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Complete Report of

Diversity and Dynamics of Epiphyte, Hemiepiphyte, and Parasite in
Tropical Forests of Doi Inthanon National Park

Part 1. Summary Report

1. Abstract

Flora and Ecology of epiphytic, hemiepiphytic and parasite plants in canopy layer were studied in the canopy of tropical montane forest of Doi Inthanon national Park. In this report we use a term, canopy plants which indicating the plants living in canopy layer and main stems as epiphyte, hemiepiphyte, parasite, and liana. In these study we applied tree climbing techniques using the single rope and double rope techniques. This method enable the direct access to the canopy layer for researchers.

Chapters 1 to 7 of main reports are the results of our taxonomic and inventory study for bryophytes and vascular plants. Our exploration of bryophytes in our main research site, a 15-ha forest dynamics plot at 1700 m altitude, found 50 families, 117 genera and 210 species, excluding those as yet unidentified to species from the top crown to ground level in the plot. Representatives of 33 families, 90 genera and 138 species of mosses (Musci), 16 families, 26 genera and 71 species of liverworts (Hepaticae), and 1 family, 1 genus and 1 species of hornwort (Anthocerotae) have been identified (See Chapter 6).

Three new moss species are reported based on the collections: they are Clastobryopsis imbricate (Chapter 2), Indopottia irieandoana (Chapter 3), and Symphyodon leiocarpus (Chapter 1). Especially, Indopottia irieandoana is a second species in this new genus recorded in 2010 from India. The novel occurrence of Scopelophila cataractae growing on tree trunks was reported (Chapter 4) and nematode galls in Lejeunea tuberculosa by (Chapter 5).

Vascular canopy plants were also prepared for the 15-ha forest dynamics plot at 1700 m altitude and also from the additional plots located at 2200-2300 m altitude (Chapter 7). From the 15-ha long-term monitoring plot, 74 species in 56 genera, and 32 families were
recorded excluding unidentified species, comprising 2 Lycopodiophytes, 24 Pteridophytes, 1 Gnetophytes, and 47 Sporophytes. Among these records, two species, Mappianthus iodoide Hand.-Mazz. and Loranthus delavayi Tiegh are new records for Thailand. From three plots around 2,213-2,293 m alt. 36 species were recorded and 22 species were shared with the 15-ha plot. The sampling efforts in upper altitude plots were, however, less than the others. Therefore, more sampling of canopy plants in the upper plots are needed before full comparison can be made. From our preliminary inventory at upper plots, however, we recorded 36 species and 12 species among them has not yet been recorded in the lower plot. It suggests the considerable differences of canopy flora occurs between the upper and lower plots, even these plots located in a same montane zone.

Thus our plant diversity inventory for bryophytes and vascular plants are successfully done. The application of tree climbing techniques to the research work enable the innovative impact to the research. This is the first systematic inventory conducted for the canopy of tropical montane forest of Thailand. Although a part of our results have not yet published, we are preparing the publication of these findings.

Our sampling of canopy plants were conducted for eleven host trees in the 15-ha research plot. In Chapter 8, Ando et al. examined the relationships between the sampling effort and recorded number of species both for bryophytes and vascular plants. The curves were not saturate and the number of species was still increasing at eleven sample host trees. The number of species is expected to be increased by increasing the sample size. Thus the further efforts are necessary to achieve the complete species diversity data and floral list of the canopy.

Our ecological studies focus on the plant community analysis of canopy plants and development of methodology to estimate the canopy plant, especially epiphytic plants on the crown. Chapter 8 focuses on the community analysis and habitat differentiation of canopy plants. By setting 222 plots on eleven host trees, all of epiphytes, parasites and lianas were recorded. The canopy plants assemblage was divided into five community types both for vascular plants and bryophytes. In the case of vascular plants, the habitat differentiations among community types were clear along the vertical gradient from top crown to lower main stem. In the case of bryophytes, the primary differentiation of habitat was occurred as host tree preference. Mastixia euonymoides with deeply and coarsely cracking bark, and other host tree species with smooth or powdered bark attract different bryophytes community types. The habitat differentiation along the vertical gradient was detected in bryophyte communities as secondary pattern. Thus the habitat differentiation pattern was totally different among the
bryophytes and vascular plants even they grow together on the stem and branches. High diversity of epiphytic plants is maintained by the habitat differentiation between community types by reducing the competitive exclusion each other. It also suggests that the complex canopy structure of the forest is also important factor to maintain the diversity of canopy plants and conservation of forest structure and tree species diversity are key for the protection of canopy plant flora.

Chapter 9 focuses on the estimation of epiphytic plants biomass on an emergent tree. We developed a method with the minimum destructive sampling. In this study, we developed a three-dimensional tree-form mapping method. The tree form of a 47 m-high emergent tree in the 15-ha forest dynamics plot was measured and reconstructed, and the distribution of epiphytes on the tree was accurately recorded. The epiphytic matter, which consists of epiphytes and canopy humus, on the tree was classified into six types on the basis of its physiognomy, and destructive sampling of the epiphytic matter was performed for each type with three or four replications. The total epiphyte biomass and canopy humus on the tree were 158.2 kg and 381.3 kg in dry weight, respectively. Approximately 96% of the epiphyte biomass was concentrated in the tree crown, above 20 m. The distribution of epiphytic matter types was found to depend on branch diameter, and their spatial distribution from the outer crown to the inner crown was successfully visualized on the three-dimensional reconstructed form of the tree. Thus the excellent method enabled minimum destructive measurement of epiphytic biomass. The further application of the method to the stand level estimation of epiphytic biomass is required. The method is also the fundamental for the ecosystem study in the canopy layer and also for the long-term monitoring of canopy plants dynamics as the method provides the accurate mapping methods of epiphyte plant on the huge trees.

Chapter 10 focuses on the wood density survey and the estimation of biomass in the 15-ha research plot. In relation to the carbon sequestration in the forest ecosystems, the accurate estimation of forest biomass is the urgent requirements. The estimation in the tropical montane zone is quite limited. The study challenged the topic and successfully estimated the biomass using the model incorporating the wood density of species. As wood density varied widely depending on ecological characteristics of species, the estimation in chapter 10 provide the most reliable biomass estimation. The method should be extended to below ground biomass in a future study.
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