

OBSERVATIONS OF A *LABIDUS COECUS* (LATREILLE)  
UNDERGROUND RAID IN THE CENTRAL HIGHLANDS OF  
COSTA RICA

BY IVETTE PERFECTO

School of Natural Resources  
University of Michigan  
Ann Arbor, Michigan 48109

The predatory effect of army ants (subfamilies Dorylinae and Ecitoninae) on other arthropods has long been appreciated (Schneirla 1933, Williams 1941, Topoff 1969, 1984) and recently their effect more generally on ant communities has been noted (Franks & Bossert 1983). Most direct observations of army ant attacks on other ant nests have been with above-ground raiders (Rettenmeyer 1963, Rettenmeyer et al. 1983). Observations of below ground raids, specifically noting particular species of other ants being attacked, are rare in the literature.

On 20 August 1991 an underground raid of *Labidus coecus* (Latreille) was observed on the grounds of the Centro de Investigaciones de Café, 10 KM west of Barba de Heredia, Heredia Province, Costa Rica. The area was in a sparsely planted monoculture of coffee where I had been studying the ant community for two months. Observations of the raid encompassed a period of about 4.5 hours from 09:00 to 13:30, in an area in which all nests of *Solenopsis geminata* F., *Dorymyrmex* sp.(=*Conomyrma*), *Pheidole* sp., and *Pheidole radoszkowskii* Mayr had been previously located and marked. Underground activity of *L. coecus* was possible to monitor from the above ground activity of *S. geminata*, *Dorymyrmex* sp., and *Pheidole* sp. Brood was brought to the surface of the ground and transported elsewhere, to other nest holes in the case of *Dorymyrmex* sp. and to nearby leaf litter by *Pheidole* sp. and *S. geminata*. Curiously, of the five nests of *Pheidole radoszkowskii* in the general vicinity, none was observed with the above ground response to *Labidus* attack.

---

*Manuscript received 31 July 1992*

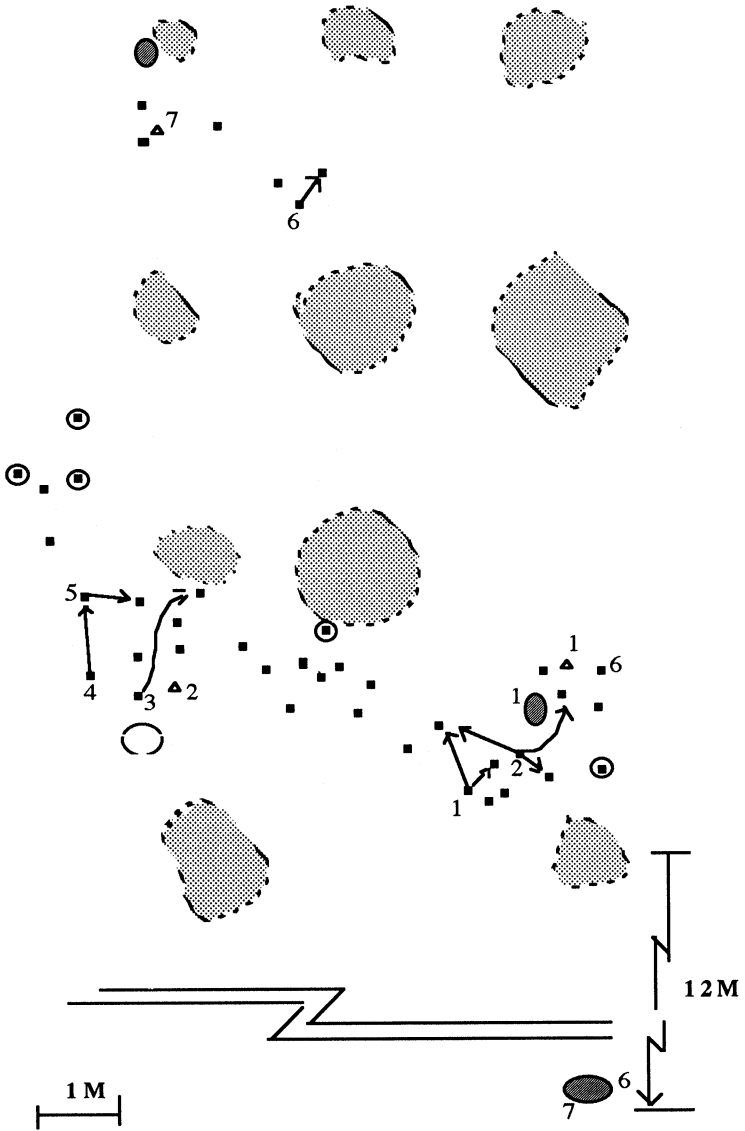
At approximately 09:00 three colonies were noted to be under attack, a *S. geminata* colony, a *Dorymyrmex* sp. colony, and a *Pheidole* sp. colony. The first *Dorymyrmex* colony under attack brought brood across the surface of the ground to at least three other nests. At about 10:00, a second *Pheidole* sp. colony, located four meters from the first, came under attack. At 11:15 two other *Dorymyrmex* colonies were attacked, taking brood to nearby nests. A queen from one of these colonies was seen running with the workers from the attacked colony to one of the other nests across the surface of the ground. At 11:46, one of the nests to which the previous two colonies had escaped came under attack, the brood taken to a nest not yet used for brood deposition, including the removal of apparently the same queen that had earlier escaped attack.

