Study on Taxonomic Descriptions of Subfamily Mimosoideae belong to family Fabaceae in Hinthada District

Ei Ei Phyo[1], Ohnmar[2], May Zin Phoo[3]

Abstract

Taxonomic investigation on family Fabaceae growing in Hinthada District, Ayeyarwady Region was carried out for plant systematic study. All of the species were collected During the flowering and fruiting period, from December 2019 to March 2020. A total of 6 species belong to Fabaceae family were collected and recorded. A complete taxonomic account of each species has been given their Scientific names, Myanmar names and English names flowering and fruiting period. Moreover, the taxonomic characters of each species have been presented with their respective photographs of habit, inflorescences, flowers as seen, L.S of flower and T.S of ovary. The Cladograms of each species of subfamilies were constructed for phylogenetic approach by using 12 key characters. The generic names of each subfamily were alphabetically arranged. Out of the total number of species were occurred as 2 wild plants and 4 cultivated plants in the study area.

Keywords: angiosperm, morphology, cladograms

Introduction

The Fabaceae family is the third largest family of flowering plants. It includes three subfamilies: Mimosoideae, Caesalpinioideae and Faboideae (Anonymous, 2012). Nowadys, it is one of the most diverse families in the world, recognized for its ecological and economic potential; divided into six subfamilies: Caesalpinioideae, Cercidoideae, Detarioideae, Dialioideae, Duparquetioideae and Papilionoideae (APG III, 2009). Gomes *et al.*, (2018) stated that the previous Mimosoideae.

The Mimosoideae included 17 genera and 93 species in the checklist of Myanmar (Kress *et al.* 2003). Langran *et al.* (2010) mentioned that Fabaceae is about 650 genera and 18,000 species worldwide distribution.

Although the researchers have been searching to identify and classify the plants in Hinthada District, the plant collection and identification of this area still left to be studied especially the species under family Fabaceae. Therefore, the present study focused on this area and the flowering plants of family Fabaceae were selected and studied as monograph.

The present study deals with 6 species of dicotyledonous plants under family Fabaceae found in Hinthada District. The 1 subfamily under family Fabaceae are also occurred in the study area. The subfamilies are Mimosoideae.

The objectives of the study are to identify and verify the selected plants of 1 subfamily in family Fabaceae; to catalog the Fabaceae's species occurring in studied area and to elaborate

[1] Demonstrator, Department of Botany, Hinthada University
[2] Demonstrator, Department of Botany, Hinthada University
[3] Demonstrator,Department of Botany,Hinthada University

a floristic list, for the subfamilies Mimosoideae, to construct the cladogram for phylogenetic approach and to give the taxonomical knowledge of studied plants for other researchers.

Materials and Methods

The family characters of studied species were examined by the aid of literatures such as, the families of Flowering Plants (Huchinson, 1959); an integrated system of Classification of Flowering Plants (Cronquist, 1981) and Taxonomy of Vascular Plants (Lawrence, 1951). The collected specimens were thoroughly examined and made taxonomic description with the help of dissecting microscope. Moreover, the hand drawings and the photographs of each specimen were made and presented in this study. Both Myanmar names and English names were confirmed by List of Trees, Shrubs, Herbs and Principal Climbers etc). In this research, the artificial key to the subfamilies, genera and species of the collected plants were constructed according to the style of artificial key mentioned by Flora of China. The Cladograms of each species of 1 subfamily was constructed by using 12 key characters in accordance with Judd *et al.* (2002). Cladogram of 6 species belong to subfamily Mimosoideae were constructed and shown in Figure No.1 and Table No. 1, 2, 3.

The generic names and species names were also arranged alphabetically. For herbarium sheets, all of the collected specimens had been air-dried and pressed according to the plant collection and preservation techniques. After then, the herbarium sheets were stored in the herbarium of Hinthada University for references and other scientific studies.

