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## **Study on External Morphology of Two *Acacia* Species**

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### **ABSTRACT**

*The external morphological characters of the plants have been utilized as the important tools of taxonomy and identification since long. Acacia is one among the tribes of the family Mimosaceae of the order Fabales. In present study, external morphological characters like, habit of the plant; phyllotaxy; shape and colour of stipular spines; colour and position of nectaries; flowering and fruiting period; type, colour and shape of inflorescence; type, shape, colour and average size of fruit; seed colour and shape; average number of seeds per pod, pleurogram position and shape etc. of Acacia leucophloea (Roxb.) Willd and Acacia tortilis (Forssk.) Hayne were studied. These exomorphic characters could be value in the floristic and systematic discussions of the taxon as the species revealed significant diagnostic features.*

**Keywords:** Morphology, Phyllotaxy, Spines, Nectaries, Pleurogram

### **INTRODUCTION**

The Leguminosae form the third largest plant family in the world, comprising about 650 genera and 18000 species. The subfamily Mimosoideae, with 3000 species in 50–60 genera, is distributed worldwide and is abundant in tropical, subtropical and warm-temperate areas (Polhill and Raven, 1981). *Acacia* is the most significant genus of the subfamily Mimosoideae. It is estimated that there are roughly 1380 species of *Acacia* worldwide, about two-third of them native to Australia and rest spread around tropical and subtropical regions of the world (Saini *et al.*, 2008). *Acacia* Mill. is an economically important genus, all parts of various *Acacia* species are used for one purpose or another as sources of food, fodder, fire-wood and a variety of natural products, such as wood, gum exudates, tannins and honey (Chaudhary, 1983; Springuel and Mekki, 1993; Al-Zoghet and Tag El-Din, 1995).

As mentioned by Kaplan (2001), as a discipline, plant morphology is 211 yr old, originated by Goethe in 1790. Morphological characters of plants have been used extensively for classification and identification of taxa. External morphological and internal anatomical characters of plants are mainly studied under floristics and these have mainly been used in phylogenetic considerations. Keeping this in mind a morphological description of two *Acacia* species is presented here.

### **MATERIAL AND METHODS**

For external morphology, few plants of *Acacia leucophloea* (Roxb.) Willd and *Acacia tortilis* (Forssk.) Hayne were identified and selected for study from their natural growing conditions of the campus of University of Rajasthan, Jaipur. Vegetative as well as reproductive characters were studied during their respective phase of growth.

## RESULTS

The detailed observations on the external morphological studies of two *Acacia* species is presented here.

### ***Acacia leucophloea* (Roxb.) Willd**

- Common name : Safed kikar
- Type : Wild
- Habit : Perennial, woody, medium sized tree (4-6 m) (Figure:1A).
- Root : Branched tap root system
- Stem : It is woody, aerial, erect, angular, branched, solid, glabrous and green.
- Leaf : Both ramal and cauline, arranged in alternate manner. They are bipinnately compound (paripinnate) with swollen leaf bases. 12-20 pairs of leaflets are present on a secondary rachis (Figure:1B,C). Leaflets are sessile, linear, entire, obtuse, glabrous and green and unicostate showing reticulate venation. Average size of leaflet is 0.4×0.1 cm. Average length of primary and secondary rachis is 2.4 cm and 1.6 cm respectively and ends of both are converted into spinules and spinulules. Primary rachis is glabrous. 2-8 pairs of secondary rachii are present on the primary rachis.

The leaves are stipulate and stipules are brown spinous, two in number, straight sharp and laterally positioned. Average size of a stipule is 5.5 mm.

Nectaries present on the primary rachis, at insertion point of lowest and last pair of secondary rachii, are sessile and red in colour (Figure:1D).

