

The Distribution in Biogeographic Region of Rare Plant Genus *Tacca* (Dioscoreaceae) in Thailand for Conservation

Tawanon Niamngon¹, Surapon Saensouk^{2*} and Piyaporn Saensouk³

¹Faculty of Environment and Resource Studies, Mahasarakham University, Kantarawichai District, Mahasarakham 44150, Thailand

^{2*}Plant and Invertebrate Taxonomy and Its Applications Unit Group, WalaiRukhvej Botanical Research Institute, Mahasarakham University, Kantarawichai District, Mahasarakham, 44150, Thailand

³Plant and Invertebrate Taxonomy and Its Applications Unit Group, Department of Biology, Faculty of Science, Mahasarakham University, Kantarawichai District, Mahasarakham 44150, Thailand

tawanon.n@msu.ac.th, surapon.s@msu.ac.th and pcornukaempferia@yahoo.com*

Abstract. *The genus Tacca (Dioscoreaceae) is used as a medicinal plant with medicinal properties, outstanding in the matter of tonic treat rash, treat inflammation in both inside and outside the body, including hepatitis, dysentery and diarrhea. In Thailand, there are five species, namely T. Chantrieri Andre, T. integrifolia Ker Gawl., T. leontopetaloides (L.) Kuntze, T. palmata Blume and T. plantaginea (Hance) Drenth, distributed to cover the biogeographical region in seven regions, which are North, Northeast, East, Southwest, Central, South-East and South of Thailand. The biogeographic region of T. chantrieri Andre is distributed cover seven regions, which is 0-1,500 meters above sea level. While, the other three species; T. integrifolia Ker, Gawl. T. leontopetaloides (L.) Kuntze and T. palmata Blume; are distributed in some areas of the geographic regions, such as North, South-East and South, at an altitude of 0-1,200 meters above sea level. And one species, T. plantaginea (Hance) Drenth, is a rare plant, distributed at altitude of 100-800 meters above sea level with covered three biogeographic regions including the Northeast, South-West and Central. The biogeographic region map of rare plant genus Tacca species in Thailand for conservation is provided.*

Received by	12 August 2019
Revised by	11 January 2020
Accepted by	13 January 2020

Keywords:

Tacca, Dioscoreaceae, Distribution, Biogeographic region, Conservation rare plant

1. Introduction

The genus *Tacca* is belonging to family Dioscoreaceae, order Dioscoreales, clade monocots. Seventeen species is reported in worldwide [1]. This genus has many outstanding medicinal properties, such as tonic, rash treatment, treating

both internal and external inflammatory wounds including hepatitis, dysentery and diarrhea. The genus *Tacca* is distributed throughout the tropical regions of the world and has center diversity in tropical Asia, except *T. parkeri* Seem. is only reported in South America [2]-[3]. In Thailand, there are only five species of reports which have a distribution center in Southern Thailand [4-6]. This genus can be found in deciduous dipterocarp forest, mixed deciduous forest, dry evergreen forest, evergreen forest and along the coast or highland area at an altitude of 0-1,000 meters [4].

For the study of the genus *Tacca*, there have been reports of distribution from around the world in 1972 by Drenth [2], while the distribution of genus *Tacca* in Thailand reported in 1993 by Phengkklai [4], which is a reported of the distribution in a wide area and unclear on location of each species in this genus. It is necessary to explore and collect data on biogeographic region, distribution area, altitude, sea water and the more precisecoordinates of the genus *Tacca*. Therefore, this study is expected to get more new information and can use the information obtained to support the distribution data, as well as can produce to biogeographic region map and can contribute to knowledge development to find ways to conserve rare plant genus *Tacca* currency further.

2. Materials and Method

The specimens from many herbaria, including the Herbarium of the Department of National Parks, Wildlife and Plant Conservation (BKF), Bangkok Herbarium (BK), Queen Sirikit Botanical Gardens Herbarium (QSBG) and Khon Kaen University Herbarium (KKU) were studied for correctly species identification, ecological data, phonological data and notes on distinguishing characters. After that, field trip for collect specimens including living, dry and spirit specimens of the genus *Tacca* specimens from all parts of Thailand during August 2016 to July 2017 are provided. Moreover,

some important characteristics and GPS data are collected. Conducting data on the distribution of biogeographic region of the genus *Tacca*, meters above sea level and create geographic location information of plant geography with

GPS, by using the QGIS Wien program (2.8.9) to create maps. The biogeographic region map of Thailand by Newman [7], which is used also for create maps as shown in Fig. 1.

