

## STUDY OF MOUNTAIN WILD GRASSES IN LOILEM DISTRICT, SOUTHERN SHAN STATE

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### Abstract

Grass belong to family Poaceae (Gramineae) and the one of the largest family in monocotyledon gramineous flowering plants. Grass taxonomy is very differ and difficulty from other flowering plants. Altogether 15 species, 13 genera, 8 tribes, 4 subfamilies in family Poaceae were collected from Loiem district of Southern Shan State of Myanmar, flowering time from 2018 to 2019. The habitat, underground portions, vegetative and reproductive parts of collected species were presented with photograph records. The whole plant portions are classified, identified, verified and evolutionary status by principles author citations of vegetative and reproductive characters. This paper highlights the modified differences characteristics and evolutionary trends of wild mountain grasses in Loilem district of Southern Shan State.

**Keywords:** Grasses taxonomy, evolution, main fodder, natural resources, soil stabilization

### Introduction

The grass family Poaceae represent the fifth largest of flowering plant families. The study species were collected in some area of Southern Shan State, especially the study area was divided into Pang Long, Laichia, Loilem, Nansann and Sannin. The study area are located between 21°11'20" N and 97°54'42" E longitude at an elevation about 2147 m (6444 ft.). According to Halfliger and Scholz's classification (1981), grasses are divided into 5 subfamilies; Bambusoideae, Pooideae, Panicoideae, Chloridoideae and Oryzoideae based on the morphological characters of spikelet (flowers) and vegetative structures. Among them 4 subfamilies are recorded, except subfamily Bamboosoideae.

Subfamily Pooideae comprises 6 species, 4 genera and 4 tribes. Genus *Arundinella* in Tribe Arundinellae, genus *Koeleria* in Tribe Aveneae, Genus *Cortaderia* in Tribe Arundineae and genus *Poa* in Tribe Festuceae. Genus *Poa* is type genus of Family Poaceae (Bor 1960). 3 species of *Arundinella hirmanica* Hook, *A. pumila* (Hochst) Steut and *A. setosa* Trin in genus *Arundinella* in Tribe Arundinellae. 1 species of *Koeleria* spp. in genus *Koeleria* in Tribe Aveneae, 1 species of *Cortaderia selloana* in genus *Cortaderia* of Tribe Arundineae and 1 species of *Poa annua* L. in genus *Poa* of Tribe Festuceae. The distinct characters of subfamily Pooideae is 1 to many flowers and usually empty glume provide many flowering glumes (lemma, palea)

Subfamily Panicoideae includes 7 species, 7 genera and 2 Tribes. 3 genera of *Themeda*, *Imperata* and *Schizachyrium* belong to Tribe Andropogoneae. 1 species of *Themeda villosa* (Poir.) Camus in genus *Themeda*, 1 species of *Imperata cylindrica* (Linn.) P.Beauv. in genus *Imperata* and 1 species of *Schizachyrium scoparium* (Michx.) Nash in genus *Schizachyrium*. 4 genera of *Echinochloa*, *Urochloa*, *Rhynchelytrum* and *Axonopus* in Tribe Paniceae. 1 species of *Echinochloa crus-pavonis* (H.B.K.) in genus *Echinochloa*, 1 species of *Urochloa panicoideae* P.B. in genus *Urochloa*, 1 species of *Rhynchelytrum repens* (Willd.) Hubb. in genus *Rhynchelytrum* and 1 species of *Axonopus affinis* Chase in genus *Axonopus*. This subfamily distinct characters are 1 to 2 exactly flowered numbers.

1 genus of *Cynodon dactylon* (Linn.) Pers. includes in Tribe *Eragrosteae* of subfamily Chloridoideae. This subfamily distinct characters are 1 to many and usually dwarf tuft culm. 1 genus of *Leersia hexandra* Swartz comprises in Tribe Oryzeae of subfamily Oryzoideae. The distinct characters of this family is always hard crustaceous flowering glumes with awn or awn

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less. These 15 species of wild grass were used in various purposes especially main fodder for cattle in survey region. Wild grasses provide for soil stabilization in survey area as destroy soil erosion by various process. This research highlights differences morphological characters of mountain wild grasses, uses for cattle fodder, soil stable condition, and it is using in various material for native region, Myanmar.

