

Diversity of Araceae in Mae Takhray National Park, Chiang Mai Province in Thailand

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Abstract— Araceae species were surveyed by strip plots width 10 m along the two nature trails in Mae Takhray National Park, Chiang Mai Province in Thailand, 1) Mae Takhray Reservoir Nature Trail in Amphoe Mae On, distances 4 kilometres (km), at 500-700 meters above mean sea level (m amsl), and 2) Park Head Office Nature Trail in Amphoe Doi Saket, distance 3 km, at 400-700 m amsl, during January 2016 to February 2018. Twelve species in seven genera were recorded; *Amorphophallus* 4 species, *Alocasia* and *Rhaphidophora* 2 species each, *Colocasia*, *Hapaline*, *Homalomena* and *Lasia* had only one species in each. Wild Taro (*Colocasia esculenta* (L.) Schott) had highest importance value index all year. Five species could be found all year, but other seven species were disappear in the arid season.

Index Terms— Araceae, forest type, importance value index, life form, nature trail

1 INTRODUCTION

Araceae species in northern Thailand were recorded almost 70 species from 210 species in 30 genera all over Thailand [1]. Most of Araceae in northern Thailand are terrestrial, epiphytic or aquatic plants, can grow well and rapidly in the rainy season and many species are dormancy in the arid season. This family shows the attractive leaf, stem, flower and fruit which have the unique pattern and makes the favorite to many people [2], [3]. The specific reports about Araceae and their habitat in Thailand are still less reported, then the research team are still interest to study and find the relationship between species diversity and distribution by the environment in the habitat.

Many species are used for food, feed, medicinal herb and decorating place, but many species are weed in agricultural areas [1]. Mae Takhray National Park, Chiang Mai Province in Thailand is a deforestation protected area after used to be disturbed by the forest concessions before constructed in 1987. This national park covers the watershed forest in Amphoe Ban Thi, Amphoe Meung, Lamphun Province and, Amphoe Mae On, Amphoe Doi Saket in Chiang Mai Province, Northern Thailand, area 513.20 sq km, states at 18°32' N-19°04' N and 99°03' E-99°24' E. Mae Takhray Dam or Mae Takhray Reservoir have been constructed in 1982, under the Royally Initiated Project of King Bhumibol Adulyadej for conserving water and developing life of poverty people nearby [4]. Nowadays, this reservoir has fishing sport service under responsibility of the local people community and the nature trails service are under authority of the

national park.

Local people and hill tribe still find natural food from this forest eventhough they have more income from farming or employment in the construction company. Many wild plants species, include Araceae have been used for cooking native dishes. Species diversity, disturbance and lost must be related to local people behavior in their daily life and the trampling of the visitor in the nature trails. Flash flood, soil erosion and forest fire always happen in this national park every year [4].

The aim of this study is need to know about Araceae species, habitats, distribution and utilization for the database of Araceae diversity and ecology in Thailand.

2 MATERIALS AND METHODS

2.1 Study site

The study sites were survey in four nature trails of Mae Takhray National Park, Chiang Mai Province in Thailand in 2016 [5] and only two nature trails were chosen to study and recorded data during January 2016 to February 2018. The strip plot method was used in the plot width 10 meters (m) along 1) Mae Takhray Reservoir Nature Trail in Amphoe Mae On, started at 18°45'04" N 99°18'35" E, distances 4 kilometers (km), at 500-700 meters above mean sea level (m amsl), and 2) Park Head Office Nature Trail in Amphoe Doi Saket, started at 18°59'53" N 99°14'22" E, distance 3 km, at 400-700 m amsl (Fig. 1.).

2.2 Data collection

Data were recorded six times in summer, rainy season and winter of two year during June 2016 to February 2018. The environmental factors; soil texture, forest type and the seasonal change were observed and recorded. Araceae species, individual number and habitat, were surveyed, recorded, photographed and collected for herbarium specimen.

