vicia narbonensis*, *Melilotus*
- **Semi-erect** — most species
- **Prostrate** — *Trifolium (subterraneum, tomentosum)*, *Medicago (constricta, minima, orbicularis,* and *rugosa)*, *Astragalus (guttatus, tribuloides)*

Thick of stem

- **Weak** — most *Medicago* species, most *Trifolium* species
- **Thin** — *Melilotus*
- **Thick** — most *Vicia* species, *Trifolium (resupinatum, cherleri)*
- **Rigid** — most *Ononis* species

Stem color

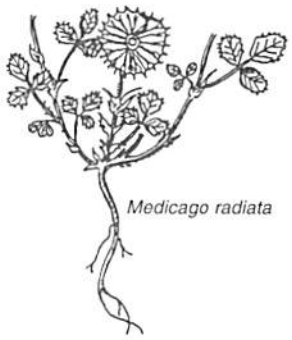
- **Green** — most species
- **Purple** — *Medicago (intertexta, orbicularis)*
- **Grayish** — *Astragalus (cruciatus, tribuloides)*

Pubescence of Stem

- **Hairy** — *Medicago (littoralis, truncatula, rotata,* and *turbinata)*, *Trifolium (tomentosum, boissieri)*, *Astragalus (hamosus, schimperi,* and *palaestinus)*, *Vicia villosa*, *Lotus edulis*, *Ornithopus compressus*
- **Glabrous** — *Medicago (polymorpha, murex)*, *Trifolium (campestre, nigrescens,* and *spumosum)*, *Coronilla scorpioides*, *Lathyrus gorgonei*, *Hippocrepis unisiliquosa*, *Trigonella caelesyriaca*, *pisum*

Branching

Branching from the base



Medicago radiata

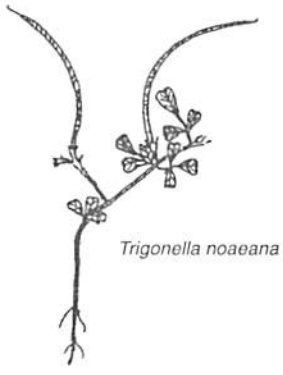
Medicago (radiata, aculeata, turbinata, and *murex)*
Trifolium (most species)
Astragalus (corrugatus, tribuloides, and *palaestinus)*
Trigonella (spinosa, arabica)

Branching above

Trifolium campestre

Medicago rotata
Trifolium campestre
Vicia (most species)