- Flowering : September-November
- Fruiting : November-March
- Inflorescence : It is Cymose. The rounded heads arranged in panicles, are creamson/pale-yellow in colour (Figure:1E).
- Flower/Floret : They are complete, bracteate, sessile, actinomorphic, hermaphrodite, pentamerous, hypogynous and cyclic (Figure:1F).
- Calyx : Five creamson sepals, in gamosepalous condition are arranged in valvate aestivation.
- Corolla : Five creamson/pale-yellow petals, in gamopetalous condition are arranged in valvate aestivation.
- Androecium : Stamens are numerous and polyandrous having dorsifixed and ditheous anthers. Filament colour is white and anther colour is yellow.
- Gynoecium : Monocarpellary , ovary superior, unilocular with marginal placentation. Style is long and stigma is capitate.
- Fruit : Legume is indehiscent and slightly curved towards corners (Figure: 1G). It is light-green when young and green-purplish when mature and have valvate appearance when mature. Average size of fruit is 10.4-1.5 cm.

Seed : Seeds are greyish-brown, conical to oval, hard and glabrous. There are average 9 seeds present per pod. Average size of seed is 4.8×3.6 mm. Pleurogram is centrally placed and is horse-shoe shaped (Figure:1H).

***Acacia tortilis* (Forssk.) Hayne**

Common name : Israeli babool

Type : Wild

Habit : Perennial, woody, medium sized tree (4-12 m) (Figure:2A).

Root : Branched tap root system

Stem : It is woody aerial, erect, angular, branched, solid, glabrous and green.

Leaf : Both ramal and cauline and are arranged in an alternate manner. They are bipinnately compound (paripinnate) with 7-12 pairs of leaflets present on a secondary rachis . Primary rachis is glabrous. 3-5 pairs of secondary rachii are present on primary rachis (Figure:2B). Leaflets are sessile, linear, entire, obtuse, glabrous and green, uncostate showing reticulate venation. Average size of leaflet is 0.3×0.1 cm. Average length of primary and secondary rachis is 2.7 and 1.6 cm respectively and ends of both are converted into spinule and spinulules respectively.

Leaf is stipulate having spinous stipules, which are two in number and laterally positioned. All are sharp and slightly curved downward and light-brown in colour (Figure:2C). Their average size is 4.8 mm and colour is light-brown.

Nectary present on primary rachis, just below the lowest pair and also at insertion point of last pair of secondary rachii is sessile and green/yellow in colour (Fig. 2D,E).

Flowering : July-October

Fruiting : October-January

Inflorescence : Cymose with axillary rounded heads, creamson/pale-yellow in colour. Average length of peduncle is 2.7 cm. (Figure:2F).

Flower/Floret : They are complete, bracteate, sessile, actinomorphic, hermaphrodite, pentamerous, hypogynous and cyclic (Figure:2G).

Calyx : Five creamson sepals in gamosepalous condition are arranged in valvate aestivation.

Corolla : Five creamson / pale-yellow petals in gamopetalous conditon are arranged in valvate aestivation.

Androecium : Stamens are numerous, polyandrous, and have dorsifixed and ditheous anthers. Filament colour is white and anther colour is yellow.

Gynoecium : Monocarpellary , ovary superior, unilocular with marginal placentation. Style is long and stigma is capitate.

Fruit : It is a indehiscent legume which is contorted or spiraled, indehiscent, light-green when young and brown when mature (Figure:2H). Average size of fruit is 13.5×1.4 cm.

Seed : Seeds are greyish-brown, oval, hard and glabrous. There are average 7 seeds present per pod. Average size of seed is 6.6×5.4 mm. Pleurogram is centrally placed and is horse-shoe shaped (Figure:2I).

