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A Survey of Riparian Species in the Bodhivijjalaya College's Forest, Srinakharinwirot University, Sa Kaeo

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ABSTRACT

The riparian forests along the Phra Prong Canal act as a buffer to protect the freshwater environment from disturbances on the adjacent land. However, degradation of riparian forests has occurred throughout the area. Data on species composition is needed for riparian restoration and management. This study investigated all vegetation types in the riparian buffers along the Phra Prong Canal. Knowing the complexity of the vegetation structure is beneficial for planning and designing riparian reforestation in this canal.

The survey of vegetation was conducted in the Bodhivijjalaya College Forest as a representative sample of the riparian forest buffer along the Phra Prong Canal. The results identified 92 riparian species belonging to 45 families. They were classified into four groups, consisting of 86 dicotyledons, 4 monocotyledons, 1 gymnosperm, and 1 fern. Several members in the families Annonaceae, Apocynaceae, Fabaceae, Phyllanthaceae, and Moraceae were dominant in this forest. Most riparian species were climbers, trees and shrubs among other life forms. The climbers commonly found in this area were: *Uvaria rufa* Blume, *Parameria laevigata* (Juss.) Moldenke, *Oxystelma esculentum* (L. f.) Sm., *Tarlmounia elliptica* (DC) H. Rob., S.C. Keeley, Skvaria & R. Chan, and *Combretum latifolium* Blume. Among the collected trees were: *Hydnocarpus anthelminthicus* Pierre ex Laness., *Garuga pinnata* Roxb., *Crateva magna* (Lour.) DC., *Hopea odorata* Roxb., *Dipterocarpus alatus* Roxb. ex G. Don, and *Streblus asper* Lour. The undergrowth consisting of shrubby trees, shrub and herbaceous plants included: *Polyalthia suberosa* (Roxb.) Thwaites, *Tabernaemontana bufalina* Lour., *Connarus cochinchinensis* (Baill.) Pierre, *Gmelina asiatica* L., *Antidesma acidum* Retz., *Allophylus cobbe* (L.) Raeusch., *Lasia spinosa* (L.) Thwaites, *Commelina* sp., and *Merremia hederacea* (Burm. f.) Hallier f.. The gymnosperm found in this study was *Gnetum montanum* Markgr. Status, uses, and pharmaceutical and phytochemical activities of the collected riparian species were also reviewed.

Keywords: Survey, Riparian Species, Bodhivijjalaya College Forest, Sa Kaeo

INTRODUCTION

Riparian forests are the areas between terrestrial and aquatic ecosystems. These ecosystems provide a unique microclimate for plant and animal diversity. Moreover, they act as a buffer to protect the freshwater environment from disturbance by agricultural activities on the adjacent land. Many reports have demonstrated that vegetation within the riparian buffer is considered to filter sediments and reduce soil erosion, to protect the water quality, and maintain the habitat structural diversity, and to provide ecological integrity (Broadmeadow and Nisbet, 2004; Schultz *et al*., 2004; Gundersen *et al*., 2010; Bain *et al*., 2012).

The Phra Prong Canal is an important waterway of Watthana Nakhon and Muang districts in Sa Kaeo province. Indeed, the river has served as a water supply for many households living along the banks and also for the irrigation of agricultural crops, namely rice, cassava, sugar cane and rubber, among others. The presence of vegetation assures stabilization and regulation of soil and water in the riparian ecosystem; however, in the Phra Prong Canal, the degradation of riparian forests is continually increasing throughout the area. Our previous study indicated that riparian forest cover along the Phra Prong Canal had consistently decreased. Those forest areas have been replaced by agricultural land and clear-cutting for irrigation systems (Moungsrimuangdee *et al.*, 2015). Thus, restoration of riparian forests is needed to help protect the freshwater environment from potent disturbances. Many studies have recommended planting native species in riparian buffers (Maitland *et al*., 1990; Kingery, 1998; Schultz *et al.*, 2004). However, information on the species composition in the riparian forests is lacking in this area. As our previous work focused only on trees with a diameter size of 4.5 cm upward (Moungsrimuangdee *et al.*, 2015), the present study investigated all vegetation types, such as herbaceous, shrub, tree, and climber, in the riparian buffers along the Phra Prong Canal. Knowing the complexity of the vegetation structure is beneficial for planning and designing riparian reforestation along this canal.

