How plants call for help:

Herbivore damage increases predation of caterpillars on trees along a tropical elevational gradient

Bonny Koane[1], Katerina Sam[2,3], Vojtech Novotny[2,3]

[1]The New Guinea Binatang Research Center, Madang, Papua New Guinea
[2]Biology Centre AS CR, v. v. i., Institute of Entomology, Ceske Budejovice, Czech Republic;
[3]University of South Bohemia in Ceske Budejovice, Faculty of Science, Czech Republic

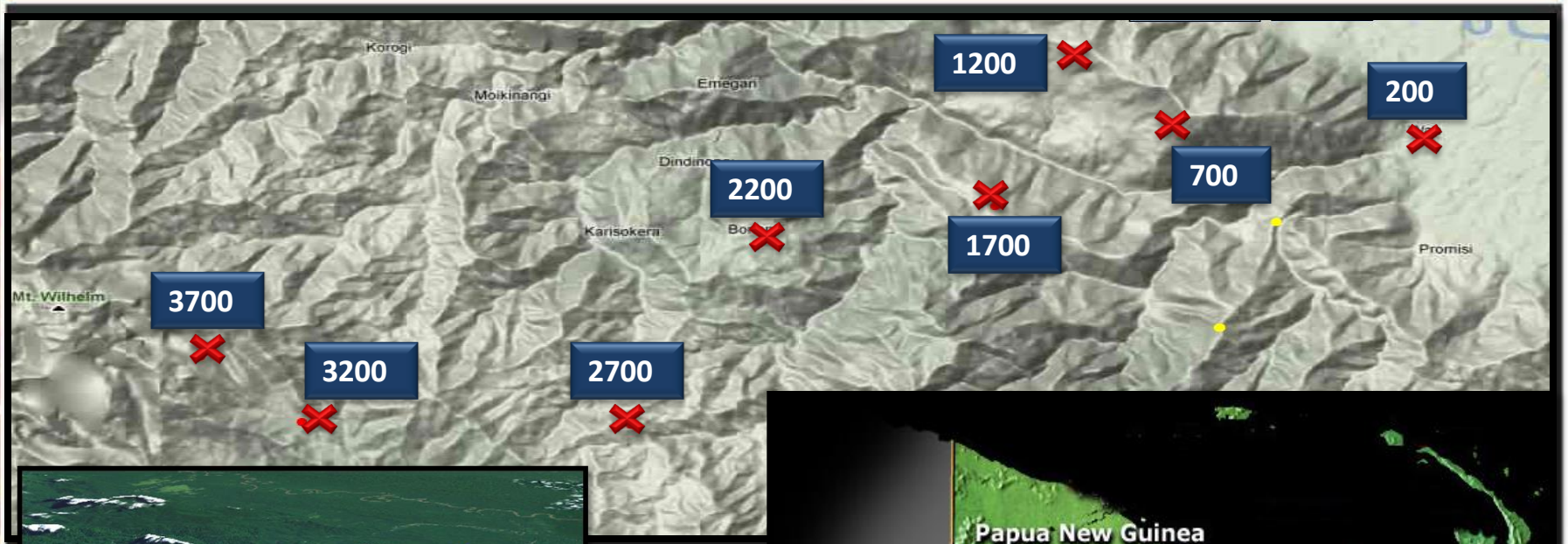
Přírodovědecká fakulta
Faculty of Science
Jihočeská univerzita v Českých Budějovicích
University of South Bohemia in České Budějovice

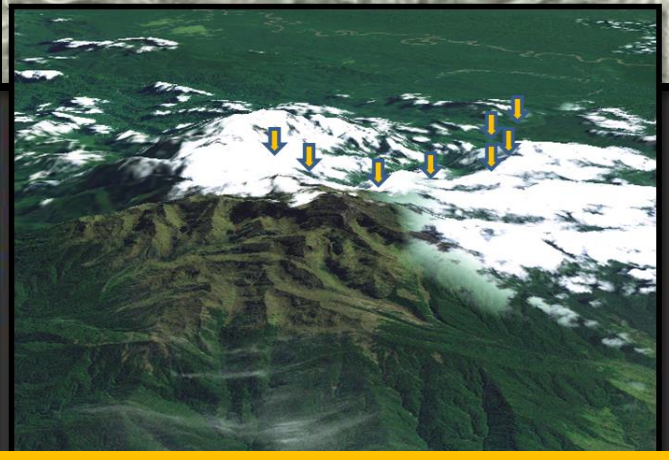
Institute of Entomology
Biology Centre AS CR, v. v. i.