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2.3 Data analysis

Species diversity and species number were calculated to species index by Shannon-Wiener Index, H' at (1) [6].

$$H' = - \sum_{i=1}^S p_i \ln p_i \quad (1)$$

where, H' = the Shannon index; S = number of species; p_i = the proportion of individuals or abundance of the i^{th} species; \ln = log base e .

The important value index (IVI%) of each species was used to evaluate the dominant species in the study site [7].

$$IVI\% = RD + RF \quad (2)$$

where, RD = relative density; RF = relative frequency.

2.4 Classification

Species were identified and classified to established dichotomous key of Araceae in this national park by comparing to the standard taxonomy textbook [2], [8], journal [1], [9] and website [3], [10].

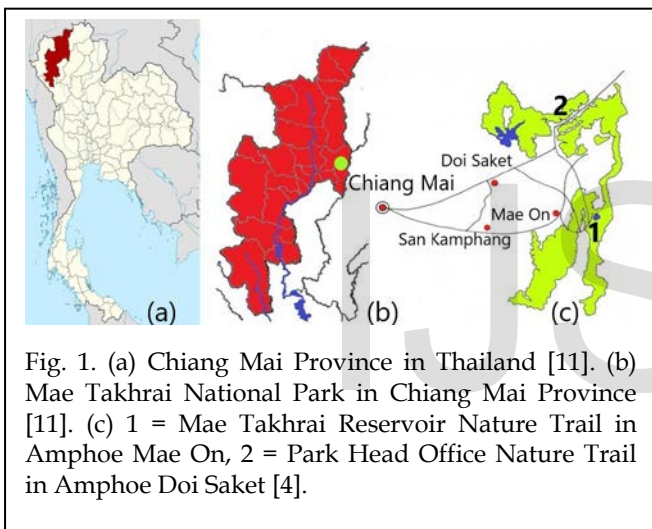


Fig. 1. (a) Chiang Mai Province in Thailand [11]. (b) Mae Takhrai National Park in Chiang Mai Province [11]. (c) 1 = Mae Takhrai Reservoir Nature Trail in Amphoe Mae On, 2 = Park Head Office Nature Trail in Amphoe Doi Saket [4].

3 RESULTS AND DISCUSSION

3.1 The forest type

The forest type in Mae Takhrai Reservoir Nature Trail is mixed deciduous forest (MDF), has many tree species with five dominance species in the top canopy; Teak (*Tectona grandis* Linn.f.), Iron wood (*Xylia xylocarpa* Taub. var. *kerrii* Nielsen), Burma padauk (*Pterocarpus macrocarpus* Kurz), Black Rosewood (*Azelia xylocarpa* (Kurz) Craib) and Rosewood (*Dalbergia oliveri* Gamble ex Prain.). Bamboos; *Gigantochloa albociliata* (Munro) Munro and Tinwa bamboo (*Cephalostachyum pergracile* Munro) found in middle canopy, many bushes and terrestrial plants are on the forest floor [12], [13].

In Park Head Office Nature Trail, the forest type is mixed deciduous forest (MDF) and deciduous dipterocarp forest (DDF). The dominance tree species is Burmese Sal (*Shorea obtusa* Wall. ex Blume), Dark Red Meranti (*S. siamensis* Miq.), Hairy Keruing (*Dipterocarpus obtusifolius* Teijsm. ex Miq.), Gurduntree (*D. tuberculatus* Roxb.) and Indochinese Keruing (*D. intricatus* Dyer.). These forest types are deciduous forest [12],

[13].

In dry season, the weather is cold and drought in the winter, but very hot in the summer. It rains very hard in the rainy season and flash flood happens many times in the area [14].

3.2 Soil texture

Soil texture is sandy soil around the reservoir and along the river. Soil in MDF is loamy skeleton, stony and erosive, well drained, shallow surface with high organic matter which covered by thick litter layer under the shade of trees [15], [16].

In DDF, soil surface texture is sand and filled with gravel, well drained and less organic matter. Soil is mainly stony soil, laterite with sandy loam and weak acid [15], [16].

