

## The Study on Phytochemical constituents and Antimicrobial activities of the leaves of *Sesbania grandiflora* (L.) Poir

Khin Myo Win<sup>1</sup>, Nyunt Nyunt San<sup>2</sup>

### Abstract

The leaves of *Sesbania grandiflora* (L.) Poir family Fabaceae is a great medicinal value. The research paper is studied at Mandalay Degree College Campus near the Nat Yae Kan village in Amarapura Township of Mandalay Region during 2018-2019. The aim of the research was to know the phytochemical constituents and antimicrobial activities in the leaves of *Sesbania grandiflora* (L.) Poir. The phytochemical constituents were studied that the leaves of *Sesbania grandiflora* (L.) Poir contained alkaloids, glycosides, tannins, saponin, carbohydrates, phenolic compounds and starch. Then, the leaves of *Sesbania grandiflora* (L.) Poir was investigated for its antimicrobial activities properties. In antimicrobial activities, the extract of ethyl acetate significantly showed inhibition zone against on *Bacillus pumilus*, *Bacillus subtilis*, *Candida albicans*, *E. coli*, *Staphylococcus aureus* and *Sacchromyces cerevisiae*. The leaves of *Sesbania grandiflora* (L.) Poir had against the antimicrobial activities and a rich source of medicinal value. So, the leaves of *Sesbania grandiflora* (L.) Poir. should be eaten because its leaves have rich source of medicinal compounds.

Key words – *Sesbania grandiflora* (L.) Poir, antimicrobial activities.

### Introduction

Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions and to defend against attack from bacteria, fungus and other pathogens (Kumar *et al* 2016).

The research paper deals with the phytochemical constituents and antimicrobial activities studied on *Sesbania grandiflora* (L.) Poir. It studies at Mandalay Degree College Campus near the Nat Yae Kan village in Amarapura Township of Mandalay Region during 2018 -2019.

The genus *Sesbania* has more than 50 species which are distributed in warm and wet regions. Some of the species are cultivated and ornamental. *Sesbania grandiflora* (L.) Poir. belongs to family Fabaceae.

*Sesbania grandiflora* (L.) Poir. commonly is a small, erect, fast-growing perennial and sparsely branched tree. The leaves are paripinnately compound with 20-50 leaflets in pairs. Flowers are arrangement to pea flowers with five petals that are differentiated into a standard, wing, and keel petals (Jiraunkoorskul, 2015). The leaves of *Sesbania grandiflora* are traditionally used to treat nasal catarrh, nyctalopia and cephalagia. *Sesbania grandiflora* possess antioxidant, antiurolithiatic, anticonvulsant, anti-arthritic, antiinflammatory, antihelminthic, antibacterial and anxiolytic activity (Mohiuddin 2019). Phytochemicals are the antibiotic properties of plants and have been reported to possess antibacterial, antifungal and anti-inflammatory activities (Ajal *et al* 2001). Arun *et al* (2014) reported that the phytocompounds of *Sesbania grandiflora* (L.) Poir. leaves were the presence of alkaloids, flavonoids, glycosides, tannins, steroid, proteins and carbohydrates. The active constituents in leaves are contained for treating various diseases (Hari *et al* 2014).

The medicinal plants have antimicrobial agent, that kills or inhibit the growth of microorganisms such as *Escherichia coli*, *Bacillus subtilis*, *Micrococcus luteus*,

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*Aspergillus niger*, *Candida albicans*, *Vibrio cholera*, *Klebsiella pneumonia*, *Salmonella typhiurium*, etc. (Kumar *et al* 2016).

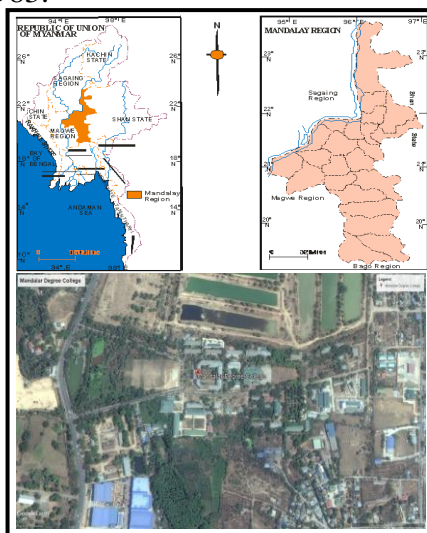
The tender leaves and flowers of *Sesbania grandiflora* (L.) Poir. are eaten as a vegetables or salads in various parts of Myanmar. The aim of the research paper is to evaluate the phytochemical constituents and antimicrobial activities from the leaves of *Sesbania grandiflora* (L.) Poir.