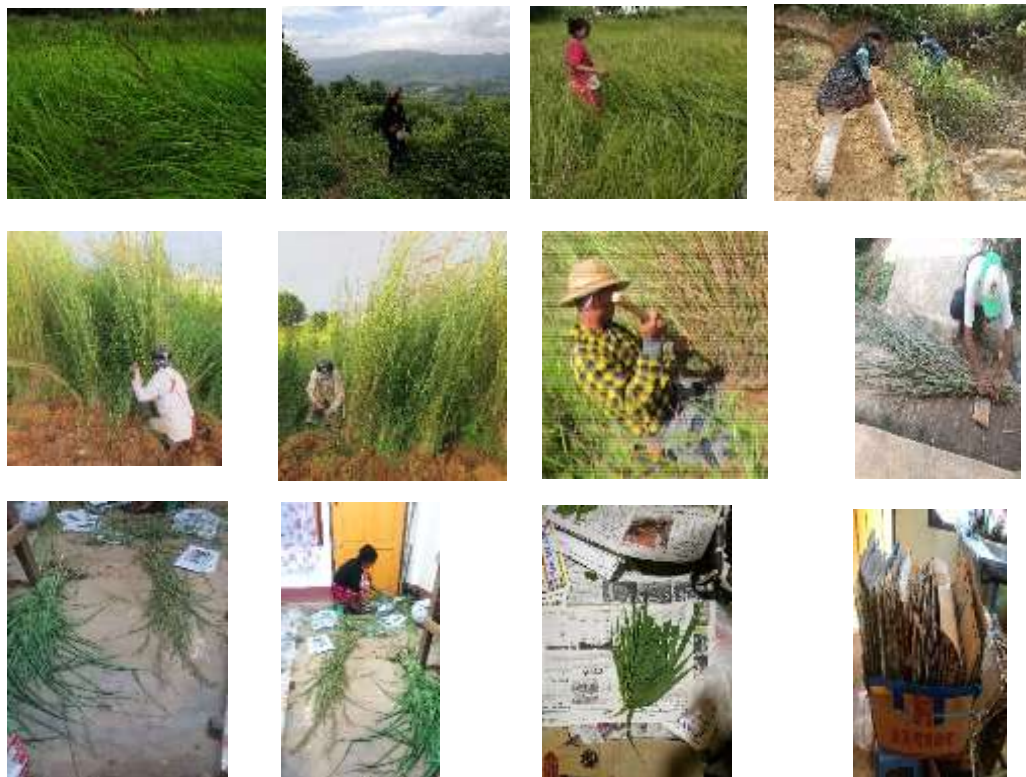
## Materials and Methods

### Collection Procedure

Specimens were collected from some area of Southern Shan State during flowering time from 2018 to 2019.

### Classification, Identification, Verification and Evolutionary Trends

The morphological of grass was classified according to Halfliger and Scholz's classification (1981) that based upon the morphological characters. The identification, verification and evolutionary trends were done by using keys, principles of many author citations; Hooker; 1897, Rhind, 1945; Stebbin, 1956; Bor, 1960; Clayton, 1977; Halfliger, 1981; Hundley, 1987; Willis, 2002, APG III, 2014.



