

Intraspecific brood theft in an Indian queenless ant

Bishwarup Paul¹, Manabi Paul¹, Sumana Annagiri^{1,*}

^{1,*} Behaviour and Ecology Lab
Dept. of Biological Sciences
IISER-Kolkata



Introduction



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Theft: The act or practice of the wrongful taking and carrying away of the personal goods or property of another (<http://universalium.academic.ru/210199/theft>).

Animal phylum	Group	Animal phylum	Group
Cnidaria	Hydroids	Mollusca	Slugs
Platyhelminthes			Snails
Annelida		Echinodermata	Sea stars, brittle stars
Arthropoda	Flies		
	Beetles	Chordata	Fish
	Bees, wasps and ants		
	Mites and spiders		
	Other insects		
	Caprellids, copepods, and amphipods		
	Crabs		
			Turtles
			Lizards
			Birds
			Mammals

Iyengar 2007

Items stolen

❖ **Stealing of food:**

- Hyenas
- Gulls
- Spiders
- Honeybees
- Ants

❖ **Stealing of other important objects:**

- Nesting site (bees)
- Brood (birds, ants)

Brood theft in ants



- For consumption
- For founding new colony
- For slave workers

Image Courtesy: www.alexanderwild.com

Pollock and Rissing 1989

Study species: *Diacamma indicum*



- ❖ Queenless ant belonging to subfamily Ponerinae.
- ❖ Found in India, Sri Lanka, Japan.
- ❖ Primitively eusocial.
- ❖ Colony size: 12-261 adults.
- ❖ Colony relocation occurs via tandem running.

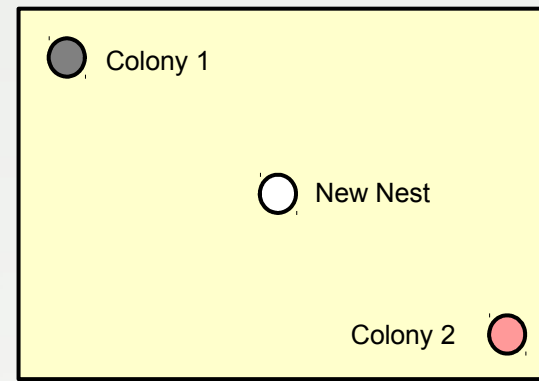


Viginier et al. 2004, Kaur et al. 2012

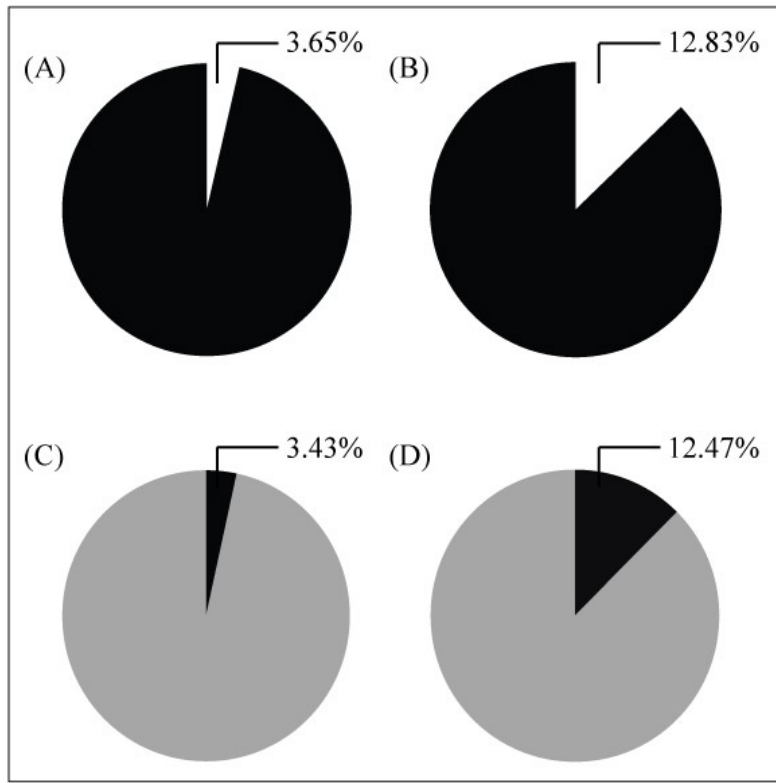
Objective

- Brood theft in laboratory conditions
- Brood theft in natural habitat
- Fate of procured pupae
- Strategy of thieves

