DIWPA: DIVERSITAS in the Western Pacific and Asia

DIWPA News Letter

Office: Center for Ecological Research, Kyoto University, Otsu, Japan

October 2018

No. 39

Message

from the Chairperson

Shin-ichi Nakano

From 21 to 22 February 2018, I attended to the 9th Workshop of Asia Pacific Biodiversity Observation Network (AP-BON) held at Kasetsart University, Bangkok, Thailand. This was the first opportunity for me to visit to Thailand, but unfortunately I could stay there only three days: my arrival was in the evening of 20 February, and leaving in the evening of 22 February. We had 71 participants from 15 nationalities, and there were experts for forest, marine and freshwater ecosystems. The workshop was mainly hosted by Prof. Yongyut Trisurat, and there were four keynote speeches in the morning of the first day. In the afternoon, we discussed about AP-BON's contribution to IPBES. In the morning of the second day, parallel sessions for the ecosystems were conducted, and I joined in the session of Freshwater Biodiversity Group chaired by Dr. Yuichi Kano, Kyushu University, and gave a talk about Freshwater BON which has been newly established in the last year by Drs. Eren Turak, Aaike De Wever and Jeanne Nel. Other speakers were Drs. Te-Yu Liao (Taiwan), Chaiwut Grudpan (Thailand), Yuichi Kano (Japan) and Chhuoy Samol (Cambodia). Prof. Tetsukazu Yahara and Dr. Mike Gill, Co-Chair of GEO BON, also attended the session. In the afternoon, we had a plenary session to discuss about the new work plan of AP-BON. I thank Professors Yongyut Trisurat, Tetsukazu Yahara, Eun-Shik Kim (South Korea) and Sheila Vergara (Philippines) for their great organization of the workshop. Thanks are also due to the support by the Ministry of Environment Japan. More information about the workshop is available at: http://www.esabii.biodic.go.jp/ap-bon/meetings/documents/summary_20180221-22.pdf

Since my stay in Thailand in this time was so short, and I really want to visit there again. The 10th AP-BON Workshop was held from 6 to 7 July 2018 in Kuching, Malaysia, but unfortunately I could not attend due to schedule conflict. GEOSS Asia-Pacific Symposium and GEO WEEK 2018 will be respectively held from 24 to 26 October and 29 October to 2 November in Kyoto, and I intend to attend them. I hope many biodiversity researchers would attend them to discuss about future collaboration for biodiversity conservation all over the world.

Message

from the Secretary General

Atsushi Ishida

We held International Field Biology Course (IFBC) in August, 2018 at Kiso in Japan. In this year, the main topic in IFBC was stream ecosystems. We invited a young researcher from Malaysia. The report from the invited researcher will be delivered in the next newsletter. Furthermore, Center of Ecological Research in Kyoto University is planning a symposium related to biodiversity and ecology. The symposium will be conducted in February 2019 in Kyoto. DIWPA will be able to invite a researcher to the symposium. Please look at the back of this newsletter.

In this summer, it was unusually hot in Japan. I sometimes found dead trees planting along roadsides, probably because of heat wave. Furthermore, many typhoons and torrential rains pounded Japan. Such abnormal weather phenomena will severely affect terrestrial ecosystems. Drought-induced tree death and collapse of forest ecosystems have been reported in many biomes worldwide under global climate change. I believe that we need to more exchange recent information relating to the change of biodiversity and ecosystem service among countries. I hope DIWPA can be a good platform for it.

Brown rot caused by *Pyrrhoderma noxium* in Ogasawara Islands. Where does it come from?

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The fungus *Pyrrhoderma noxium* (Corner) L.W. Zhou and Y.C. Dai is infamous for causing brown root rot in a variety of woody tree species in landscapes, orchards and forests. This fungus is distributed in tropical and sub-tropical regions in Southeast and East Asia, Oceania, Australia, Central America and Africa. It has a wide range of hosts including more than 200 species in 59 families (Ann *et al.* 1999) and several new tree species have recently been added to this list. The economically important plants attacked by *P. noxium* include cacao (*Theobroma cacao*), coffee (*Coffea* spp.) and rubber (*Hevea brasiliensis*) as well as diverse fruit, nut, ornamental and other native/exotic trees. This pathogen shows little host specificity (Sahashi *et al.* 2010). Its wide geographical distribution and the severe damage which it causes have drawn significant concerns.