**Figure 1** Collection procedure

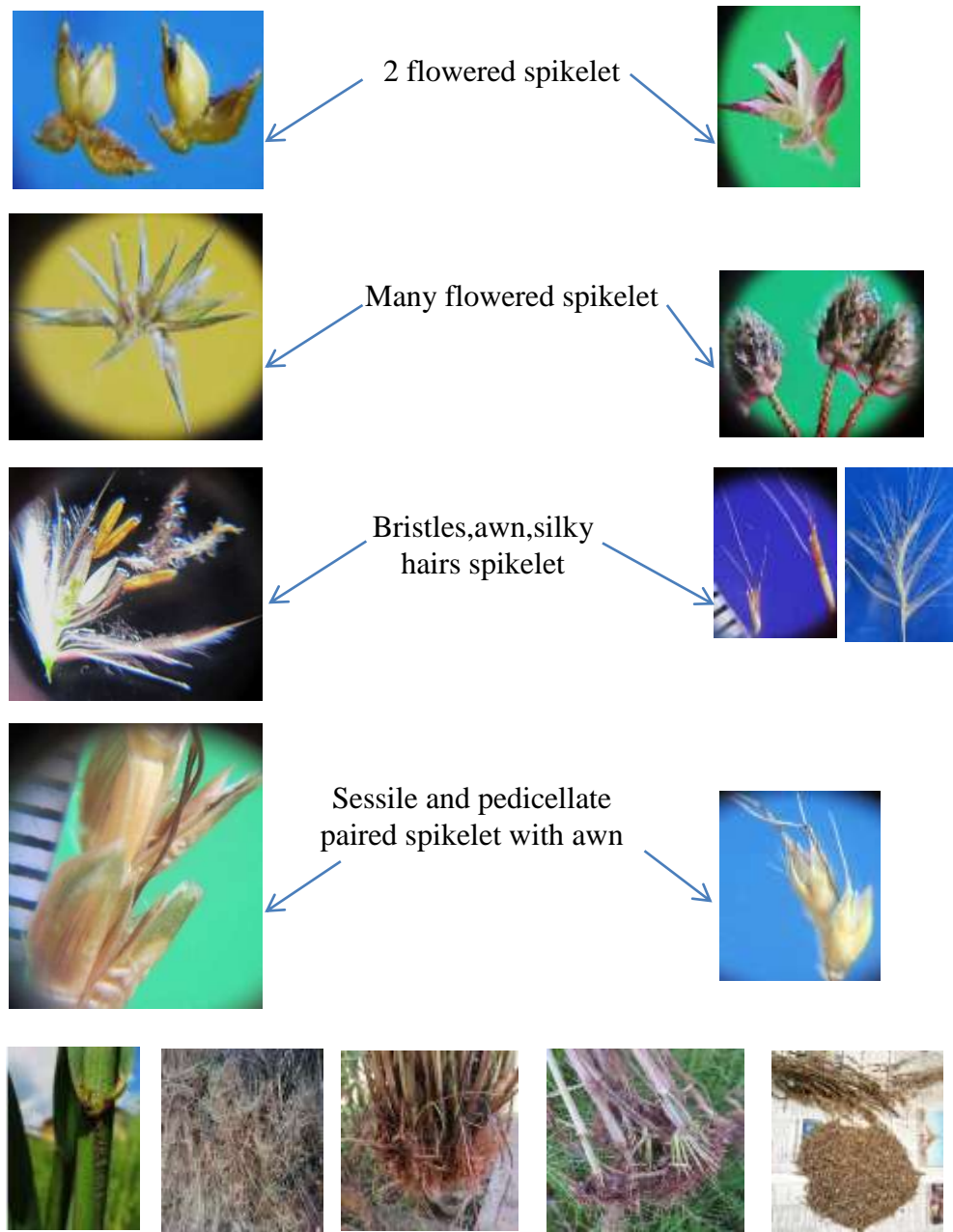
## Results

### Morphology of Grass

#### Spikelet structure

The spikelet is the unit of inflorescences. It can be differentiated into 1 to 2 flowered and 1 to many flowered spikelet. Spikelet comprises glumes. The basally outer 2 glumes is lower empty

glume and upper empty glume. The flowering glumes; outer lemma and inner palea arrange the above of empty glumes. All glumes may be various modified characters etc. texture, silky hairs, bristles and awns.