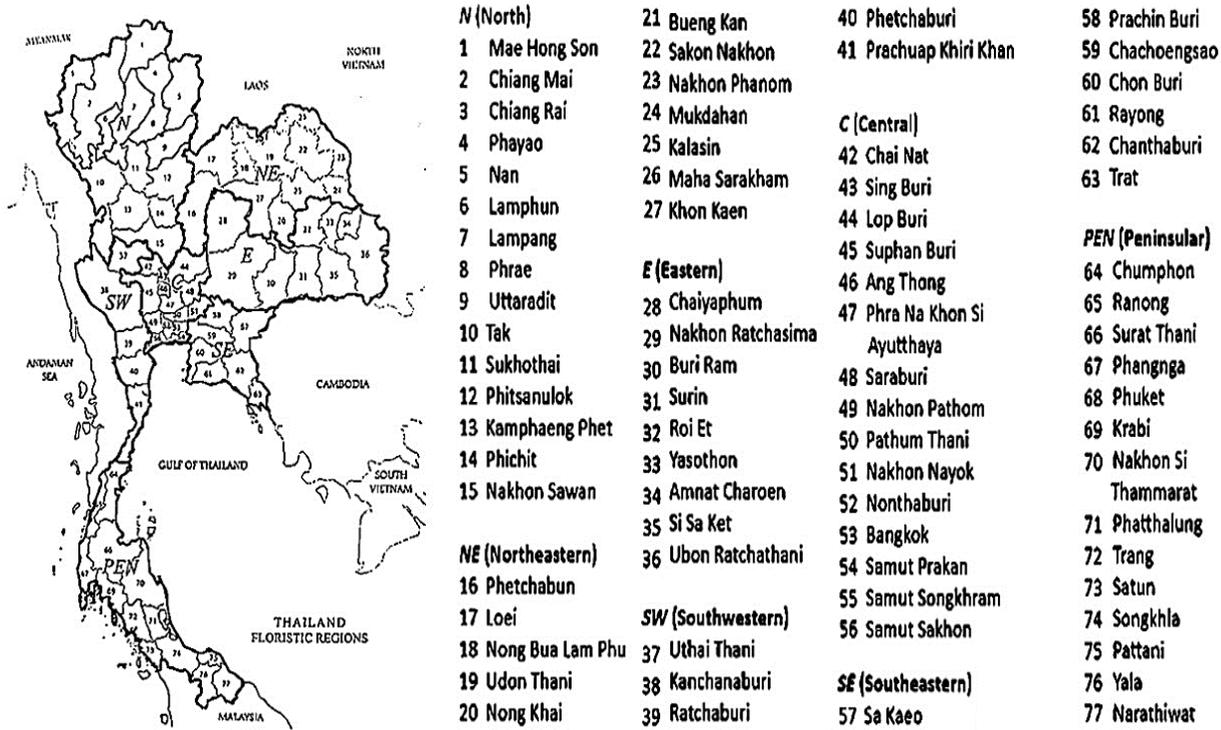


Fig.1 : Biogeographic Region Map of Thailand by Newman [7]

3. Results and Discussion

The genus *Tacca* in Thailand found that there are five species covers distributed in seven biogeographic regions, namely North (N), North-Eastern (NE), Eastern (E), South-Western (SW), Central (C), South-Eastern (SE) and Peninsular (P) of Thailand.

According to this study *Tacca chantrieri* Andre has a distribution that covers seven biogeographic regions at the altitude of 0-1,500 meters above sea level and found in 36 provinces. Corresponding to the report of Phengklai [4] and Chayamarit [5] stating that *T. chantrieri* Andre is distributed throughout all regions of Thailand. But not in accordance with some data reported that the altitude from 50-1,000 meters above the sea level (see Table 1; Fig. 2 and Fig.3).