The conventional diagnosis of brown root rot caused by *P. noxium* involves observation of the symptoms and isolation of the pathogen from diseased tissues. Trees infected with *P. noxium* normally show slow and reduced growth, discoloration and wilting of foliage, defoliation and dieback of branches (Sahashi *et al.* 2012) (**Fig. 1**). The exposed roots and basal stem are often encrusted with a yellowish-brown, brown or brownish-black mycelial mat (**Fig. 2**). The disease name "brown root rot" describes this symptom. However this fungus causes "white rot" which makes the wood soft, spongy and whiter than normal. Well-developed white rots caused by *P. noxium* have conspicuous brown lines permeating the rotted wood, which is known as white pocket rot (**Fig. 3**).

Fig. 2. A dark brown to black mycelial crust at the stem base; encrustation sometimes grows up to over 1m above the ground.

Fig. 1. Trees infected with *P. noxium* defoliation and dieback of branches.

Fig. 3. Well developed white rot with conspicuous brown lines.

White pocket rot fungi can selectively remove lignin from wood leaving substantial amounts of cellulose in isolated areas. Most affected trees die within only a few months of infection. Mature fruiting bodies were sometimes observed on dead and/or fallen trees (**Figs. 4a**, **b**).

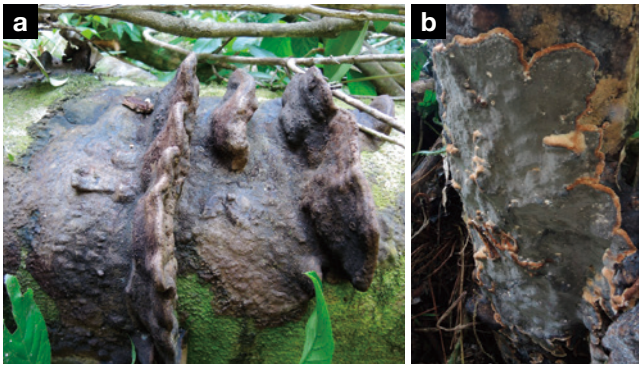

Fig. 4. Mature fruiting bodies of *Pyrrhoderma noxium* on dead fallen trees. a: A conk-shaped fruiting bodies. After these fruiting bodies occurred, the tree was fallen. b: A resupinate type of fruiting body.

P. noxium can be isolated from infected tissues on potato dextrose agar (PDA). Brown colonies form on PDA accompanied by irregular dark brown lines or patches.

In Japan, brown root rot was first found in windbreaks composed of *Casuaira equisetifolia*, *Calophyllum inophyllum*, *Podocarpus macrophyllus*, *Garcinia subelliptica*, *etc.* on Ishigaki Island in Okinawa Prefecture in 1988 (Abe *et al.* 1995). Since then, the disease has gained increasing attention as it has appeared on several of the Ryukyu Islands in both Okinawa and Kagoshima Prefectures, causing serious problems for shade, windbreak and ornamental or landscape trees. Recently, there have been concerns about severe damage to mango (*Mangifera indica*) trees in orchards and to big trees around "Utaki", a sacred site in Okinawa. So far, the northernmost distribution point of the disease is Amami Oshima Island (Sahashi *et al.* 2007). Cape Sata in Kagoshima Prefecture, which is the southernmost point of Kyushu Island, is the northernmost record of basidiocarps. The pathogenicity of *P. noxium* against commercially important species in Kyushu and Honshu has been explored using inoculation tests (Sahashi *et al.* 2014). The results suggested that there is a possibility of serious damage if *P. noxium* invades the temperate zone of Japan as climate change progresses.

In 2008, the first suspected case of brown root rot was found on *Pittosporum boninense* in Chichi-jima in the Ogasawara Islands, oceanic islands located approximately 1,000 km south of Tokyo. In 2009, the pathogen was isolated from dead *Neolitsea sericea* var. *aurata* and was positively identified as *P. noxium.* In 2012, there were 33 recorded host species of *P. noxium* including 13 endemic species (Shimada *et al.* 2013). These numbers had increased to 41 host species including 15 endemic species by 2014 (Sahashi *et al.* 2015). Interestingly, basidiocarps of *P. noxium* were recorded on the Ogasawara Islands in 1916. However, if this recent damage was due to recently introduced new genotype(s), the scale of the damage could become enormous. The pathogen has a wide host range with little host preference and there are many endemic species in the Ogasawara islands.

