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Nest Structure and Nesting Habits of *Polyrhachis muelleri* Forel, 1893 in Eastern Thailand (Hymenoptera: Formicidae)

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ABSTRACT.- We investigated the nest structure and nesting habits of *Polyrhachis muelleri* Forel, 1893 in Eastern Thailand where we found 23 colonies dwelling and nesting in the shrub layer about 1.0 - 4.5 m above the forest floor. They construct their nests on the underside of broad - leaves of different tree species. The nests were constructed of a loose and thin pure silk possessing an oval or elliptic shape. The present paper recorded a new distribution for this ant species in Thailand at Khao Soi Dao Wildlife Sanctuary, Chanthaburi province and also recorded new host plants. Nest structure and nesting habits are discussed in comparison with those of other *Polyrhachis* and other genera.

KEY WORDS: *Polyrhachis muelleri*, Formicidae, ants, nesting habits, Thailand.

INTRODUCTION

Polyrhachis is one of the largest ant genera in the world, distributed in the Old World tropics and subtropics. Currently, 470 species have been described around the world. They construct nests in all strata, from deep in the soil up to the forest canopy (Liefke et al., 1998). The architecture of *Polyrhachis* nests is astonishing. Many species are able to construct silk nests with the aid of their larvae (Liefke *et al.,* 1998). Some of *Polyrhachis* ants construct nests without larvae silk, nesting in rotting logs on the forest floor or digging into the soil creating cavities. Although the biodiversity study of *Polyrhachis* has been regarded as poorly known in Thailand, Jaitrong and Nabhitabha (2005) recorded about 20 species distributing throughout the country, but the lack of investigations into behavior and ecology have resulted in them being poorly known until now.

Polyrhachis muelleri Forel, 1893 is not only an arboreal ant that is found in Thailand, it is also distributed in Malaysia, Java, Borneo and Philippines, where they serve an important function in tropical ecosystem. We were interested in their behavior and how they constructed their nests; therefore, we concentrated our survey to study nests in the eastern part of Thailand, in order to know their real function in ecosystem.

MATRIAL AND METHODS

This study was conducted at Khao Ang Reu Nai Wildlife Sanctuary (KARNWS), Chachoengsao Province and Khao Soi Dao Wildlife Sanctuary (KSDWS) Chanthaburi

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Province, Eastern Thailand between 2004 and 2005. We surveyed Polyrhachis nests on the ventral surface of broad-leaves along the forest roads, measured the height of the nests positions above the forest floor. We collected 4 young and 19 mature nests in plastic bags, labeled the host plants and carried them back to laboratory. During night time, we observed their behavior and activities. In the our Laboratory of Entomology, Natural History Museum, National Science Museum, Thailand, we conducted the measurements of the nest size, observed nest structure, counted the numerous ants (adult, larvae, pupae, queen and the reproductive ants of male and female) and looked for food resources.

These Polyrhachis specimens were sent to the Ant Collection, Kagoshima University, Japan, to review and confirm their systematics.

RESULTS

The workers of *Polyrhachis muelleri* Forel, 1893 were a single size (monomorphic type), which were black and about 7-8 mm in length (figure 2). The larvae and pupae are greenish about 6-7 mm in length. The pupa of this ant was wrapped by a thin cocoon. The colony sizes were very small with only 36-92 workers consisting of a few winged ants and only 1 queen per colony.

Nesting sties

The species under our investigation were found in 23 colonies at KARNWS, Chachoengsao Province and KSDWS, Chanthaburi Province, Eastern Thailand, which consisted of young and matured nests. All of the colonies were found in disturbed areas along the forest road, except 2 nests from KSDWS, which were found in the primary forest (Dry evergreen forest) near a stream. The *P. muelleri* dwell and construct their nests at the shrub layer about 1.0 - 4.5 meters above the forest floor.

Within the study sides of Eastern Thailand, we found *P. muelleri* nesting on the ventral side of the leaves of varied trees, which are broad-leaved plants, such as *Xerospermum noronhianum* (Blume) Blume, *Garcinia vilersiana* Pierre, *Gonocaryum lobbianum* (Miers) Kurz, *Sageraea elliptica* (A.DC.) Hook.F. & Thomson, *Canthium* sp. *Diospyros* sp., *Pterospermum diversifolium* Blume and *Syzygium* sp.

Nest structure

Polyrhachis muelleri constructed their nests on the ventral side of broad-leaved plants. Normally the nests cover about 30-50 % of leaf surface and contained openings around the nest ridge (figure 3). The nests were oval or elliptical in shape between 70 and 110 mm in length and between 40 and 60 mm width in matured nests, but circular in shape and 20-35 mm in diameter in new nests. The pavilions were built loosely and thinly by larva silk and one is able to see workers, greenish larvae and pupae inside the nest. The wallpaper was made from pure larval silks without dead plant and soil particle supplementing the construction of matured nests. In the new colonies, we found the nests were made from larval silks combined with soil particles and discarded food particles. Inside the nests, we found a brownish or golden sticky silk cover on the leaf surface at the middle of nest, which is used for hanging and fixing their eggs, larvae and pupae (figure 4). The head of the pupae hanging down, making it easy for them to molt when they become an adult.