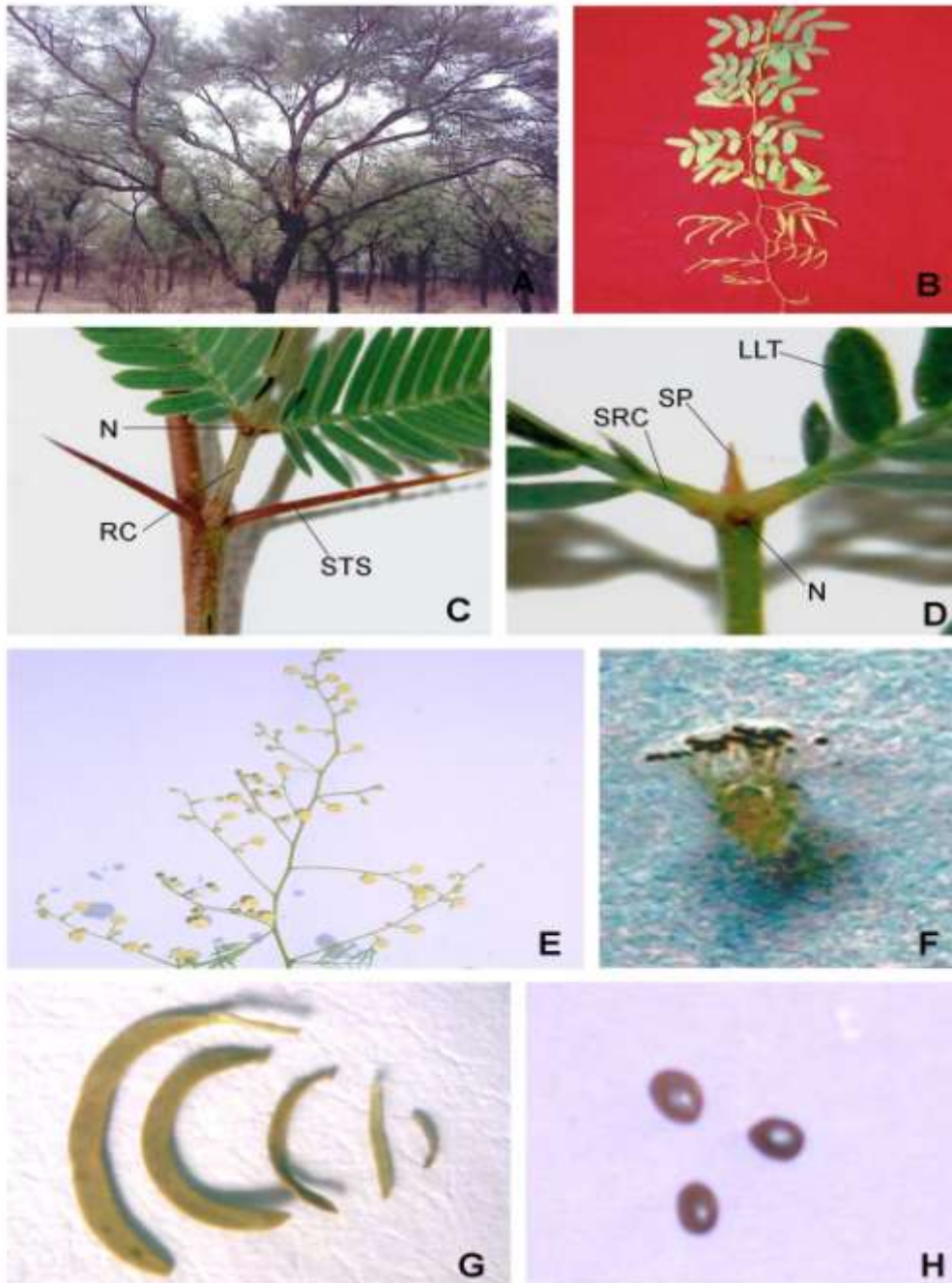


Figure 1 (A-H): External morphology of *A. leucophloea*

A-Habit of the plant; B-A twig showing phyllotaxy; C-Showing two stipular spines and nectary present on primary rachis at the insertion point of lowest pair of secondary rachii; D-Showing nectary present on primary rachis at the insertion point of last pair of secondary rachii and spinule terminating primary rachis; E- A flowering branch; F-Enlarged view of a single flower/floret; G-Different developmental stages of pod; H-Enlarged view of seeds