Akiba *et al.* (2015) examined the population genetics of *P. noxium* in Japan with 20 microsatellites and found high levels of genetic diversity within 128 isolates from 12 of the Ryukyu Islands and three of the Ogasawara Islands. All isolates had unique genotypes indicating that basidiospore infection is a primary dissemination method for the formation of new disease foci. The highly polymorphic nature of the microsatellite loci suggested that Japanese populations are indigenous or were introduced a very long time ago because genetic diversity is commonly lower in introduced populations than in native populations due to the so-called "founder effect". In addition, two distinct populations with little admixture were detected from Ryukyu and Ogasawara islands, suggesting the possible invasion of a genetically distinct population to the Ogasawara Islands, possibly introduced via basidiospores or mycelia within wood carried by a typhoon from the Mariana Islands.

Researchers have also focused on how *P. noxium* has spread throughout the regions of Asia. Genomic analyses of isolates from Taiwan, the Ryukyu and Ogasawara islands showed that Taiwanese isolates grouped together with Ryukyu isolates, separately from Ogasawara isolates (Chung *et al.* 2017). The pattern of gene flow within and between islands suggested that human activity such as planting of infected seedlings may have promoted the movement of *P. noxium* and provided new environments for the population to increase.

Further population genetics studies using isolates collected from around the world will be useful to understand the evolutionary history of *P. noxium* and its worldwide dispersal routes. Analyses of the genetic relationships and ecological differences among *P. noxium* lineages across eastern Asia and Oceania are ongoing and include isolates from Japan, Taiwan, Hong Kong, Malaysia, Australia, and the Pacific islands of Palau, Guam, Saipan, Yap, Pohnpei, Kosrae and American Samoa (**Fig. 5**). It is important to predict the pathogen's behavior and invasive capacity, especially under the conditions of climate change in the near future.

Fig. 5. The research trip to Micronesia. Under the infected tree in Pohnpei with the member from USA, Korea, Japan and Pohnpei. See the dark brown to black mycelial crust on the base.

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Phu Koa - Phan Kham National Park in Northeast Thailand

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Introduction

Phu Kao–Phu Phan Kham National Park (PKNP) is one of the 127 national parks in Thailand. The national park is named after the Phu Kao (PK) and Phu Phan Kham (PPK) mountain ranges of the Khorat Plateau which covers an area of 318.4 km^2. It is located between 16°44'–17°2'N and 102°25'–102°43'E in Nong Bua Lamphu Province, south of Udon Thani Province and north of Khon Kaen Privince (**Fig. 1**).

Fig. 1. Location of Phu Kao – Phu Phan Kham National Park in Thailand ("Thailand_location_map.svg" by NordNordWest is licensed under CC BY-SA 3.0, https://commons.wikimedia.org/wiki/File:Thailand_location_map.svg)

Based on the stratigraphic sequences and fossil correlation, two assemblages of the trigoniodid bivalves are indicators of non-marine cretaceous bivalves that once inhabited in the area. Such assemblages have been found in PK and the Khorat Plateau of northeastern Thailand (Sha *et al.* 2012).

In PK area, three village communities, Dong Bak, Wang Mon and Chai Mongkala, have settled down in its central plain. These communities expanded very rapidly within the last 20 years, which resulted in the severe forest fragmentation and degradation of the plain. The government of Thailand designated this national park as its 50th national park on September 20, 1985, as a measure to stop the severe degradation of this area caused by an increase in human activities over the past 20 years (Trisurat 2007). The Phu Koa Mountain Range consists of two parallel lines of mountains. The outer line is steeper and higher and ranges from 447 m to 580 m a.s.l., whereas the inner line is lower, ranges from 313 m to 380 m a.s.l..

Meteorology and geology in PK

From the climate record over the 34 years from 1982 to 2017, the highest monthly mean temperature was 30.0 °C in the month of April, and the lowest temperature was 22.7 °C in December. Annual rainfall was 1,295.5 mm (**Fig. 2**). The maximum precipitation was 289.0 mm in August, and the minimum precipitation was 3.0 mm in December. The period of rainy season is usually from June to October. The rainy days reached 21.5 days in August, and 0.8 day in December. At the beginning and end of the rainy season, storms sometimes occur and result in natural disasters, such as flooding. In PK, there is a dam known as Ubonrat dam which 1,674,100,000 m^3 of water flow through

per year.