Introduction

1. Can plants “call for help” when they are under attack by herbivores?
2. What predators will respond to such call?
3. How safe are herbivores from predators in rainforests from lowlands to alpine zone?
4. How the main groups of predators change with altitude?

Study area

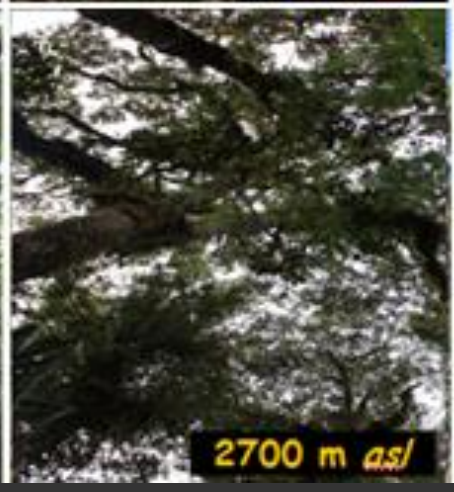




8 study sites separated by 500 m altitudinal distance, starting from 200-3700 m asl

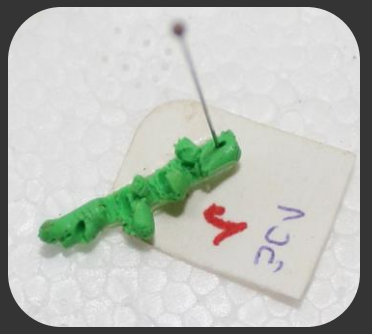
Study area

Examples of the forest type at each of our study sites



Methods

300 caterpillars daily on 30 trees



checked every 24 hours for predator attacks

Methods

At each elevational site:

- 15 trees with herbivory
  - experimental
- 15 trees without herbivory
  – control
- checked daily for predator attacks for 6 days

Control
(undamaged leaf with caterpillar)

Experimental
(damaged leaf with caterpillar)

Methods

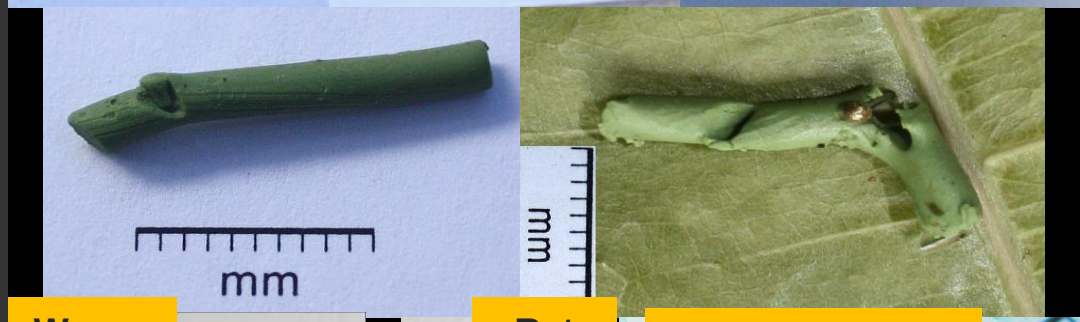
"Bite guide"

http://tvardikova.weebly.com/downloads.html

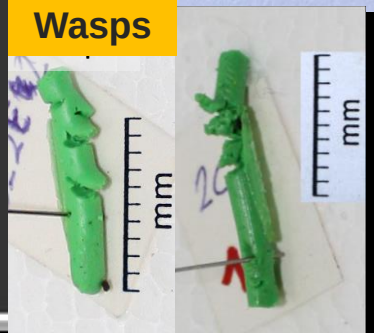
Low, P. *et al*. *Entomologia Experimentalis et Applicata*
DOI: 10.1111/eea.12207