## Materials and Methods

### Sample Collection

The leaves of *Sesbania grandiflora* (L.) Poir. (Family - Fabaceae) were collected from different places of Mandalay Degree College Campus during 2018 to 2019. This College is located between 96° 01' and 96° 06' east longitude and between 21° 52' and 21° 57' north latitudes. The latitude of this area is about 112.7 m above sea level (Fig. 1). The taxonomic identification has been done by referring the literature of Hooker, 1879 and Dassanayake, 1983.

**Figure 1. Location Map of Mandalay Degree College**



### Anatomical studies

The samples were carried out by cutting free hand section with razor blade. Thin section were selected and placed in chloral hydrate solution. These clear sections were stained with safranin and temporary mounted in dilute glycerin. This slide was observed under the fluorescent microscope and photomicrographs with magnifications 10X and 40X. Descriptive terms of the anatomical features are as given according to Metcalf and Chalk (1950) method and Esau (1960).

### Phytochemical screening

The fresh leaves were washed and shade dried for four days. The dried leaves were powdered with a blender and stored in well-sealed closed vessels for phytochemical and antimicrobial activities studies. The presence or absence of alkaloid, flavonoids, saponins, polyphenol, glycosides, tannins, starch, reducing sugars and carbohydrates were studied according to the methods of Harbone (1984), British Pharmacopeia (1968).

## Antimicrobial activity

### Test organisms

The solvent extracts of leaves were tested against six organisms including *Bacillus pumilus*, *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, *Candida albican* and *Saccharomyces cerevisiae*. Test organisms, code numbers and diseases were shown in Table 1. The tests were conducted at the Chemistry Department, Patheingyi University.

**Table 1. Test microorganisms, Code number and Diseases.**

No	Test microorganisms	Code No.	Diseases
1.	<i>Bacillus pumilus</i>	IFO-12102	Fever
2.	<i>Bacillus subtilis</i>	IFO-90571	Food spoilage and fever
3.	<i>Escherichia coli</i>	AUH- 5436	Diarrhea, dysentery,
4.	<i>Staphylococcus aureus</i>	AUH8465	Food poisoning, boils,
5.	<i>Candida albican</i>	NITE09542	Gastrointestinal infection, candidiasis.
6.	<i>Saccharomyces cerevisiae</i>	NITE52847	Food spoilage yeast