T. integrifolia Ker Gawl., found that three distribution areas covering biogeographic regions namely North, Eastern, South - Western and Peninsular and found in 16 provinces at altitude of 0-1,200 meters. Corresponding to the report of Phengklai [4] and Chayamarit [5] stating that *T. integrifolia* Ker Gawl. is distributed in North and Peninsular of Thailand But not in accordance with some data reported that the altitude from 10-350 meters above sea level. (see Table 1; Fig. 2 and Fig.3)

T. leontopetaloides (L.) Kuntze found that in four distribution areas covering biogeographic region namely North-Eastern, Eastern, South-Eastern and Peninsular and found in 18 provinces at altitude of 0-400 meters. Corresponding to the report of Phengklai [4] and Chayamarit [5] stating that *T. leontopetaloides* (L.) Kuntze is distributed in Eastern, South - Western, South - Eastern and Peninsular of Thailand except in North - Eastern. (see Table 1; Fig. 2 and Fig.3)

T. palmate Blume found that two distribution areas covering biogeographic region namely South - Eastern and Peninsular and found habitat of 8 provinces at altitude of 0 - 550 meters. Corresponding to the report of Phengklai [4] and Chayamarit [5]. But not in accordance with altitude from 50-300 meters above sea level. (see Table 1; Fig. 2 and Fig.3).

A rare species, *T. plantaginea* (Hance) Drenth [8], is found in three distribution areas covering biogeographic region namely North-Eastern, South-Western and Central. There are found in four provinces and seven areas at altitude of 100-800 meters. Corresponding to the report of Phengklai [4] and Chayamarit [5] stating that *T. plantaginea* (Hance) Drenth is distributed in North-Eastern and South-Western of Thailand except in the Central (see Table 1; Table 2; Fig. 2; Fig.3 and Fig.4).

Species	Biogeographic region	Habitat (Province)	Altitude
1) <i>Tacca chantrieri</i> Andre	N (North)	Mae Hong Son, Chiang Rai, Chiang Mai, Phayao, Nan, Lampang, Phrae, Sukhothai, Phitsanulok	160 - 1,500
	NE (North -Eastern)	Phetchabun, Loei, Udon Thani, Khon Kaen	300 - 800
	E (Eastern)	Chaiyaphum, Nakhon Ratchasima, Roi Et, UbonRatchathani	150 - 806
	SW (South - Western)	Kanchanaburi	200 - 750
	C (Central)	SuphanBuri, Nakhon Nayok	60 - 350
	SE (South - Eastern)	Chon Buri, Chanthaburi, Trat	50 - 400
	PEN (Peninsular)	Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Nakhon Si Thammarat, Phatthalung, Trang, Satun, Songkhla, Yala, Narathiwat	0 - 600
2) <i>T. integrifolia</i> Ker Gawl.	N (North)	Nan	400
	SE (South - Eastern)	Trat	50
	PEN (Peninsular)	Ranong, Surat Thani, Phangnga, Yala, Krabi, Nakhon Si Thammarat, Trang, Phatthalung, Satun, Songkhla, Narathiwat	0 – 1,200
3) <i>T. leontopetaloides</i> (L.) Kuntze	NE (North -Eastern)	Sakon Nakhon, Maha Sarakham, Kalasin	167 - 300
	E (Eastern)	Nakhon RatchasimaBuri Ram, Surin , Roi Et, , UbonRatchathani	120 - 400
	SE (South - Eastern)	Chon Buri, Trat	50 - 400
	PEN (Peninsular)	Chumphon, Ranong, Surat Thani, Phangnga, Krabi, Trang, Songkhla,	0 – 200
4) <i>T. palmata</i> Blume	SE (South - Eastern)	PrachinBuri , Chanthaburi, Trat	0 - 100
	PEN (Peninsular)	Surat Thani, Nakhon Si Thammarat, Krabi, Trang, Satun	20 - 550
5) <i>T. plantaginea</i> (Hance) Drenth	NE (North -Eastern)	Chaiyaphum, Phetchabun	220 -806
	SW (South - Western)	Kanchanaburi	170 - 300
	C (Central)	Saraburi	100

Table 1 Biogeographic region of genus *Tacca* (Dioscoreaceae) in Thailand

Species	Biogeographic region	Habitat		Altitude	Latitude	Longitude
		Province	Area			
<i>T. plantaginea</i> (Hance) Drenth Staus: Rare plant*	NE (North -Eastern)	Phetchabun	Nam Nao National Park	600-800	16°44'58.9"N	101°35'07.3"E
		Chaiyaphum	Thung Lui Lai	700	16°32'11.9"N	101°48'30.4"E
			Ban Nam Phrom	220	15°40'00 "N	102°0'00"E
			Chulabhorn Dam	806	16°32'41.4"N	101°39'05.6"E
	SW (South - Western)	Kanchanaburi	Huai Mae Khamin Waterfall	300	14°38'17.1"N	98°59'11.7"E
			Sai Yok Noi Waterfall	170	14°14'20.3"N	99°03'26.7"E
	C (Central)	Saraburi	Namtok Sam Lan National Park	100	14°26'23.7"N	100°57'38.3"E

