

Morphological, Histological and Phytochemical Studies of *Sesbania grandiflora* (L.) Poir. Leaves (Pauk-pan-ni)

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Abstract

Sesbania grandiflora (L.) Poir. belongs to the family Fabaceae. It is commonly known as Pauk-pan-ni in Myanmar and Vegetable hummingbird in English. The plant used in colic disorder, jaundice, poisoning condition, small pox, eruptive fever, epilepsy etc. The plant was collected from Botataung Quarter of Pyay Township Area, Bago Region, during the months of November-July in 2018-2019. In this study, the plant was identified with the help of available literatures. It was small tree. Leaves were pinnately compound and deciduous. Flowers were vexillary and petals were differentiated into standard, wings and keels. Fruits were pods. In the histological study, the leaves were dorsiventral with thick cuticle. The stomata were present on both surfaces and anisocytic type. The trichomes were present simple and unicellular. In the midrib, the vascular bundles were collateral and tanniferous cells were distributed in the vascular bundles and prismatic crystals were found in the parenchymatous cells. In preliminary phytochemical investigation, alkaloid, glycoside, saponin, reducing sugars, carbohydrate, phenolic compound, flavonoid, steroid, terpenoid, tannin were present and α -amino acid and cyanogenic glycoside were not absent in this plant. The diagnostic characters of powdered leaves have been examined. The aims of this research have the potential to be used for medicinal purpose in leaves of *Sesbania grandiflora*.

Introduction

The family Papilionaceae (Fabaceae) is the largest three families of the order Leguminales. This includes about 375 genera. The members of the family are being distributed in the temperate regions of both northern and southern hemispheres (Pandey, 1999).

A tribe Robineae of about 21 genera distributed in tropical to warm temperate America, or pantropical. A genus *Sesbania* of about 50 species widespread in tropical to warm temperate regions. Hundley and Chit Ko Ko (1987), Dassanayake (1991) and Kress *et al.*, (2003) mentioned that the plant was named as Pauk-pan-ni in Myanmar.

The exact origin of *S. grandiflora* is not known but it is considered native to many southeast Asian countries. A closely related species, *S. formosa*, is native to northern Australia (Gutteridge, Ross and Max Shelton, 2007).

One of the cosmopolitans of natural orders, the second largest of flowering plants, containing between 6000 and 7000 known species of the three sub orders it is only the first that is cosmopolitan, the two others not reaching beyond the tropical and warm temperate zones (Hooker, 1879).

It is adapted to the lowland tropics up to 800 m, occasionally to 1,000 m and the environments with mean annual temperatures of 22 - 30°C. It is frost sensitive and intolerant to extended periods of cool temperatures. *S. grandiflora* is more suitable for the humid sites. It can be grown on a wide range of soils including those that are poor and waterlogged. It tolerates to acidic soils. It may grow in alkaline, poorly drained, saline, low fertility soils. It is well adapted to heavy clay soils (Karmakar *et al.*, 2016).

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Sesbania grandiflora (L.) Poir. is an Indian medicinal plant which belongs to family Leguminosae. It is cultivated in South or West Indian in the ganga valley and in Bengal. The plant contains rich in tannins, flavonoids, coumarins, steroids and triterpenes. The plant used in colic disorder, jaundice, poisoning condition, small pox, eruptive fever, epilepsy etc. (Bahera *et al.*, 2012).

In this paper, the plant *Sesbania grandiflora* (L.) Poir. (Pauk-pan-ni) which is widely grown in Botataung quarter of Pyay Township Area, Bago Region, were studied for morphological characters of entire plant, histological characters and phytochemical investigation of leaves.

The aim of the present research is to know the chemical composition and the medicinal values of *Sesbania grandiflora* (L.) Poir. To achieve this aim, the objectives of the research work are to verify the morphological characters as well as to examine the anatomical characters and also to analyze the phytochemical properties of leaves.

Materials and Methods

The specimens were collected from Botataung quarter of Pyay Township, Bago Region, during the flowering and fruiting period of November 2018 to July 2019. The vegetative and reproductive parts were studied and identified by using the literature of Hooker (1879), Backer (1963) and Dassanayake (1991). Data were documented by photographs.

