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Biodiversity of Mushrooms in Conservative Forest in Dansai District of Loei Province, Thailand

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Abstract: Dansai District is located in Loei Province, Northeast Thailand, rich in natural resources and composes of many kinds of forests, such as evergreen forests and mixed-deciduous forests. The objectives of the study are to determine the diversity of mushrooms and investigate the values of the forest influencing the community way of life and exploration of problems and guidelines for developing the forest along with sufficiency economy theory. The study includes compilation of data from past studies, semi-structured interview with the local communities and discussion with focus group. The survey was done once a month during the rainy season from May to August in 2012 and 2013. The results of the survey revealed 56 species belonging to 26 families, 38 genera. A total of 52 mushroom species belong to Basidiomycota, while 4 species belong to Ascomycota. The community forest remains fertile due to the conservation effort by the community leaders and a group of villagers. A community forestry board were set up to conserve the forest and proposed to the government at Dansai Vocational Community College to officially declare the forest as a formal community forest. The conservation management relied upon the kinship relations, seniority, and religious belief along with the enforcing authorities. If an encroacher is found, he would be fined according to the regulations and defamed publicly. However, encroachment still exists. In general, community forest is valuable and directly affected the villagers' ways of life in which they could generate income from the forest, particularly reducing the daily expenses and promoting their socio-cultural perspective.

Keywords: Mushroom, Conservation, Sufficiency Economy, Community Forest

INTRODUCTION

The remaining forest area in Loei Province, Thailand is estimated at approximately 7,893.54 km^2 or around 4,933,462.5 Rai (in 2012) which consists of dry evergreen forests and high mountains at about 300–600 m above the mean sea level (Information Center, Loei Technical College, 2012). Na Haeo District, whose border is connected to Dan Sai District of Loei Province, is rich in

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plants, animals, bacteria, and mushrooms. However, up-to-date research on biodiversity of wild mushrooms in this area is scanty. Thus, investigation on biodiversity of wild mushrooms and utilisation of natural resources from the forests is of great importance. Nowadays, many edible mushrooms have been scientifically tested in order to search for their bioactive compounds as free radical antioxidants, including Bod mushroom (Fangkrathok *et al.* 2013), Khon Khao mushroom (Attarat & Phermthai 2015), Na Muang mushroom (Gao *et al.* 2000; Zhao *et al.* 2011), Pluak mushroom (Cone mushroom) (Boonyanuphap & Hansawasdi 2011), Hing Kuek Ma mushroom (Judprakob *et al.* 2013) or even Lingzhi mushroom (*Ganoderma* sp.) (Li *et al.* 2013; Chen *et al.* 2014). Dansai is recognised as one of the areas that are noted for their greatest abundance of mushrooms, in which the villagers gain their living by foraging for wild edible mushrooms. At present, the success of the new cooperative organisations in the northeast of Thailand is based on the traditional unit of villages through communal rituals of guardian spirits, whose realm defines the community. More importantly, since Thailand emphasised economic growth through exploitation of its rich natural resources base at the expense of environmental and social consequences, Dansai has encountered a rapid decline in wild edible mushroom populations. The environmental degradation due to this exploitation has been devastating and the loss of large areas of forest has left rural people poorer, less self-sufficient, and with fewer opportunities. With this regard, sustainable development for improving the quality of life for the villagers while maintaining mushroom populations is needed. Before setting out the implementation plans for the sustainable strategy, the information pertaining to the mushroom biodiversity and the villagers' way of life is required. Therefore, this study was carried out to investigate the existing biodiversity of wild edible mushrooms along with the villagers' way of life and the conservation effort made by the community in Dansai to establish the strategies for sustainable exploitation of wild edible mushrooms and also to improve the villager's quality of life.

MATERIALS AND METHODS

The Collection of Mushroom Samples

The mushroom survey was conducted with 20 replications covering 3 areas of community forest in Dansai District from May to August 2012 and from May to August 2013, coincided with the rainy season (Fig. 1). Every mushroom was collected and its habitat conditions were recorded. The samples were photographed using Canon 600D camera. The physical factors including temperature (30ºC–35ºC), light density (16.8–17.0 MJ/m^2) and relative humidity (80%) were noted. In addition to the mushroom samples collected from the community forest during the survey, mushrooms were also gathered and bought from the villagers who went into the forest in Dansai for mushroom foraging. The details of the mushroom collection for the classification at the species level are as follows (Arora 1986; Stamets 2005; Orson *et al.* 2006; Webster & Weber 2007; Fereira 2010):

1) Various characteristics of easily-perishable mushrooms were recorded, including the liquid that leaked out when the mushrooms were torn, the change of colours of each part of the mushrooms and the colours of the bruises.
2) Other related ecological information was also recorded, including the trees that were found near the ground where the mushrooms grew, the types of forests, the nature of the mushrooms' development as well as the photos of the mushrooms in their natural habitats. After the mushrooms were brought to the laboratory, their visible physical features were described and the photos of the mushrooms were taken.
3) The mushroom samples were then made dried using a hot air oven at approximate temperature of 50°C. When the samples were dry, they were placed in transparent plastic boxes with silica sand inside to prevent insect infestation. The mushroom samples were labelled with their names, sources, date of survey, names of collectors, and examiners. Then, they were stored in the mushroom museum's cabinet.