Results

In this study, a total number of 6 species belong to 4 genera of 1 subfamilies under family Fabaceae were identified and described. The collected species were placed under family Fabaceae, Order Fabales, Class Magnoliopsida (Angiospermae) of Division Spermatophyta. The list of collected species belong to Fabaceae family were found in Hinthada District, Ayeyarwady Region were shown in Table (1).

Table 1. List of the collected species of family Fabaceae in Hinthada District

Sub-families	No.	Scientific Name	Myanmar Name	English Name
Mimosoideae	1	*Acacia auriculiformis* A. cunn ex Benth.	Malaysia paduak	Ear-pod-wattle
	2	*Acacia pennata* (L.) Wild.	Supoke-gyi	Climbing wattle
	3	*Albizia lebbeck* (L.) Benth	Kokko	Unknown
	4	*Albizia procera* (Roxb.) Benth	Sit	White siris
	5	*Leucaena leucocephala* (Lam.) de Wit.	Awaiyar	White lead tree
	6	*Mimosa pudica* L.	Htikayon	Sensitive plant

An artificial key to the four genera of subfamily Mimosoideae

1a. Inflorescences simple racemes

2a. Petals 5 or 4; free or fused; stamens 10 or few, free

3a. Long pedunculated, more than 5.0cm long

4a. Small trees; inflorescences head globular; leaflets not sensitive to touch..... ***Leucaena***

4b. Undershrubs; inflorescences head globular to widely ellipsoid; leaflets sensitive to touch .....***Mimosa***

1b. Inflorescences spikes or panicles

2b. Petals 5, fused; stamens numerous, fused

3b. Shortly pedunculated, less than 5.0 cm long

5a. Inflorescences umbellate head …….. *Albizia*

5b. Inflorescences spikes …….. *Acacia*

An artificial key to the two species of genera *Acacia*

1a. Trees, branchlets without scattered prickles

2a. Leaves simple, phyllodes; flowers light golden, yellow

3a. Pods flat, initially straight, at maturity strongly curved, twisted and irregularly coiled..... ***Acacia auriculiformis***

1b. Climbing shrubs, branchlets with scattered prickles

2b. Leaves bipinnately compound, never phyllode; flowers creamy white

3b. Pods not cartilaginous and twisted at maturity …..... ***Acacia pennata***

1. Subfamily Mimosoideae

1.1. Genus *Acacia* Miller, Gard. Dict. Abr., ed. 4. 1754.

1.1.1. *Acacia auriculiformis* A. Cunn. ex Benth., London J. Bot. 1: 377. 1842.

Myanmar Name	-	Malaysia-pa-dauk
English Name	-	Ear-pod wattle or Australian wattle
Flowering and fruiting period	-	June to February

Evergreen glabrous trees, 25.0-35.0 m tall; acute at the apex, entire along the margin, oblique at the base, alternate, petiolate, stipulate, pulvinate. Inflorescences axillary fasciculate spikes, 5.0-8.5 cm long. Flowers tiny, about 0.5 cm by 0.4 cm, bracteate, sessile, bracteolate, complete, bisexual, regular, actinomorphic, 5-merous, hypogynous, light golden yellow. Calyx 5, tubular, valvate, sepaloid, inferior. Corolla 5, subcampanulate, about 0.3 cm by 0.1 cm, valvate, petaloid, inferior. Stamens numerous, monadelphous; filaments unequal, 0.2-0.3 cm long; anthers dithecous, dorsifixed, longitudinal dehiscence, inferior. Monocarpellary, unilocular, many ovules in the locule, marginal placentation; style short, about 0.3 cm long; stigma simple; gynophore absent, ovary oblongoid, superior. Legumes flattened, 3.2-16.0 cm by 1.0-2.0 cm, Seeds many, flattened, shiny black. The specimens were shown in Plate No. 1.

1.1.2. *Acacia pennata* (L.) Willd., Sp. Pl., ed. 4, 4: 1090. 1806.