At 12:04 an attack on a *Dorymyrmex* sp. colony some 6 meters from the site of the other attacks was noted as was an attack on another *Pheidole* sp. colony at 13:30. Another attack on a *Dorymyrmex* sp. colony in the original area was seen at 12:10. Finally an enormous attack on a large *S. geminata* colony was observed about 12:15, approximately 12 meters from the site of the original attacks. This nest was excavated to observe the thousands of *L. coecus* workers swarming throughout the *S. geminata* nest. Interestingly, no surface activity of any of the species was observed in the 12 meter intervening area.

I continued monitoring the area until 16:00, but found no evidence of further *L. coecus* attacks. Later in the day, at 12:30, 13:45, and 15:54, specific colonies that had been attacked were observed returning to the nest with brood.

A map indicating the approximate position of the nests under attack, the sequence of the attack, which *Dorymyrmex* sp. nests received brood from which other nests, and the position of all other nests in the general area is shown in figure 1.

The behavior patterns of the three species under attack were quite distinct. An attack on *Dorymyrmex* sp. was noticed by the presence of large number of pupae (inside cocoons) on the surface of the ground around the nest entrance, quickly followed by the moving of these and other brood to other nearby *Dorymyrmex* entrance holes, once to a nearby abandoned hole of a cicadellid larva. It was clear that the existence of so many "nests" in a small



area provided refuge sites from attacking *L. coecus*. Indeed of 10 so-called nests excavated in the general vicinity of the attack, only two were found with queens and the rest had workers and brood only. The formation of this type of satellite colony has been reported for many ant species as a means to expand their foraging domain while maintaining contact through an exchange of foraging workers as well as the transport of immature forms back and forth (Higashi & Yamauchi 1979, Yamauchi et al. 1987). However, Droual (1984) reported it as an anti-predator behavior in the ant *Pheidole desertorum*. Based on my observations, I propose that for *Dorymyrmex* sp., the formation of satellite colonies is also a mechanism to evade predation by army ants.

The three *Pheidole* sp. colonies observed under attack were seen to rapidly move brood out of the nest in many directions. Following the escaping ants revealed that the brood were being hidden in a variety of sites, under leaf matter and within rolled-up dry leaves. No *Pheidole* sp. colony was observed returning to the original nest site with brood. One excavated *Pheidole* sp. nest under attack revealed a relatively small number of *L. coecus* individuals, and no obvious attempt to defend the nest by majors under way.

A total of two *S. geminata* nests were observed under attack. The first was observed only from the surface. In it one could see *S. geminata* majors bringing dead *L. coecus* to the surface and discarding them. But the main behavior was moving brood away from the nest. The second *S. geminata* nest was rapidly excavated revealing a massive number of *L. coecus*, many engaged in combat with *S. geminata* majors, but most were simply moving rapidly in columns, apparently using the underground foraging trails previously established by *S. geminata*. The bulk of the *S. geminata* workers appeared to be engaged in taking brood away from the

Figure 1. Sketch of the area raided. Large shaded areas indicate approximate area of the canopy of individual coffee bushes. Small squares indicate *Brachymyrmex* sp. nest openings, open triangles those of *Pheidole* sp., circled squares those of *Pheidole radoszkowskii*, solid ovals those of living (shaded) and dead (unshaded) *Solenopsis geminata*. Arrows indicate nest openings from which and to which brood were taken by *Dorymyrmex* sp. Numbers indicate approximate times that each nest was raided (1 = 09:00, 2 = 10:00, 3 = 11:15, 4 = 11:30, 5 = 11:45, 6 = 12:00, 7 = 13:30). Note that the *S. geminata* nest at the bottom of the figure is about 12 meters from the concentration of the earlier part of the raid, and is included in the figure out of scale, as indicated by the jagged lines. The lower left scale indicator refers to the rest of the map.

nest, rather than in any defensive behavior. Brood were taken to what appeared to be any site on the surface of the ground that offered even the slightest bit of cover.

The entire attack was completely subterranean, the only *L. coecus* observed on the surface being an occasional individual that appeared to be lost, not engaging in any obvious offensive behavior, or those individuals brought to the surface dead by *S. geminata* majors.

In the general area of the raid there were five nests of *Pheidole radoszkowskii*, none of which was observed under attack during the 4.5 hours of observation. This would suggest that *P. radoszkowskii* has some defense, perhaps chemical, that enables it to avoid the attacks of *L. coecus*, or perhaps that it is not energetically worth for *L. coecus* to prey on *P. radoszkowskii*.