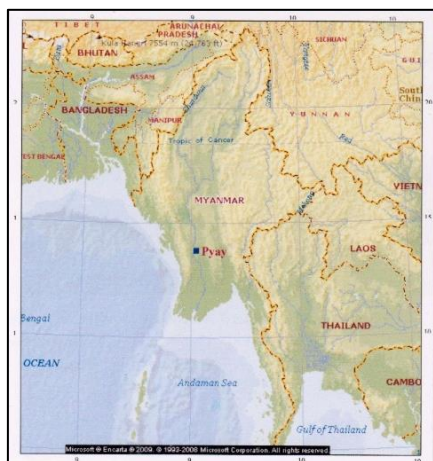


Figure (1) Location map of collecting site, Pyay, Bago Region. Source: Microsoft Encarta 2009.

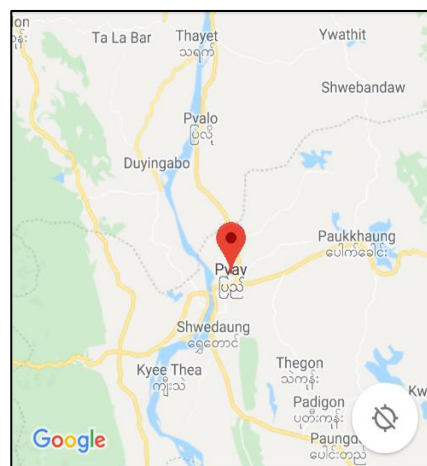


Figure (2) Location map of collecting site, Pyay, Bago Region. Source: Google map

The histological characteristics of the leaves were studied by preparing freehand sections of the fresh specimens. The following reagents were used to examine the section according to the method of Trease and Evans (2002).

1. Chloral hydrate solution was used to clearing agents.
2. Phloroglucinol and hydrochloric acid was used to test lignin.
3. Ferric chloride solution B.P for testing tannins.
4. Acetic acid and sulphuric acid were used to test calcium oxalate crystals.
5. Colour reaction tests were done by applying the method of Treas and Evans (1978), Marini-Brttolo and et.al. (1981) and Harbone (1984).

The Preliminary Phytochemical Investigation of the Leaves of *Sesbania grandiflora* (L.) Poir.

In this phytochemical test, the air-dried powdered of leaves were tested for alkaloid, glycoside, saponin, cyanogenic glycoside, phenolic compound, flavonoid, steroid, terpenoid, tannin, carbohydrate, base compound, α -amino acid and reducing sugar.

These experiments were investigated by using extracts obtained from water and various solvents. The phytochemical tests were conducted by Department of Botany, Pyay University. These tests were conducted by the methods of British Pharmacopeia (1968), Treas and Evans (2002). The results were shown in Table (2).

Results

Morphological characters of *Sesbania grandiflora* (L.) Poir.

Scientific Name	:	<i>Sesbania grandiflora</i> (L.) Poir.
Synonyms	:	<i>Robinia grandiflora</i> L. <i>Sesban coccinea</i> (L.f.) Poir.
English Name	:	Vegetable hummingbird, Agati
Myanmar Name	:	Pauk-pan-ni
Family	:	Fabaceae

Small tree, up to 1.52 – 6.09 m high. Stem cylindrical and erect. Leaves alternate, pinnately compound, the leaflet 8 - 15 pairs, each 3.4 - 4.5 cm long and 1.0 – 1.5 cm wide, the laminae oblong, the tips rounded, the margin entire, the bases rounded to obtuse, the upper surfaces glabrous, the lower one pubescent, petiolule 0.1 - 0.2 cm long, pubescent, the rachises 12 – 26 cm long, pubescent. Inflorescences are axillary racemes, loosely arranged 2 – 3 flowered, the peduncles 2 – 3 cm, flower red, 7 - 8 cm, pedicel 1.5 – 1.7 cm long. Flowers bracteate, bracteolate, pedicellate, complete, bisexual, irregular, zygomorphic, pentamerous, hypogynous. Calyx (5), synsepalous, 1.2 – 2.0 cm long and 3.8 – 4.0 cm wide, subtruncate to subbilabiate, glabrous, sepeloid, persistent. Corolla 1 + 2 + (2), brightly red, apopetalous, vexillary, petals are differentiated into standard ovate, wings falcate-oblong, keels subrostrate and recurved, imbricate and descending, standard 6.3 – 7.0 cm long and 3 – 4 cm wide, wings 7.5 – 8.4 cm long and 1.0 – 1.9 cm wide and keel 9.0 – 9.5 cm long and 2.0 – 3.5 cm wide. Stamens 1 + (9), diadelphous, filament long and curved, nine stamens are fused to form a staminal tube, 10 – 11 cm long, anther dithecos, dorsifixed, introrse, exerted, longitudinal dehiscence. Carpel 1, monocarpellary, unilocular, marginal placentation, many ovules in each locule, style 11.0 – 11.5 cm long, stigma simple and capitate, ovary linear oblong, gynophore distinct, ovary superior. Fruit pod, cylindrical, 16 – 47 cm long, curved, green, 15 – 30 seeded with septa, septate transversely between the seeds, the margin thickened. Seeds numerous, ovoid to oblong-reniform with a small lateral hilum.