Huay Bong is a small creek that lies from the north to the south in the area of PK, and the water of the creek flows into Nam Phong River in the west PK. Of 114 km^2 area, it is located in Nam Pong basin which makes up Nam Chi basin. (**Fig. 2**). Huay Bong creek is a major creek with a total length of 13.5 km and its annual runoff yield is of approximately 7.68 L min^{-1} km^{-1} and 28,090,000 m^3 (data from the weather station at Ubonrat dam, 2017).

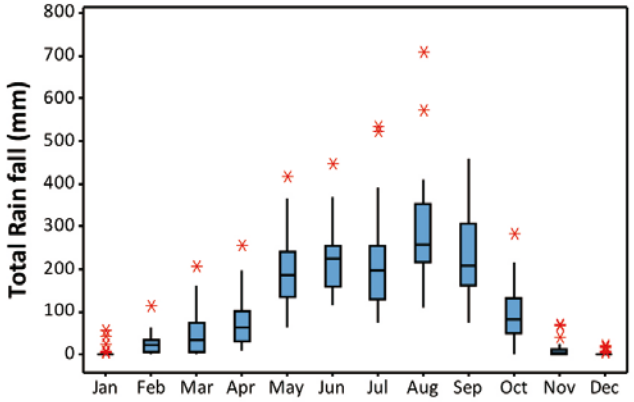

Fig. 2. Monthly precipitation from 1982 to 2017

Forest vegetation in PK

The vegetation mainly consists of three types of forests, mixed deciduous forests (MDF), dry dipterocarp forests and dry evergreen forests. Almost all trees in MDF are dry-deciduous trees that have an off-leaf period during the dry season (Ellis *et al.* 2010, Santisuk *et al.* 1991, Myers *et al.* 2000, Stibig *et al.* 2007 and Bajracharya *et al.* 2007).

In the MDF, 23 predominant woody plants have clumped distribution (**Table 1**), where clumped distribution is the most common type of tree dispersion pattern in PK. For clumped distribution, the distance between neighboring individuals is minimized which suggests that soil resources are patchily distributed in PK (Bajracharya *et al.* 2007). As a result of relatively heavy seeds, the dispersal distance is shorter, thereby contributing to their clumped distribution.

Table 1. The distribution pattern of individual trees of 23 predominant woody plants species (Important value, IV > 11). A value of 1 in Morisita's index ($I\delta$) indicates a random distribution, the values more than 1 indicate a clumped distribution, and the values less than 1 indicate a uniform or regular distribution.

Scientific name	Family	Iδ
Cananga odorata	Annonaceae	1.8
Pterocarpus marcocarpus	Fabaceae	1.3
Shorea obtula	Dipterocarpaceae	4.1
Vitex pinnata	Verbenaceae	1.6
Bauhinia saccocalyx Pierre.	Fabaceae	1.5
Sindora siamensis	Caesalpiniaceae	1.7
Lagerstroemia floribunda	Lythraceae	3.8
Terminalia corticosa	Combretaceae	1.8
Dalbergia nigrescens	Papilinoideae	4.0
Hymenopyramis brachiata	Lamiaceae	2.2
Bombax anceps	Bombacaceae	3.1
Sterculia guttata	Sterculiaceae	2.8
Haldina cordifolia	Rubiaceae	1.6
Anthocephalus chinensis	Rubiaceae	2.2
Dipterocarpus obtusifolius	Dipterocarpaceae	6.0
Irvingia malayana	Rvingiaceae	6.0
Pentaptera tomentosa	Combretaceae	3.3
Caesalpinia godefroyana	Leguminosae	2.9
Hymenodictyon excelsum	Rubiaceae	1.7
Shorea siamensis	Dipterocarpaceae	3.0
Xylia xylocarpa	Leuminosae-Mimosoideae	1.9
Rothmania wittii	Rubiaceae	5.3
Microcos paniculata	Tiliaceae	5.5

Data sources are from Popradit *et al.* (2015)

Scenario in forest conservation in PK

The Royal Thai Government has emphasized the importance of maintaining biodiversity (Bajracharya *et al.* 2007), and the government has identified continued development as the reason for serious deterioration of the natural and environmental resources in Thailand. In 1995, Thailand was grobally ranked among the bottom ten tropical countries with the worst annual rate of forest loss (Popradit *et al.* 2015). The Government has implemented two measures; first, they have designed forest policy to avoid further deforestation and to increase forest cover; second, they have established a network of local governments to oversee issues related to protected forests and reforestation. Although PK was declared as a protected area more than 20 years ago, forest invasion by local people has ongoing until now.