MATERIALS AND METHODS

Study area

The study was conducted in the Bodhivijjalaya College Forest (13º 54’ 51” N 102º 22’ 42” E) as a representative sample of riparian forest buffers along the Phra Prong Canal, which originates from the Phra Prong Dam located in the mountains of the Pang Sri Da National Park. The length of the Phra Prong Canal is about 176 km, passing through Watthana Nakhon and Muang districts, Sa Kaeo province. The elevation ranges from 50 to 100 m above msl. The soil properties are clay to sandy loam with a pH of 4.76 and organic matter of 2.62% (Moungsrimuangdee *et al*., 2015). Online meteorological data were freely accessed from the Bodhivijjalaya College, Watthana Nakhon district weather station belonging to the National Electronics and Computer Technology Center (http://agritronics.

nstda.or.th). The average temperature was 27 ºC with 73% relative humidity and 2,100 mm annual rainfall in 2014–2015.

Data collection and analysis

The survey of plant diversity was performed in the riparian forest located along the east side of Bodhivijjalaya College, Srinakharinwirot University, Sa Kaeo Campus. The area has been established as a Demonstration Riparian Forest Learning and Research Center. Many vegetation types have been observed along the stream line over a distance of 7 km in a belt 5–10 m from the banks. The study was performed at least once every month from February to June, 2015 in an attempt to obtain flower and fruit samples. Herbarium specimens were collected for identification and verification. The riparian species were identified in the laboratory of Bodhivijjalaya College, Srinakharinwirot University. Taxonomic nomenclature and life forms followed Pooma and Suddee (2014).

RESULTS AND DISCUSSION

The survey identified 92 riparian species, which were classified into four groups, consisting of 86 dicotyledons, 4 monocotyledons, 1 gymnosperm, and 1 fern belonging to 45 families as shown in Table 1. Several members in the families Annonaceae, Apocynaceae, Fabaceae, Phyllanthaceae, and Moraceae were dominant in this forest.

From Table 1, most riparian species were climbers, trees, and shrubs among other life forms. The climbers commonly found in this area were: *Uvaria rufa* Blume, *Parameria laevigata* (Juss.) Moldenke, *Oxystelma esculentum* (L. f.) Sm., *Tarlmounia elliptica* (DC) H. Rob., S.C. Keeley, Skvaria & R. Chan, *Combretum latifolium* Blume, *Acacia megalagena* Desv. var. *indo-chinensis* I. C. Nielsen, *Ventilago harmandiana* Pierre, *Poikilospermum suaveolens* (Blume) Merr., and *Ampelocissus* sp. Among the tree species were: *Hydnocarpus anthelminthicus* Pierre ex Laness., *Garuga pinnata* Roxb., *Crateva magna* (Lour.) DC., *Hopea odorata* Roxb., *Dipterocarpus alatus* Roxb. ex G. Don, *Streblus asper* Lour., *Knema globularia* (Lam.) Warb., *Nauclea orientalis* (L.) L., and *Xanthophyllum lanceatum* J. J. Sm. The undergrowth consisted of shrubby trees, shrubs and herbaceous plants including: *Polyalthia suberosa* (Roxb.) Thwaites, *Tabernaemontana bufalina* Lour., *Connarus cochinchinensis* (Baill.) Pierre, *Gmelina asiatica* L., *Antidesma acidum* Retz., *Allophylus cobbe* (L.) Raeusch., *Lasia spinosa* (L.) Thwaites, *Commelina* sp., and *Merremia hederacea* (Burm. f.) Hallier f. The gymnosperm found in this study was *Gnetum montanum* Markgr. This species was also reported in the riparian forest along the Sok Canal, Surat Thani province (Kong-ied *et al.*, 2011).

Research on the effectiveness of medicinal plants has been widely conducted. A review of the status, uses, and pharmaceutical and phytochemical activities of some riparian species was accessed and the results are shown in Table 1. The collected species that have been categorized as threatened in The

IUCN Red List were: *Lasia spinosa* (L.) Thwaites, *Hopea odorata* Roxb., *Homonoia riparia* Lour., and *Gnetum montanum* Markgr. Many species were found to be used as vegetables, (*Diplazium esculentum* (Retz.) Sw., *Lasia spinosa* (L.) Thwaites, *Tiliacora triandra* (Colebr.) Diels, and *Oxystelma esculentum* (L. f.) Sm.), fruits (*Hymenocardia punctata* Wall. ex Lindl., *Antidesma ghaesembilla* Gaertn., *Nephelium hypoleucum* Kruz, and *Ampelocissus* sp.), and ornamentals (*Tabernaemontana bufalina* Lour., and *Oxyceros horridus* Lour.). Several species have been shown to be a source of antimicrobial, anti-inflammatory, anti-oxidant, and antidiabetic value among other activities. For example, fractions of the root and stem of *Derris scandens* (Roxb.) Benth. had strong antibacterial effect against *Bacillus megaterium*, good antialgal (*Chlorella fusca*), and antifungal (*Microbotryum violaceum*) properties (Hussain *et al*., 2015). Moreover, a clinical study also showed that ethanol extraction of *D. scandens* stems could significantly decrease low back pain in patients in Sa Kaeo province similar to the efficacy of the drug, Diclofenac (Srimongkol *et al.*, 2007). *Sphenodesme pentandra* Jack has been found to be a host plant of *Cladomyrma sirindhornae*, a new species from Thailand (Jaitrong *et al*., 2013). Study of the relationship between this ant and its host plant is underway.