**Figure 2** Basic morphology of grass

- I. Subfamily - Pooideae
- 1. Scientific Name - *Arundinella hirmanica* Hook.
- Myanmar Name - Kyu – yaing



Habit, prop root,



Inflorescence, spikelet, grain



Florets

**Figure 3** *Arundinella hirmanica* Hook.

**Distinct characters:** Strongly tall over 1m , culm like small bamboo,inflorescence very large open panicle, spikelet cluster on rachis ,readily fragile, florets 2; lower neuter; upper bisexual, grain likely to rice, grain are used for important fodder for cattle in army of survey area. (Southern Shan State)

- 2. Scientific Name - *Arundinella pumila* (Hochst) Steut
- Myanmar Name - Kaing



Habit, rhizome, ligule



Inflorescences, spikelets, florets

**Figure 4** *Arundinella pumila* (Hochst) Steut



**Distinct characters:** strongly reed like tall culm, rhizome system, inflorescences very large open plumose panicle, spikelet cluster , very small, bristle numerous, florets 4 - 6 , lowest to middle floret perfect, the upper most neuter, inflorescences are used for cleaning material. (Southern Shan State)

**3. Scientific Name - *Arundinella setosa* Trin.**

**Myanmar name - Kyu**



Habit                      inflorescences                      rhizome                      ligule                      Florets

**Figure 5 *Arundinella setosa* Trin.**

**Distinct characters:** Strongly reed tall culm, rhizome system, inflorescences very large plumose open panicle, spikelet paired, slender, florets 3-5, lowest fertile, middle to upper most sterile, inflorescences are used for cleaning material. (Southern Shan State)

**4. Scientific Name - *Koeleria* spp.**

**Myanmar Name - Nil**



Habit, root, inflorescences

**Figure 6 *Koeleria* spp.**

**Distinct characters:** strongly grow on hilly side culm, roots firmly to soil, inflorescences dense like racemes, spikelet dense on rachis, florets 14 - 23. Widely distributed on hilly side, so they prevent for hilly road erosion condition. (Southern Shan State)

5. Scientific Name - *Cortaderia selloana* (Schult.) Asschers et Graebn

Myanmar Name - Kaing



Habit, rhizome



Inflorescences, florets

Figure 7 *Cortaderia selloana* (Schult.) Asschers et Graebn

**Distinct characters:** Reed - like culm, distinctly wide lanceolate – ovate leaves, inflorescences large loosely open panicle, spikelet crowded at the rachis node, spikelet paired or more, florets 5- 6; lowest to middle fertile and the upper most usually neuter. This species is used for washing material in region. (Southern Shan State)

6. Scientific Name - *Poa annua* L.

Myanmar Name - Myet- mwer



Habit

roots

draft culm

inflorescences



Spikelet

florets

Figure 8 *Poa annua* L.

**Distinct characters:** culm very small and up to 16 cm high, inflorescences densely narrow racemes, spikelet densely alternate on narrow rachis, florets 18 - 23 ; all flowers usually fertile.(Southern Shan State)



**II. Subfamily Panicoideae**

**7. Scientific Name - *Themeda villosa* (Poir.) Camus**

**Myanmar Name - Myet – sawe- lai**



Habit, rhizome



Bulb, inflorescences

**Figure 9** *Themeda villosa* (Poir.) Camus

**Distinct characters:** strongly tall culm, rhizome and bulb distinct, inflorescences large spike like raceme and down ward to ground, involucre bract strongly cover to spikelet, spikelet paired, florets 2, lower and upper fertile. Underground part used in traditional medicine.

(Southern Shan State).

**8. Scientific Name - *Imperata cylindrica* (Linn.) P. Beauv.**

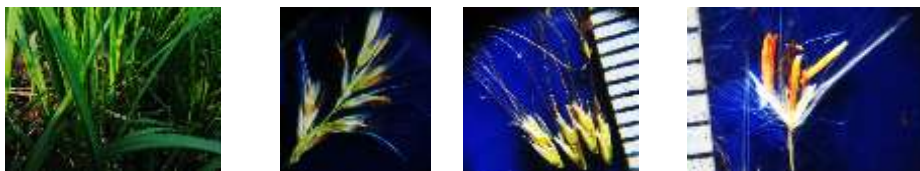
**Myanmar Name - Kyet - mei, Dawn-mei-pyan**