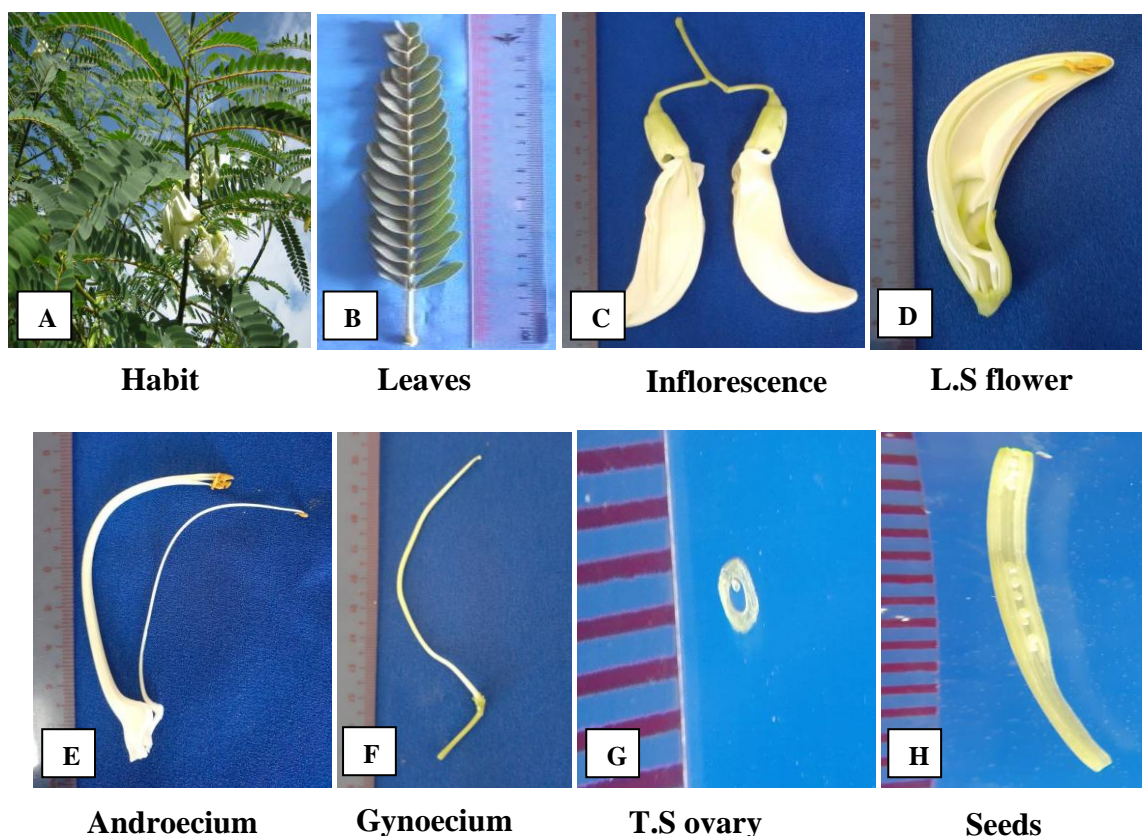
## Results

### Morphological characters of *Sesbania grandiflora* (L.) Poir. in Lam, Enc 7:127, 1806.

Family	- Fabaceae
Myanmar name	- Pauk-pan-phyu
English Name	- Humming bird, Swamp pea, Agati
Flowering period	- June to October

Perennial small tree up to 6.0 m high; stems and branches terete, pubescent while young, glabrous with age. Leaves unipinnate-compound, paripinnate, alternate; stipules obliquely ovate; petioles long; rachis long; leaflets oblong, rounded at the base, entire along the margin, obtuse or emarginate at the apex, glabrous, pubescent on both surface. Inflorescences solitary or in paired, 2 to 4 flowered. Flowers bisexual, zygomorphic, hypogynous, pentamerous, white. Calyx subtruncate to sublobate, glabrous. Corolla papilionaceous, standard ovate, without basal appendage; wings oblanceolate, glabrous, keels oblong, glabrous. Stamens 10, diadelphous; free filaments; anther uniform. Ovary superior, linear-oblongoid, glabrous, unilocular, with many ovules on the marginal placentae; style long; stigma simple. Pods dehiscent, 10- to 40 seeded, linear-oblongoid, straight or somewhat curved. Seeds reddish-brown, thick, non-endospermic.

**Uses** - The leaves are used anthelmintic, tonic, treat worms, biliousness, fever, gout, itchiness, and leprosy, nyctalopia, sprains, bruises, aperients, diuretic, laxative and alexeteric.



