

DO FLOWERS REPEL ANTS ?



– A comparative study in a Bornean rainforest –

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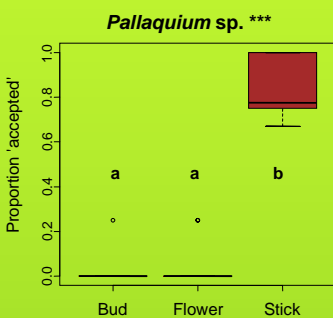
Introduction

Ants are often unable to pollinate, but frequently consume nectar and may have a negative impact on pollination by other animals (Altshuler 1999). Therefore, plants may greatly benefit by repelling ants from flowers (Ghazoul 2001). We tested flowers from 18 plant species for potential ant repellence in a lowland rainforest in Borneo (Danum Valley, Sabah, Malaysia).

Methods

Five ants (*Dolichoderus thoracicus* workers) were placed into an arena with one flower, one bud, one old flower and one stick as control. Encounters of ants with each item were assigned either as 'accepted' (ants walked over or stayed on item) or as 'repelled' (ants changed direction after contact) during an observation period of two minutes. Proportion of interactions scored as 'accepted' was obtained for 6-10 replicates per plant (arcsine-transformed for ANOVA).

Canopy flowers 20-60 m above ground



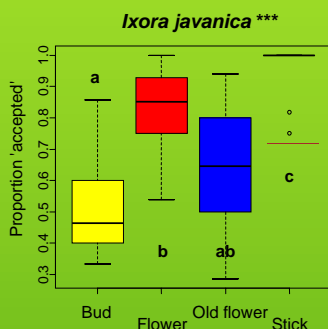
Family	Plant species	ANOVA	Acceptance rank
Cucurbitaceae	<i>Alsomitra macrocarpa</i>	$F_{2,17} = 23.8^{***}$	$b < f < s$
Dipterocarpaceae	<i>Hopea nervosa</i>	$F_{3,24} = 2.3$	
Meliaceae	<i>Dysoxylum alliaceum</i>	$F_{2,13} = 3.6$	
Myrtaceae	<i>Eugenia</i> sp.	$F_{2,18} = 5.3^*$	$b < f = s$
Sapotaceae	<i>Pallaquium</i> sp.	$F_{2,18} = 85.0^{***}$	$b = f < s$



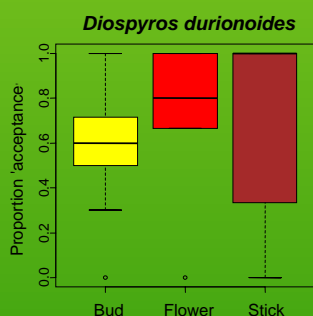
Exotic plants growing in secondary vegetation



Family	Plant species	ANOVA	Acceptance rank
Asclepiadaceae	<i>Asclepias curassavica</i>	$F_{2,18} = 0.04$	
Convolvulaceae	<i>Ipomoea cairica</i>	$F_{1,5} = 23.3^{**}$	$f < s$
Myrsinaceae	<i>Ardisia elliptica</i>	$F_{2,17} = 3.1$	
Rubiaceae	<i>Ixora coccinea</i>	$F_{2,16} = 1.2$	
Rubiaceae	<i>Ixora javanica</i>	$F_{3,27} = 29.1^{***}$	$b = o = f < s$
Rutaceae	<i>Citrus grandis</i>	$F_{3,16} = 2.9$	



Understory vegetation lower than 5 m above ground



Family	Plant species	ANOVA	Acceptance rank
Ebenaceae	<i>Diospyros durionoides</i>	$F_{2,16} = 2.9$	
Euphorbiaceae	<i>Baccaurea stipulata</i>	$F_{2,18} = 0.2$	
Fabaceae	<i>Fordia</i> sp.1	$F_{3,22} = 3.0$	
Fabaceae	<i>Fordia</i> sp.2	$F_{3,25} = 6.2^{**}$	$b = o < f = s$
Fabaceae	<i>Fordia</i> sp.3	$F_{2,14} = 7.5^{**}$	$f = b < s$
Lamiaceae	<i>Callicarpa longifolia</i>	$F_{2,18} = 5.3^*$	$f < b = s$
Myrtaceae	<i>Eugenia tawaensis</i>	$F_{2,17} = 17.4^{***}$	$f < o = s$



Figure 1. Boxplots showing the ants' acceptance of items. Groups marked with different letters (a, b, c) were different according to Tukey's HSD.