Branching 1 stem or few



Trigonella noaeana

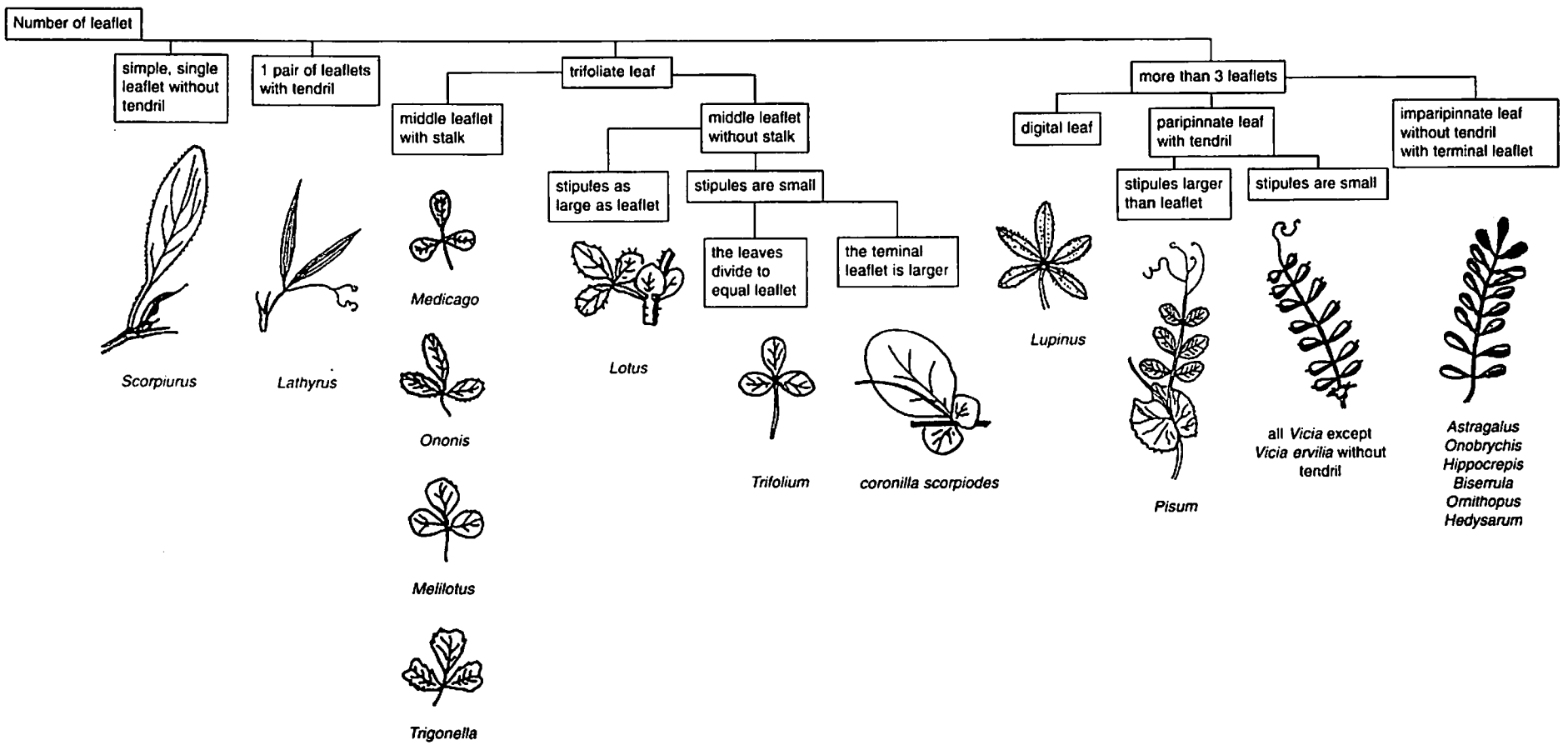
Trifolium subterraneum
Trigonella (monspeliaca, noaeana, and *foenum-graecum)*

Subterranean & aerial branches

Vicia sativa supsp. amphicarpa

Vicia sativa supsp.amphicarpa

3- LEAVES


Number of leaflet
simple, single leaflet without tendril
1 pair of leaflets with tendril
trifoliate leaf
more than 3 leaflets
middle leaflet with stalk
middle leaflet without stalk
digital leaf
paripinnate leaf with tendril
imparipinnate leaf without tendril with terminal leaflet
stipules as large as leaflet
stipules are small
stipules larger than leaflet
stipules are small
the leaves divide to equal leaflet
the teminal leaflet is larger
Scorpiurus
Lathyrus
Medicago
Ononis
Melilotus
Trigonella
Lotus
Trifolium
coronilla scorpiodes
Lupinus
Pisum
all Vicia except Vicia ervilia without tendril
Astragalus
Onobrychis
Hippocrepis
Biserrula
Ornithopus
Hedysarum

