International Journal of Agricultural Technology 2017 Vol. 13(3):425-431
Available online http://www.ijat-aatsea.com
ISSN 2630-0192 (Online)

The Study of Seasonal and Climate Changes on Macrofungi Biodiversity in the Community Forest at Sai Yok District, Kanchanaburi Province, Thailand

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Sutjaritvorakul, T., Permpoonsinsup, W., Srigobue, P. and Koomsubsiri, A. (2017). The Study of Seasonal and Climate Changes on Macrofungi Biodiversity in the Community Forest at Sai Yok District, Kanchanaburi Province, Thailand. International Journal of Agricultural Technology 13(3):425-431.

Abstract Kanchanaburi province is located in western of Thailand, which is a large area with a wide varieties of living organisms, because of the extreme variations in climatical and geographical conditions. The aim of research was to study seasonal and climate changes on biodiversity of macrofungi in community forest at Sai Yok district, Kanchanaburi province. The biodiversity of macrofungi is important for future comparison to understand the fungal biodiversity. This research was performed during dry and wet season in 2016. Macrofungi were collected and morphological identified according to their macro and microscopic structures. Fifteen species were found including thirteen saprophytic macrofungi and two mycorrhizal mushroom. In addition, the result revealed that seven species (46.66 %) is an edible mushroom. It suggested that these edible mushroom can be consumed in dailylife of local people living in this area, and seasonal and climate changes were directly affected to macrofungi biodiversity.

Keywords: Biodiversity, Macrofungi, Seasonal change, community forest

Introduction

Fungi are a group of eukaryotic organisms that play a key role in terrestrial ecological system. They can form symbiotic associations with plant root as mycorrhizal fungi, contributing to essential nutrient cycling, decomposing organic matter and some are pathogenic fungi (Gadd *et al*. 2003). Macrofungi exhibit a large fruiting body. They are ubiquitous in terrestrial and aquatic environments. Edible macrofungi are a good source of protein, vitamins, minerals and neutraceuticles. Moreover, some of edible mushrooms are economic importance such as *Termitomyces* spp., *Astraeus hygrometricus* (Cuptapun, *et al*., 2010; Wiriya, *et al*., 2014; Pavithra, *et al*., 2015). Macrofungi have been investigated for searching for new therapeutic bioactive metabolites

that are responsible for their anticancer, antioxidant and antimicrobial properties (Sutjaritvorakul, *et al*. 2010; Wani, *et al*., 2010; Orachaipunlap, *et al*. 2016). Climate is recognized to be a key factor for fruiting body formation. Seasonal changes have been linked to changes in the phenology, abundance and distribution of fungal species (Diez, *et al*., 2013). Many species are found in the rainy season, while there are a few species can be found throughout the year (Dijk, *et al*., 2003; Andrew, *et al*., 2013). Kanchanaburi is a large province located in western of Thailand, with a wide variety of plants, because of the extreme variations in climatical and geographical conditions. For indigenous peoples, non-timber forest product such as plants, medicinal plants and edible mushrooms have been used in dailylife since ancient times.The use of non-timber product as food or medicine together with folklore systems continue to serve a large portion of the people, especially in rural area (Terakunpisut *et al*., 2007). Therefore, edible mushrooms are important to the way people live in this area.

The objective of research was to study seasonal and climate changes on biodiversity of macrofungi in community forest at Sai Yok district, Kanchanaburi province.

Materials and methods

Study site

Community forest at Sai Yok District, Kanchanaburi Province (Lat 14.239422° N, Long 99.058970° E) is located in western of Thailand. This research was performed in dry and wet season (2016), and was conducted by collecting mushroom samples in the month with the least average rainfall (February) and the month with the highest average rainfall (October) of this district.