Flowering and fruiting periods	:	November 2018 to July 2019
Study area	:	18° 48'28"N 95°14'12"E 588 m
Locality	:	Pyay Township, Bago Region

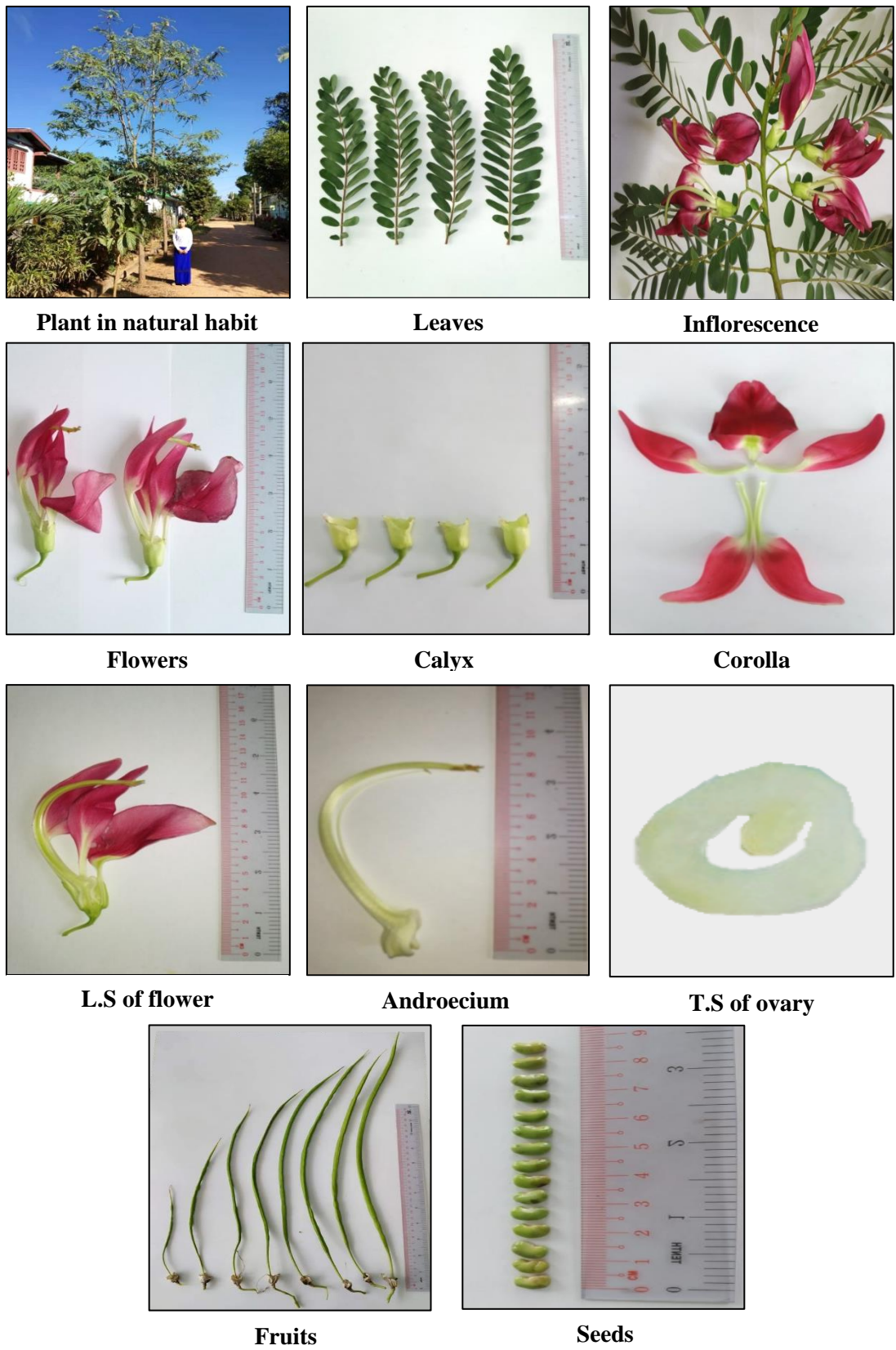


Figure (3) Morphological characters of *Sesbania grandiflora* (L.) Poir.

Histological Characters of *Sesbania grandiflora* (L.) Poir.

Lamina

In surface view, the epidermal cells of both surfaces are thin-walled and parenchymatous. The epidermal cells of lower surface are wavier than the upper ones. Stomata are present in equal numbers on both surfaces. They are anisocytic type, oval in outline with two reniform shaped guard cells. The trichomes are unicellular, uniseriate present on both surfaces.

In transverse section, the cuticle is present on both surfaces. The upper cuticle is thicker than the lower ones. Palisade cells are found below the upper epidermis are small and arranged at right angle to the surface. Palisade cells are one to two layered. The spongy mesophyll cells are three to four layered, chloroplasts are abundant in all mesophyll cells and thin-walled, parenchymatous cells with intercellular spaces.

The vascular bundles of the lateral veins embedded in mesophyll cell. Vascular bundles are collateral type. Xylem lies towards the upper epidermis. Phloem lies towards the lower epidermis. Parenchyma cells are also present.

Midrib

In surface view, the epidermal cells of both surfaces are more or less rectangular, parenchymatous and thin-walled, rod-shaped prismatic crystals are present.

In transverse section, the midrib is slightly convex above, covered with smooth cuticle, the upper epidermal cells are rectangular, compactly arranged. The lower epidermal cells are smaller than the upper epidermis. Below the upper epidermis, the collenchymatous cells are two to three layered and located above the lower epidermis, the collenchyma is two to four layered. The collenchyma is angular in cells.