Table 1 Riparian species in the Bodhivijjalaya College's Forest, Srinakharinwirot University, Sa Kaeo province.

No.	Family name	Scientific name	Thai name	Life form*	Status/Uses/ Pharmaceutical assays/ Phytochemistry
1	Athyriaceae	*Diplazium esculentum* (Retz.) Sw.	Phak kut khao	TerF	Edible fern Antimicrobial activity (Amit *et al.*, 2011)
2	Achariaceae	*Hydnocarpus anthelminthicus* Pierre ex Laness.	Krabao nam	T	
3	Anacardiaceae	*Semecarpus cochinchinensis* Engl.	Rak khao	T	
4	Annonaceae	*Alphonsea sp.*	Tam yao	ST/T	
		Dasymaschalon lomentaceum Finet & Gagnep.	Prong kio	S	Anti-inflammatory, analgesic and antipyretic activities (Jantharangkul, 2007)
		Dasymaschalon sp.	-	S	
		Desmos chinensis Lour.	Sai yut	C	Ornamental Anti-Rhizoctonia solani activity (Plodpai *et al.*, 2013)
		Desmos sp.	-	C	
		Goniothalamus sp.	-	T	
		Polyalthia suberosa (Roxb.) Thwaites	Klueng klom	S/ST	Edible ripe fruits, decoction of root used as abortifacient (Mahapatra *et al.*, 2012)
		Uvaria rufa Blume	Phi phuan noi	C	Essential oil from leaf and stem barks (Thang *et al.*, 2014) Antituberculosis activity (Macabeo *et al.*, 2012)
5	Apocynaceae	*Amphineurion marginatum* (Roxb.) D. J. Middleton	Khruea sai tan	C	
		Hoya sp.	-	C	Ornamental
		Ichnocarpus frutescens (L.) W. T. Aiton	Khruea pla song daeng	C	Antidiabetic activity in root extract (Barik *et al.*, 2008)

Table 1 Continued

No.	Family name	Scientific name	Thai name	Life form*	Status/Uses/ Pharmaceutical assays/ Phytochemistry
		Oxystelma esculentum (L. f.) Sm.	Chamuk pla lot	C	Rare economic Indian climber (Buragohian *et al.*, 2011) Edible young shoot Antimicrobial and lipid peroxidation
		Parameria laevigata (Juss.) Moldenke	Khruea khao muak	C	
		Tabernaemontana bufalina Lour.	Phrik nai phran	ST	Ornamental
		Toxocarpus villosus (Blume) Decne.	Thao wan daeng	C	
		Wrightia religiosa (Teijsm. & Binn.) Benth. ex Kurz	Mok ban	S	Ornamental
6	Araceae	*Lasia spinosa* (L.) Thwaites	Phak nam	H	IUCN Red List of Threatened Species (Gupta, 2013) Edible leaves and rhizomes Antinociceptive activity in leaf extract (Goshwani *et al.*, 2012)
7	Asteraceae	*Tarlmounia elliptica* (DC) H. Rob., S. C. Keeley, Skvaria & R. Chan	-	C	Antimicrobial and antioxidant activity (Sulayman and Touqeer, 2015)
8	Burseraceae	*Garuga pinnata* Roxb.	Ta khram	T	Antidiabetic (Shirwaikar *et al.*, 2006), antioxidant (Thupurani *et al.*, 2012), and antiulcer (Sachan *et al.*, 2014) activities in bark extract
9	Cannabaceae	*Trema orientalis* (L.) Blume	Phang rae yai	ST	Source of pulping (Jahan *et al.*, 2007) Antioxidant and antibacterial activities (Uddin, 2008) Biopesticides (Adesina and Afolabi, 2014)
10	Capparaceae	*Capparis micracantha* DC.	Chingchi	S/ST	
		Crateva magna (Lour.) DC.	Kum num	T	Antipyretic activity (Chidambaram *et al*., 2011)
11	Combretaceae	*Combretum latifolium* Blume	Uat chueak	C	Cotton dyeing from stem extract (Chairat *et al.*, 2015)
12	Commelinaceae	*Commelina* sp.	Phak plap	H	