Leaf shapes

Linear

Trifolium arvense
Trifolium purpureum
Trifolium angustifolium

Linear to lanceolate

most *Lathyrus* species

Lanceolate

Hippocrepis bicontorta
Astragalus epiglottis
Astragalus tribuloides

Obcordate

Medicago littoralis
Trifolium stellatum
Trigonella arabica

Oblong

Trifolium argutum
Trigonella cylindraceae
Vicia hulensis

Spatulate

Hymenocarpos

Elliptical

Trifolium boissieri
Trifolium lappaceum
Vicia narbonensis

Rhombic

Trifolium pauciflorum
Trifolium spumosum

Obovate to cuneate

Medicago laciniata
Medicago polymorpha
Medicago rigidula

Leaf apex

Acute

Lathyrus lentiformis

Obtuse

Vicia narbonensis

Rounded

Trifolium clussii

Notched

Trifolium tomentosum
Trifolium cherleri
Vicia hybrida

Mucronate

Trifolium purpureum
Trifolium arvense
Vicia tenefolia

Truncate

Medicago rigidula
Trifolium pilulare
Trigonella monantha

Leaf margin

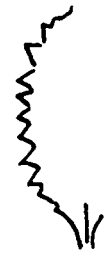
Entire

Pisum elatius

Serrate

Medicago rugosa
Medicago scutellata
Ononis sicula
Ononis reclinata

Dentate



Trifolium stellatum
Trigonella spinosa
Trigonella noaeana

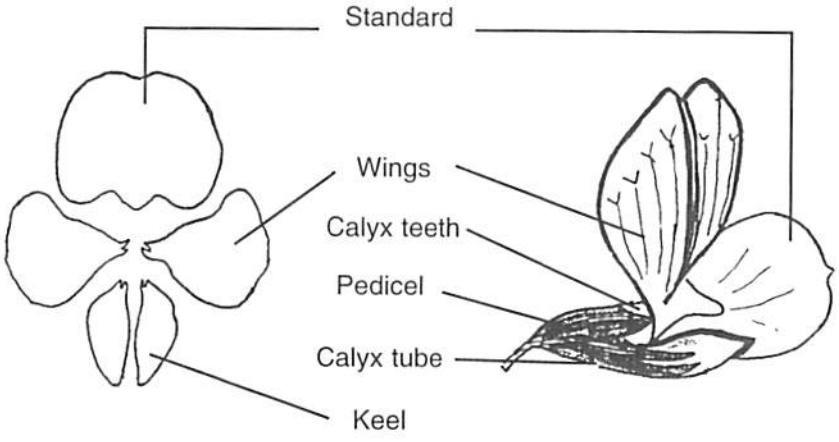
Laciniate

Medicago rotata
Medicago laciniata

4- FLOWER

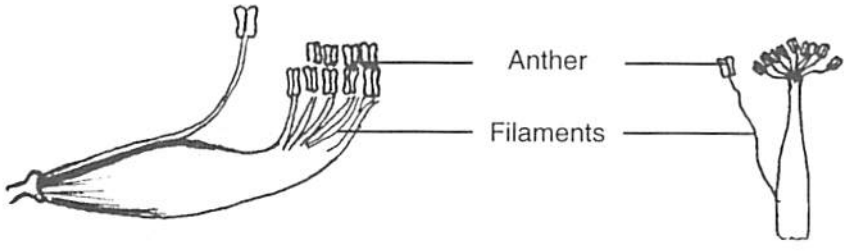
The form of flower in the sub-family Papilionoideae is butterfly like and composed of 5 petals:
1-Standard (1-petal)
2-Wings (2 separate petals)
3-Keel (2-united petals or free)

Petals



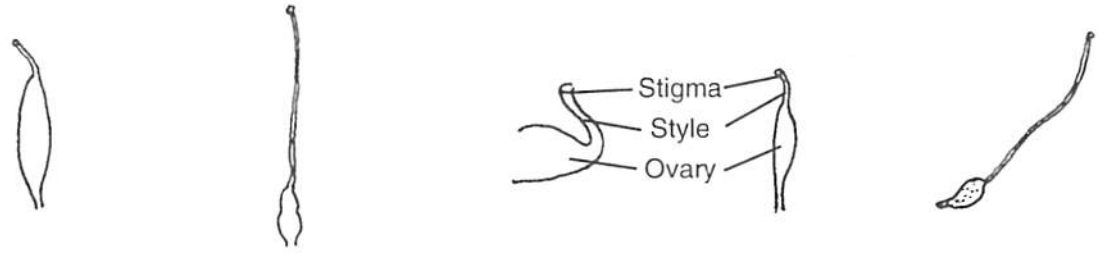
Androecium

Inside the flowers 10 stamens, usually 9 united + 1 free, sometimes 5+5 or 10 united, free

