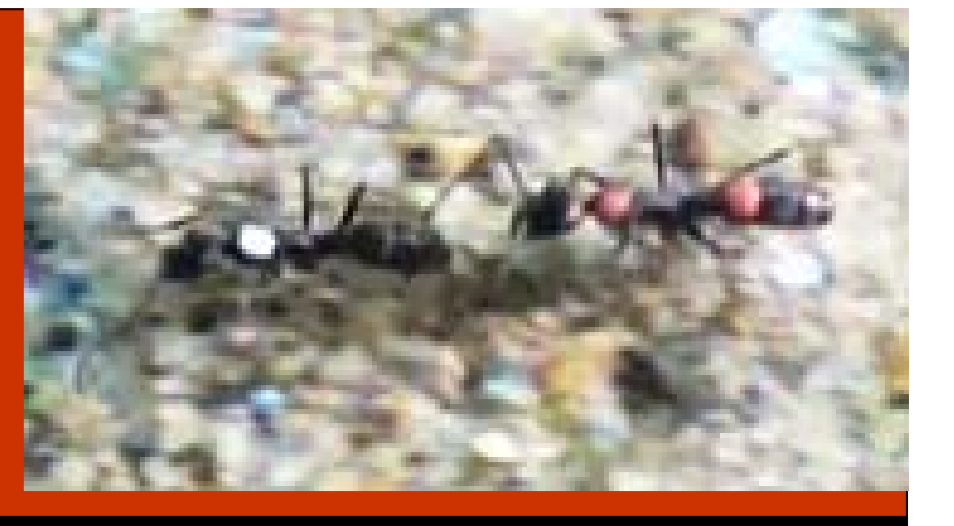




# Investment vs Vulnerability tradeoff during brood transport a case study of an Indian queenless ant *Diacamma indicum*

P060

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## INTRODUCTION

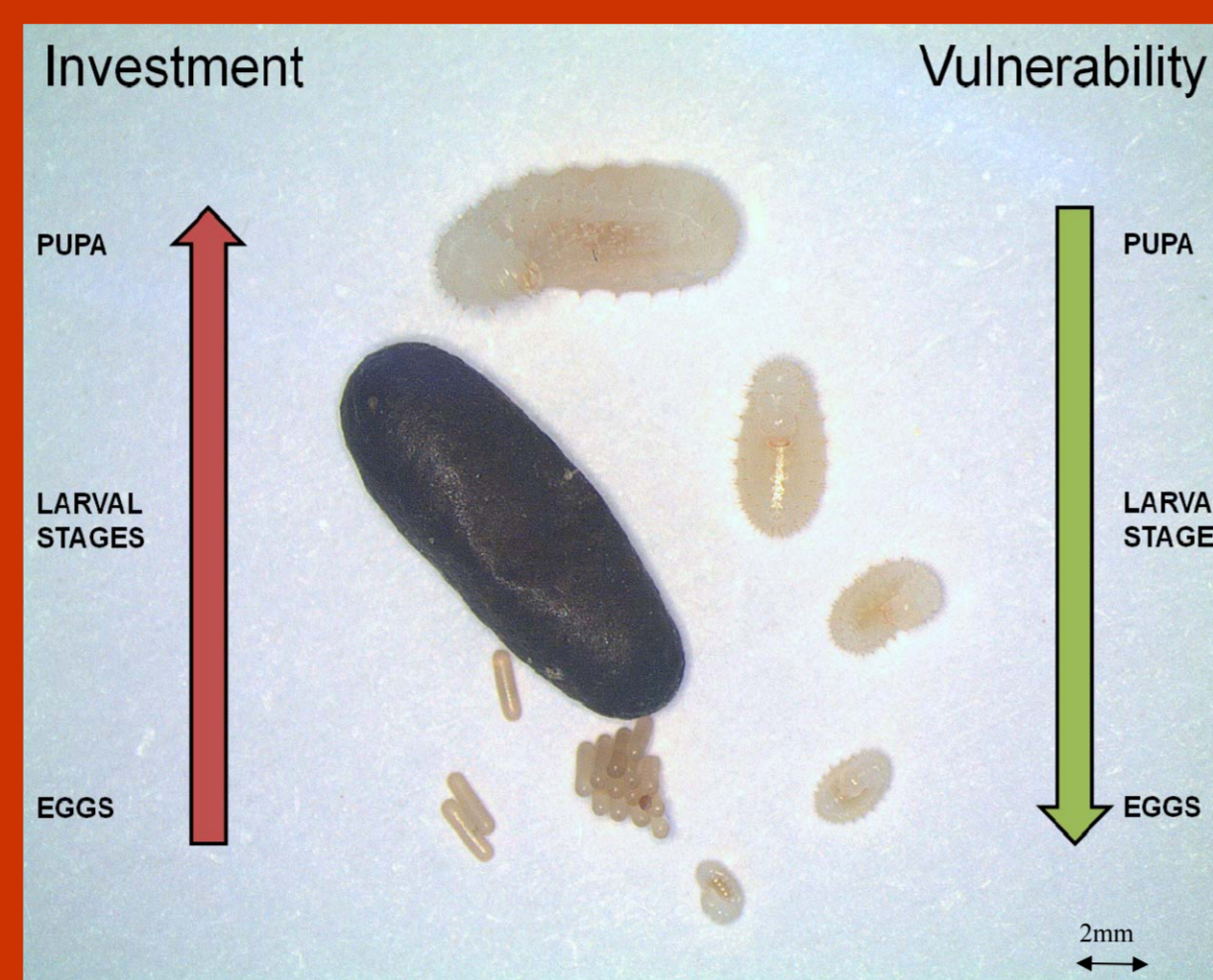
- Ant colonies consist of reproductive female, workers, immature youngs and males.
- All brood items i.e. eggs (E), larvae (L) and pupae (P) of a colony receive nutrition, protection and care form of the investment from the colony members.
- Pupa is final stage with more investment but covered and hence less vulnerable. Larva is comparatively lesser investment but more vulnerable.
- Model system, *Diacamma indicum* (Subfamily: Ponerinae) where workers of the colony relocate employing tandem running behaviour.
- Tandem running, a mechanism by which one ant lead another colony members and the latter maintains tactile signal with the help of her antenna and walk from one location to other. Thus, tandem leaders are responsible for relocating the colony.