Habit

inflorescences

rhizome



Sharply leaves

spikelet

florets

**Figure 10** *Imperata cylindrica* (Linn.) P. Beauv

**Distinct characters:** medium tall culm, very strongly rhizome and invasive alien species, inflorescence densely silky cylindrical panicle, spikelet very long lightly with silky bristles, florets 2, lower male or neuter ; upper fertile, very exotic species and especially readily invasive to surrounding species by their rhizome and lightly flowers. (Southern Shan State)

9. Scientific Name - *Echinochloa crus – pavonis* (H.B.K.)

Myanmar Name - Myet –let –thae



Habit



roots



inflorescences



Spikelet



florets



**Figure 11** *Echinochloa crus – pavonis* (H.B.K.)

**Distinct characters:** Aquatic invasive species, mediate tall, rigid culm, inflorescences densely spike like receme, awn like empty and flowering glumes, florets 2, lower male and upper fertile. This species is very distrub to rice field. (Southern Shan State)

10. Scientific Name - *Urochloa panicoides* P.B.

Myanmar Name - Nil



Habit



inflorescences



rhizome



ligule



spikelet



florets

**Figure 12** *Urochloa panicoides* P.B.

**Distinct characters:** Aquatic spongy tall culm, rhizomatous to stoloniferous, inflorescences spike like raceme, dense alterately arrange spike , spikelet sunken in rachis, spikelet paired or triad, florets 2, lower male; upper fertile. This species is very useful for cattle fodder and it is buying in raining season for fodder. ( Southern Shan State)

11. Scientific Name - *Rhynchelytrum repens* ( Willd.) Hubb.

Myanmar Name - Nil



Habit



Stoloniferous



roots



inflorescences

**Figure 13** *Rhynchelytrum repens* ( Willd.) Hubb



**Distinct characters:** Small stoloniferous roots culm, inflorescences raceme like plumose panicle, pinkish to red spikelets cluster; spikelets 6 - 15 florets, lowest to uppermost fertile with plumose bristles, readily broken on rachis. This species is so graceful and growing on hilly side reddish color muddy soil.( Southern Shan State)

**12. Scientific Name - *Schizachyrium scoparium* ( Michx.) Nash**

**Myanmar Name - Yasa- myet**



Habit, inflorescences, rhizome



Spikelet, floret

**Figure 14** *Schizachyrium scoparium* ( Michx.) Nash

**Distinct characters:** reed like culm, strongly roots, inflorescences spike like raceme with distinct involucre bract, spikelet paired, florets 2; lower and upper florets fertile with involucre bracts. This species leaves is aromatic and used for fodder. (Southern Shan State)

**13. Scientific Name - *Axonopus affinis* Chase**

**Myanmar Name - Nyet-daw –ni**



Habit inflorescences rhizome spikelet florets

**Figure 15** *Axonopus affinis* Chase

**Distinct characters:** small landscaping grass, strongly rhizome, inflorescences digitately arrange, spikelet alterately arranged sunken in flattened rachis, florets 2; lower floret neuter, upper fertile. This grass is important as a landscaping lawngrass in Myanmar.( Southern Shan State )

### III. Subfamily Chloridoideae

14. Scientific Name - *Cynodon dactylon* (Linn.) Pers

Myanmar Name - Myesa- myet

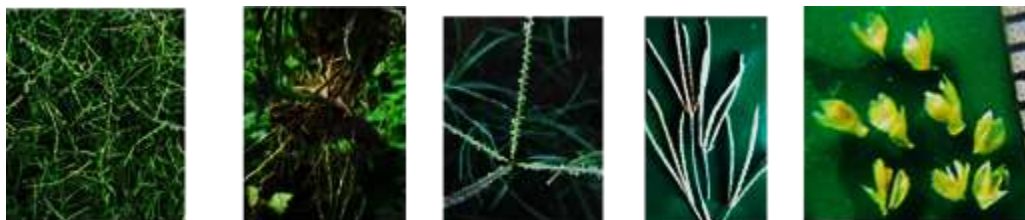


Figure 16 *Cynodon dactylon* (Linn.) Pers

**Distinct characters:** culm small stoloniferous, inflorescences digitate, spikelet sunken in rachis, floret 1 : fertile, glumes crustaceous. This species is land habitat and if they grow near the aquatic is used as traditional species in spirit . (Southern Shan State)