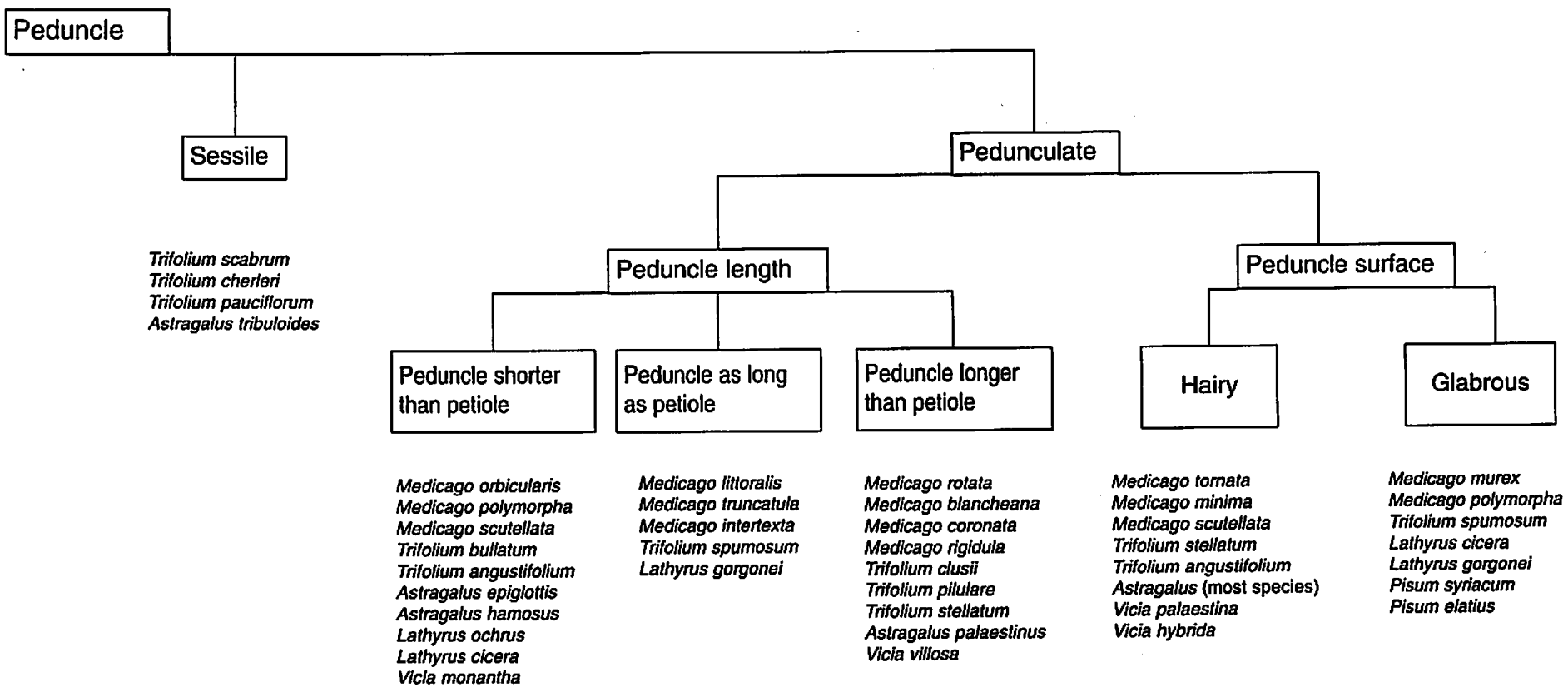


Gynoecium

1 ovary including 1 or more ovule



Lotus *Trifolium* *Vicia* *Medicago* *Onobrychis*


Peduncle
Sessile
Pedunculate
Trifolium scabrum
Trifolium cherleri
Trifolium pauciflorum
Astragalus tribuloides
Peduncle length
Peduncle surface
Peduncle shorter than petiole
Peduncle as long as petiole
Peduncle longer than petiole
Hairy
Glabrous
Medicago orbicularis
Medicago polymorpha
Medicago scutellata
Trifolium bullatum
Trifolium angustifolium
Astragalus epiglottis
Astragalus hamosus
Lathyrus ochrus
Lathyrus cicera
Vicia monantha
Medicago littoralis
Medicago truncatula
Medicago intertexta
Trifolium spumosum
Lathyrus gorgonei
Medicago rotata
Medicago blancheana
Medicago coronata
Medicago rigidula
Trifolium clusii
Trifolium pilulare
Trifolium stellatum
Astragalus palaestinus
Vicia villosa
Medicago tornata
Medicago minima
Medicago scutellata
Trifolium stellatum
Trifolium angustifolium
Astragalus (most species)
Vicia palaestina
Vicia hybrida
Medicago murex
Medicago polymorpha
Trifolium spumosum
Lathyrus cicera
Lathyrus gorgonei
Pisum syriacum
Pisum elatius

Type of inflorescence

Racemes

All *(Medicago, Astragalus, Vicia and Lathyrus)*

Racemes form

Umbellate

Trigonella astroites
Trigonella arabica
Trigonella stellata

Capitate

Trigonella monspeliaca
Trigonella cylindraceae

Racemes length

Short racemes

Medicago (all species)

Long racemes

Vicia (most species)

Number of flowers/racemes

Solitary

Lathyrus cicera
Vicia hybrida

1-2 flowers

Medicago aculeata
Astragalus guttatus

Up to 12 flowers

Medicago intertexta
Astragalus epiglottis

Up to 30 flowers

Medicago coronata
Vicia villosa

Head

Trifolium (most species)