Ants

Birds



Wasps



Rat

Predatory beetle

Birds and Ants

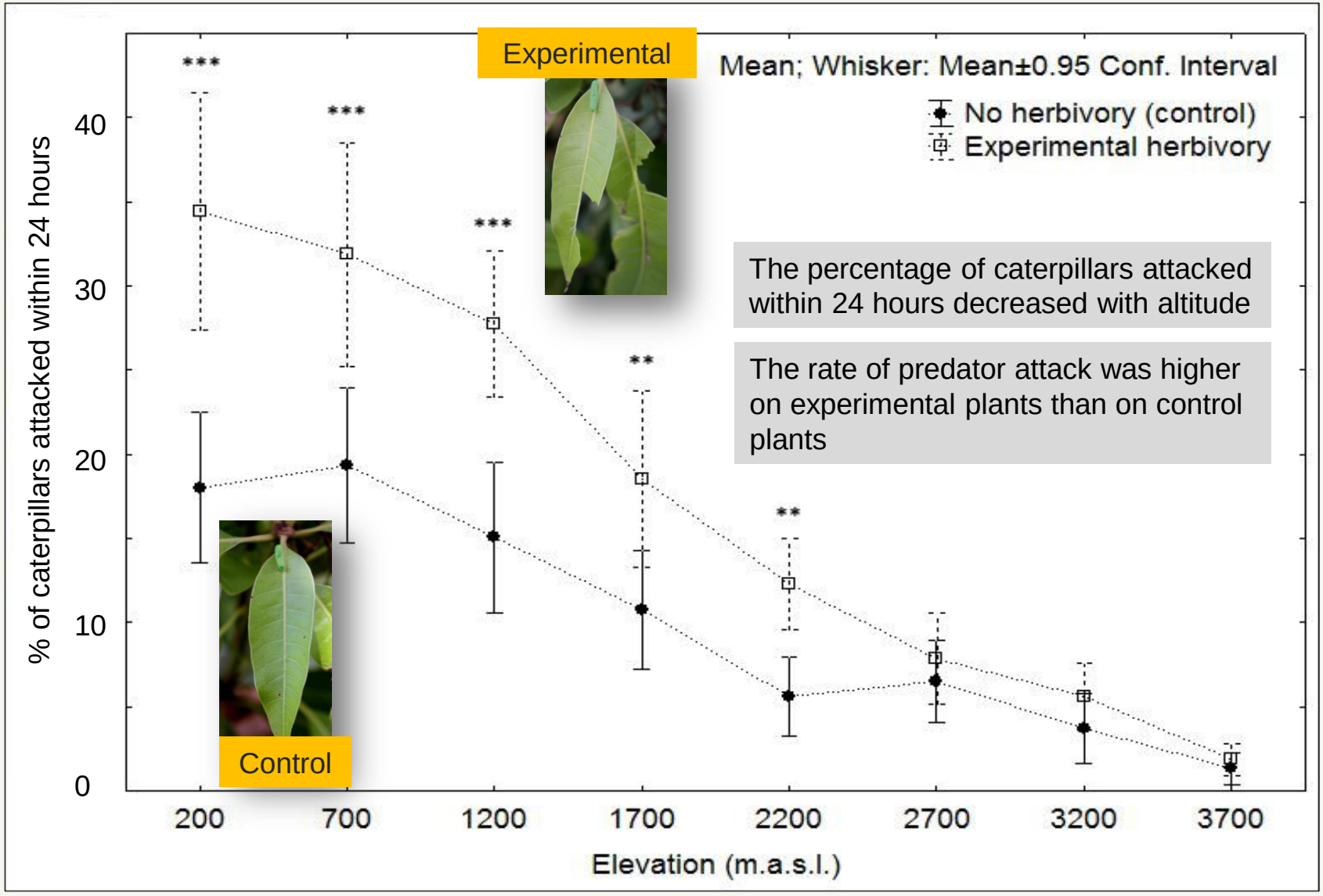
Bird surveys:

- 9 surveys using 16 point counts each, spaced by 150 m
- 6 surveys using mist nets 200 m for 12 hours

Ant surveys:

- 4 surveys using tuna baits at each experimental tree

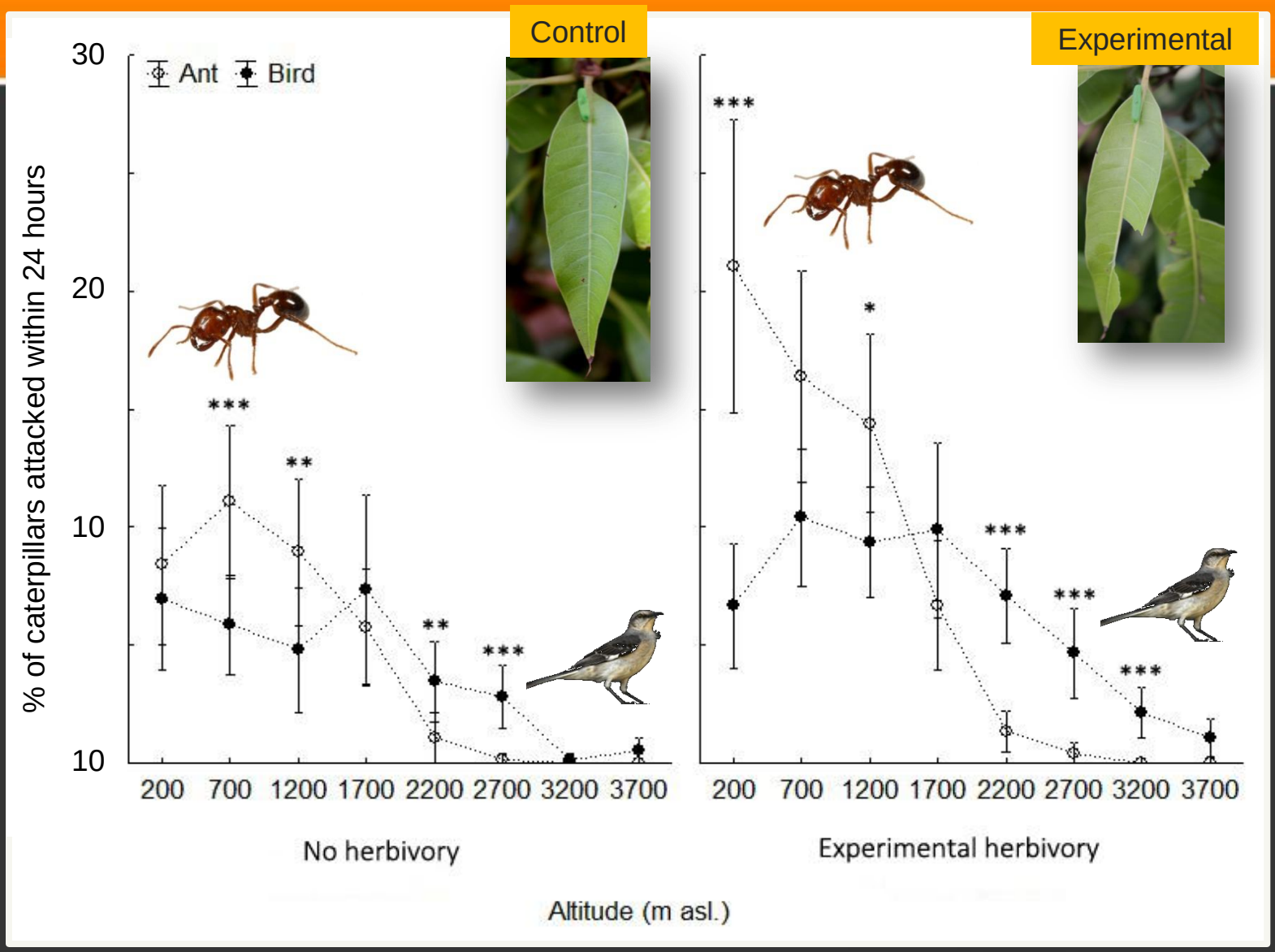
Predation rate



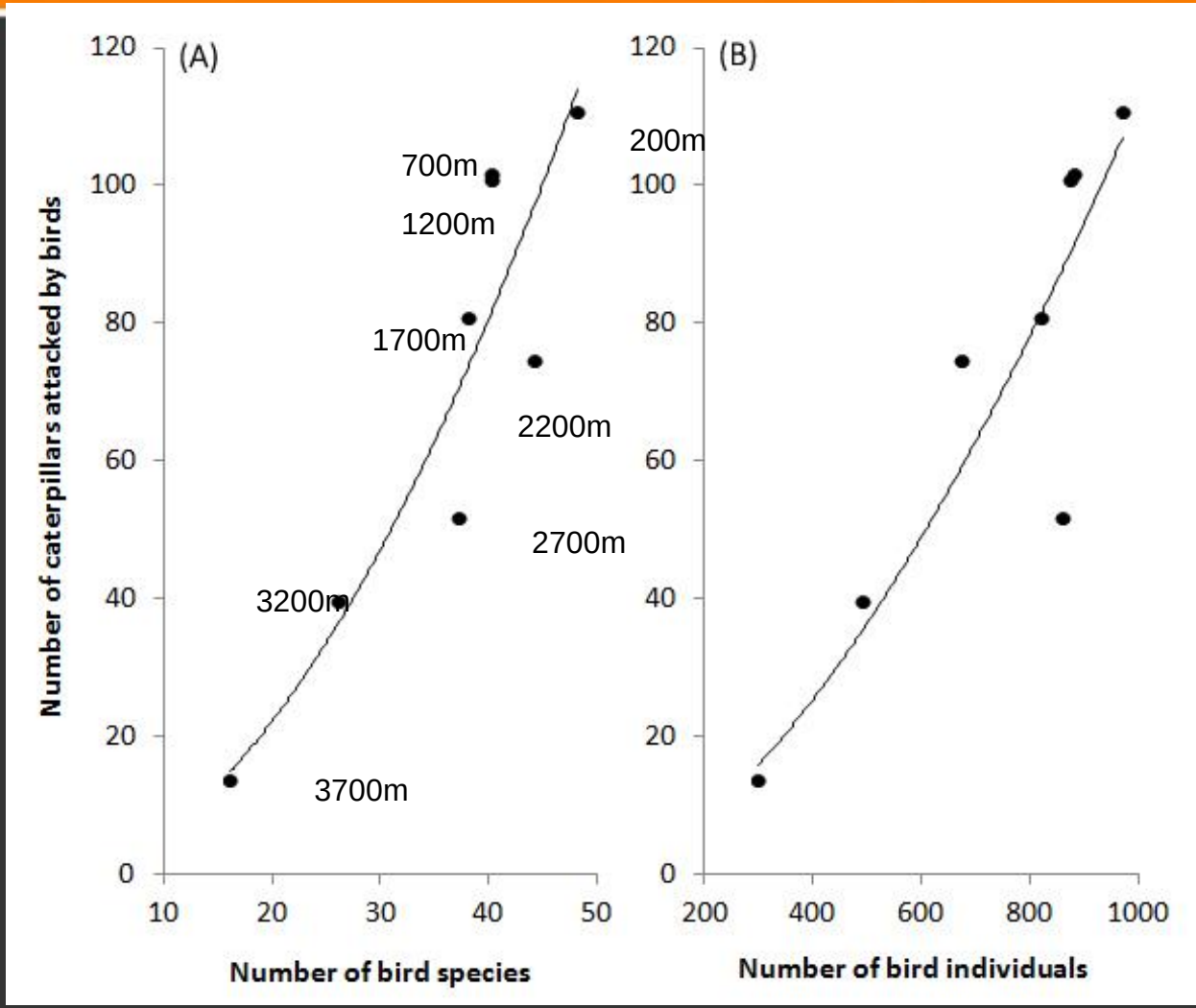
The percentage of caterpillars attacked within 24 hours decreased with altitude

The rate of predator attack was higher on experimental plants than on control plants

Predators


Control
Experimental
Ant
Bird
% of caterpillars attacked within 24 hours
30
20
10
10
***
**
**
***
*
***
***
***
200 700 1200 1700 2200 2700 3200 3700
200 700 1200 1700 2200 2700 3200 3700
No herbivory
Experimental herbivory
Altitude (m asl.)