Identification of the Roles and Functions of Mushrooms in Ecosystems

Identification of the roles and functions of mushrooms in ecosystems and habitats was done by observing the substrates that each mushroom species attached to during the field survey (Sakolrak *et al.* 2010). The studied mushrooms can be classified as follows:

1) Saprophytic mushrooms, which can be noticed by their attachment to dead leaves or plants.
2) Mushrooms that have relationships with other creatures, which can be divided into:
   - Ectomycorrhizal mushrooms, which grow directly on the soil.
   - Termite mushrooms that have relationships with termites or Cone mushrooms, which can be noticed from their features.
3) Plant parasitic mushrooms, which grow on living trees but in deteriorating conditions with other mushrooms growing on them.
4) Unknown function mushrooms, which are the ones that cannot be diagnosed and their origins cannot be clearly specified.

The local wise men and villagers whose daily life is involved in mushroom foraging and forest conservation were interviewed with the help of a semi-structured schedule. The subjects were asked to describe about the average consumption frequency of mushrooms, the way of getting mushrooms (forest or local market) and the number of mushroom species that were cooked for one meal. This qualitative research was conducted and data were gathered from past studies. Participatory Rural Appraisal (PRA) techniques and intensive group discussion were included in this study to gain knowledge from the villagers, who have planned to conserve the forest for sustainable exploitation of wild edible mushrooms (Fig. 2). With this regard, problems pertaining to a decline in

mushroom population were identified and the strategies of natural exploitation of natural resources were established.

Figure 1: The community forest at Dansai District, Loei Province, Thailand.

Figure 2: The discussion between the leaders of the community with his people in the village.

RESULTS AND DISCUSSION

The results of the survey revealed a total of 56 species of mushrooms, belonging to 26 families, 38 genera. Basidiomycota comprises 52 mushroom species in total while Ascomycota comprises 4 mushroom species. Based on their roles and functions in ecosystems, the mushrooms collected from the forest of Dansai could be classified into 25 saprophytic mushrooms, 20 ectomycorrhizal mushrooms, 4 termite mushrooms, 4 plant parasitic mushrooms, and 3 unknown role and function mushrooms. The results obtained in the present study showed that the community forest remains fertile and is appropriately conserved by the community leaders and a group of the villagers who set up a community forestry board and proposed to the government at Dansai Vocational Community College to officially declare the forest as a formal community forest. Moreover, the mushrooms in the forest of Dansai were found to be diverse. Since mushrooms provide direct benefits to the forest by setting in motion of the ultimate return of the organic building blocks to the ecosystem for reuse, the mushroom diversity data are important in this research due to the fact that diverse mushrooms can build soil fertility and sustainability for the forest trees.

During the field survey and the collection of wild edible mushrooms in the community forest in Dansai in 2012–2013, the climate in both years varied constantly and discouraged the growth of mushrooms. Heavy rain in the first year caused mushrooms to grow and decompose quickly, and therefore, only a small number of mushrooms were collected for classification. In the following year, the long period of drought which lasted quite long in the rainy season was the cause of very limited amounts of mushrooms or even none. Because the mushrooms collected in 2012–2013 were quite rare due to unfavourable growth conditions, the mushrooms found are less diverse than those found in the past years, as informed by the villagers.

According to the interview, the conservation management relies upon the kinship relations, seniority, and religious belief along with law enforcement. Should any encroachers be found, they would be fined according to the regulations and publicly defamed. However, forest encroachment by the villagers is identified as the main problem despite such strict regulations. To deal with this problem, encouraging the villagers to come to realise the importance of forest and biodiversity should be one effective way to conserved to community forest for sustainable exploitation of wild edible mushrooms.

Even though the conservative forest “Community Forest” movement has become more increasingly active in Thailand, Thai society is indeed facing a turning point. Thailand is searching for a more sustainable mode of forest use than the cultivation of forest frontiers shared by most rural societies. The past protected area management system which emphasised the ownership and control of forest by the state and overlooked the interaction between human and resources has failed because the annual rate of deforestation in Thailand is still as high as 2.6%. Therefore, people in the community rather than technology should be the target and the government turns to aim at introducing a new approach for protected area management that would involve local people in the process, for example, a case of buffer zone management through collaborative

efforts at the south-eastern corner of the buffer zone of community forest, in the Northeast of Thailand.

This strategy has also been introduced to conserve the community forest in Dansai, in which Participatory Rural Appraisal (PRA) techniques including secondary data study, physical survey, participatory meeting, and semi-structured interviewing were employed in data gathering throughout the project. In this context, the villagers were informed of the contribution of wild mushrooms to the forest fertility and encouraged to forage for mushrooms in the right season in order to enable sustainable exploitation of natural resources. This study suggests that there is a chance to create a better understanding among rural people of the importance of forest and nature conservation that will lead to a better management of natural resources in the future.

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