Twelve species in seven genera were recorded at 400-600 m amsl. Araceae was not found at 600-700 m amsl because soil was sandy, filled with gravel, well drained, less organic matter, very high light intensity and drought in the dry season, while at low elevation the distribution of species showed densely under shade of trees, nearby the rivers and the reservoir. Soil moisture in each season is also the main effect to Araceae distribution like the reported in Doi Inthanon National Park [17] and Doi Suthep-Pui National Park [18].

3.3 Araceae diversity

Five species in five genera were evergreen; *Alocasia acuminata* Schott, *Colocasia esculenta* (L.) Schott, *Homalomena aromatica* (Spreng.) Schott, *Lasia spinosa* (L.) Thwaites, *Rhaphidophora chevalieri* Gagnep. The other seven in three genera were deciduous; *A. hypnosa* J.T.Yin, Y.H.Wang & Z.F.Yu, *Amorphophallus fuscus* Hett., *A. krausei* Engl., *A. macrorhizus* Craib, *A. paeoniifolius* (Dennst.) Nicols., *Hapaline benthamiana* Schott and *Rhaphidophora peepla* (Roxb.) Schott. (Table 1, Fig. 2., Fig. 3.). However, mature *R. peepla* was not deciduous plant in Doi Inthanon [17] and Doi Suthep-Pui National Park [18], this is the different between ages of the same species.

Colocasia esculenta and *Lasia spinosa* were helophyte, always grew along the rivers and around the reservoir. *Rhaphidophora chevalieri* and *R. peepla* were epiphyte and/or lithophyte. The other seven species were geophyte (Table 1).

The habitat of *Alocasia acuminata*, *A. hypnosa*, *Hapaline benthamiana*, *Homalomena aromatica* and *Rhaphidophora chevalieri* were in MDF, while *Amorphophallus fuscus* and *A. paeoniifolius* were in DDF, but *A. krausei*, *A. macrorhizus*, *Colocasia esculenta*, *Lasia spinosa* and *Rhaphidophora peepla* were in both MDF and DDF (Table 1, Fig. 2., Fig. 3.).

3.4 Species index

Species index between seasons were difference. This value was highest in the rainy season, and in the winter was higher than the summer of each year (0.74, 0.20, 0.13 in first year and 1.76, 0.72, 0.18 in second year.). The results showed that individual number of species in second year were higher than first year and the flora conservation in this protected area must be succeed to this family.

3.5 The importance value index

The importance value index (IVI%) in the rainy season also showed the highest species number and individual number of each species. In the rainy season, June 2017, the top five domi-

nant species in Mae Takhrui National Park (Table 1) were *Colocasia esculenta* (46.69%), *Hapaline benthamiana* (35.55%), *Amorphophallus macrorrhizus* (26.74%), *Amorphophallus krausei* (21.92%) and *Rhaphidophora peepla* (13.60%). In the summer and the winter of 2017-2018, *Colocasia esculenta* still had highest IVI%, while many species had very low value or only 0% because of the dormancy. This dominance species also show highest IVI% along the river and in the arid season like the reported in Doi Suthep-Pui National Park [18].

TABLE 1 Araceae species in Mae Takhrui National Park, habit, life form, habitat and the importance value index (IVI%) in June 2018.