Elevation - Birds

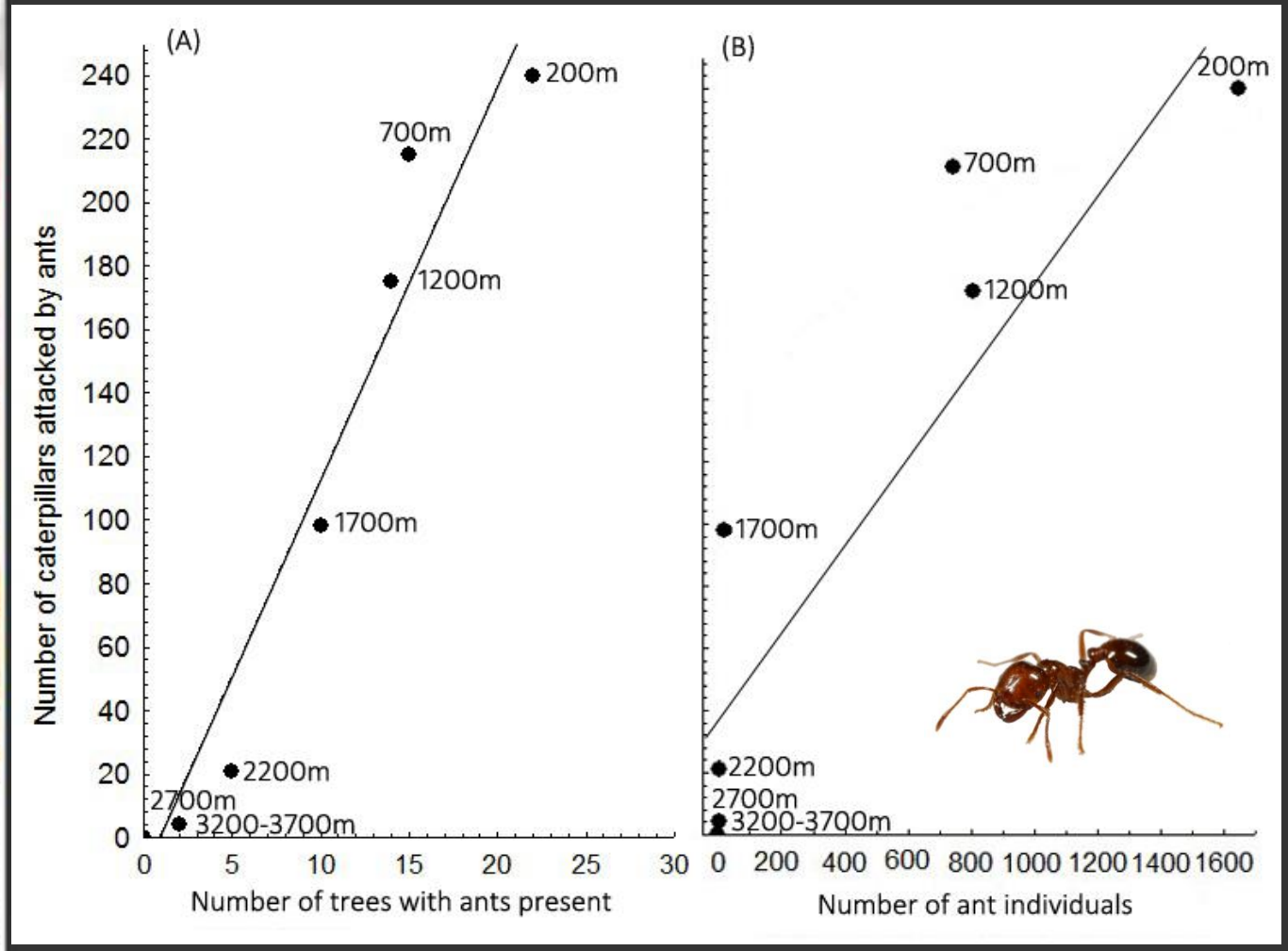


Number of attacks on caterpillars caused by birds correlated closely with the species diversity and abundance of insectivorous birds.

This suggest plasticine caterpillars are may be a suitable method to monitor predators and their activity.

Insectivorous birds

Elevation – Ants



We found significant correlation between the number of trees where ants were present and attacks caused by ants.

The abundance of ants at tuna baits did not correlated with the number of attack on plasticine caterpillars.

Presence/absence of ants on trees is more important than their abundance

Conclusions

- Predation of caterpillars decreases with elevation
- Ants are more important in lowlands, birds dominate at higher altitudes
- Predation by ants and birds correlates with their abundance
- Damage by herbivores attracts birds and ants and increases predation rate
- This effect is stronger for ants than for birds

Acknowledgement

Jimmy Mosses, Tom Fayle
The New Guinea Binatang Research staff
Many field assistants and carriers

Results presented here are available: Herbivore damage increases avian and ant predation of caterpillars on trees along a complete elevational forest gradient in Papua New Guinea" by **Sam, K.; Koane, B.; Novotny, V., *Ecography* 2014**, doi. 10.1111/ecog.00979

Grant Agency of University of South Bohemia 136/2010/P

Czech Science Foundation Grant 206/08/H044
The Christensen Fund
Idea Wild
Grant Agency of University of South Bohemia 146/2012/P

This presentation was created within the project Center of excellency for global study of biodiversity and function of forest ecosystems, reg. no. CZ.1.07/2.3.00/20.0064, which is co-financed by the European Social Fund and the state budget of the Czech Republic.

esf european social fund in the czech republic
EUROPEAN UNION
MINISTRY OF EDUCATION, YOUTH AND SPORTS
OP Education for Competitiveness
INVESTMENTS IN EDUCATION DEVELOPMENT