**Question: During relocation do ants show preferential attention to pupae in order to maximize returns on their investments?**



Above: Brood vulnerability test (BVT), right-open and unguarded (BVTOU), center-cover and unguarded (BVTCU) and left-cover and guarded (BVTG)

Left: Brood items of *D. indicum* i.e. eggs, various instar of larvae and pupa



## Brood test plate for examining individual preference in isolation



### Brood preference at Individual level: In isolation

**Follower choice (n=105):**

**L>P**

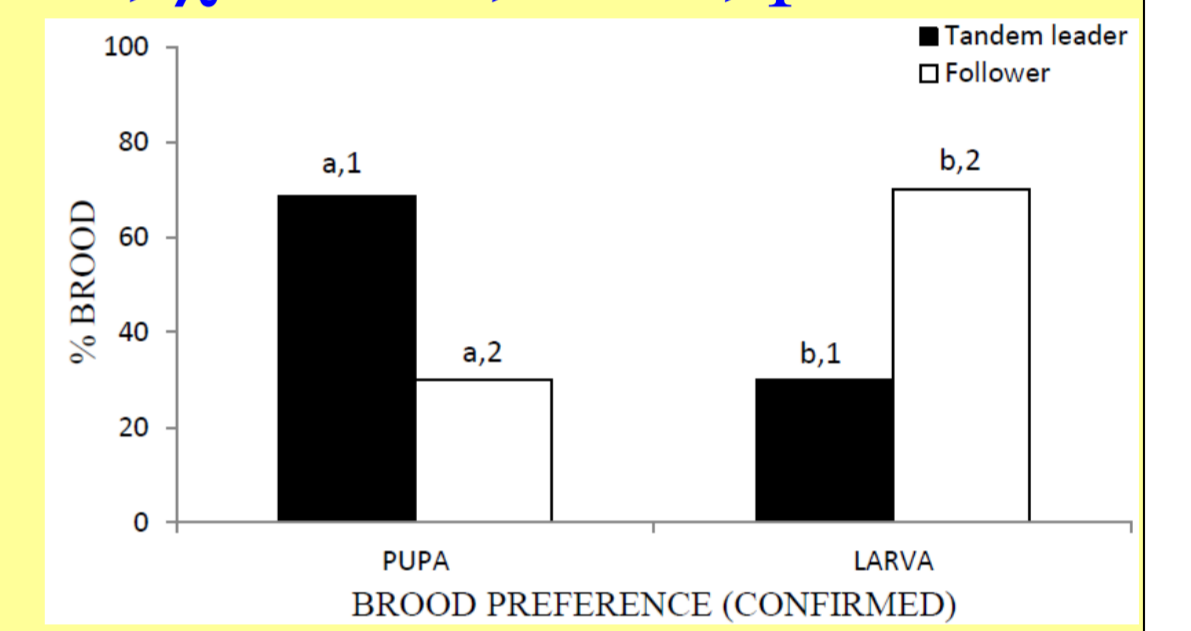
Chi-square test,  $\chi^2=9.6$ ;  $df=$ ;  $p=0.002$ .