| Species | Habit ^a | Life form ^b | Habitat ^c | IVI% |
|--|--------------------|------------------------|----------------------|-------|
| 1. <i>Alocasia acuminata</i> Schott | E | Geo | MDF | 6.05 |
| 2. <i>Alocasia hypnosa</i> J.T.Yin, Y.H.Wang & Z.F.Yu | D | Geo | MDF | 8.30 |
| 3. <i>Amorphophallus fuscus</i> Hett. | D | Geo | DDF | 13.77 |
| 4. <i>Amorphophallus krausei</i> Engl. | D | Geo | MDF, DDF | 21.92 |
| 5. <i>Amorphophallus macrorrhizus</i> Craib | D | Geo | MDF, DDF | 26.74 |
| 6. <i>Amorphophallus paeoniifolius</i> (Dennst.) Nicols. | D | Geo | DDF | 8.88 |
| 7. <i>Colocasia esculenta</i> (L.) Schott | E | Helo | MDF, DDF | 46.69 |
| 8. <i>Hapaline benthamiana</i> Schott | D | Geo | MDF | 35.55 |
| 9. <i>Homalomena aromatica</i> (Spreng.) Schott | E | Geo | MDF | 5.72 |
| 10. <i>Lasia spinosa</i> (L.) Thwaites | E | Helo | MDF, DDF | 6.89 |
| 11. <i>Rhaphidophora chevalieri</i> Gagnep. | E | Epi/Lith | MDF | 5.89 |
| 11. <i>Rhaphidophora peepla</i> (Roxb.) Schott | D | Epi/Lith | MDF, DDF | 13.60 |
| | | | Total | 200 |

^a Habit; E = Evergreen, D = Deciduous

^b Life form; Geo = Geophyte, Helo = Helophyte, Epi = Epiphyte, Lith = Lithophyte

^c Habitat; MDF = Mixed deciduous forest, DDF = Deciduous dipterocarp forest

3.6 Key to Araceae species

Stem and leaf morphology of Araceae are identified and classified to establish dichotomous key (Fig. 2., Fig. 3.) because this study could not find the inflorescence and infructescence in young plants or not in the flowering season [19].

1. Simple leaf.....2
1. Compound leaf.....9
2. Underground stem.....3
2. Aerial stem.....8
3. Petiole green, prickle, leaf dark green, margin pinnatifid.....
.....*Lasia spinosa*
3. Petiole green, leaf smooth, glaucous, margin entire.....4

4. Leaf number 1-2, leaf color green, green and white or green and grey.....*Hapaline benthamiana*
4. Leaf number from 3 to numerous.....5
5. Leaf and petiole green, smooth with white glaucous.....
.....*Colocasia esculenta*
5. Leaf green, smooth, vernicose.....6
6. Leaf shape elliptic to ovate, leaf apex acuminate, leaf base cuneate.....*Homalomena acuminata*
6. Leaf shape sagittate, ovate-lanceolate, cordate, obovate, leaf apex acute, leaf base sagittate.....7
7. Leaf shape sagittate, ovate-lanceolate, width 8-20 cm, length 15-60 cm.....*Alocasia acuminata*
7. Leaf shape deltoid, width 20-45 cm, length 25-50 cm.....
.....*Alocasia hypnosa*
8. Stem angles, leaf color bluish green, leaf shape lanceolate, falcate-lanceolate, width 3-8 cm, length 13-30 cm.....
.....*Rhaphidophora chevalieri*
8. Stem terete, leaf blade dark green, leaf shape oblong-lanceolate, width 4-11 cm, length 8-25 cm.....
.....*Rhaphidophora peepla*
9. Petiole green, smooth surface10
9. Petiole green, rough surface, scale or trichome.....11
10. Scatter dark brown, leaf apex acuminate, color green, width 2-5 cm, length 5-20 cm.....*Amorphophallus fuscus*
10. Scatter dark green, leaf apex acute, adaxial green, abaxial white glaucous, width 2-11 cm, length 11-48 cm.....
.....*Amorphophallus krausei*
11. Petiole surface scale or hairy, scatter white, reddish brown, purplish red, adaxial green or bluish green, abaxial pale green, width 5-16 cm, length 10-36 cm.....
.....*Amorphophallus macrorrhizus*
11. Petiole surface rough, papillae, scatter pale green to blackish green, adaxial and abaxial green, width 2-12 cm, length 3-35 cm*Amorphophallus paeoniifolius*

3.7 The utilization

Local people use four Araceae species for cooking food. Wild Taro or *Colocasia esculenta* and Unicorn Plant or *Lasia spinosa* are picked young leaf for vegetable cuisine. *Amorphophallus fuscus* and *Hapaline benthamiana* were picked young leaf and inflorescence for cooking food.