Fungal identification

The fungal species were identified by morphological characteristics according to their microscopic structures such as colure, size, shape of spore and macroscopic structure such as fruiting bodies. Specimens for examining in light microscopy were mounted in the water, Melzer's reagent, and lactophenol-cotton blue for investigation of spores and other microscopic characters. In this study, identification of fungi was referered to Genera of polypores nomenclature and taxonomy (Ryvaede, 1991), Wood-rotting fungi of North America (Gilbertson, 1980), Mushrooms and Macrofungi in Thailand

(Soytong, 1994), Diversity of mushrooms and macrofungi in Thailand (Chansrikul, *et al*., 2008), North America Mushroom: a field guide to edible and inedible (Miller and Miller, 2006) and Wild Mushrooms of Thailand: Biodiversity and Utilization (Sanoamuang, 2010)

Diversity analysis

The value of diversity analysis was expressed in Simpson's diversity index (D). It was determined according to the following equation (Simpson, 1949; Krishanu, *et al*., 2017).

$$D = 1 - \frac{\Sigma ni(ni-1)}{N(N-1)}$$

ni = Total number of organism of a particular species.
N = Total number of organism of all species.
D = Simpson's diversity index

Results and Discussion

The results showed that seasonal and climate changes were directly affected to abundance and distribute of macrofungi species. The average rainfall of surveyed period during Feburary (dry season) and October (rainy season) was 3.60 and 250.7 mm., respectively (Data obtained from Hydro and Agro Informatics Institute, Ministry of Science and Technology, Thailand) (Figure 1), and the comparison of climatic data of Kanchnaburi province between dry season and rainy season was shown in Table 1.

Fifteen species of macrofungi were found in community forest at Sai Yok district, Kanchanaburi province. Fungal species were found including thirteen saprophytic macrofungi and two mycorrhizal fungi (Table 2). *Astraeus hygrometricus* and *Russula delica* are mycorrhizal fungi that found in this area. Two species of mycorrhizal fungi can be found in only rainy season, while *Ganoderma applanatum, Ganoderma lucidum*, *Schizophyllum commune*, *Microporus xanthopus* and *Trametes* sp. can be found both in dry and rainy seasons. Most of macrofungi are saprophyte and seven species were found to be an edible mushroom. In addition, *G. applanatum* and *G. lucidum* can be used as food and medicinal fungi (Pukahuta, *et al*., 2016). The diversity index of macrofungi in the dry and rainy seasons was presented in Table 2. The dry season had lower Simpson's diversity index than the rainy season (0.783 and 0.904 respectively). Therefore, the biodiversity of macrofungi species found in

rainy season that was greater than dry season. It could be suggested that the difference in climate such as rainfall, humidity and temperature could affect the number and diversity of macrofungi and mushroom.

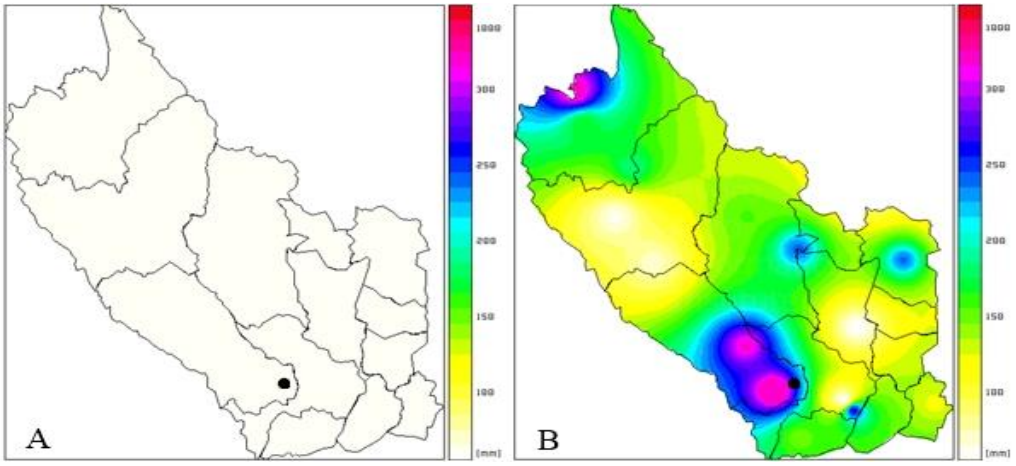

Figure 1. The average rainfall of Kanchanaburi province in February (A) and October (B) in 2016, Study site (●)