**Tandem leaders(n=98):**

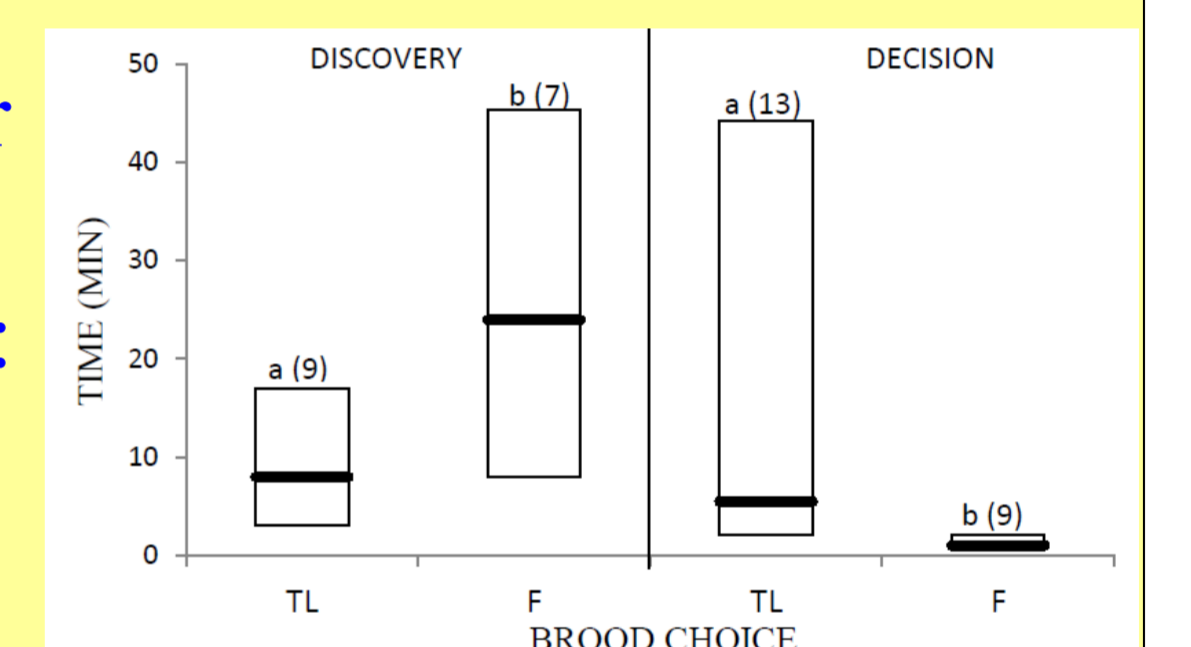
**P>L**

Chi-square test,  $\chi^2=10.5$ ;  $df=1$ ;  $p=0.0001$

Based on cases where tested individual had physical antennated other brood items before making final choice. Tandem leader:  $\chi^2=9.6$ ;  $df=$ ;  $p=0.002$ . Follower:  $\chi^2=9.6$ ;  $df=$ ;  $p=0.002$



Tandem leaders takes less time to discover (MWT:  $U=7093.5$ ,  $df_{1,2}=98,102$ ,  $p=0.0001$ ) but more time to decide, MWT:  $U=7985.5$ ,  $df_{1,2}=98,102$ ,  $p=0.0001$ .