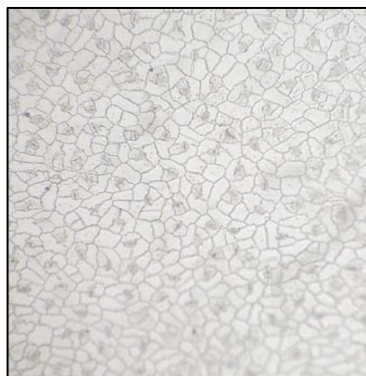
The vascular bundles are collateral typed and crescent in shape accompanied with fibres above and below, tanniferous cells are distributed in the vascular bundles and rod-shape. Prismatic crystals are present in the parenchymatous cells. Resin ducts are present in the vascular bundles and phloem fibres are present below the vascular bundle. Xylem arrange in radial row and endarch centrifugal type with lignified wall and spiral thickenings. In large vascular bundles, protoxylem lies towards the upper side and metaxylem also lies towards the lower side. Phloem cells are thin walled and consists of sieve tubes, companion cells and phloem parenchyma cells.

Petioles

In surface view, the epidermal cells of both surfaces are thin-walled and rectangular to polygonal in shape, unicellular trichomes are present. Anthocyanin pigments are present in the epidermal cells.

In transverse section, the epidermal cells are parenchymatous and compactly arranged, unicellular, trichomes are present on both upper and lower epidermis, but more numerous on upper epidermis. The collenchyma one to two layered below the vascular bundle, two to three layered above the vascular bundle are collateral type. The parenchyma cells are rounded, 8 - 10 layers above the vascular bundle and 8 - 11 layers below.

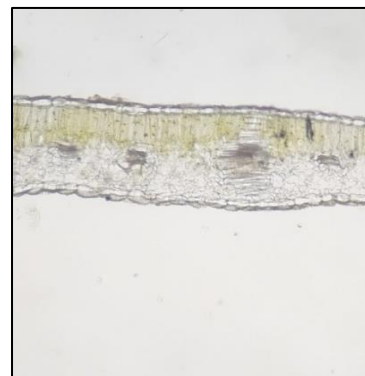
The vascular bundles are arranged as continuous ring. Resin ducts are embedded in the vascular bundles and tanniferous cells are scattered around the vascular bundles and prismatic crystals are found in the parenchymatous cells. Xylem is composed of annular and spiral thickening. Phloem cells are thin walled and consists of sieve tubes, companion cells and phloem parenchyma cells.