Brood theft in lab



n = 8



Brood of victim colony

Brood of thief colony

Preference towards stealing pupae	14/15
Percentage of thieves	1.35 ± 0.73%
Success of stealing	75.3 ± 33.7%
Advantage of one colony	Resident

Defense against stealing

[Video: Successful stealing attempt](#)

[Video: Unsucessful stealing attempt](#)

Aggressive interactions	
Antennal boxing (AB)	Ants face each other and repeatedly beat each other with antennae in quick succession
Chase (CH)	One ant chases the other till the one being chased runs away
Bite (BI)	One or more ants bite another one with mandible
Drag (DR)	One or more ants drag another one to stop from running away
Hold down (HD)	One or more ants hold down another one in place to stop from running away

[Video:AB](#)

[Video:CH](#)

[Video: BI-DR-HD](#)

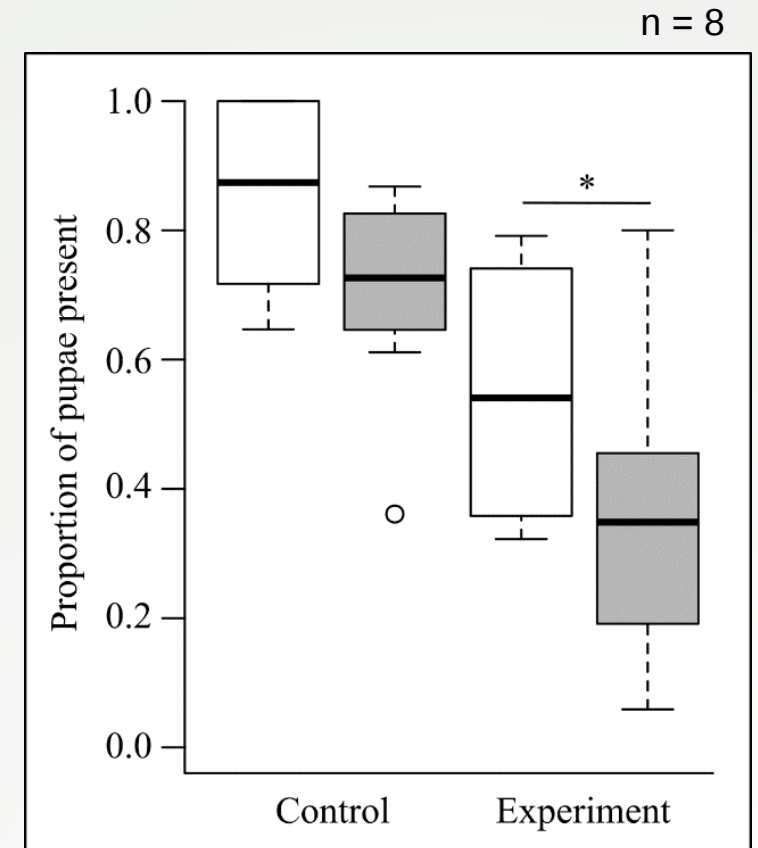
Brood theft in natural habitat

- **Direct observation:**
2 pupae stolen
- **Indirect observation:**
Recollected colonies had less number of pupae than expected.
(Wilcoxon paired-sample test, Exp: $T = 3$, $n = 8$, $p = 0.039$;
Control: $T = 5$, $n = 8$, $p = 0.078$)

- **Calculation of expected pupae:**

$$R_x = P_x / P_{x-1}$$

$$E_{x+1} = P_x \times R_x$$



Fate of procured pupae

n = 8

- No preference towards self or foreign pupae during procurement.
(Mann-Whitney U test: $U = 6249$, $df1 = 111$, $df2 = 111$, $p = 0.854$)

- **7-day observation:**

n = 8, total pupae = 371

Pupae eclosed = 262 (70.6%)

No difference in treatment towards self or foreign pupae.