### IV. Subfamily - Oryzoideae

15. Scientific Name - *Leersia hexandra* Swartz

Myanmar name - Thaman-myet



Figure 17 Oryzoideae

**Distinct characters:** Aquatic small culm, mix grow in rice field, inflorescences spike like raceme, spikelet alterately arrange sunken in rachis, floret 1, fertile, very closely affinity to *Oryza*. This species is eaten by birds but this mature ovary like *Oryza*. ( Southern Shan State)

### Evolutionary Trends Based on Principles Morphology Characters of Grasses for 4 Subfamilies

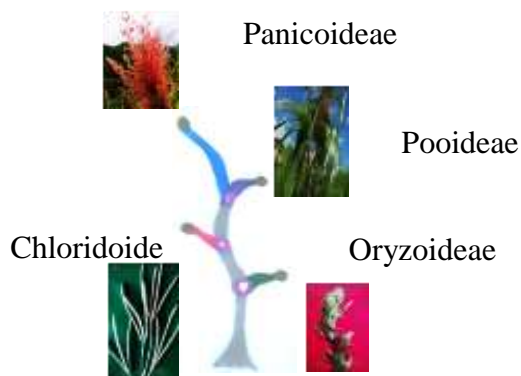
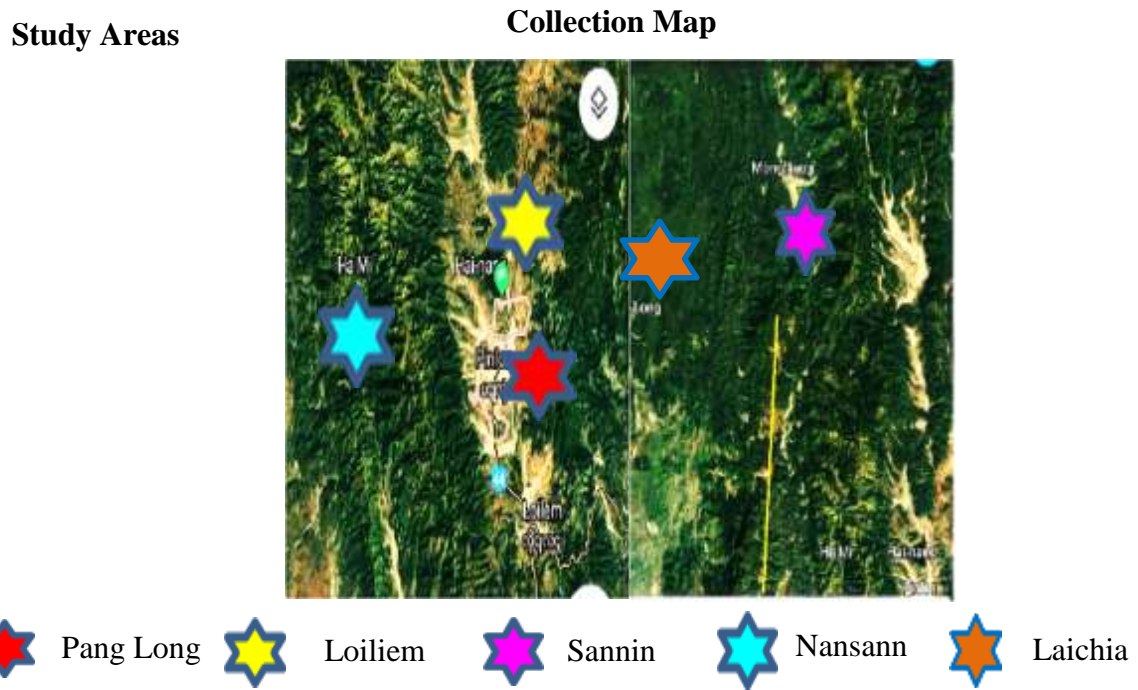
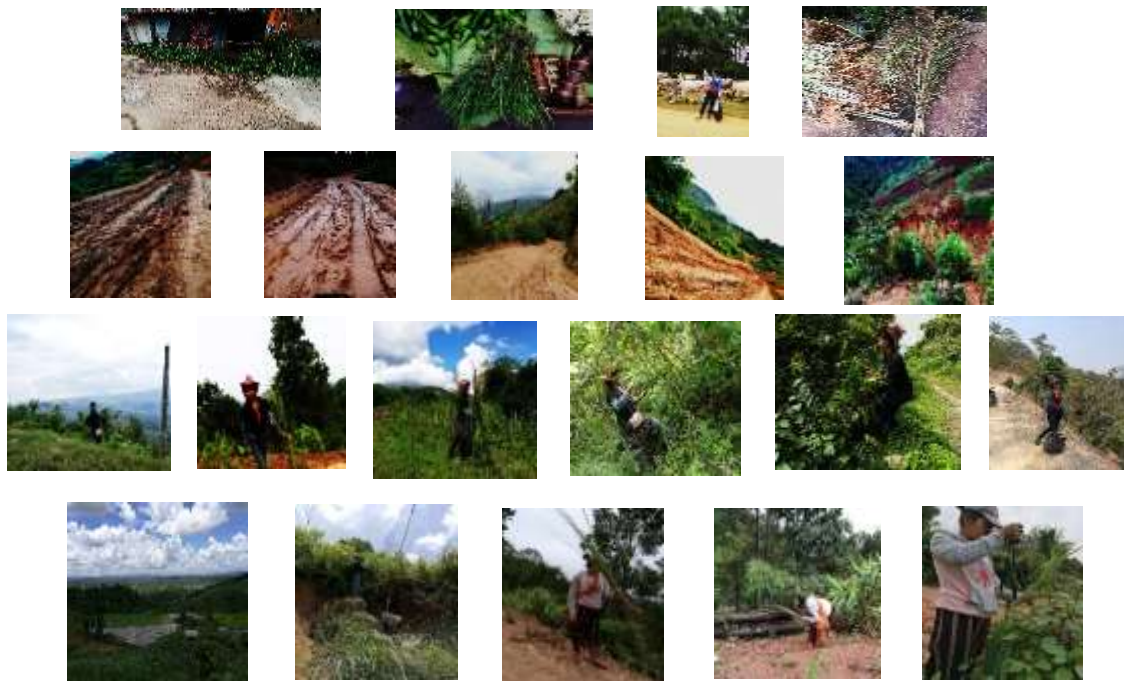