Head form

Cylindrical

Trifolium arvense

Globular

Trifolium cherleri
Trifolium lappaceum

Ovoid

Trifolium pilulare
Trifolium echinatum

Oblong

Trifolium purpureum

Head length

Long up to 5 cm

Trifolium angustifolium
Trifolium purpureum

Medium up to 1 cm

Trifolium campstre
Trifolium resupinatum

Short up to 5 mm

Trifolium bullatum
Trifolium tomentosum

Number of flowers/head

1-2 flowers

Trifolium pilulare

4-8 flowers

Trifolium pauciflorum

10-15 flowers

Trifolium bullatum

Corolla

Yellow

most *(Medicago, Trigonella, Coronilla* and *Biserrula)*
Lathyrus (ochrus, gorgonei and aphaca)
Vicia (lutea, hybrida)
Trifolium campestre
Lotus edulis

Orange to yellow

Medicago (intertexta, scutellata and *turbinata)*

Yellowish to white

Astragalus hamosus

White

Trifolium (arvense, cherleri, pilulare, scabrum and *tomentosum)*
Trigonella (arabica, caelesyriaca)

Cream

Trifolium scutatum

Bluish to white

Astragalus (cruciatus, and *schimperi)*

Pink

Trifolium clusii
Astragalus annularis

Purple

Trifolium (angustifolium, pauciflorum and *purpureum)*
Vicia villosa

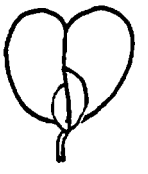
Pale purple to violet

Vicia monantha

Standard

Standard form

Notched	Elliptical	Ovate to oblong limb	Ovate limb
			
Trifolium tomentosum *Trifolium angustifolium* *Trigonella stellata* *Lathyrus gorgonei*	*Trifolium subterraneum*	*Trifolium argutum* *Trifolium stellatum*	*Trifolium spumosum* *Trigonella arabica*