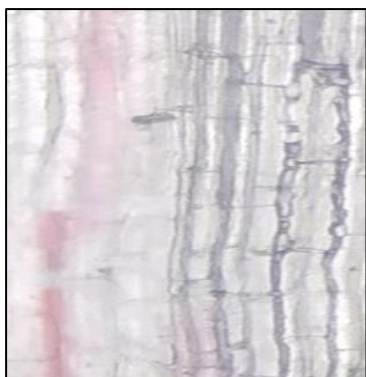
Upper surface view of lamina showing anisocytic type of stomata (X100)



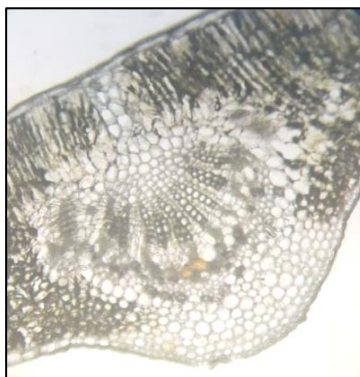
Lower surface view of lamina showing anisocytic type of stomata (X100)



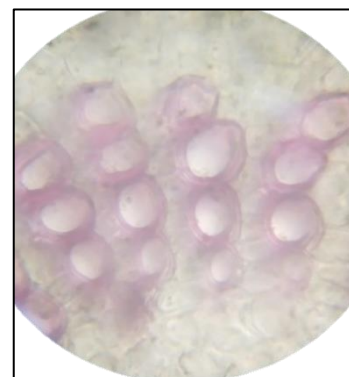
T.S of lamina showing mesophyll cells (X400)



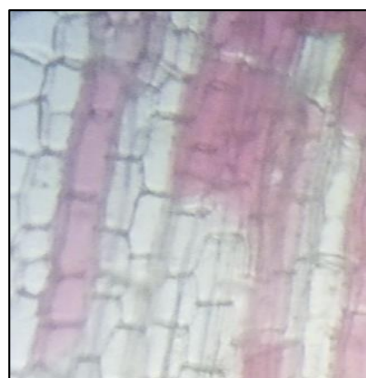
Surface view of midrib showing epidermal cells (X400)



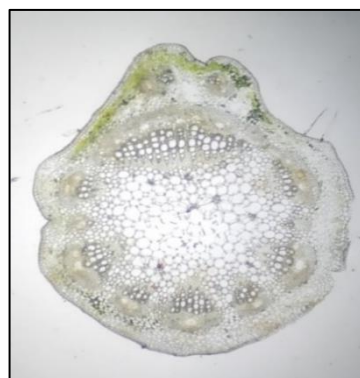
T.S of midrib showing mesophyll cells and vascular bundle (X100)



T.S of midrib showing close up view of vascular bundles (X400)



Surface view of petiole showing epidermal cells with anthocyanin (X400)



T.S of petiole showing cortex and vascular bundles (X40)



T.S of petiole showing continuous ring of vascular bundles (X400)

Figure (4) Histological characters of *Sesbania grandiflora* (L.) Poir.

Microscopical Characters of Powdered Leaves of *Sesbania grandiflora* (L.) Poir.

The powdered leaves are green, fibrous, stomata, trichomes, pitted vessels, annular vessels and partly spiral vessels are observed.

Table(1) Diagnostic characters of dried powdered leaves of *Sesbania grandiflora* (L.)


Diagnostic Characters	Leaves	
Colour	Green	
Odour	Slightly tea	
Taste	Bitter	
Texture	Smooth	

Figure (5) Powered leaves of *Sesbania grandiflora* (L.) Poir.