Note: * = Chamchumroon [8]

Table 2 Biogeographic region of rare plant genus *Tacca* (Dioscoreaceae) in Thailand



Fig. 2: Species diversity of genus *Tacca* (Dioscoreaceae) in Thailand:
 (A) *Tacca chantrieri* Andre;
 (B) *T. integrifolia* Ker Gawl.;
 (C) *T. leontopetaloides* (L.) Kuntze;
 (D) *T. palmata* Blume,
 (E) *T. plantaginea* (Hance) Drenth

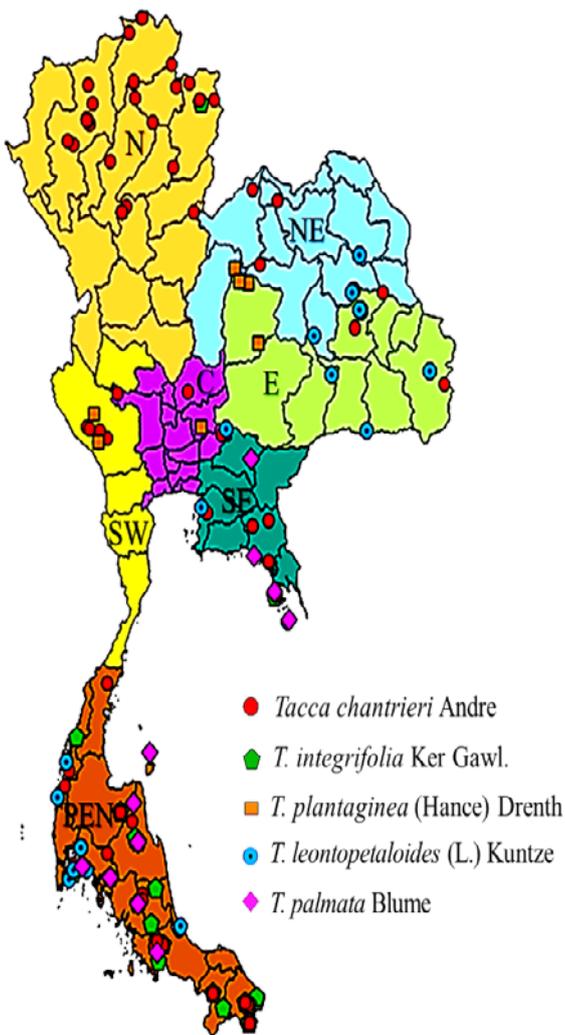


Fig. 3: Biogeographic Region Map of genus *Tacca* (Dioscoreaceae) in Thailand

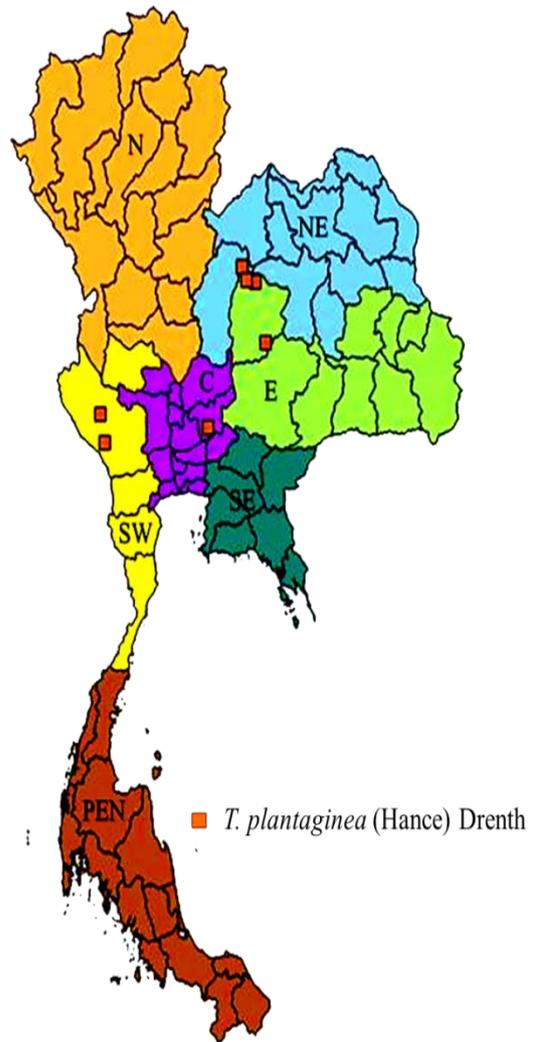


Fig. 4: Biogeographic Region Map of rare plant *Tacca plantaginea* (Hance) Drenth in Thailand