In the laboratory, we nurtured the ants in plastic boxes. After the nests were damaged, the workers quickly reconstructed their nest by using the old silks. Some ant colonies made on the underside of leaves. When being turned up, the workers will quickly re-build their nests on the underside with their old silken patches. Additional information on food: *P.muelleri* prey on small insects and other ants such as

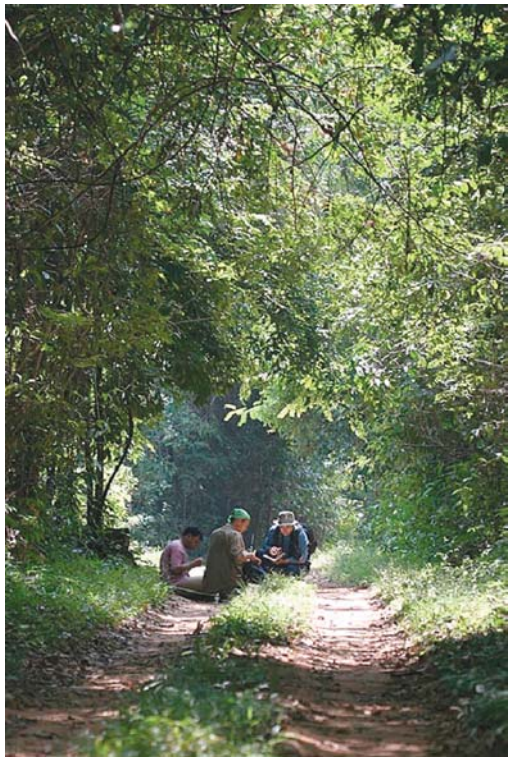

Fig. 1 Site study, observing *Polyrhachis muelleri* along the forest road sites.

Fig. 2 Worker ant of *Polyrhachis muelleri* were a single size (monomorphic type), black and about 7-8 mm in length.

Fig. 3 Silk nest of *Polyrhachis muelleri*, built loosely and thinly and not yet combined with dead plant and soil particle supplementation.

Fig. 4 Inside a removed silk nest consisting of sticky silks covering a leaf surface at the middle of nest, which used for hanging and fixing their eggs or pupae.

Table 1 Showing a comparison of host plants in the present paper and previous paper.

Present paper	Previous paper (Liefke *et al.,* 1998)
Xerospermum noronhianum (Sapindaceae)	*Achasma* sp. (Zingiberaceae)
Garcinia vilersiana (Guttiferae)	*Donax grandis* (Maranthaceae)
Gonocaryum lobbianum (Icacinaceae)	*Musa* sp. (Muraceae)
Sageraea elliptica (Annonaceae)	*Citrus* sp. (Rutaceae)
Canthium sp. (Rubiaceae)	Palms
Diospyros sp. (Ebenaceae)	
Syzygium sp. (Myrtaceae)	
Pterospermum diversifolium (Sterculiaceae)	

Oecophylla smaragdina, *Camponotus* spp., *Odontoponera denticulata*. Sometimes we found their predators in the nest, such as the spider (*Myrmirachne* sp.).

DISCUSSION

In Thailand, the ant which was the subject of our investigations had been recorded only in KARNWS, eastern Thailand (Jaitrong and Nabhitabhata, 2005). In this study, we recorded a new distribution datum for this ant, which is in the KSDWS, Chanthaburi province, but it is still a rather rare ant species. The information on behavior or nesting site of *P. muelleri* had been little known or studied, with the exception of Liefke et al (1998), which reported on nesting and food resources of the ant genus *Polyrhachis* in West-Malaysia; however, this paper is the first record on nesting habits, nest structure and behavior from eastern Thailand.

The colony sizes of this ant is very small if compared with others *Polyrhachis* of same subgenus (*Myrmhopla*), e.g., of *P. schellerichae*, *P. arachne*, *P. dives*, *P. furcata*, or *P. bicolor* they all have larger colonies (Liefke *et al.,* 1998); however, the nest habits of *P. muelleri* do not overlap with those *Polyrhachis.* Our ant dwelled and foraged at the shrub layer. We observed that they hunt the butterfly caterpillars; thus, the ant which investigated was important for protected their host plants from the pest.

P. muelleri constructed their nest in vegetation (Jacobson, 1908; Dorow & Maschwitz., 1990), which different from the ponerine ants that mostly nest in the soil or rotting logs without larval silk e.g., *Harpegnathos saltator* in Southern India (Peeters *et al.,* 1994), *Odontomachus rixosus* in West Java (Ito *et al.,* 1996) or the amblyoponine is *Amblyopone* sp. (*reclinata*-group) in West Java (Ito, 1993); moreover, the habitat of constructing their nests differently from other Polyrhachis e.g. *Polyrhachis proxima*, *Polyrhachis illaudata* or *Polyrhachis halidayi*, those that nest in the soil or rotting logs (Jaitrong and Ting-nga, 2005). Liefke *et al.* (1998) reported that the nesting habitat overlap with *Polyrhachis bicolor* is also similar to nesting behavior of the *Dolichoderus thoracicus*-group in the Malayan rain forest (Maschwitz *et al.,* 1991).