***Mimosa pennata* L., Sp. Pl. 1: 522. 1753.**

Myanmar Name	-	Supoke-gyi
English Name	-	Climbing wattle or Rusty mimosa
Flowering and fruiting period	-	March-October (Flowering)
		July to April (Fruiting)

Shrubs, branchlets with scattered prickles. Leaves bipinnately and paripinnately compound, alternate, pinnae 9-20 pairs; leaflets about 31 pairs, acute at the apex, entire along the margin, 1.1-2.0 cm by 0.2 cm; petiolate, stipules of young leaves Inflorescences terminal and axillary panicles with globose heads. Flowers about 0.6 cm by 0.3 cm, bracteate, pedicellate, bracteolate, complete, bisexual, regular, actinomorphic, 5-merous, hypogynous, creamy white. Calyx 5, sub-campanulate, tube 0.2-0.3 cm long, valvate, petaloid, inferior. Corolla 5, campanulate, tube 0.2-0.4 cm long, valvate, petaloid, inferior. Stamens numerous, monadelphous; filaments unequal, white, about 0.3-0.6 cm long; anthers dithecous, dorsifixed, pale yellow, longitudinal dehiscence, inferior. Monocarpellary, unilocular, many ovules in the locule, marginal placentation; style short and curved; stigma simple; gynophore present, ovary oblongoid, superior. Legumes strap-shaped, 10.0-16.0 cm by 2.1-2.6 cm, flattened Seeds 8-12, elliptic, flattened, black. The specimens were shown in Plate No. 2.

An artificial key to the 2 species of genera *Albizia*

1a. Inflorescences simple corymbs and umbellate head 2

2a. Flowers color pink, pedicellate, pods stramineous..... ***Albizzia lebbek***

1b. Inflorescences paniculate and globose head 2

2b. Flowers color white to cream; sessile, pods not stramineous ... ***Albizzia procera***

1.2. Genus *Albizia* Durazz., Mag. Tosc. 3(4): 13. 1772.

1.2.1. *Albizia lebbeck* (L.) Benth., Hook. London J. Bot. 3: 87. 1844.

***Mimosa lebbeck* L., Sp. Pl. 1: 516. 1753.**

Myanmar Name	-	Kokko
English Name	-	Unknown
Flowering and fruiting period	-	May to September (Flowering)
		October to May (Fruiting)

Perennial large deciduous trees, 25.0-30.0 m tall; Leaves bipinnately and paripinnately compound, alternate, pinnae 4-9 pairs; leaflets 3-7 pairs, rounded obtuse at the apex, entire along the margin, cuneate at the base, petiolate, stipulate. Inflorescences terminal and axillary umbellate heads, 15-40 flowered, peduncles 5.5-10.0 cm long. Flowers fascicles on pedunculate heads, 4.0-4.5 cm by 0.3-0.5 cm, bracteate, pedicellate, bracteolate, complete, bisexual, regular, actinomorphic, 5-merous, hypogynous. Calyx 5, tubular, pubescent, valvate, sepaloid, inferior. Corolla 5, campanulate, valvate, petaloid, inferior. Stamens numerous, monadelphous; filaments unequal; anthers dithecous, dorsifixed, introrse, exserted, longitudinal dehiscence, inferior, white and red. Monocarpellary, unilocular, 4 or more ovules in the locule, marginal placentation; style long; stigma simple; gynophore absent, ovary

oblongoid, superior. Pods oblong, straight, the seeds,19.0-28.0 cm by 3.0-5.5 cm. Seeds 4-12, circular to oval, compressed, brown. The specimens were shown in Plate No. 3.

1.2.2. *Albizia procera* (Roxb.) Benth., Hook, London J. Bot. 3: 89. 1844.