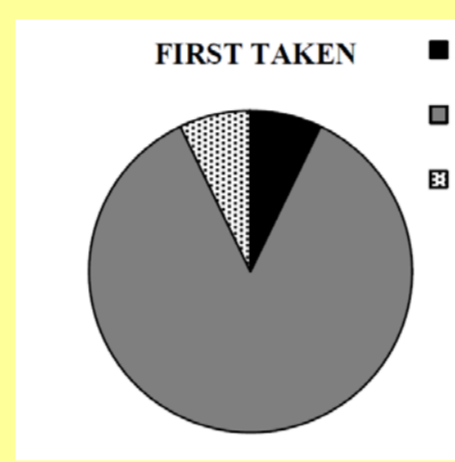


### Brood vulnerability

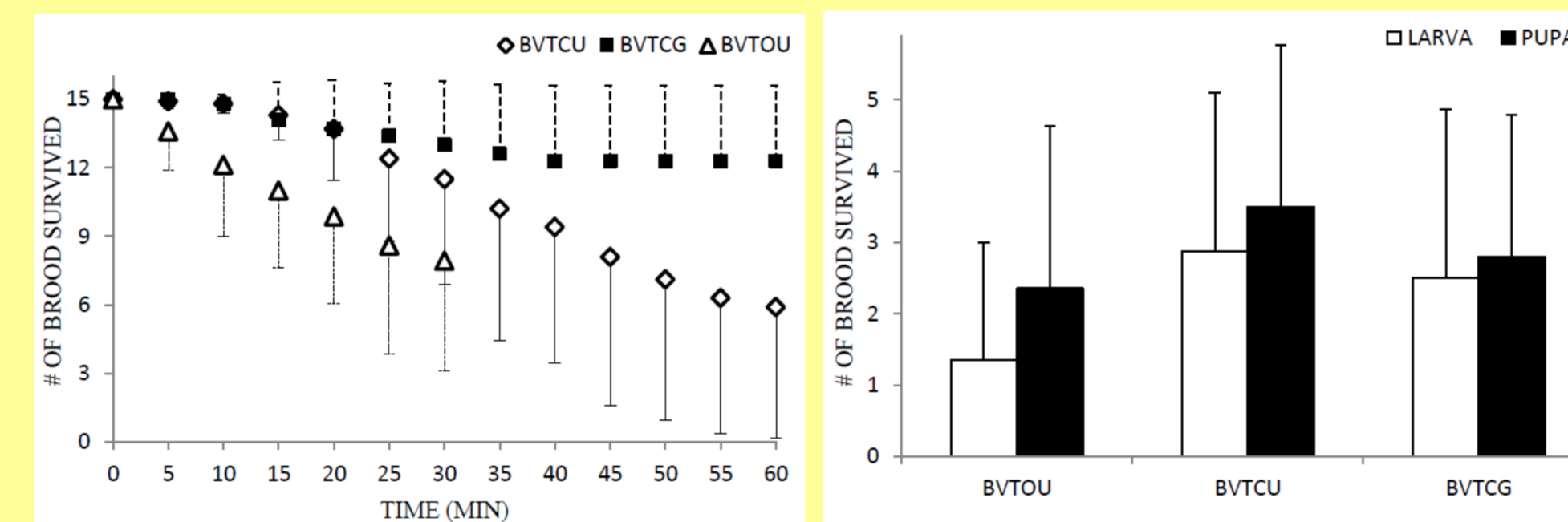
Predators preference,  $n=14$

**L>P**

Chi-square test,  $\chi^2=7.14$ ;  $df=1$ ;  $p=0.008$



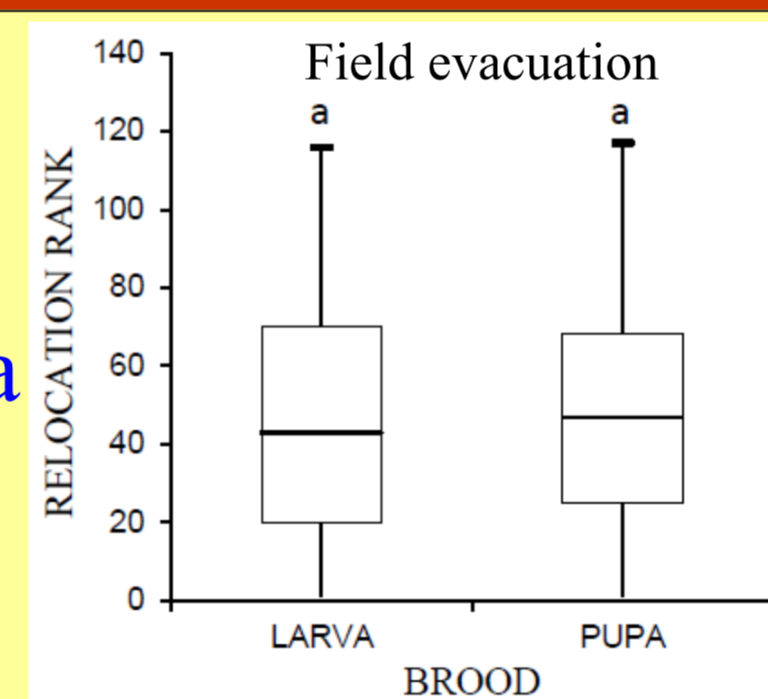
Open and unguarded brood faced high rate of predation while covered and guarded had received the highest protection from predators



