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Mini Review

Diversity of Araceae in the National Parks of Kanchanaburi, Chiang Mai and Kamphaeng Petch Province in Thailand

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Abstract

Araceae is a family of monocotyledonous plants and has been recorded first time since 1789 by A. L. de Jussieu [1]. Kew Science reported 139 genera 4,236 species followed the authorities of Angiosperm phylogeny group (APG IV) [2], instead of 140 genera 4,167 species [3]. Nevertheless, The Genera of Araceae had been reported 125 genera 3,750 species in 2011 [4], but the Global Biodiversity Information Facility has recently reported 5,953 species in more than 230 genera [5]. The accepted genus and species are still be checked correctly by the taxon experts. Araceae in Thailand has been studied and reported by Bangkok Herbarium since 1921 [6]. In 2012, Flora of Thailand Journal, volume 12 reported 209 species in 26 genera, which did not still comprise the genus *Lemna*, *Wolffia* and *Spirodella* in subfamily Lemnoideae [7]. Nowsday, the record of Araceae diversity should be more than in 2012. Araceae is used for food, medicine, industry and decorate place by local people [8].

Introduction

Diversity of Araceae were surveyed along the nature trails of four national parks in Kanchanaburi Province, western Thailand; Chaleamrattanakosin, Erawan, Lamkhlongngu, Sai Yok during 2007 to 2012 [9, 10, 11]. Three national parks in Chiang Mai Province, northern Thailand; Doi Inthanon, Doi Suthep-Pui and Mae Takhrai were recorded during 2013 to 2018 [12, 13, 14]. From 2018-2019, Khlong Wang Chao and Khlong Lan National Park in Kamphaeng Petch Province, lower northern Thailand were surveyed [15, 16]. Fifty-three species of 18 genera were usually found along the streams and rivers; 20 species of Amorphophallus, Arisaema 6 species, *Rhaphidophora* 4 species, *Colocasia* 3 species, *Alocasia*, *Lemna*, *Pothos*, *Remusatia*, *Sauromatum* and *Typhonium* 2 species each, and found only one species each of *Aglaonema*, *Englerarum*, *Hapaline*, *Homalomena*, *Lasia*, *Leucocasia*, *Schismatoglottis* and *Scindapsus* (Table 1).

Discussion

In Kanchanaburi Province, 9 genera 24 species were found. We had reported all

Araceae only in Chaleamrattanakosin National Park, but especially recorded the genus *Amorphophallus* in three national parks; Erawan, Lamkhlongngu and Sai Yok. The altitudes in these areas were not high, 150-700 m amsl. The forest types were deciduous dipterocarp forest (DDF) and mixed deciduous forest (MDF) [9, 10, 11]. Habitats of individual species in Chiang Mai Province varied to the altitude and forest types. Thirty-five species in sixteen genera found at Doi Inthanon, Doi Suthep-Pui and Mae Takhrai National parks, at elevation 300-2,565 m amsl, in moisture soil and along the rivers in DDF, MDF, dry evergreen forest (DEF), lower montane forest (LMF) and upper montane forest (UMF) [12, 13, 14]. In Kamphaeng Petch Province, we found 21 species in 16 genera, at 200-300 m amsl, in MDF and DEF of Khlong Wang Chao and Khlong Lan National Park [15, 16]. Habit and life form of Araceae [17] were also reported. We found 18 species in 11 genera were evergreen, growing all year. The deciduous 35 species were in 9 genera (Table 1). Life forms of 42 species were geophyte (terrestrial with underground storage organ, rhizome or tuber). One species, *Remusatia hookeriana* was also epiphyte (climbing on tree) and six species were also lithophyte (grow or climbing on the rock); *Alocasia acuminata*, *Amorphophallus longituberosus*, *A. maxwellii*, *A. saraburiensis*, *Colocasia fallax*, *Homalomena aromatica* (Table 1). Four species were helophyte (grow in marshy ground). *Colocasia esculenta* and *Lasia spinosa* were found along the rivers, but *Remusatia pumila* and *Schismatoglottis calyptrata* were helophyte and also lithophyte, found only on the rock along the waterfall. Two *Lemna* species were hydrophyte (aquatic plant), floating in the basin along the rivers (Table 1). Four *Rhaphidophora* species were evergreen, epiphyte and/or lithophyte. Another climbing species, *Scindapsus officinalis* was found only in the rainy season to early winter, creeping on the ground, climbing on the tree or rock (geophyte, epiphyte and lithophyte). Almost Araceae in our studies grew in deciduous forest and had the dormancy stage in the arid season. While the climbing species need high relative humidity in habitats along the rivers.