No pupae were consumed or newly eclosed were harmed.

All newly eclosed integrated with the colony.

- **Eclosion of pupae of different categories:**
Foreign pupae eclosed at a faster rate than self-pupae.

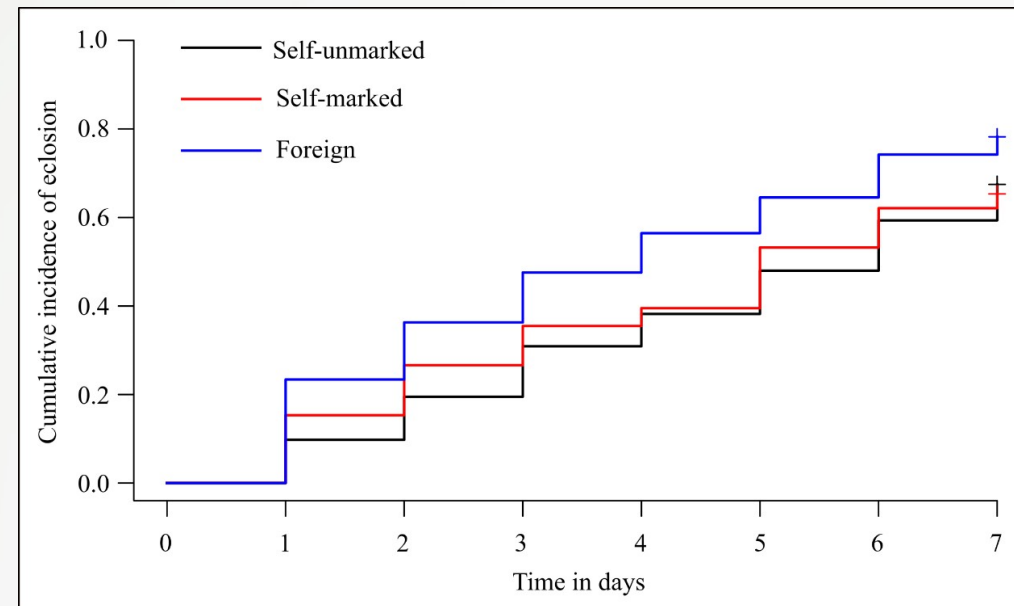
(Log-rank test: $\chi^2 = 9.6$, $df = 2$, $p < 0.01$)

Hazard ratios from Cox proportional hazards model:

Self-unmarked: 1

Self-marked: 1.03

Foreign: 1.50, $p = 0.01$)



Strategy of thieves

- Spending less time in victim colony.

(Mann-Whitney test: $U=1881.5$, $df_1=43$, $df_2=53$, $p<0.001$)

- Interacting with less number of non-nestmates.

(Mann-Whitney test: $U=1797$, $df_1=43$, $df_2=53$, $p<0.001$)

- Increasing speed while stealing.

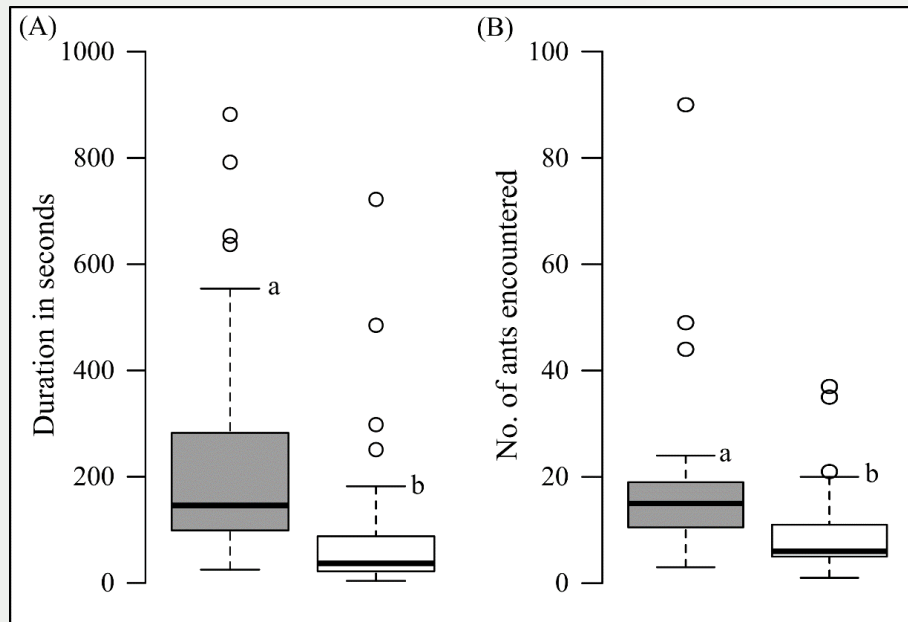
Welch's ANOVA:

$F(2,78.7) = 40.13$, $p < 0.001$

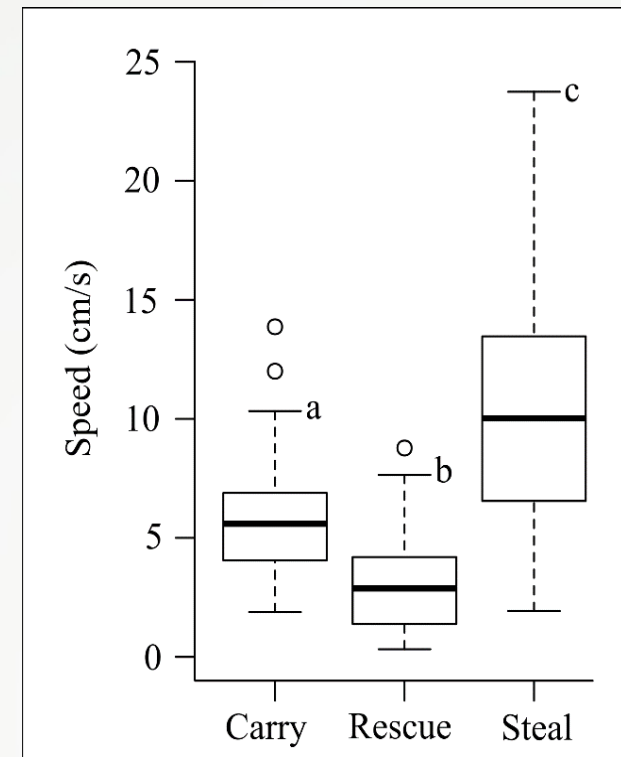
Post-hoc using Games-Howell test:

Significantly different at $p < 0.05$

Tracking done using MtrackJ plugin of ImageJ.



Unsuccessful attempt
Successful attempt



Discussion

- Brood stealing occurs in *D. indicum*.
- Thieves stole pupae in majority.
- Vulnerability of a colony during relocation may make them prone to steal by conspecifics.
- Aggressive interactions towards thieves are key to the defense mechanism.
- Thieves increase efficiency by increasing speed.
- Ants emerged from stolen pupae integrate into the colony.
- First study to report brood theft in the Ponerinae and in the tropics.

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References

- Breed, M.D., Cook, C. & Krasnec, M.O., 2012. Cleptobiosis in Social Insects. *Psyche: A Journal of Entomology*, 2012, pp.1–7.
- Iyengar, E. V., 2008. Kleptoparasitic interactions throughout the animal kingdom and a re-evaluation, based on participant mobility, of the conditions promoting the evolution of kleptoparasitism. *Biological Journal of the Linnean Society*, 93(4), pp.745–762.
- Kaur, R., Anoop, K. & Sumana, A., 2012. Leaders follow leaders to reunite the colony: relocation dynamics of an Indian queenless ant in its natural habitat. *Animal Behaviour*, 83(6), pp.1345–1353.
- Pollock, G. & Rissing, S., 1989. Intraspecific brood raiding, territoriality, and slavery in ants. *American naturalist*, 133(1), pp.61–70.
- Viginier, B. et al., 2004. Very low genetic variability in the Indian queenless ant *Diacamma indicum*. *Molecular ecology*, 13(7), pp.2095–100.



Thank you