Table 1. Climatic data of Kanchanoburi province between dry season and rainy season in 2016

Climatic data	Dry season	Rainy season
Rainfall amount	3.6 mm	250.7 mm
Humidity	43%	80%
Average pressure	1013.6 mb	1008.6 mb
Average wind speed	8.9 mph	7.2 mph
Maximum temparature	36ºC	34ºC
Minimum temparature	24ºC	27ºC
Average temparature	30ºC	30.5ºC
Average UV index	8	6
Average sun hours	114.5 hr.	75.3 hr.

Table 2. Macrofungi in community forest at Sai Yok district, Kanchanaburi province in dry season and rainy season in 2016

Fangal strain	Family	Observed number		Edibility
		Dry	Wet	
Auricularia sp.	Auriculariaceae	-	10	edible
Ganoderma applanatum	Ganodermataceae	6	4	edible
Ganoderma lucidum	Ganodermataceae	4	2	edible
Schizophyllum commune	Schizophyllaceae	14	28	edible
Microporus xanthopus	Polyporaceae	7	8	inedible
Daldinia concentrica	Xylariaceae	-	6	inedible
Russula delica	Russulaceae	-	24	edible
Xylaria sp.	Xylariaceae	-	11	inedible
Leucocoprinus cepaestipes	Agaricaceae	-	5	inedible
Gloeophyllum odoratum	Gloeophyllaceae	-	2	inedible
Astraeus hygrometricus	Diplocystaceae	-	16	edible
Cyathus striatus	Nidulariaceae	-	18	inedible
Ramaria cyanocephala	Clavariaceae	-	27	edible
Clavaria sp.	Clavariaceae	-	15	inedible
Trametes sp.	Polyporaceae	8	4	inedible
Simpson's diversity index		0.783	0.904	

The dry season was predominated by the polypores and bracket fungi because there is decreased in rainfall and humidity, increased in sunlight and temperature, most of the fleshy macrofungi cannot tolerate these conditions. While, the gilled and fleshy mushrooms were found in the rainy seasons as this period is favourable for their production, since there is adequate moisture, suitable temperature, humidity and sunlight, which also aids the macrofungi in the degradation of organic matter (Andrew, *et al*., 2013). In this study, mycorrhizal fungi were found in rainy season because water availability was recognized to be a key factor for fruiting body formation of ectomycorrhizal fungi. Although the weather conditions play an important role, they do not completely explain the growth and productivity of wild mushrooms. Mycorrhizal fungi depend on the physiological state of host trees may well drive the growth of these fungi (Kauserud *et al*., 2008; Egli, 2011).

These results on the occurrence of the macrofungi revealed the source of edible and medicinal fungi in this district. The importance of macrofungi and mushroom is not only concerned in the ecosystem and human diet but also in bioremediation, biodegradation, pharmaceutical and other biotechnological applications.

Conclusion

Biodiversity of macrofungi was investigated in community forest at Sai Yok district, Kanchanaburi province in dry and rainy seasons in 2016. They were consisted of fourteen species of macrofungi. The results revealed that most of macrofungi are saprophyte, and seven species were found to be an edible ones. Two species of mycorrhizal fungi can be found in only rainy season. Moreover, abiotic factors such as the average rainfall, temparature and humidity have directly involved in fungal diversity.

Acknowledgement

The authors gratefully acknowledge climatic data support from the Hydro and Agro Informatics Institute, Ministry of Science and Technology, Thailand and National Research Council of Thailand (NRCT) for the financial support.

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(Received: 30 March 2017, accepted: 30 April 2017)