**Figure 2. Morphological characters of *Sesbania grandiflora* (L.) Poir**

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

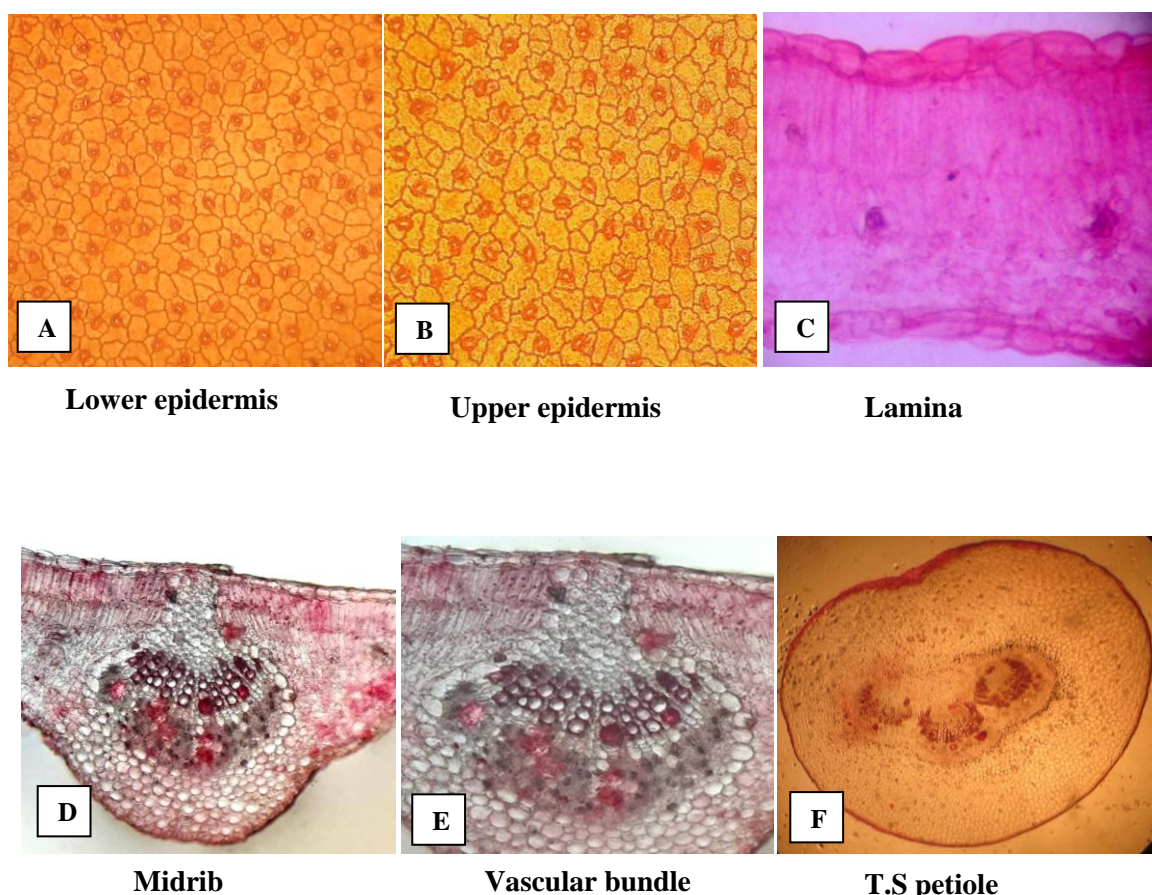
The leaflets of *Sesbania grandiflora* are dorsiventral, upper and lower epidermis single layered covered by thin cuticle. Stomata are anisocytic type and present on both surface but more towards the lower surface. (Fig.3A,B).

In the transverse section of lamina, the upper and lower epidermis is single layered. The mesophyll cell is differentiated into palisade and spongy parenchyma. Palisade cells are formed 2-layered, cells compactly arranged, long and tubular; chloroplast abundant; spongy parenchyma present 3 to 5-layered (Fig.3C).

In midrib, the leaflets of *Sesbania grandiflora* (L.) Poir is plano-convex shaped, epidermal cells 1-layered, angular collenchyma cells 2 to 3 layered, 1-4 layered of parenchyma cells closely arranged in the form of neck of the round bottom flask. Vascular bundle tissue consists of one large vascular bundle, collateral and closed type, collenchymatous cells 1-4 layers arranged near the vascular bundle (Fig.3D,E).

In transverse section of petiole, epidermis parenchyma cell is 1-layered, the cells oval or barrel-shaped, cuticle thin; trichomes absent. Parenchyma cells 5 or 6 layered, the cells oval or barrel in shape; collenchymas cells 7 to 10 layered, intercellular space present. Vascular bundles tissue consists of 3 bundles tissues. These bundles arranged discontinuous semicircular ring, each bundle is oval-shaped and collateral type (Fig.3F).





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

**Phytochemical constituents of *Sesbania grandiflora* (L.) Poir.**

The powdered leaf extracts of *Sesbania grandiflora* (L.) Poir were present alkaloids, flavonoids, polyphenols, saponins, glycosides, carbohydrates and tannin (Table 2). Starch and reducing sugar were not detected in this experiment.