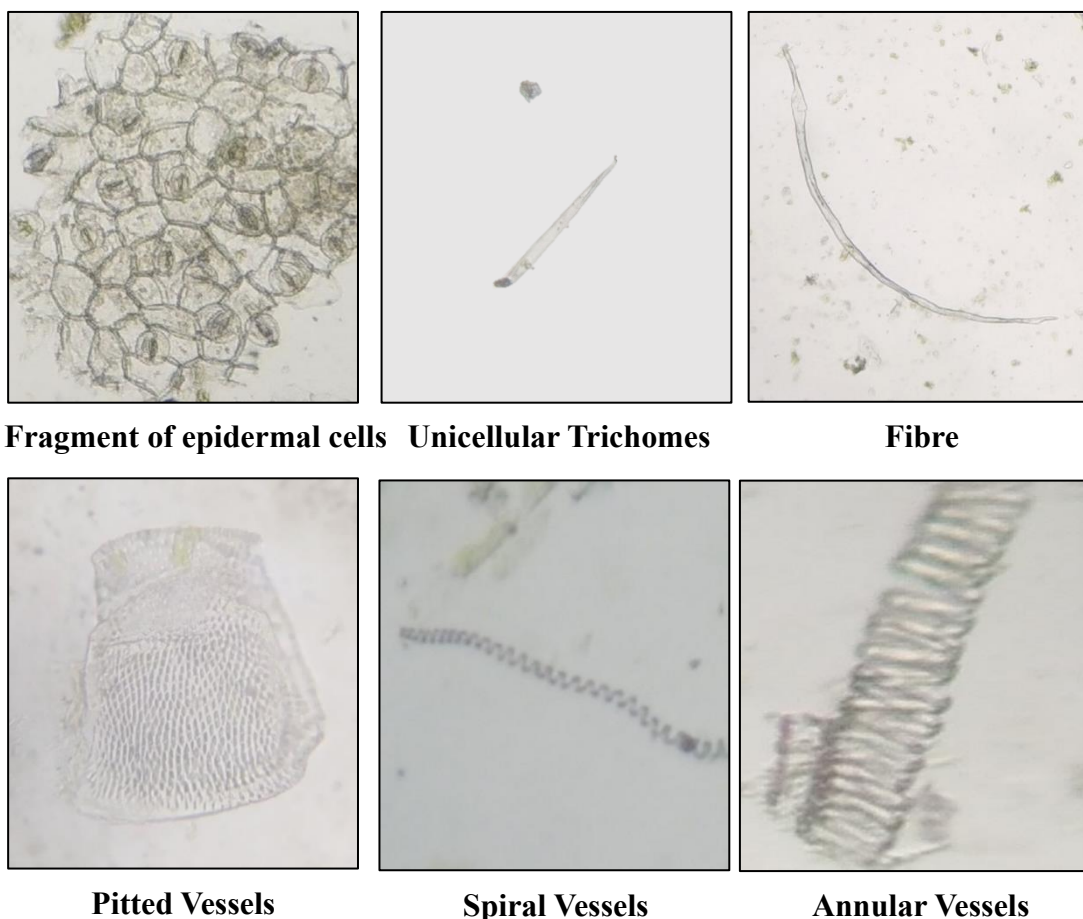


Figure (6) Microscopical characters of powdered leaves of *Sesbania grandiflora* (L.) Poir.

Preliminary Phytochemical Tests of Powered Leaves of *Sesbania grandiflora* (L.) Poir.

In preliminary phytochemical tests, it was found that alkaloid, glycoside, saponin, reducing sugars, carbohydrate, phenolic compound, flavonoid, steroid, terpenoid, tannin and neutral compounds however α -amino acid and cyanogenic glycoside were not found in leaves. The results of preliminary phytochemical tests were shown in Table (2).

Table (2) Preliminary phytochemical investigation on the powdered leaves of *Sesbania grandiflora* (L.) Poir.

No	Chemical constituents	Extract	Test reagents	Observation	Results
1	Alkaloid	1% HCl	1.Mayer's reagent 2.Dragendorff's reagent 3.Wagner reagent	White ppts Reddish ppts Yellow ppts	+ + +
2	Glycoside	H ₂ O	10% Lead acetate solution	White ppts	+
3	Saponin	H ₂ O	Distilled water	Marked frothing	+
4	Reducing sugar	H ₂ O	Fehling solution	Reddish ppts	+
5	Carbohydrate	H ₂ O	10% α -naphthol solution Conc: H ₂ SO ₄ acid	Pale Pink ring	+
6	Phenolic compounds	H ₂ O	5% FeCl ₃ solution	Brown colour	+
7	Flavonoid	MeOH	Mg turning Conc: HCl acid	Pale Pink colour	+
8	Steroid	pet-ether	Acetic anhydrate Conc: H ₂ SO ₄ acid	Deep green colour	+
9	Terpenoid	EtOH + CHCl ₃	Conc: H ₂ SO ₄ acid	Reddish brown colour	+
10	Tannin	H ₂ O	1% gelatin solution	White ppts	+
11	α -amino acid	H ₂ O	Ninhydrine reagent	Colour not change	-
12	Acid / Base / Neutral compound	H ₂ O	Bromocresol green solution	Green colour	Neutral compound
13	Cyanogenic glycoside	H ₂ O	Conc: H ₂ SO ₄ acid Sodium picrate paper	Colour not change ppts = Precipitate	-