The *P. muelleri* nests were built of loose larval silk on the ventral side of broad-leaved plants, which agrees with the findings of Liefke

et al., 1998, who found this ant in West-Malaysia, but found it in different host plants from our plants. The present paper records new host plants that are listed in table 1. Most host plants from both studies were smooth surfaced leaves without hair, except for two colonies that were found in summer; they moved the nests and reconstructed on a *P. diversifolium* leaf, a plant which is rough to the touch and possesses bristly leaves. As a cause for the nests constructed on *P. diversifolium* leaves, we thought that moisture was important for this behavior and activity, because the summer is very dry and during early morning, the hair of leaf is able to collect moisture from atmosphere to the leaf surface. The dominant trees that our ant used for nesting were *G. lobbianum* and *X. noronhianum*, because of both plant are common in disturbed areas along the forest road and the leaf sizes are just large enough for nesting.

Our ant used larval silk to construct their nest, unlike *Oecophylla* spp., which creates enclosures for their pure silk nests by pulling leaves together (Doflein, 1905: Liefke et al., 1998), while *P. muelleri* used only one leaf to construct the nest on the surface below. It is similar to the nesting of *Dolichoderus* species of the *thoracicus* group, which nests under leaves of different tree species (Maschwitz *et al.,* 1991), but *P. muelleri* nests are much larger and also on different host plant. Normally, other *Polyrhachis* construct the nests without silk or silk reinforced by dead plant and soil particles, except for *P. bicolor*, which used pure silk, but differently than with our ant in that *P. bicolor* nests were located either between two or three relatively small leaves (Liefke *et al.,* 1998). Moreover, the pupae of this ant constructed their cocoon loosely, which enables one to see inside the cocoon, while the pupae of *Oecophylla* is without a cocoon, in contrast, the ground dwelling ant not use larva silk possesses a strong cocoon

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LITERATURE CITED

Buschinger, A., R.W. Klein and U. Maschwitz. 1994. Colony structure of an bamboo-dwelling *Tetraponera* sp. (Hymenoptera: Formicinae: Pseudomyrmecinae) from Malaysia. *Insectes Sociaux* 41: 29-41.

Doflein, F. 1905. Beobachtungen an den Weberameisen (*Oecophylla smaragdina*). *Biol.Zentbl*. 25: 497-507.

Dorow, W.H.O. and U. Maschwitz. 1990. The arachne-group of *Polyrhachis* (Formicidae, Formicinae) weaver ants cultivating Homoptera on bamboo. *Insectes Sociaux* 37: 73-89.

Forel, A. 1893. Les formicides dela Empire des Indes et de Ceylan. Part 3. *Journal of the Bombay Natural History Society* 8: 17-36.

Jacobson, E. 1908. Zur Verfertigung der Gespinnstnester von *Polyrhachis bicolor* SM. Auf Java. *Leiden Notes Mus*. 30: 63-67

Jaitring, W. and J. Nabhitabhata. 2005. A list of Known Ant Species of Thailand (Formicidae: Hymenoptera). *The Thailand Narural History Museum Journal* Volume 1 (1): 9-54.

Jaitrong, W. and T. Ting-nga. 2005. Ant Fauna of Peninsular Botanical Garden (Khao Chong), Trang Province, Southern Thailand (Hymenoptera: Formicidae). *The Thailand Natural History Museum Journal* 1(2): 137-147.

Liefke, C., W.H.O. Dorow, B. Hölldobler and U. Maschwitz. 1998. Nesting and food resources of syntopic species of the ant genus *Polyrhachis* (Hymenoptera, formicidae) in West-Malaysia. *Insectes Sociaux* 45: 411-425.

Maschwitz, U. and H. Hänel. 1985. The migrating herdsman *Dolichoderus (Diabolus) cuspidatus*: an ant with a novel mode of life. *Behavioral Ecology and Sociobiology* 17: 171-184.

Maschwitz, U., K. Dumpert, T. Botz and W. Rohe. 1991. A sink-nest weaving Dolichoderine ant in a Malayan rain forest. *Insectes* Sociaux 38: 307-316.

Mercier, J.-L. and A. Lenoir. 1999. Individual flexibility and choice of foraging strategy in *Polyrhachis laboriosa* F. Smith (Hymenoptera: Formicidae). *Insectes Sociaux* 46: 267-272.

Moffett, M.W. 1988. Foraging Behavior in the Malayan Swarm-Raiding Ant *Pheidologeton silenus* (Hymenoptera: Formicinae: Myrmicinae). *Annals* of The *Entomological Society of America* 81(2): 356-361.

Peeters, C., B. Hölldobler, M. Moffett amd T.M.Musthak Ali. 1994. "Wall-papering" and elaborate nest architecture in the ponerine ant *Harpegnathos saltator*. *Insectes Sociaux* 41: 211-218.