**Table 2. Phytochemical analysis of leaf extract of *Sesbania grandiflora* (L) Poir.**

No.	Test	Extract	Test reagent	Observation	Results
1.	Alkaloids	1% HCl	Mayer's reagent	Cream ppt	+
2.	Flavonoid	EtOH	Lead acetate	White ppt	+
3.	Poly Phenol	EtOH	10% FeCl <sub>3</sub> solution	Brown ppt	+
4.	Starch	EtOH	Iodine solution	White ppt	-
5.	Saponins	D.W	Distilled water and NaHCO <sub>3</sub> solution	Frothing	+
6.	Glycosides	D.W	10% lead acetate solution	Milky white ppt.	+
7.	Reducing sugar	D.W	Benedict's solution	No change	-
8.	Carbohydrates	D.W	10% naphthanol + Conc: H <sub>2</sub> SO <sub>4</sub>	Cream colour	+
9.	Tannins	D.W	1% FeCl <sub>3</sub> solution	Yellowish brown	+

+ = present  
- = absent

ppt: = precipitation      D.W = Distilled water  
Conc: = Concentrated

### Antimicrobial activities on the leave extract of *Sesbania grandiflora* (L.) Poir.

The antimicrobial activities of extracts of leaves were carried out by various solvents such as, methanol, ethanol, ethyl acetate, chloroform and petroleum-ether.

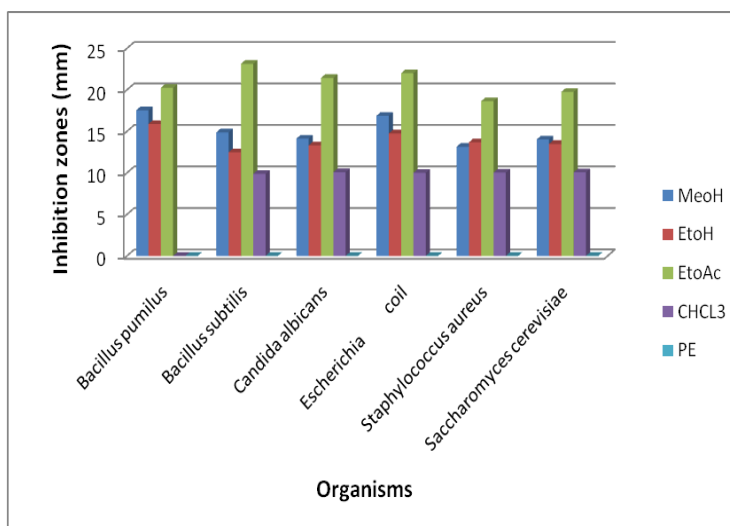
In this study, the methanol extract showed the inhibition zones of 17.54 mm and 16.88 mm against *Bacillus pumilus* and *Escherichia coli*. The zones of inhibition were slightly different for *Staphylococcus aureus* (13.15 mm), *Candida albicans* (14.13mm) and *Saccharomyces cerevisiae* (14.02 mm) in the methanol extract.