Table 1 Continued

No.	Family name	Scientific name	Thai name	Life form*	Status/Uses/ Pharmaceutical assays/ Phytochemistry
13	Connaraceae	*Connarus cochinchinensis* (Baill.) Pierre	Thop thaep	S/ST	
14	Convolvulaceae	*Merremia hederacea* (Burm. f.) Hallier f.	Thao sa uek	HC	
15	Cucurbitaceae	Unknown 1		C	
16	Dilleniaceae	*Tetracera loureireii* (Finet & Gagnep.) Pierre ex Craib	Rotsukhon	C	
17	Dipterocarpaceae	*Dipterocarpus alatus* Roxb. ex G. Don	Yang na	T	Timber, oleoresin
		Hopea odorata Roxb.	Ta khian thong	T	The IUCN Red List of Threatened Species (Ashton, 1998) Anti-inflammatory (Yang *et al.*, 2013)
18	Euphorbiaceae	*Homonoia riparia* Lour.	Khrai nam	S/ST	The IUCN Red List of Threatened Species (Kumar, 2013) Antimicrobial activity from leaf extract (Patil *et al.*, 2014)
19	Fabaceae	*Acacia megaladena* Desv. var. indo-chinensis I. C. Nielsen	Khi rat	C	
		Acacia pennata (L.) Willd.	Nam khi raet	C	
		Acacia sp.	-	C	
		Bauhinia coccinea (Lour.) DC. subsp. *coccinea*	Ka long	ScanS	
		Derris cf. *scandens* (Roxb.) Benth.	Thao wan priang	C	Antimicrobial from root and stem extract (Hussain *et al.*, 2015) Anti-inflammatory (Srimongkol *et al.*, 2007)
		Lasiobema scandens (L.) de Wit	Kradai ling	C/ScanS	
		Paraderris laotica (Gagnep.) Adema	-	C	
		Peltophorum dasyrrhachis (Miq.) Kurz	A rang	T	
20	Gnetaceae	*Gnetum montanum* Markgr.	Mueai	C	The IUCN Red List of Threatened Species (Baloch, 2013)
21	Lamiaceae	*Gmelina asiatica* L.	Khang maeo	S	
		Sphenodesme pentandra Jack	Ho sa phai khwai	C	Host of *Cladomyrma sirindhornae* (Jaitrong *et al.*, 2013)

Table 1 Continued

No.	Family name	Scientific name	Thai name	Life form*	Status/Uses/ Pharmaceutical assays/Phytochemistry
22	Lauraceae	*Beilschmiedia roxburghiana* Nees	Fi mop	T	
		Cinnamomum iners Reinw. ex Blume	Chiat	T	
23	Loranthaceae	*Loranthus sp.*	-	PaS	
24	Lythraceae	*Lagerstroemia floribunda* Jack	Ta baek na	T	
25	Malvaceae	*Colona auriculata* (Desf.) Craib	Po phran	S	
		Microcos tomentosa Sm.	Phlap phla	T	
26	Marantaceae	*Donax canniformis* (G. Forster) K. Schum.	Khlum	H	
27	Melastomataceae	*Memecylon caeruleum* Jack	Phlong khi khwai	S	
28	Menispermaceace	*Tiliacora triandra* (Colebr.) Diels	Thao ya nang	C	Vegetable Antimalarial activity (Pavanand *et al.*, 1989)
29	Moraceae	*Artocarpus lacucha* Roxb. ex Buch. - Ham.	Hat	T	
		Ficus callophylla Blume	-	T	
		Ficus heterophylla L. f.	Salot nam	CrS	
		Ficus hispida L.f.	Ma duea plong	ST	Antioxidant from leaf extract (Shanmugarajan and Devaki, 2008)
		Ficus racemosa L.	Ma duea u thum phon	T	Edible fruits Antidiabetic activity from stem bark (Rana *et al.*, 2013)
		Streblus asper Lour.	Khoi	T	Antimicrobial activity from leaf extract (Wongkham *et al.*, 2001)
30	Myristicaceae	*Knema globularia* (Lam.) Warb.	Lueat raet	T	The IUCN Red List of Threatened Species (World Conservation Monitoring Centre, 1998)
31	Myrtaceae	*Syzygium ripicola* (Craib) Merr. & L. M. Perry	Wae	S	
32	Passifloraceae	*Passiflora foetida* L.	Ka thok rok	ExC	Edible ripe fruits Antiulcer and antioxidant activity (Sathish *et al.*, 2011)