***Mimosa procera* Roxb., Pl. Coromandel 2(1): 12, t. 121. 1799.**

Myanmar Name	-	Sit
English Name	-	White siris
Flowering and fruiting period	-	May to September (Flowering)
		September to February (Fruiting)

Deciduous trees, 3.0-18.0 m tall. Leaves bipinnately and paripinnately compound, alternate, pinnae 3-5 pairs; leaflets 6-12 pairs1.6-3.7 cm by 1.3-2.0 cm, obtuse or emarginate at the apex, entire along the margin, oblique at the base; petiolate, stipulate, petiolulate, pulvinate. Inflorescences terminal and axillary paniculate heads, many flowered. Flowers about 1.5 cm by 1.1 cm, bracteate, sessile, bracteolate, complete, bisexual, regular, actinomorphic, 5-merous, hypogynous, creamy white. Calyx 5, tubular, about 0.4 cm by 0.1 cm, valvate, sepaloid, inferior. Corolla 5, campanulate, about 0.6 cm by 0.2 cm, valvate, petaloid, inferior. Stamens numerous, monadelphous; filaments unequal, about 1.4 cm long, slender; anthers dithecous, dorsifixed, introrse, exserted, longitudinal dehiscence, inferior. Monocarpellary, unilocular, many ovules in the locule, marginal placentation; style short; stigma simple; gynophore absent, ovary oblong, glabrous, superior. Legumes flattened, 10.0-25.0 cm by 1.2-3.0 cm, Seeds many, compressed, brown. The specimens were shown in Plate No. 4.

1.3. Genus *Leucaena* Benth., J. Bot. (Hooker) 4: 416. 1842, nom. cons.

1.3.1. *Leucaena leucocephala* (Lam.) de Wit., Taxon. 10: 54. 1961.

***Mimosa leucocephala* Lam. Encycl. 1: 12. 1783.**

Myanmar Name	-	Awaiyar
English Name	-	White lead tree
Flowering and fruiting period	-	April to July (Flowering)
		August to October (Fruiting)

Small trees, 2.0-4.0 m tall. Leaves bipinnately and paripinnately compound, alternate, pinnae 9 pairs; leaflets 18 pairs, 0.9-1.4 cm, acute at the apex, ciliate along the margin, cuneate at the base; rachis 2.3-3.4 cm long; petiolate, stipulate, petiolulate, pulvinate. Inflorescences axillary globular heads, peduncle about 20.0-65.0 cm long, glabrous. Flowers about 1.1 cm by 0.5 cm, ebracteate, sessile, ebracteolate, bisexual, complete regular, actinomorphic, 5-merous, hypogynous, creamy white. Calyx 5, campanulate, valvate, sepaloid, inferior. Petals 5, apopetalous, about 0.3 cm by 0.1 cm, valvate, petaloid, inferior. Stamens 10, apostemonous; unequal, about 0.6–0.8 cm long anther; dithecous, dorsifixed, introrse, exserted, longitudinal dehiscence, inferior. Monocarpellary, unilocular, marginal placentation; style filiform and short; stigma capitate; gynophore present, ovary oblongoid, pubescent, superior. Legumes flattened, 11.2-14.6 cm by 1.9–2.1 cm, green. Seeds 6-25, flattened, glossy dark green; pleurogram present. The specimens were shown in Plate No. 5.

1.4. Genus *Mimosa* L., Sp. Pl. 1: 516. 1753.

1.4.1. *Mimosa pudica* L., Sp. Pl. 1: 518. 1753.

Myanmar Name - Htikayon

English Name - Sensitive plant or sleepy plant

Flowering and fruiting period - Throughout the year

Undershrubs, 0.5-1.0 m high, thorny. Leaves sensitive, bipinnately and paripinnately compound, alternate, pinnae 2 pairs; leaflets 10-20 pairs, opposite, linear-lanceolate, 0.3-0.7 cm by 0.1-0.6 cm, acute at the apex, ciliate along the margin, rounded at the base, glabrous above, petiolate, thorny stipules, petiolulate, pulvinate. Inflorescences axillary globular heads. Flowers small, long pedunculate, 0.3 cm in diameter across at anthesis, bracteate, sessile, bracteolate, complete, bisexual, regular, actinomorphic, 4-merous, hypogynous, red. Calyx 4, very minute, campanulate, valvate, sepaloid, inferior. Corolla 4, campanulate, valvate, petaloid, inferior. Stamens 4, apostemonous; filaments pinkish red, long and curved; anthers pale yellow, dithecous, dorsifixed, exserted, longitudinal dehiscence, inferior. Monocarpellary, unilocular, 2-4 ovules in the locule, marginal placentation; style curved and filiform; stigma simple; gynophore absent, ovary ovoid, glabrous, superior. Legumes oblong, 0.8-1.4 cm by 0.2-0.3 cm, slightly recurved, flattened 1margin persistent. Seeds 2-4, subcircular to ovoid, flattened, light brown. The specimens were shown in Plate No. 6.