Many species were used for food; Vegetable Fern (*Diplazium esculentum* (Retz.) Sw., Broken Bone tree (*Oroxylum indicum* (L.) Kurz, Bitter Cucumber (*Momordica charantia* Linn.), Wild Yam (*Dioscorea hispida* Dennst.), etc., for medicinal herb; *Stenoma tuberosa* Lour., *Crinum wattii* Baker, etc., for basket work; wild bulbisiana (*Musa balbisiana* Colla), Tinwa Bamboo (*Cephalostachyum pergracile* Munro), *Gigantochloa albociliata* (Munro) Munro, Rattan (*Plactocomia* sp.) and for decorating house; Staghorn (*Platyterium holttumii* Joncheere) and *P. wallichii* Hook.f.

The utilization was also reported in many Hmong villages in northern Thailand [20]. However, utilization of wild plants must be only used under household and according to regulations of the Department of National Parks, Wildlife and Plant Conservation (Office of National Park, 2015). The status of almost Araceae species in Thailand are still at least concern (LS) by the category of the international Union for Conservation of Nature and Natural Resources (IUCN) in the IUCN Red List of

Threatened Species [21].

4 CONCLUSION

Araceae species in two nature trails at Mae Takhray National Park were found 12 species in seven genera. The habitats were in mixed deciduous forest (MDF) and deciduous dipterocarp forest (DDF) at 400-600 m amsl. Species index and species number were highest in the rainy season. The dominant species all year was Wild Taro or *Colocasia esculenta* Schott.

