

Species richness of ants and the impact of invasive "tramp" ant species in plantations of oil palm *Elaeis guineensis* in Borneo and the Peninsula Malaysia



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Introduction

The strong global demand for oils and fats has caused a rapid growth of the oil palm industry in the ASEAN region, leading to the conversion of large areas of land to oil palm production. Malaysia and Indonesia produce over 83% of the total world output of palm oil. Oil palm plantations have been increasingly perceived as environmentally damaging. Negative impacts include pesticide usage, declining soil health, loss of biodiversity and proliferation of exotic animal species. The industry itself as well as non-governmental organisations (NGOs) have identified and are constantly addressing these problems.

Hypotheses

We expected:

- A low species richness of ants in oil palm plantations compared with natural rain forest habitats
- The dominance of certain ant species leading to the formation of "ant mosaics"
- A high influence of exotic ant species
- A high similarity of plots in both parts of Malaysia

METHODS

Ants were studied in two oil palm plantations, each much larger than 1000 ha and farmed with integrated pest management, on Borneo (28. Sept. to 19. Oct. 2004) and the Peninsula Malaysia (10 to 29. Aug. 2005).



Fig. 1 The sample sites in Borneo (Tawau, Golden Hope Plantation, N 04.23' E 117° 51') and Peninsula Malaysia (Banting, Golden Hope Research Centre N 02° 48' E 101° 28').

Ants were sampled during the harvest from 2-4 freshly cut palm fronds of each palm and stored in alcohol. We sampled 675 palms from 13 fields on Borneo and 553 palms from 6 fields in the Peninsula Malaysia. Ants were identified with a reference collection in our lab at the University of Ulm, Germany (www.antbase.de).

Establishment of plantations leads to a complete change of the ecosystem and only little is known about animal life in these huge areas (3,376,664 ha in Malaysia in 2000). Ants are the dominant insect group inside the plantations and play a role in ecological control of pest insects. Our ongoing project compares the diversity of the ant communities in canopies of oil palm plantations in Sabah and Peninsula Malaysia and investigates the influence of non-native ant species. As *Elaeis guineensis* originates from Africa we supposed that oil palm plantations could propagate invasive ant species to South East Asia.

Results

The rarefaction plots showed that our sampling was almost complete (Fig. 2). Altogether we sampled 49 species of canopy ants, 36 species in each plot. 23 species were shared between both plots, resulting in a moderate beta-diversity (quantitative Sørensen Index: 0.47). A total of 37 ant species was predicted by the ICE-estimator for each plot (ICE chosen according to Brose and Martinez 2004). Only 17 (Borneo) and 23 (Peninsula Malaysia) species made 95% of all species occurrences (SO). We found a massive impact of exotic ant species: 9 species with altogether 46 % of all SO were non-native (Fig. 3). *Technomyrmex albipes*, *Oecophylla longinoda* and *Anoplolepis gracillipes* were the most abundant ant species in the palm canopy. The dominance of certain ant species resulted in an "ant mosaic" with 7 dominant and 10 subdominant species (see Fig. 4).

Literature

Brose U, Martinez ND (2004) Estimating the richness of species with variable mobility. *Oikos* 105:292-300

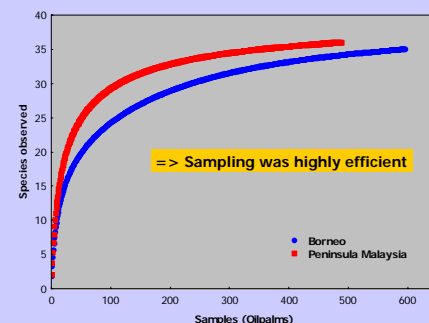


Fig. 2 Rarefaction plot of our study, confirming the low species richness of the oil palm plantations.

Summary

We found:

- a low species richness of arboreal ants in plantations: 36 species in each plot, 49 species altogether
- a set of typical "oil palm ant species" forming clearly defined ant communities
- 46 % of all species occurrences belonged to nine invasive "tramp" ant species
- Plots in both parts of Malaysia differed in subdominant native species

Upshot :

- Oil palm plantations act as effective dispersal barriers for native arboreal ants and as a pool for invasive ant species that may endanger Malaysia's biodiversity.

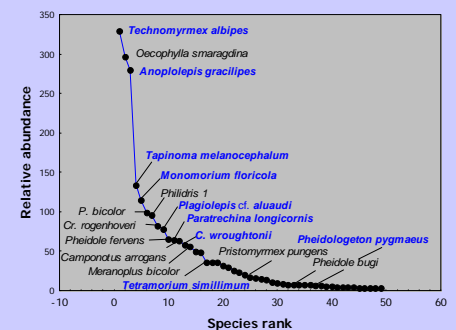


Fig. 3 Combined species abundance plot for both study sites. Blue colour indicates invasive ant species, black are native species. Given are only identified species.

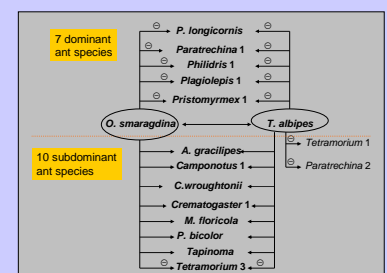


Fig. 4 *O. smaragdina* and *T. albipes* are co-dominant and positively associated within the ant mosaics, but exclude 5 other dominant ant species. 10 other species are subdominant and co-occur with the dominants on the palms.



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