Table 2. Comparable taxa and character states of 6 species in subfamily Mimosoideae

Characters / Taxa	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
A	Trees	-	Simple	Glabrous	Oblongoid Spikes	-	Synpetalous	Monadelphous	Numerous	-	Pubescent	Many
B	Shrubs	+	Bipinnately compound	Glabrous	Globose head	-	Synpetalous	Monadelphous	Numerous	+	Pubescent	Many
C	Trees	-	Bipinnately compound	Pubescent	Umbellate head	-	Synpetalous	Monadelphous	Numerous	-	Glabrous	Many
D	Trees	-	Bipinnately compound	Pubescent	Paniculate head	-	Synpetalous	Monadelphous	Numerous	-	Glabrous	Many
E	Small trees	-	Bipinnately compound	Glabrous	Globose head	-	Apopetalous	Free	10 (few)	+	Pubescent	Few
F	Under - shrubs	+	Bipinnately compound	Pubescent	Globose heads	+	Synpetalous	Free	4 (few)	-	Glabrous	Few
Outgroups	Trees	Branchlets with prickles (+)	Leaves Simple	Leaflets glabrous	Spikes	Leaflets sensitive (-)	Apopetalous	Stamens free	Stamens numerous	Gynophore (+)	Ovary glabrous	Seeds many

A – *Acacia auriculiformis* A. Cunn. ex Benth.
B – *Acacia pennata* (L.) Willd.
C – *Albizia lebbeck* (L.) Benth.
D – *Albizia procera* (Roxb.) Benth.
E – *Leucaena leucocephata* (Lam.) de Wit.
F – *Mimosa pudica* L.

I - Habit
II - Branchlets with prickles (+)/(-)
III - Leaves type
IV - Leaflets glabrous/pubescent
V - Inflorescences type
VI - Leaflets sensitive (+)/(-)
VII - Apopetalous/synpetalous
VIII - Stamens free/adelphous
IX - Stamens number
X - Gynophore (+)/(-)
XI - Ovary glabrous/pubescent
XII - Seeds number

Table 3. Representation of primitive and derived characters of comparable taxa and character data matrix of 6 species in subfamily Mimosoideae

Characters / Taxa	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total
A	0	1	0	0	0	0	1	1	0	1	1	0	5
B	2	0	1	0	1	0	1	1	0	0	1	0	7
C	0	1	1	1	1	0	1	1	0	1	0	0	7
D	0	1	1	1	1	0	1	1	0	1	0	0	7
E	1	1	1	0	1	0	0	0	1	0	1	1	7
F	3	0	1	1	1	1	1	0	1	1	0	1	11

A – *Acacia auriculiformis* A. Cunn. ex Benth.
B – *Acacia pennata* (L.) Willd.
C – *Albizia lebbeck* (L.) Benth.
D – *Albizia procera* (Roxb.) Benth.
E – *Leucaena leucocephata* (Lam.) de Wit.
F – *Mimosa pudica* L.

I - Habit
II - Branchlets with prickles (+)/(-)
III - Leaves type
IV - Leaflets glabrous/pubescent
V - Inflorescences type
VI - Leaflets sensitive (+)/(-)
VII - Apopetalous/synpetalous
VIII - Stamens free/adelphous
IX - Stamens number
X - Gynophore (+)/(-)
XI - Ovary glabrous/pubescent
XII - Seeds number

A B C D

A. Habit B. Inflorescences C. Flower as seen D. T.S of ovary

Plate 1. *Acacia auriculiformis* A. Cunn. ex Benth.