LLT-Leaflet; N-Nectary; RC-Primary rachis; SP-Spinule; STS-Stipular spine; SRC-Secondary rachis

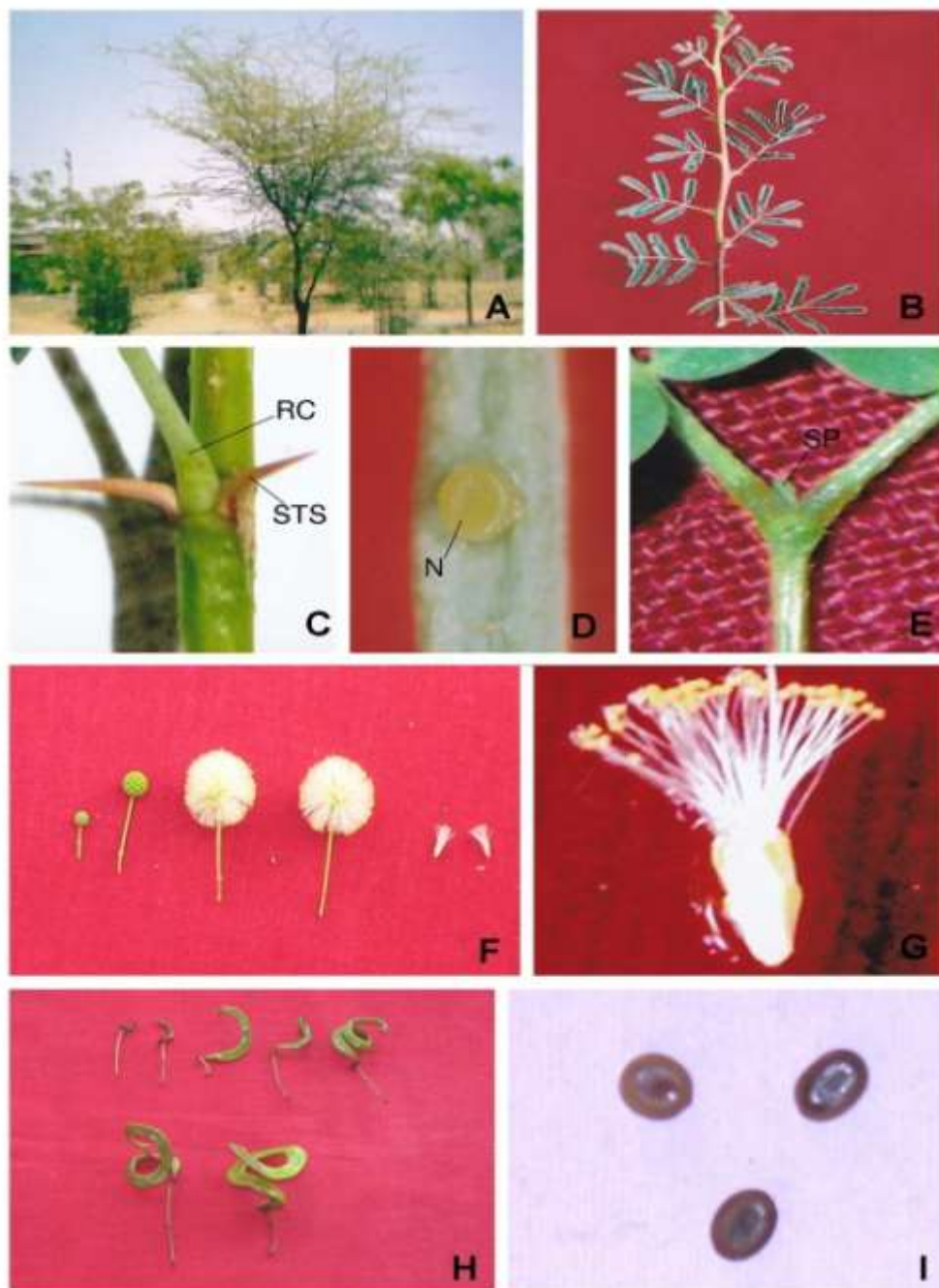


Figure 2 (A-I): External morphology of *A. tortilis*

A-Habit of the plant; B-A twig showing phyllotaxy; C-Showing two stipular spines; D-Showing nectary present on primary rachis at just below the lowest pair of secondary rachii ; E- Showing nectary present on primary rachis at insertion point of last pair of secondary rachii and spinule terminating primary rachis; F-Different development stages of inflorescence; G- Enlarged view of a single flower/floret; H-Different developmental stages of pod; I-Enlarged view of seeds

N-Nectary; RC-Primary rachis; SP-Spinule; STS-Stipular spine

## DISCUSSIONS

Advocating floral characters, Bentham (1842) was the first to clearly restrict the boundaries of the genus *Acacia*. The data gathered on floral characteristics in all the five species are by and large in agreement with previous authors like Miller (1754) who based on original diagnosis included 24 species in the genus, and described *Acacia* as having: "...a tubulose flower, consisting of one leaf, with many stamina or threads, which are many of them collected into a kind of sphere or globe, the point of the flower afterward becomes a pod, in which one, included several seeds, each of which is separated by transverse diaphragms, and are generally surrounded with a whitish pulp." The data gathered here on floral characteristics such as type of inflorescence; symmetry; presence of reproductive organs; arrangement; position and number of floral organs; calyx; corolla (except colour of petals); androecium and gynoecium etc. broadly resemble in both the species and are in agreement with the previous report. However, the features like presence and position and colour of nectary, number of pairs of secondary rachii and leaflets, flowering and fruiting period, seed and fruit characteristics differ in the species studied here and form diagnostic features of the species. These may be helpful in preparing identification keys and in phylogenetic discussions.