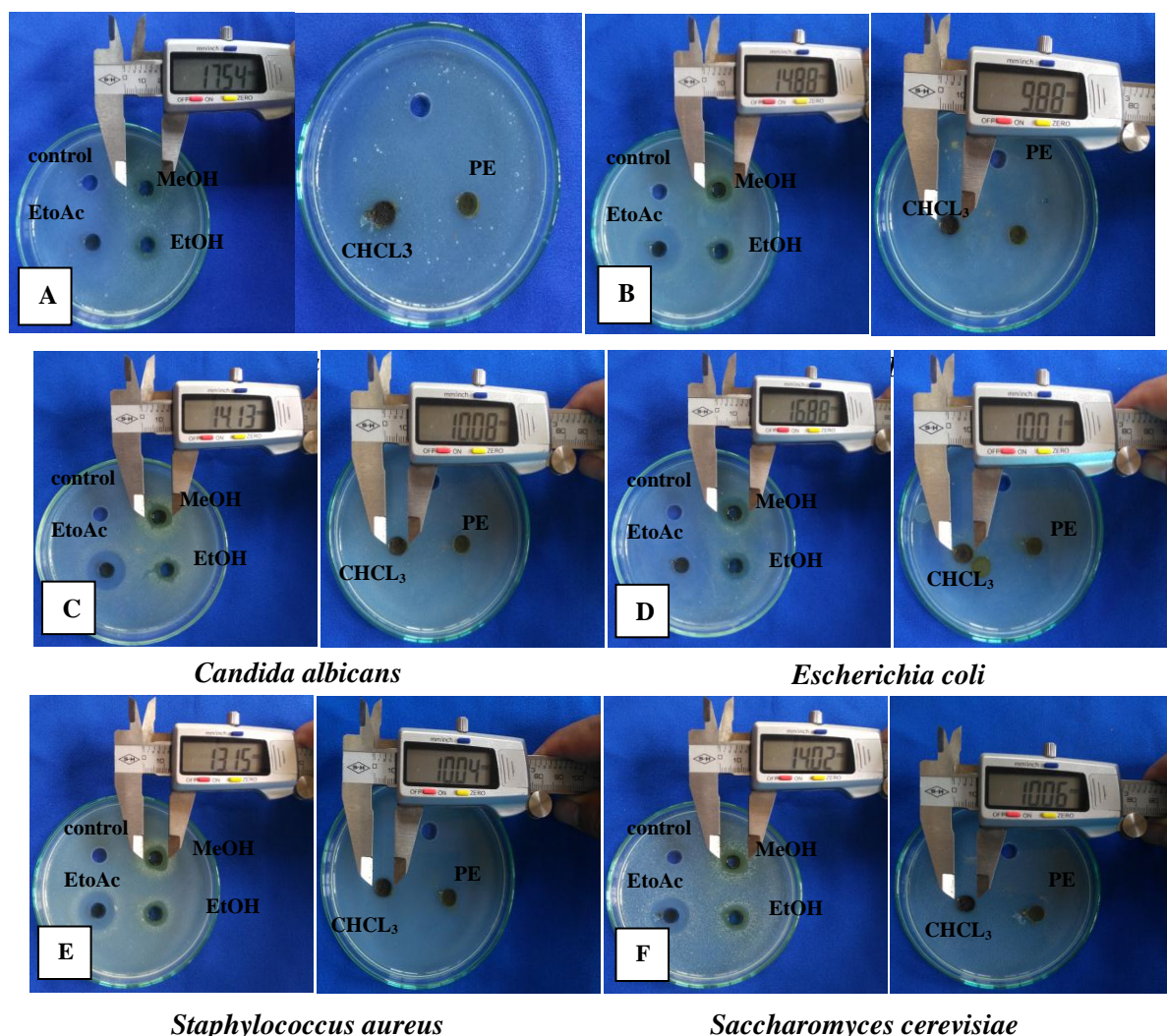
The ethanol extract showed that the moderate zones of inhibition against *Bacillus subtilis* (12.48 mm), *Candida albicans* (13.32 mm), *Staphylococcus aureus* (13.68 mm) and *Saccharomyces cerevisiae* (13.49 mm). The inhibition zones of ethanol extracts showed against *Bacillus pumilus* (15.89 mm) and *Escherichia coli* (14.75 mm). The highest zone of inhibition of ethyl acetate extract of *Sesbania grandiflora* (L.) Poir. showed *Bacillus subtilis* (23.14 mm), *Bacillus pumilus* (20.25 mm), *Candida albicans* (21.44 mm), *Escherichia coli* (22.01 mm), *Staphylococcus aureus* (18.64 mm) and *Saccharomyces cerevisiae* (19.76 mm) against leave extract in ethyl acetate. The zones of inhibition were slightly showed *Bacillus subtilis* (9.88 mm), *Candida albicans* (10.08 mm), *Escherichia coli* (10.01mm), *Staphylococcus aureus* (10.04 mm) and *Saccharomyces cerevisiae* (10.06 mm) against chloroform extracts. No antibacterial activity was shown by Petro-ether extract of leave against test organisms. The results of antimicrobial activity of the leaf extracts against six microorganisms as shown in table 3 and figure 4, 5.

**Table 3. Antimicrobial activities of different solvent extracts from *Sesbania grandiflora* (L.) Poir.**

Sample	Solvents	Organisms					
		<i>Bacillus pumilus</i>	<i>Bacillus subtilis</i>	<i>Candida albicans</i>	<i>E-coil</i>	<i>Staphylococcus aureus</i>	<i>Saccharomyces cerevisiae</i>
Paukpan phyu	MeoH	17.54mm (++)	14.88 mm (++)	14.13 mm (+)	16.88 mm (++)	13.15 mm (+)	14.02 mm (+)
	EtoH	15.89 mm (++)	12.48 mm (+)	13.32 mm (+)	14.75 mm (++)	13.68 mm (+)	13.49 mm (+)
	EtoAc	20.25 mm (+++)	23.14 mm (+++)	21.44 mm (+++)	22.01 mm (+++)	18.64 mm (++)	19.76 mm (+++)
	CHCL <sub>3</sub>	-	9.88 mm (+)	10.08 mm (+)	10.01 mm (+)	10.04 mm (+)	10.06 mm (+)
	PE	-	-	-	-	-	-
Agar well- 8mm, 10mm-14mm (+), 15mm-19mm (++) , 20mm above (++++)							