A B C D

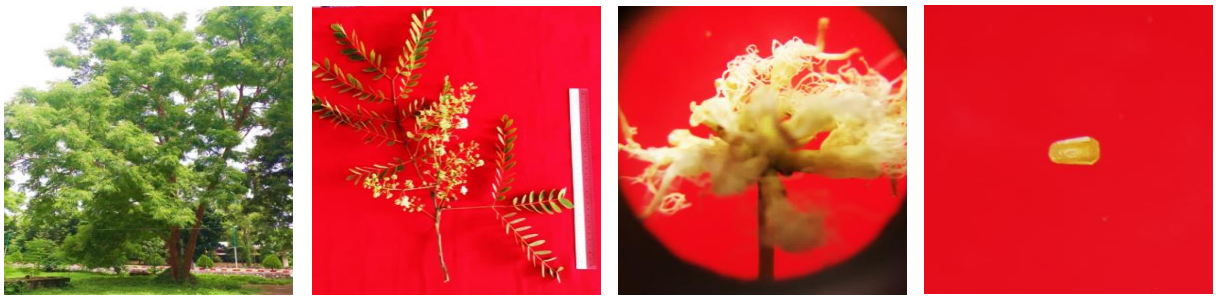
A. Habit B. Inflorescences C. Flower as seen D. T.S of ovary

Plate 2. *Acacia pennata* (L.) Willd.

A B C D

A. Habit B. Inflorescences C. Flower as seen D. T.S of ovary

Plate 3. *Albizia lebbeck* (L.) Benth.



A B C D

A. Habit B. Inflorescences C. Flower as seen D. T.S of ovary

Plate 4. *Albizia procera* (Roxb.) Benth.

A B C D

A. Habit B. Inflorescences C. L.S of flower D. T.S of ovary

Plate 5. *Leucaena leucocephala* (Lam.) de Wit.

A B C D

A. Habit B. Inflorescences C. Flower as seen D. L.S of flower E. L.S of fruit

Plate 6. *Mimosa pudica* L.

Table 4. All the matching coefficients represented in a data matrix of 6 species in subfamily Mimosoideae