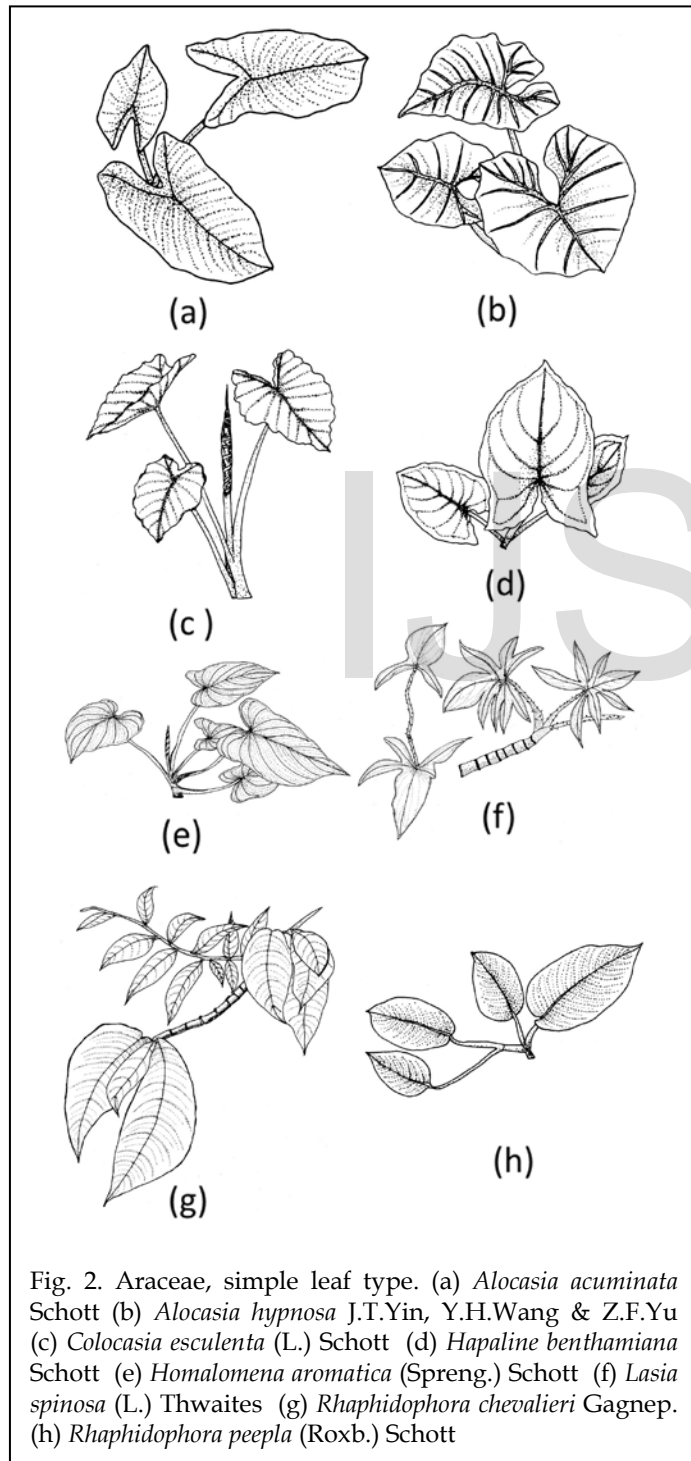


Fig. 2. Araceae, simple leaf type. (a) *Alocasia acuminata* Schott (b) *Alocasia hypnosa* J.T.Yin, Y.H.Wang & Z.F.Yu (c) *Colocasia esculenta* (L.) Schott (d) *Hapaline benthamiana* Schott (e) *Homalomena aromatica* (Spreng.) Schott (f) *Lasia spinosa* (L.) Thwaites (g) *Rhabdophora chevalieri* Gagnep. (h) *Rhabdophora peepla* (Roxb.) Schott

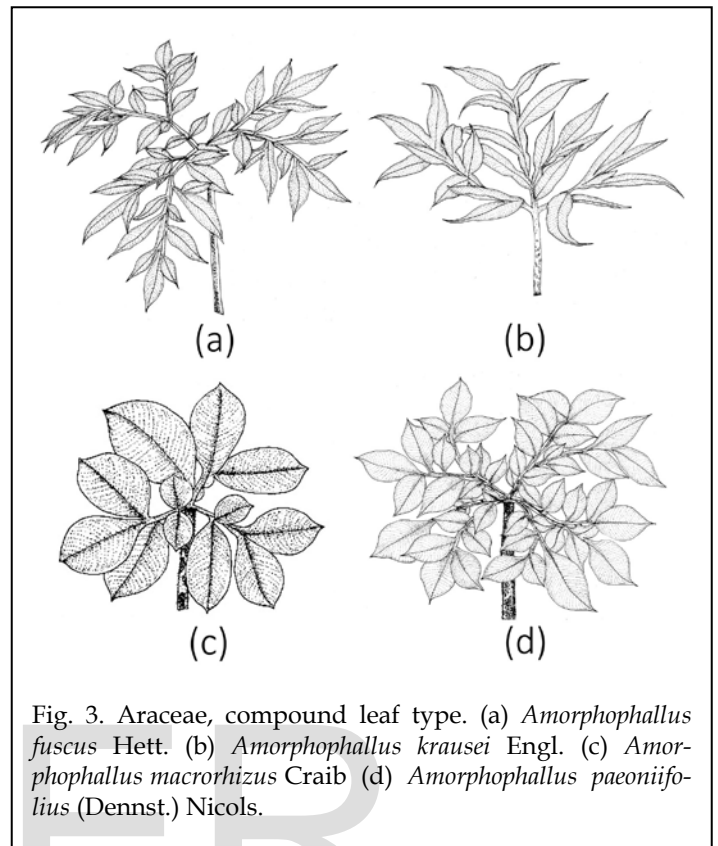


Fig. 3. Araceae, compound leaf type. (a) *Amorphophallus fuscus* Hett. (b) *Amorphophallus krausei* Engl. (c) *Amorphophallus macrorhizus* Craib (d) *Amorphophallus paeoniifolius* (Dennst.) Nicols.

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