Oblong	Retuse to 2 lobed	Linear
		
Trifolium clusii	*Pisum syriacum*	*Trifolium glanduliferum*

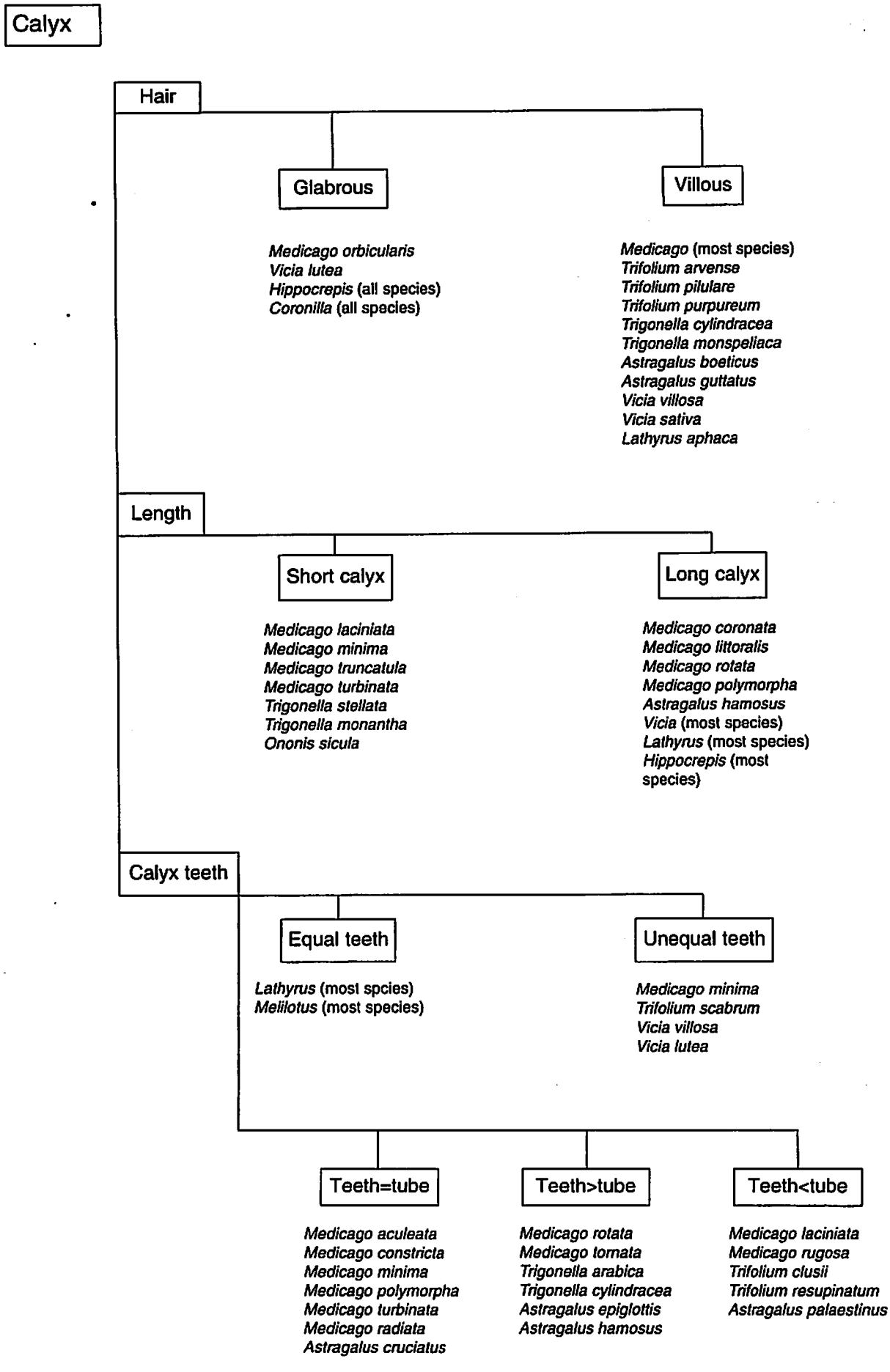
Keel & wings

Keel longer than wings

Medicago truncatula
Medicago orbicularis
Ononis hirta
Trigonella foenum-graecum

Keel shorter than wings

Medicago polymorpha
Vicia sativa
Vicia lutea
Trifolium clusii


Calyx
Hair
Glabrous
Medicago orbicularis
Vicia lutea
Hippocrepis (all species)
Coronilla (all species)
Villous
Medicago (most species)
Trifolium arvense
Trifolium pilulare
Trifolium purpureum
Trigonella cylindracea
Trigonella monspeliaca
Astragalus boeticus
Astragalus guttatus
Vicia villosa
Vicia sativa
Lathyrus aphaca
Length
Short calyx
Medicago laciniata
Medicago minima
Medicago truncatula
Medicago turbinata
Trigonella stellata
Trigonella monantha
Ononis sicula
Long calyx
Medicago coronata
Medicago littoralis
Medicago rotata
Medicago polymorpha
Astragalus hamosus
Vicia (most species)
Lathyrus (most species)
Hippocrepis (most species)
Calyx teeth
Equal teeth
Lathyrus (most spcies)
Melilotus (most species)
Unequal teeth
Medicago minima
Trifolium scabrum
Vicia villosa
Vicia lutea
Teeth=tube
Medicago aculeata
Medicago constricta
Medicago minima
Medicago polymorpha
Medicago turbinata
Medicago radiata
Astragalus cruciatus
Teeth>tube
Medicago rotata
Medicago tornata
Trigonella arabica
Trigonella cylindracea
Astragalus epiglottis
Astragalus hamosus
Teeth<tube
Medicago laciniata
Medicago rugosa
Trifolium clusii
Trifolium resupinatum
Astragalus palaestinus

5- PODS

Mature pods

- Dehiscent

Ononis (most species)
Vicia (most species)
Lathyrus (most species)
Pisum (most species)

- Indehiscent

Medicago (most species)
Trifolium (most species)

Pods coils

- Coils number
  - 1 — *Medicago radiata*
  - 1-2 — *Medicago coronata*
  - 2-3 — *Medicago noeana*
  - 3-5 — *Medicago minima*
  - 4-6 — *Medicago rotata*
  - 5-7 — *Medicago aculeata*
- Coil direction
  - Clockwise — *Medicago aculeata*, *Medicago truncatula* c.v *cyprus*
  - Anti-clockwise — most *Medicago* species
- Coil contact
  - Ajacent coils not in contact at all — *Medicago praecox*