Table 1. Differences in the ants' acceptance of items. Significance levels of repeated measures ANOVA indicated by asterisks as * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. Acceptance ranked for buds, flowers, old flowers and sticks according to Tukey's HSD: '<' - acceptance significantly lower, '=' - not significantly different.

Results

Half of the tested plant species showed ant-repellent flowers and/or buds (Fig. 1, Tab. 1). The plant lifeform had a clear effect: ants accepted understory flowers significantly more than those from the canopy, while flowers from the secondary vegetation had an intermediate value (Fig. 2) (ANOVA $F_{2,15} = 4.5$, $P < 0.05$).

Conclusion

Floral tissues may produce chemical substances that are repellent or deterrent to ants. Our experiments on 18 plant species indicate that the ants' acceptance of flowers from the canopy is lower than of understory flowers, suggesting that there may be a higher selective pressure for canopy plants to exclude ants from their flowers.

Acknowledgements

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References

- Altshuler, D.L. (1999) Novel interactions of non-pollinating ants with pollinators and fruit consumers in a tropical forest. *Oecologia* 119: 600-606
 Ghazoul, J. (2001) Can floral repellents pre-empt potential ant-plant conflicts? *Ecology Letters* 4: 295-299

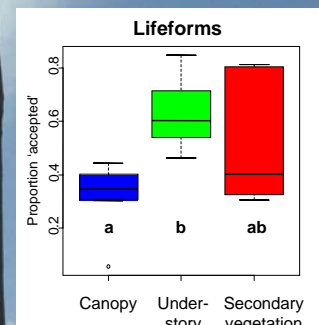
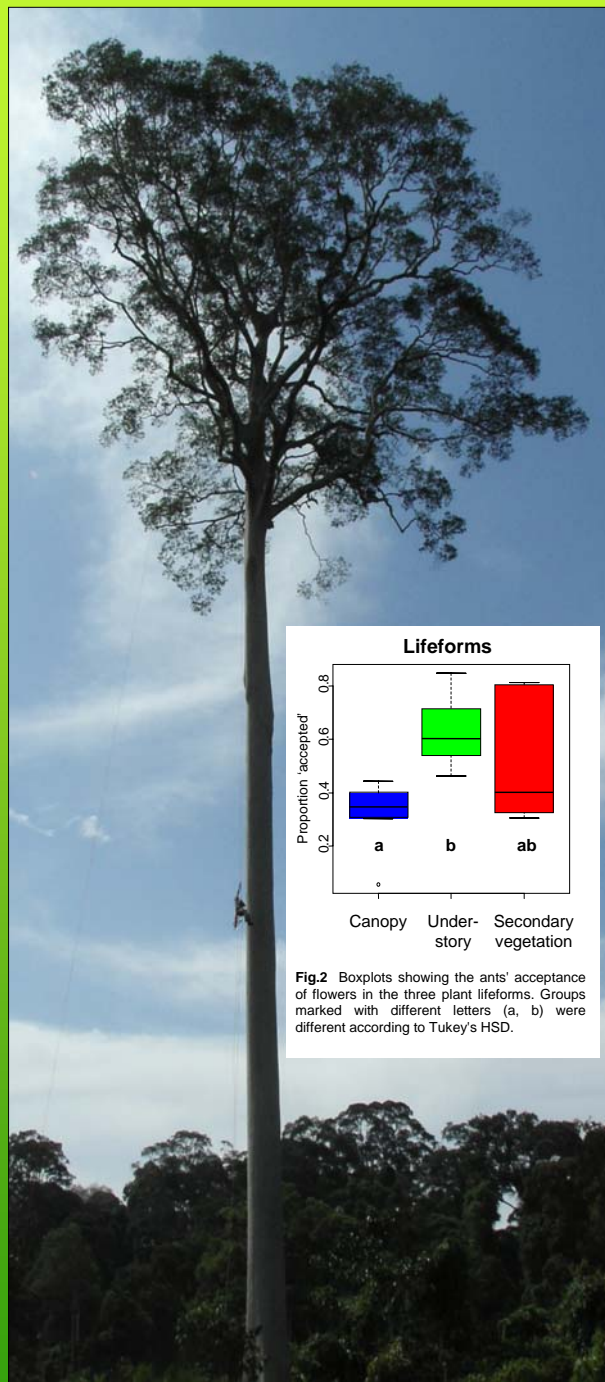


Fig.2 Boxplots showing the ants' acceptance of flowers in the three plant lifeforms. Groups marked with different letters (a, b) were different according to Tukey's HSD.