Table 1 Continued

No.	Family name	Scientific name	Thai name	Life form*	Status/Uses/ Pharmaceutical assays/Phytochemistry
33	Phyllanthaceae	*Antidesma acidum* Retz.	Mao soi	S/ST	Edible ripe fruits
		Antidesma ghaesembilla Gaertn.	Mao khai pla	S/T	Edible ripe fruits
		Aporosa walliichii Hook. f.	-	ST	
		Baccaurea ramiflora Lour.	Ma fai pa	T	Edible ripe fruits
		Breynia retusa (Dennst.) Alston	Khram-nam	S/ST	
		Bridelia stipularis (L.) Blume	Ma ka khruea	ScanS/ST	Source of anthocyanin (Sreenivas *et al*., 2011)
		Hymenocardia punctata Wall. ex Lindl.	Faep nam	S/T	Edible fruits
34	Oleaceae	*Jasminum scandens* (Retz.) Vahl	Siao phi	C/ScanS	
35	Orchidaceae	*Aerides falcata* Lindl. & Paxton	Ueang kulap phuang	EO	Ornamental
36	Polygalaceae	*Xanthophyllum lanceatum* J. J. Sm.	Chumsaeng	ST	
37	Primulaceae	*Ardisia sanguinolenta* Blume	Ma cham kong	S/ST	
38	Rhamnaceae	*Ventilago denticulata* Willd.	Kong kaep	C	Antifungal activitity from leaf extract (Sornprasert *et al*., 2012)
		Ventilago harmandiana Pierre	Khruea plok	C	Anti-inflammatory activity (Panthong *et al*., 2004)
		Ziziphus cambodiana Pierre	Ta khrong	ST	
39	Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	Chiang phra nang ae	T	Antimicrobial activity from bark extract (Neeharika *et al.*, 2010)
40	Rubiaceae	*Mitragyna diversifolia* (Wall. ex G. Don) Havil.	Kra thum na	S/ST	
		Nauclea officinalis (Pierre ex Pit.) Merr. & Chun	Khi min	T	
		Nauclea orientalis (L.) L.	Kan lueang	T	Anti – staphylococcal activity (Cruz and Jubilo, 2014)
		Oxyceros horridus Lour.	Khut khao khruea	ScanS	Ornamental
		Xantonnea parvifolia (Kuntze) Craib	Khrop chakkrawan	S	
41	Rutaceae	*Glycosmis pentaphylla* (Retz.) DC.	Khoei tai	S/ST	
42	Salicaceae	*Casearia grewiifolia* Vent.	Kruai pa	T	

Table 1 Continued

No.	Family name	Scientific name	Thai name	Life form*	Status/Uses/ Pharmaceutical assays/Phytochemistry
43	Sapindaceae	*Allophylus cobbe* (L.) Raeusch.	To sai	S	Antimicrobial and cytotoxic activity (Islam *et al.*, 2012)
		Lepisanthes rubiginosa (Roxb.) Leenh.	Ma huat	S/ST	Edible ripe fruits
		Nephelium hypoleucum Kruz	Kho laen	T	Edible ripe fruits
44	Urticaceae	*Poikilospermum suaveolens* (Blume) Merr.	Kha man	C	
		Unknown 2		C	
45	Vitaceae	*Ampelocissus* sp.	Som kung	C	Edible ripe fruits
		Tetrastigma sp.	Khruea khao nam	C	

Remarks: *C = Climber, CrS = Creeping Shrub, ExC = Exotic Climber, EO = Epiphytic Orchid, H = Herb, HC = Herbaceous Climber, PaS = Parasitic Shrub, S = Shrub, ScanS = Scandent Shrub, ST = Shrubby Tree, T = Tree, TerF = Terrestrial Fern

CONCLUSION

A vegetation survey was conducted in the riparian forest along the Phra Prong Canal, belonging to Bodhivijjalaya College, Srinakharinwirot University, Sa Kaeo province. The results identified 92 riparian species belonging to 45 families. They were classified into four groups, consisting of 86 dicotyledons, 4 monocotyledons, 1 gymnosperm and 1 fern. Several members in the families Annonaceae, Apocynaceae, Fabaceae, Phyllanthaceae, and Moraceae were dominant in this forest.

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