  - Ajacent coils loosely pressed together — *Medicago laciniata*

  - Very compact coils — *Medicago constricta*

Spines

- Spinless pods

Medicago scutellata

- With spines
  - Right angle to coil surface

Medicago rotata

  - Varying in direction

Medicago blancheana

  - Spreading horizontally hooked at apex

Medicago minima

  - Long, fine and curved

Medicago littoralis

Hair

- Glabrous
  - *Trigonella caelesyriaca*
  - *Trigonella spinosa*
  - *Astragalus corrugatus*
- Hairy-Pubescent
  - *Trigonella cylindracea*
  - *Trigonella monantha*
  - *Astragalus epiglottis*
  - *Astragalus schimperi*
  - *Ononis reclinata*

Pods shapes

Fish-hook shape

Astragalus hamosus

Snail shape

Medicago scutellata

Button shape

Medicago orbicularis

Cock-comb shape

Onobrychis crista-galli

Barrel shape

Medicago truncatula

Sea-urchin shape

Medicago intertexta

Disk shape

Medicago rugosa

Horse-shoe shape

Hippocrepis unisiliquosa

Fringed margin

Medicago radiata

Grooved

Astragalus palaestinus

Crown like

Medicago coronata

Arcuate

Trigonella cylindracea

Falcate

Trigonella corniculata

With peak

Coronilla scorpioides

Hooked at apex

Lotus edulis

Flattened toothed

Biserrula pelecinus

Linear

Vicia sativa

Linear-oblong

Lathyrus cicera

Linear-cylindrical

Trigonella astroites

Lenticular

Trifolium bullatum

Ovoid

Trifolium cherleri

Ovoid-beaked

Ononis serrata

Ovoid-obtuse

Trifolium pilulare

Ovoid-globular

Trifolium tomentosum

Spherical-ovoid

Medicago constricta

Circular

Trigonella spinosa

Globular

Melilotus indicus

Cylindrical

Medicago rigidula

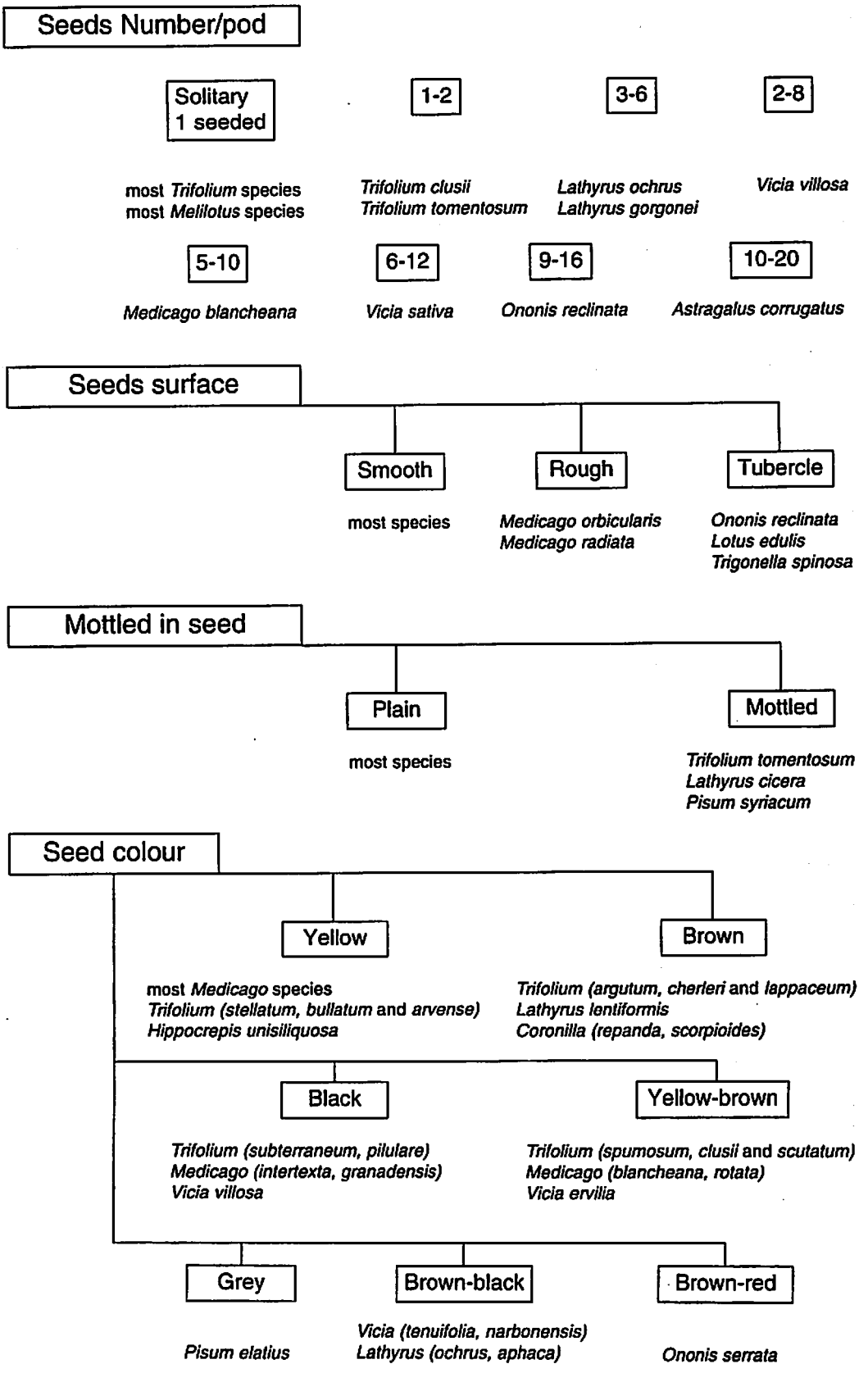
Cylindrical-inflated

Ononis sicula

Oblong-rhombic

Vicia narbonensis

6- SEEDS


Seeds Number/pod
Solitary 1 seeded
most Trifolium species
most Melilotus species
1-2
Trifolium clusii
Trifolium tomentosum
3-6
Lathyrus ochrus
Lathyrus gorgonei
2-8
Vicia villosa
5-10
Medicago blancheana
6-12
Vicia sativa
9-16
Ononis reclinata
10-20
Astragalus corrugatus
Seeds surface
Smooth
most species
Rough
Medicago orbicularis
Medicago radiata