Figure 18 Evolutionary Trends Based on Principles Morphology Characters of Grasses for 4 Subfamilies



**Figure 19** Collection Map

**Useful of Wild Grasses for Main Natural Resources Fodder and Status of Survey Areas**



**Figure 20** Useful of Wild Grasses for Main Natural Resources Fodder and Status of Survey Areas



## Discussion and Conclusion

All grasses are belong to the family Poaceae (graminae) in Order Poales (Bor 1960). In this present study 15 species, 13 genera, 8 tribes and 4 subfamily are systematicallly arranged according to Halfliger and Scolz's classification (1981). The most distributed number of species included in subfamily Panicoideae. Tribe Paniceae is more abundant than tribe Andropogoneae in this subfamily. Genera of *Echinochloa*, *Urochloa*, *Rhynchelytrum* and *Axonopus* in trbe Paniceae are usually perfect fertile florets with modified glume texture and rhizomatous advance characters. *Echinochloa crus – pavonis* (H.B.K.) comprises awned flowering glume. *Rhynchelytrum repens* (Willd.) Hubb. possess bristles like advance features for species distribution. *Urochloa panicoides* P.B. have densely stiff hairs with leaf-sheath, all perfet florets fertile. *Axonopus affinis* Chase. comprises firmly strong rhizomatous with stoloniferous culm and it has exactly upper fertile floret. These are gradually adaptation from simplicity to complexity of modified characters and more resistant to all natural conditions. In tribe Andropogonneae, Genus *Themeda* and *Schizachyrium* are modified very distict involucre bracts with their inflorescences and each floret. The floret glumes with densely bristles in *Themeda villosa* (Poir.) Camus while *Schizachyrium scoparium* (Michx.) Nash with silkly like hairs. Both genera with long distint awns in flowering glumes and empty glumes. Moreover all glumes texture are crustaceous that is advance modification for adaptation in reproductive structures covering for sexual organs. Genus *Imperata cylindrica* (Linn.) P. Beauv. is strongly dominant in survey area as their lightly spikelet with dense silkly hairs and this genus is invasive alien species in Myanmar. All species of subfamily Panicoideae are mainly for fodder and *Axonopus affinis* Chase. is widely useful for lawngrass. All of modified advance characters are more occur in their including respectively species of this subfamily Panicoideae.

The second large number subfamily Pooideae include reed - like arborescent characters to small dwarf culm habit. Genus *Arundinella* in tribe Arundinellae is more number than other genus. *Arundinella hirmanica* Hook. is very arborescent tall grass and up to 1m inflorescences with very perfect spikelet and cultivated for cattle fodder in army for domatic animals. *Arundinella pumila* (Hochst) Steut. grow on hilly side and very distint bristle of flowering glumes. These bristles are advance mechanisms for spikelet distribution. *Arundinella setosa* Trin. is growing on hilly side to downward side position and their spikelet comprises many floret with awns. This genus is very firmly for to native soil stabilization of hilly side and control adaptation to environmet status. All of 3 species are widely used in cleaning material for buying economic market in region, Myanmar. Genus *Koeleria* spp. in tribe Aveneae grow hilly side region and their distribution by densely arrange fertile spikelet structures. Genus *Cortaderia selloana* (Schult.) Asschers et Graebn in Tribe Arundineae grow on hilly downside and very plumose inflorescence It is possess broader leaf blade arrange in based of culm and it's infloresceces are very useful for cleaning material for daily uses in region. Genus *Poa* in tribe Fescuteae is type genus of family Poaceae and dense strongly taft dwarf habit. Their florets are many fertile and distrbuted by fertile mature seeds as their flowering time is very quickly and early mature. Advance modify characters of subfamily Pooideae is sencond evolutionary status in survey region. Therefore subfamily Panicoideae are more advance taxonomic charcters than subfamily Pooideae.

Genus *Cynodon dactylon* (Linn.) Pers includes in tribe Eragrosteae of subfamily Chloridoideae is exactly 1 fertile floret with advance their strongly stoloniferous culm structure. This genus has all spikelets are fertile with advance all glumes crustaceous characters and third evolutionary status modify structures species. This is used in traditional spirit plant in some native Myanmar.

Genus *Leersia hexandra* Swartz comprises in tribe Oryzeae of subfamily Oryzoideae is very affinity to genus *Oryza* by their crustaceous texture flowering glumes and stamens number 6.

But *Leersia* have not empty glumes while *Oryza* with empty glumes. The rest 3 subfamilies have 3 stamens. 6 stamens occur in subfamily Oryzoideae. This is the most primitive stamen characters than 3 stamens subfamilies. Subfamily Oryzoideae is the most primitive status than the rest 3 subfamilies. According to conclusion, the most advance evolutionary status is subfamily Panicoideae the second is subfamily Pooideae and then the subfamily Chloridoideae. The most primitive is subfamily Oryzoideae. Therefore, this research highlights the significance role of grasses are important for main natural resources of fodder livestock, daily uses material for humanity, provide soil stabilization and balance environment status, evolutionary trends in region, Myanmar.

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