	A	B	C	D	E	F
A	-					
B	0.7	-				
C	0.8	0.7	-			
D	0.8	0.7	1.2	-		
E	0.4	0.6	0.4	0.4	-	
F	0.2	0.4	0.6	0.6	0.5	-

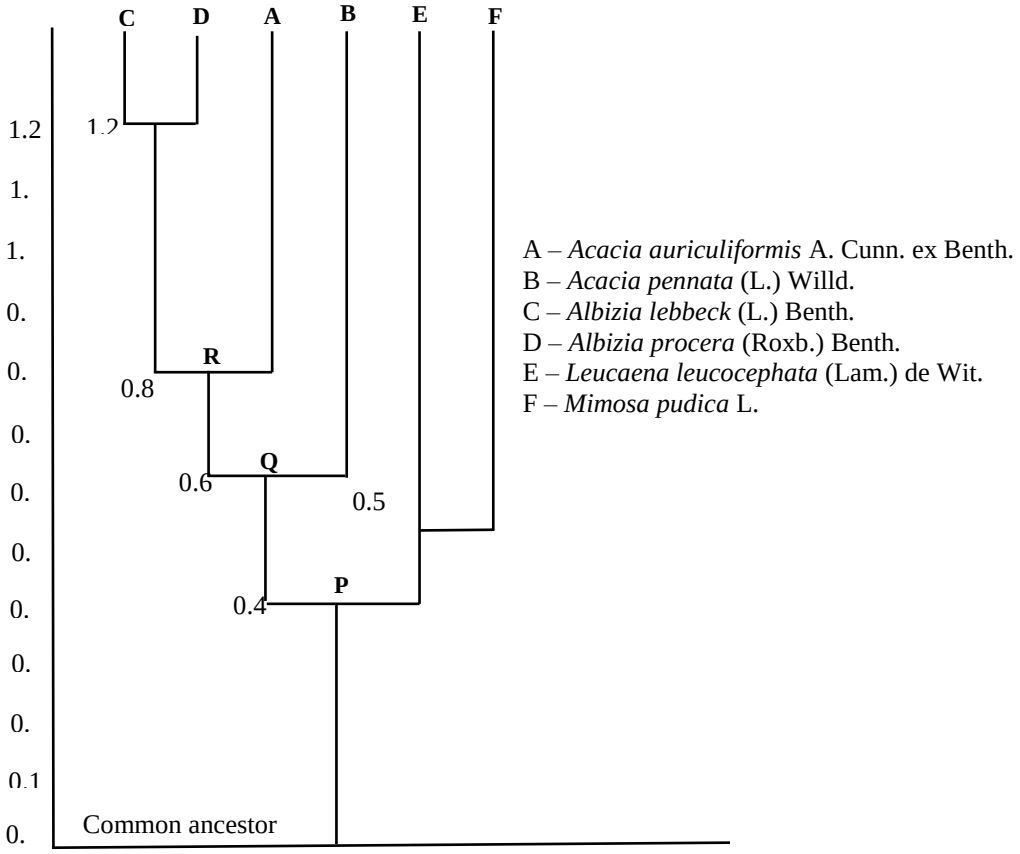


Figure 1. Construction of Cladogram of 6 species in subfamily Mimosoideae

Discussion and Conclusion

The present research work deals with the taxonomic study on Fabaceae family found in Hinthada District, Ayeyarwady Region. In this study, the collected specimens including 6 species were described and that of 4 genera, 1 subfamily have been undertaken. It was observed that 2 species were wild and 4 species cultivated. *Leucaena leucocephala*, *Mimosa pudica*, were wild species and Acacia auriculiformis, Acacia pennata, Albizia Lebbeck, Albizia procera were cultivated ones in the study area.

The subfamily *Mimosoidae* included 6 species of 4 genera, and then it has been considered to be the smallest.

In subfamily Mimosoideae, it was observed that 6 species derived from a common ancestor denoted that the point P. *Mimosa pudica* and *Leucaena leucocephala* were autapomorphies because of the derived character states of character No. I, III, V, VIII, IX, XIII that differ from the other species. Therefore, the two species *Mimosa pudica* and *Leucaena leucocephala* restricted from the other species. However, *Mimosa pudica* derived from *Leucaena leucocephala* because of the derived character state of character No. I. *Acacia auriculiformis* and *Acacia pennata* were synapomorphies because of the derived character states of character No. VII, VIII, XI that were the same and the others were different by using the selection of 12 key characters. Therefore, the genus *Acacia* included same character states and the species possessed different character states. In addition, *Albizia procera* and *Albizia lebbeck* were synapomorphies because of the derived character states that were the same by using the selection of 12 key characters. Therefore, the genus *Albizia* included same character states.

It was observed that 3 monophyletic groups in subfamily Mimosoidae could be delimited from the Cladogram of Figure No. 1. Each of the two descent linkages from one common ancestor (P), which called sister groups. The sister group pairs of Figure No. 1 were the taxa F, E and B, A, D, C (first pair group); B and A, D, C (second pair group); A and D, C (third pair group). The taxa E and F, *Leucaena leucocephala* and *Mimosa pudica* were paraphyletic that consists of a common ancestor (P) and but not all, known descendants of that ancestor. Then, *Mimosa pudica* derived from *Leucaena leucocephala*. The taxa E and F group contains a common ancestor (P) and the lineage was leading to the taxa B, A, C, D. Because it had left out two taxa E and F, which also descends from common ancestor (P). Moreover, taxa C and D, *Albizia lebbeck* and *Albizia procera*, alone could be interpreted as polyphyletic as these two taxa did not have a single common ancestor that is part of the group. The taxa C and D, *Albizia lebbeck* and *Albizia procera*, had 3 common ancestors denoted that the points R, Q, P.

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