Tubercle
Ononis reclinata
Lotus edulis
Trigonella spinosa
Mottled in seed
Plain
most species
Mottled
Trifolium tomentosum
Lathyrus cicera
Pisum syriacum
Seed colour
Yellow
most Medicago species
Trifolium (stellatum, bullatum and arvense)
Hippocrepis unisiliquosa
Brown
Trifolium (argutum, cherleri and lappaceum)
Lathyrus lentiformis
Coronilla (repanda, scorpioides)
Black
Trifolium (subterraneum, pilulare)
Medicago (intertexta, granadensis)
Vicia villosa
Yellow-brown
Trifolium (spumosum, clusii and scutatum)
Medicago (blancheana, rotata)
Vicia ervilia
Grey
Pisum elatius
Brown-black
Vicia (tenuifolia, narbonensis)
Lathyrus (ochrus, aphaca)
Brown-red
Ononis serrata

Seed form

Reinform  all *(Medicago & biserrula)* species	**Sub-globular-reinform**  *Ononis reclinata*	**Sub-globular**  *Lathyrus cicera*
Ovoid-reinform  *Trifolium cherleri*	**Ovoid**  *Trifolium resupinatum*	**Oblong**  *Coronilla scorpioides*
Globular  *Vicia villosa*	**Ovoid-oblong**  *Trifolium scabrum*	**Ovoid-globular**  *Trifolium pilulare*
Cylindrical  *Trigonella monantha*	**Ellipsoidal-ovoid**  *Trifolium stellatum*	**Curved**  *Hippocrepis unisiliquosa*

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Reference Sources

Kernick, M. D. 1978. Papilionacea (=Fabaceae). Pages 573-658 *in* Indigenous Arid and Semi-Arid Forage Plants of North Africa, the Near and Middle East: EMASAR Phase II. Technical data. FAO, Rome, Italy.

ICARDA. 1986. ICARDA, Aleppo (Syria). 1986. Introduction to Forage Legumes. 55 pp.

Zohary. M. 1987. Papilionaceae. Pages 34-224 *in* Flora Palaestina: Platanaceae to Umbelliferae. Part II: Text.

Polunin. O and Huxley. A. 1981. *Medicago-Onobrychis.* Pages 96-105 *in* Flowers of the Mediterranean. Chatto and Windus, London, UK.

Quinlivan. B. J.; McComb and Devitt, A.C. 1974. Annual Medics in Western Australia. Western Australia Department of Agriculture, Bulletin. No 3874. 20 pp.

K. A. Lesins and Lesins, I. 1979. Genus *Medicago* (Leguminosae): A Taxogenetic Study. Dr. W. Junk bv. Publishers, the Hague. The Netherlands. 27 pp.