4. Conclusions

The study of distribution in biogeographic region of the genus *Tacca* (Dioscoreaceae) in Thailand is studied by examining dried plant specimens in herbaria from Thailand and the survey in the field. Five species of genus *Tacca* are collected which is distributed cover seven biogeographic region in 42 provinces. The center diversity is located in Peninsular or South part of Thailand. The biogeographic region of *T. chantrieri* Andre is distributed cover seven regions, which is 0-1,500 meters above sea level. While, the other three species; *T. integrifolia* Ker, Gawl. *T. leontopetaloides* (L.) Kuntze and *T. palmata* Blume; are distributed in some areas of the geographic regions, such as North, South-East and South, at an altitude of 0-1,200 meters above sea level. And one species, *T. plantaginea* (Hance) Drenth, is a rare plant, distributed at altitude of 100-800 meters above sea level with covered three biogeographic regions including the Northeast, South-West and Central. The biogeographic region map of rare plant genus *Tacca* species in Thailand for conservation is made by using the QGIS Wien program (2.8.9) and can be used the information obtain to support the distribution data, as well as to develop knowledge to find ways to conserve rare plants in the genus *Tacca* in Thailand in the future.

Acknowledgements

The authors are grateful to Program in Biodiversity, WalaiRukhvej Botanical Research Institute and Department of Biology, Faculty of Science Mahasarakham University for their facilities during the study. Warm thanks to the curators and staff of the herbaria visited (BK, BKF, KKU and QSBG). We are grateful to the National Park staff for all the places that provide study support.

References

- [1] The Plant List. (2013). Dioscoreaceae. [Online]. Available from: <http://www.theplantlist.org/browse/A/Dioscoreaceae/>. [cited 2 September 2017].
- [2] Drenth E. (1972). A revision of the family Taccaceae. *Evolution and Biogeography of Plants*, 20(2), 367-405.
- [3] Drenth E. (1976). *Flora Malesiana*, Volume 7 part 4. Rijksherbarium, Leiden.
- [4] Phengkklai C. (1993). *Flora of Thailand*. Vol. 6 part 1. Bangkok, The Forest Herbarium.
- [5] Chayamarit K., Pooma, R. and Phattarahirantris N. (2014). A Checklist of Plants in Thailand, Volume 1. Bangkok, Natural Resources and Environmental Policy and Planning, pp. 203.
- [6] Pooma R. and Suddee S. (2014). Thai plant names (Revised edition 2014). Bangkok, Forest Herbarium of the Department of National Parks, Wildlife and Plant Conservation.
- [7] Newman M, Barfod A and Esser JH. (2016). *Flora of Thailand*. Vol. 13, part 2. Bangkok, The Rumthai Press.
- [8] Chamchumroon V, Suphuntee N, Tetsana N, Poopath M and Tanikkool S. (2017). *Threatened Plants in Thailand*. Bangkok, Department of National Parks, Wildlife and Plant Conservation.

Biographies



Tawanon Niamngon was born in Thailand. He received the M.Sc. degree in 2018. He currently works at Faculty of Environment and Resource Studies, Mahasarakham University, Thailand.



Surapon Saensouk was born in Thailand. He received the Ph.D. degree in 2006. He is currently an associate professor at Biodiversity program of WalaiRukhvej Botanical Research Institute, Mahasarakham University, Thailand. His research interests include Plant Taxonomy, Biodiversity, Chromosome, Pollen, Plant Anatomy, Plant Geography and Ethnobotany.



Piyaporn Saensouk was born in Thailand. She received the Ph.D. degree in 2008. She is currently an assistant professor at Department of Biology, Faculty of Science, Mahasarakham University, Thailand. Her research interests include Plant Tissue Culture, Plant Conservation, Plant Anatomy, Pollen, Chromosome and Ethnobotany.