**Figure 4. A bar graph of inhibition zones diameters (mm) of various extracts from leaves of *Sesbania grandiflora* (L.) Poir. against six organisms**





**Figure 5. Antimicrobial activities of *Sesbania grandiflora* (L.) Poir. leaves extract**

### Discussion and Conclusion

In this study, the phytochemical constituents and antimicrobial activities of leaves of *Sesbania grandiflora* (L.) Poir. were investigated. *Sesbania grandiflora* (L.) Poir. (Family - Fabaceae) is a small erect, sparsely branched tree. The leaves are unipinnately compound leaves, paripinnate. Inflorescences are solitary or in paired. Flowers were bisexual, zygomorphic, caducous. Corolla is papilionaceous. Stamens were 10, diadelphous. Pods are dehiscent.

The microscopical characters of leaflets of *Sesbania grandiflora* (L.) Poir were shown in (figure 3). The leaflets were dorsiventral, upper and lower epidermis single layered covered by thin cuticle. Stomata were anisocytic type and present on both surfaces but more towards the lower surface. The mesophyll cell was differentiated into palisade and spongy parenchyma. Palisade cells are formed 2-layered. In midrib, the leaflets were plano-convex shaped. Vascular bundle tissue consisted of one large vascular bundle, collateral and closed type. In petiole, epidermis parenchyma cell were one-layered and oval or barrel-shaped, cuticle thin; trichomes absent. Vascular bundles tissue consisted of 3 vascular bundles. These bundles arranged discontinuous semicircular ring and collateral type. These observed



characters agreed with Yadav (2010) and Veerabhadrappe (2017). These characters can help for the identification of medicinal plants.

*Sesbania grandiflora* (L.) Poir. had various compounds in its leaves. The result of the phytochemical constituents observed that the presence of alkaloid, flavonoid, saponin, tannin, glycosides, carbohydrates, and polyphenol were contained in the leaves extract. These findings agreed with Venkateshwarlu *et al* (2012) and Jiraungkoorskul (2015). Thus, the leaves of *Sesbania grandiflora* (L.) Poir indicated their medicinal value due to the presence of phytochemical constituents.

The present study that the leave extract of *Sesbania grandiflora* (L.) Poir. were tested on six types of organisms. The methanol extract inhibited the clear zones of 17.54 mm and 16.88 mm against *Bacillus pumilus* and *Escherichia coli*. The ethanol extract showed that the inhibition zones of against *Bacillus pumilus* (15.89mm) and *Escherichia coli* (14.75mm). The ethyl acetate extract of *Sesbania grandiflora* (L.) Poir. showed the highest zone of inhibition *Bacillus subtilis* (23.14mm), *Bacillus pumilus* (20.25mm), *Candida albicans* (21.44mm), *Escherichia coli* (22.01 mm), *Staphylococcus aureus* (18.64 mm) and *Saccharomyces cerevisiae* (19.76 mm) respectively. The chloroform extract showed that the slightly inhibition against the test organisms. No antimicrobial activity was shown by Petroleum-ether extract of leaf against test organisms. According to the result, the ethyl acetate extract of the *Sesbania grandiflora* (L.) Poir. leaves have shown significant antibacterial activity against test organisms. Therefore, the leaves extracts of *Sesbania grandiflora* have good antimicrobial activity against test organisms.

It can be concluded that the presence of alkaloids, tannins, saponins, flavonoids, carbohydrates in the leaves of *Sesbania grandiflora* were responsible for its antimicrobial activity. It may be suggested that ethyl acetate is the effectiveness solvent for the antibacterial activity from the leave extract of *Sesbania grandiflora* (L.) Poir. For further research, the leaves of *Sesbania grandiflora* (L.) Poir should be investigated for antioxidant, anticancer, antidiabetic activity.

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