Ecological study was reported to species index with highest values in the rainy season. The importance value index of most species found in the rainy season, but many species were disappeared in the winter and summer after the dormant stage [9-16]. The seasonal change in most areas were the same. Almost species grew well in the rainy season. It rained hardly and

flash flood often happened. Many species along the streams and rivers were disappeared. In the winter, the weather was cold and drought. In the summer, the weather was very hot and many vegetation species went to dormancy stage. The wildfire by human activities always burn to the forest every year [11-16]. Herbarium specimen were collected and established dichotomous key of species in each national park to identify species [9-16]. Araceae specimens were photographed and collected for identify species by morphology and anatomy characteristics in the laboratory research. The results showed the different of epidermal layers, stomatal types, and calcium oxalate crystal types [18-23]. The phenology study; growth, flowering, fruiting, seed germination, and propagation parts dispersal; seed, bulbil, tuber of many species were recorded in both study sites [9-16]. Seed germination and growth of *Amorphophallus paeoniifolius* [24], bulbil germination and growth of *Amorphophallus muelleri* [25] and phenology study of 15 species in *Amorphophallus* and one species each in *Aglaonema*, *Alocasia*, *Arisaema*, *Colocasia*, *Hapaline*, *Pycnospatha*, *Remusatia* and *Typhonium* were recorded in greenhouse conditions [26]. Araceae are useful in daily life of local people. Many species were attractive and needed for greenhouse collection. Threats of Araceae species were both from seasonal changing and human activities.

Table 1: Araceae species in national parks of Kanchanaburi, Chiang Mai and Kamphaeng Petch Province.

	Species	Habit	Life form	Habitat	Kanchanaburi	Chiang Mai	Kam- phaeng Petch	IUCN Status
1	**Aglaonema Schott**							
	Aglaonema simplex (Blume) Blume	E	Ge	MDF	✓	-	✓	LC
2	**Alocasia (Schott) G.Don**							
	A. acuminata Schott	E	Ge, Li	MDF, DEF	✓	✓	✓	-
	A. navicularis (K.Koch & C.D. Bouché) K.Koch & C.D. Bouché	E	Ge	LMF	-	✓	-	-
3	**Amorphophallus Blume ex Decne.**							
	A. albispathus Hett.	D	Ge	MDF	✓	-	-	-
	A. bulbifer (Roxb.) Blume	D	Ge	MDF	✓	-	-	-
	A. cruddasianus Prain ex Engl.	D	Ge	MDF	✓	-	-	-
	A. curvistylis Hett.	D	Ge	MDF	✓	-	-	VU
	A. flotoi (S.Y.Hu) Govaerts	D	Ge	MDF	✓	✓	-	-
	A. fuscus Hett.	D	Ge	LMF	-	✓	-	-
	A. krausei Engl.	D	Ge	MDF	✓	✓	✓	-
	A. lacourii Linden & André	D	Ge	MDF	✓	-	-	-
	A. longituberosus (Engl.) Engl. & Gehrm.	D	Ge, Li	MDF	✓	-	-	-
	A. macrophyllus (Gagnep. ex Serebryanyi) Hett. & Claudel	D	Ge	MDF	✓	-	-	-
	A. macrorhizus Craib	D	Ge	DDF, MDF	-	✓	✓	-
	A. maxwellii Hett.	D	Ge, Li	MDF	✓	-	-	-
	A. muelleri Blume	D	Ge	MDF, DEF	✓	✓	✓	-
	A. operculatus Hett. & Sizemore	D	Ge	MDF	✓	-	-	-
	A. paeoniifolius (Dennst.) Nicolson	D	Ge	DDF, MDF	✓	✓	✓	LC
	A. saraburiensis Gagnep.	D	Ge, Li	MDF	✓	-	✓	-
	A. scutatus Hett. & T.C.Chapm.	D	Ge	MDF	✓	-	-	-
	A. tenuispadix Hett.	D	Ge	MDF	✓	-	-	-
	A. thaiensis (S.Y.Hu) Hett.	D	Ge	DEF, LMF	-	✓	-	-
	A. yunnanensis Engl.	D	Ge	DEF, LMF	-	✓	-	-
4	**Arisaema Mart.**							
	A. consanguineum Schott	D	Ge	LMF, UMF	-	✓	-	-