Conflict between the national park staffs and the local people in PK creates severe problems, such as illegal use and/or the occupation of park lands.

As the natural forests have economical uses, and they serve as a major food bank to the local people, such as mushroom, bamboo shoots, medicinal herbs, wild fruits and wild animals, more communications between the local people and researchers are needed to reduce the anthropogenic effects on natural forests' rich resources.

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CALL FOR NEW MEMBER OF DIWPA

We are now calling for membership of DIWPA. Membership fee is no charge. When you become a member, you can;

1. Receive the DIWPA News Letter

You can receive the News Letter by post or e-mail. News Letter contains various information of biodiversity research in Asia Pacific area, especially reports on every project and activities of AP-BON (Asia–Pacific Biodiversity Observation Network) as well as J-BON (Japan Biodiversity Observation Network), IPBES (Intergovernmental Science and Policy Platform on Biodiversity and Ecosystem) and new big project which is "Observation, Evaluation and Prediction of Biodiversity in Asia" by the Environment Research and Technology Development Fund. All you can get above information is ONLY in DIWPA News Letter except that AP-BON provides them in its own website.

2. Apply for the Field Biology Course

You can apply for the Field Biology Course sponsored by DIWPA. The chosen candidate would participate the Field Biology Course which is organized by Kyoto University. There are few international initiatives which conduct educational activities such as DIWPA even though some of the initiatives carry out biodiversity research.

3. Run your articles regarding your biodiversity activities in DIWPA News Letter

DIWPA introduces our member's various activities in DIWPA News Letter. Your activities would spread throughout the world, and you may receive more information about biodiversity conservation as well as the supports.

4. Build up a circle of friends within biodiversity research

Ask DIWPA when you want some information of foreign countries regarding your biodiversity research. DIWPA can introduce people who have information you want. More than 400 members in 41 countries belong to DIWPA network.

If you would like to join DIWPA, please contact to "***DIWPA@ecology.kyoto-u.ac.jp***".

DIWPA scholarship for

"Symposium of Integrative Biology 2019 : Biodiversity in Asia"

DIWPA invites applications for a scholarship to attend "Symposium of Integrative Biology 2019 : Biodiversity in Asia" which will be held on February 21-22, 2019 at Kyoto University, Japan. Kyoto University is proud of its diverse and large pool of ecologists and environmental scientists. Some studies behavior of mammals, others studies diversity of plants, and still others study ecological function of microbial organisms. Here we aim to integrate such biological knowledge to tackle further understanding of the nature, and share its efforts with diverse group of biologists in Asia.

This year, we will also have an additional workshop regarding the application of drone mapping techniques to the environmental science, where the participants will learn the techniques and discuss future application of the tool for the research. One of the main functions of DIWPA is "capacity building of scientists in particular young scientists from developing countries". We look forward to your applications.

DIVERSITAS in the Western Pacific and Asia (DIWPA) is an international network for the promotion of cooperative studies and information exchange on biodiversity in the Western Pacific and Asia. The term of "Western Pacific and Asia" is used in this proposal to intend to cover East Asia, South Asia, Southeast Asia, Melanesia, Micronesia, Australia and New Zealand. DIWPA aims to connect existing networks of people working on biodiversity and research projects in Asia and the Western Pacific. For more information, please visit our URL: http://diwpa.ecology.kyoto-u.ac.jp/index.html

Details

1. **Date** : February 21-22, 2019
2. **Place :** Maskawa Hall, Kyoto University, Kyoto
   Center for Ecological Research, Kyoto University, Otsu, Shiga
3. **Application :**
   Applicants should be a member of DIWPA at the time of October 31, 2019.
   If you would like to join DIWPA, please contact to DIWPA@ecology.kyoto-u.ac.jp.
   Applicants interested in drone mapping techniques are particularly preferable.
   Applicants should prepare the following documents.
   1) CV
   2) A statement of their interests in the field of ecology
   3) A recommendation letter
4. **Application submission and deadline :**
   Submit an application to DIWPA office (DIWPA@ecology.kyoto-u.ac.jp) by e-mail before **November 20, 2018**.
5. **Financial support :**
   Kyoto University provides a scholarship to cover his/her expenses for accommodations and travel.

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