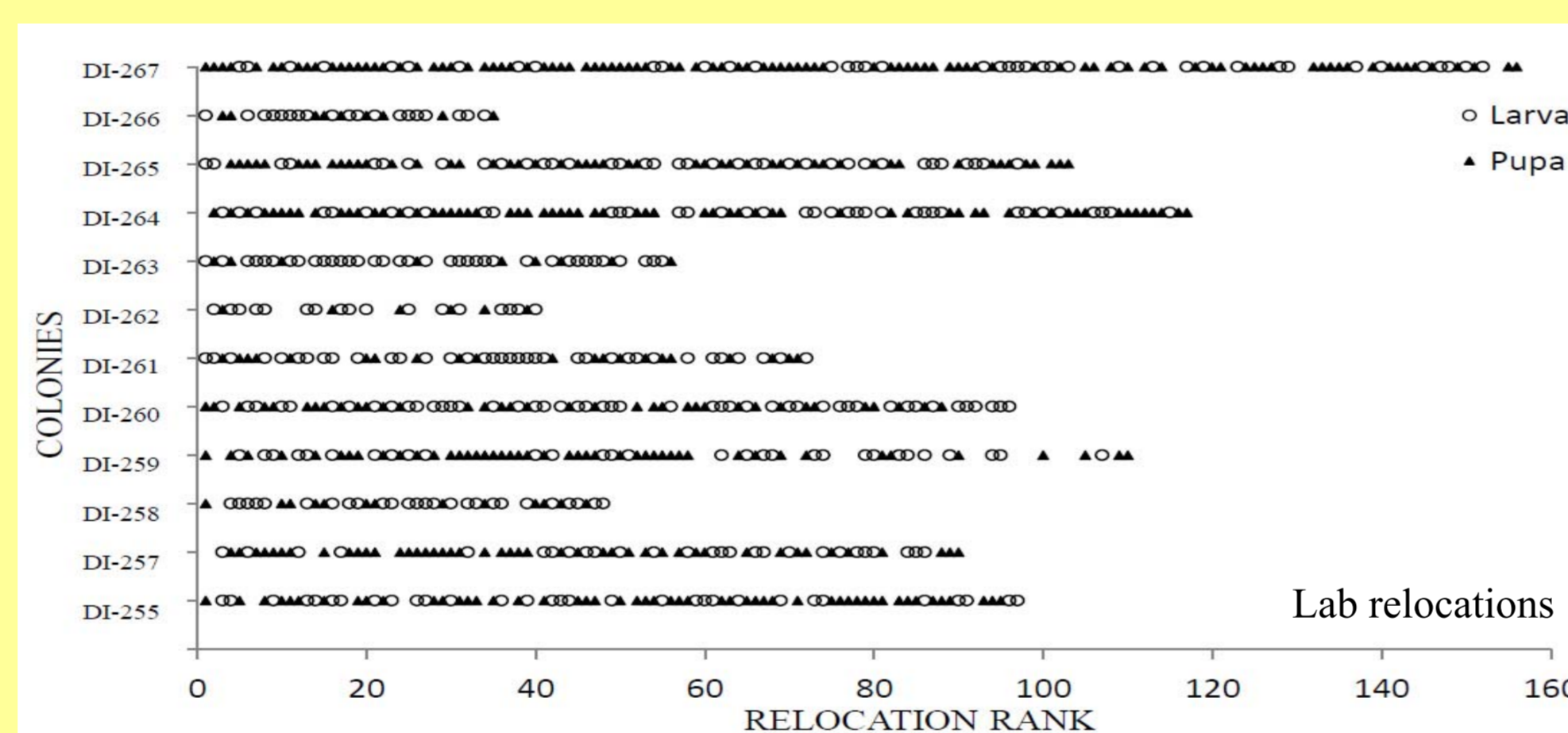
### Brood transport: colony level

10 out of 16 field evacuation showed no preference while 3 colonies showed preference to larvae and other 3 towards pupa (rank analysis, MWT,  $P<0.05$ )

**P=L**



11 out of 12 lab relocations colonies showed no preference (rank analysis, MWT,  $P<0.05$ )



### Brood preference at Individual level: During relocation

**Unguarded brood transport**

91 test plates, 63 tandem leaders,

**P>L > E**

( $\chi^2:5.3-22.3$ ,  $df=1$ ,  $p=0.0001$ )

**Guarded brood transport**

At the end of relocation tandem leaders encounter test plates with 5 workers with brood in mandibles plus additional 5P, 5L and 5E

**P=L**

Rank analysis, WPST:  $T=15.0$ ;  $N=12$ ;  $P=0.07$

## EXPERIMENTS

### I. FIELD STUDY

- Brood vulnerability by predation** was examined by placing test plates (5P, 5L, 5E) in the field in 3 conditions (BVTOU-brood vulnerability test—open and unguarded ( $n=14$ ), BVTCU—brood vulnerability test—cover and unguarded ( $n=10$ ), BVTG-brood vulnerability test—cover and guarded( $n=10$ )) and brood predation was recorded for atleast 30 minutes.
- Emergency evacuation:** The order in which brood items were evacuated was video recorded by applying water stress.

### II. LAB STUDY

- Brood transport in the presence of colony members:** colonies were induced to relocate & behavioural observations of all transport events was conducted
- Brood transport in the absences of adult colony member:** At the end of relocation test plates (1P, 1L, 1E) were presented to scouts & the transport events were recorded

#### Notes:

- Colony members were given unique color identification for each experiment

- Arena with dimension 1.45m X 1.75m was employed for the experiment
- Light and air current followed by removal of top cover from the nest drives colony members to locate new nest
- Bar graph representing mean  $\pm$  SD.
- Error bars represent standard deviation
- Box plot represents median, upper and lower quartile as central, upper and lower lines of box and range and whiskers
- Same letter show no significant difference among categories ( $p>0.05$ )

## CONCLUSIONS

- In the natural habitat of these ants, larvae are more vulnerable than pupa.
- Covered and guarded brood items are less vulnerable.
- The overall pattern of brood transport during relocation is random.
- The individual preference of pupa by tandem leader is balanced by the preference of larva by the followers.
- Tandem leaders relax thier preference for pupae in the presence of nestmates.

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## REFERENCES

- Hölldobler B, Wilson EO (1990) *The Ants* (Harvard University Press, Cambridge, Massachusetts).
- Casacci LP et al. (2013) Ant Pupae Employ Acoustics to Communicate Social Status in Their Colony's Hierarchy. *Curr Biol* 23:323–327.