(+) = Present

Discussion and Conclusion

In this present study, the morphological, phytochemical and histological characters of *Sesbania grandiflora* (L.) Poir. have been undertaken.

In the morphological study, the plant is small tree. Leaves are multifoliate, paripinnate compound, stipulate, stipels minute, the lamina oblong, the leaflets 8 – 15 pairs, the tip rounded, margin entire, the base rounded to obtuse, petiolules, rachises and petioles are puberrulous, these characters were in agreement with those given by Backer (1963) and Dassanayake (1991). But, Hooker (1879) and Dassanayake (1991) mentioned that the leaves tip was mucronate. The characters were not in agreement with those statement.

Inflorescences are short axillary racemes, pubescent which is in agreement with those stated by Hooker (1879), Dassanayake (1991), Kyaw Soe and Tin Myo Ngwe (2004).

The flowers are red, showy bracteate, bracteolate, pedicellate, bisexual, irregular, zygomorphic, hypogynous. Sepals (5), fused, synsepalous, campanulate, 2-lipped, persistent. Petals 1 + 2 + (2), free, apopetalous, petals with long clawed, the posterior standard broad, the two-lateral winged, the inner keels obtuse and blunt at the end, imbricate and descending. These characters are similar to those mentioned by (Hooker (1879), Backer (1963) and Dassanayake (1991).

Stamens are diadelphous, nine stamens are fused to form staminal tube, the anther ditheous, dorsifixed, introrse, exerted, longitudinal dehiscence. Carpel 1, monocarpellary, 1-loculed, ovary linear and curved, the stigma simple and capitate, the gynophore long and distinct which were similar to the finding of Hooker (1879) and Dassanayake (1991).

In the histological study, in surface view, the stomata are anisocytic types and usually in equal numbers on both surfaces. In transverse section, the upper cuticle is thicker than the lower cuticle, the epidermis of leaf is characterized by the common occurrence of angular folds in the anticlinal walls, by the development of papillae. These characters are agreement with those reported by Metcalfe and Chalk (1950).

The midrib is above slightly, convex. The vascular bundles are collateral type, accompanied by fibers above and below, tanniferous cells and rod-shaped prismatic crystals are present in the parenchymatous cells. Resin-ducts are present below the vascular bundles. These characters are in agreement with those mentioned by Shantha *et al.*, (2012).

In transverse section of petiole, unicellular, uniseriate, trichomes are present. The vascular bundles are continuous rings. The resin ducts are present in the vascular bundles. Tanniferous are scattered around the vascular bundles, and the prismatic crystals are present in the parenchymatous cells. These characters are in agreement with those stated by Metcalfe and Chalk (1950).

Diagnostic characters of *Sesbania grandiflora* Pers. are green in colour, slightly tea odour, bitter, smooth in the texture. The powdered leaves are green, fibrous, stomata, trichome, pitted vessels, annular vessels and partly spiral vessels are observed. Those are agreement with Aye Aye Aung (2011).

The preliminary phytochemical investigation was carried out on the powdered leaves of *Sesbania grandiflora* (L.) Poir. According to the results, it indicates that alkaloid, glycoside, saponin, reducing sugars, carbohydrate, phenolic compound, flavonoid, steroid, terpenoid, tannin, neutral compounds were present but α -amino acid and cyanogenic glycoside were absent in leaves. These characters are agreement with Central Council Research in Unani Medicine (1987).

In conclusion, the present research showed that not only usefulness of medicinal values from *Sesbania grandiflora* (L.) Poir. but also, chemical constituents of the plant. Therefore, the species *Sesbania grandiflora* Pers. grown in Myanmar will be beneficial for local people.

Acknowledgements

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