	A. kerrii Craib	D	Ge	DEF, LMF	-	✓	-	-
	A. maxwellii Hett. & Gusman	D	Ge	MDF, DEF	-	✓	✓	VU
	A. omkoiense Gusman	E	Ge	UMF	-	✓	-	-
	A. putii Gagnep.	D	Ge	MDF	✓	-	-	-
	A. yunannanense Buchet	E	Ge	UMF	-	✓	-	-
5	**Colocasia Schott**							
	C. affinis Schott	D	Ge	LMF	-	✓	-	-
	C. esculenta (L.) Schott	E	He	DDF, MDF, LMF	✓	✓	✓	LC
	C. fallax Schott	D	Ge, Li	LMF	-	✓	-	-
6	**Englerarum Nauheimer & P.C.Boyce**							
	E. hypnosum (J.T.Yin, Y.H. Wang & Z.F.Xu) Nauheimer & P.C.Boyce	D	Li	MDF	-	✓	✓	-
7	**Hapaline Schott**							
	H. benthamiana Schott	D	Ge	MDF	✓	✓	✓	-
8	**Homalomena Schott**							
	H. aromatica (Spreng.) Schott	E	Ge, Li	LMF	-	✓	-	-
9	**Lasia Lour.**							
	L. spinosa (L.) Thwaites	E	Ge, He	DDF, MDF, DEF	✓	✓	✓	LC
10	**Lemna L.**							
	Lemna sp.	E	Hy	DDF	-	✓	-	-
	L. aequinoctialis Welw.	E	Hy	MDF	-	-	✓	LC
11	**Leucocasia Schott**							
	L. gigantea (Blume) Schott	E	Ge	MDF	✓	✓	✓	-
12	**Pothos L.**							
	P. chinensis (Raf.) Merr.	E	Ep	MDF, DEF	-	-	✓	-
	P. scandens L.	E	Ep	UMF	-	✓	-	-
13	**Remusatia Schott**							
	R. hookeriana Schott	D	Ep, Ge	UMF	-	✓	-	-
	R. pumila (D.Don) H.Li & A.Hay	D	Li	DEF, LMF	-	✓	-	-
14	**Rhaphidophora Hassk.**							
	R. chevalieri Gagnep.	E	Ep, Li	DEF	-	✓	✓	-
	R. decursiva (Roxb.) Schott	E	Ep, Li	LMF	-	✓	-	-
	R. megaphylla H.Li.	E	Ep, Li	DEF	✓	✓	✓	-
	R. peepla (Roxb.) Schott	E	Ep, Li	LMF, UMF	-	✓	-	-
15	**Sauromatum Schott**							
	S. hirsutum (S.Y.Hu.) Cusimano & Hett.	D	Ge	LMF, UMF	-	✓	-	-

	S. horsfieldii Miq.	D	Ge	LMF, UMF	-	✓	✓	-
16	**Schismatoglottis Zoll. & Moritzi**							
	S. calyptrata (Roxb.) Zoll. & Moritzi	E	Ge, Li	DEF	-	-	✓	-
17	**Scindapsus Schott**							
	S. officinalis (Roxb.) Schott	D	Ep, Ge, Li	MDF	-	✓	✓	-
18	**Typhonium Schott**							
	T. roxburghii Schott	D	Ge	DEF	-	✓	-	-
	T. trilobatum (L.) Schott	D	Ge	MDF	-	-	✓	-

Note: Habit; E = Evergreen, D = Deciduous, Life form; Ep = Epiphyte, Ge = Geophyte, He = Helophyte, Hy = Hydrophyte, Li = Lithophyte, Habitat; DDF = Deciduous dipterocarp forest, MDF = Mixed deciduous forest, DEF = Dry evergreen forest, LMF = Lower montane forest, UMF = Upper montane forest, IUCN Status; LC = Least Concern, VL = Vulnerable

In Thailand, threatened plant species were recorded 16 species in *Typhonium*, 15 species in *Amorphophallus*, *Pothos* 5 species, *Sauromatum* 2 species, and one species each in *Aglaonema* and *Pycnospatha* [27]. The International Union for Conservation of Nature or IUCN Red List showed the report of threatened species by evaluation biodiversity risk status of Araceae in Thailand [28]. The record showed only 16 genera 25 species; *Cryptocoryne* 6 species, *Lemna* 3 species, *Amorphophallus* and *Amydrium* 2 species each, and one species each in *Aglaonema*, *Alocasia*, *Arisaema*, *Colocasia*, *Landoltia*, *Lasia*, *Pistia*, *Pygnospatha*, *Scindapsus*, *Spirodela*, *Typhonium* and *Wolffia*. The status LC (Least Concern) found 23 species, VU (Vulnerable) 2 species and DD (Data Deficient) 1 species. From our study, 5 species were reported to LC and VU was belonged to 2 species (Table 1).

Conclusion

However, Araceae diversity in Thailand are still surveyed and recorded by many researchers. We do hope to report more data in other national parks for publishing more Araceae database in Thailand.

Conflicts of interest: None

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