The importance of presence of spines in *Acacia* has been emphasized in literature as the generic name *Acacia* was derived from Greek word "Akis" (a sharp point) referring to the thorny structures (Kaushik and Dhiman, 2000). These structures are suggested to be the modifications of stipules. In both the species, stipules are modified into spinous structures which are curved downward and light-brown in *A. tortilis* and are straight and brown in *A. leucophloea*. The fact that lateral spines are modified stipules is supported by the nodal anatomy that the spines are vascularised by the lateral traces in the similar manner as the stipules are vascularised at a trilacunar three trace node reported earlier by Sharma and Pillai (1985).

Bhattacharyya and Maheshwari (1973) considered the exomorphological features of nectaries as reliable taxonomic characters for delimiting the taxa at specific and varietal level, when these features are applied in combination with other vegetative, floral and fruit characters. The data reported here seem to justify these observations. In *A. leucophloea* the nectaries are red, whereas in *A. tortilis* these are green in colour. In *A. leucophloea* nectaries present on the primary rachis, at insertion point of lowest and last pair of secondary rachii whereas in *A. tortilis* it is present on just below the lowest pair and also at insertion point of last pair of secondary rachii. The data suggest this character (nectaries) as a strong feature of consideration for phylogenetic analysis. Whibley (1980) described the pods of *Acacia* as linear to oblong, flat to cylindrical, straight or curved or spirally twisted, papery to woody and usually dehiscent. In both the species studied here, pods are indehiscent legumes however

shape, colour and appearance of the mature pod, and average number of seeds per pod varies according to the species. The data seems to be helpful in phylogenetic considerations. Al-Gohary and Mohamed (2007) considered seed shape and dimensions, surface texture and sculpture, areole form and hilum shape and position in some taxa of *Acacia*, for seed descriptions. In present study, size and shape of the seeds varies according to the species, however colour of seed, position and shape of pleurogram is similar. The data are in full support of that the seed morphological characters are also useful to solve the phylogenetic discussions.

In present study, as both the species of *Acacia* revealed some significant diagnostic external morphological characters, these characters may be helpful in preparing identification keys and in phylogenetic analysis.

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