*Brachymyrmex musculus* also occurs in the area and was evidently attacked by *L. coecus*. Since *B. musculus*'s nests are very small and subterranean, they had not been previously mapped and the specific attack pattern on them was not carefully followed. It is obvious, nevertheless, that *B. musculus* also brought their brood to the surface and began hiding it in a variety of places, similar to *Pheidole* sp.

Of all the colonies attacked (including three *Pheidole* sp., two *S. geminata*, and numerous *Dorymyrmex* sp.), the following day provided evidence of mortality in only one of the attacked colonies. The smaller of the two *S. geminata* colonies was completely gone, and there was no evidence of a new colony anywhere nearby. The disappearance of this colony was verified by digging the nest the next morning after the raid. The nest of the second, larger *S. geminata* colony was physically reformed (it had been excavated the day before) and appeared to be significantly smaller than before the attack. All other colonies that had been in the area previously were evident and alive the day after the attack. A summary of all attacked nests and their fate is presented in table 1.

These observations corroborate the speculations of Rettenmeyer (1963) that *L. coecus* is primarily an underground raider, and represent the first report of a raid that was completely subterranean. Furthermore, all previous reports of raids of this species bracket the time period from 19:45 to 08:15, effectively restricted to night time activity (Rettenmeyer 1963), while the raid reported herein

Table 1. Attacked and unattacked ant colonies and their fate, resulting from the raid of *Labidus coecus*.

Species	Colonies in area	Colonies attacked	Colony mortality (number killed)
<i>Dorymyrmex</i> sp.	27	18	0
<i>Pheidole radoszkowskii</i>	5	0	0
<i>Pheidole</i> sp.	3	3	0
<i>Solenopsis geminata</i>	3	2	1
<i>Brachymyrmex musculus</i>	many	many	?

occurred between 09:00 and 13:30. I speculate that, since the present raid was during the late morning and early afternoon hours, the previous concentration of observations during the night time hours may be because that is the only time raiding columns become epigeaic.

As noted above, *S. geminata* was the only species that actually lost a nest due to the raid. This species would appear to be especially vulnerable to subterranean raids due to its extensive network of subsurface trunk trails. In the area of observation, several *S. geminata* nests had been mapped with semi-surface covered trails extending over an area of more than 16M (Perfecto, unpublished manuscript). Such trunk trails offer obvious opportunities to the underground raids of *L. coecus*.

#### ACKNOWLEDGEMENTS

I thank Susy Remold, Stuart Ketcham and John Vandermeer for their help in the field, John Vandermeer for valuable comments on the manuscript, and the Coffee Institute (ICAFE) for allowing me to use their facilities. This research was possible with funding from an NSF grant to the author.

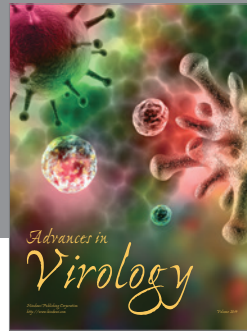
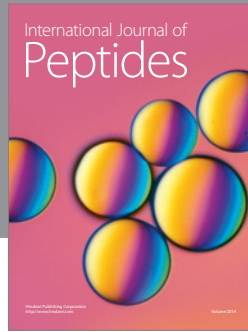
#### SUMMARY

An underground raid of the army ant *Labidus coecus* (Latreille) is reported in a coffee plantation in Costa Rica. Observations of the raid were made for a period of 4.5 hours during daylight. Underground activity of *L. coecus* was possible to monitor due to previous marking of nests of other ground-nesting ant species: *Solenopsis geminata* F, *Dorymyrmex* sp., *Pheidole* sp. and

*Pheidole radoszkowskii* Mayr. The behavior of each of these species when under attack by *L. coecus* is described. Brood was brought to the surface and transported elsewhere by *S. geminata*, *Dorymyrmex* sp. and *Pheidole* sp. *Dorymyrmex* sp. transported the brood to other nests, suggesting the use of satellite colonies as anti-predator behavior. None of the *P. radoszkowskii* colonies located in the general area of the raid were observed under attack during the raid period.

## LITERATURE CITED

- FRANKS, N. R. & W. H. BOSSERT  
 1983. The influence of swarm raiding army ants on the patchiness and diversity of a tropical leaf litter ant community. In E. L. Sutton, T. C. Whitmore, and A. C. Chadwick, eds., *Tropical Rain Forest: Ecology and Management*, pp. 151–163. Blackwell, Oxford.
- DROUAL, R.  
 1984. Anti-predator behaviour in the ant *Pheidole desertorum*: the importance of multiple nests. *Animal Behaviour* **32**(4): 1054–1058.
- HIGASHI, S. & K. YAMAUCHI  
 1979. Influence of a supercolonial ant *Formica (Formica) yessensis* Forel on the distribution of other ants in Ishikari Coast. *Japanese Journal of Ecology*, **29**(3): 257–264.
- TOPOFF, H. R.  
 1969. A unique predatory association between carabid beetles of the genus *Helluomorphoides* and colonies of the army ant *Neivamyrmex nigrescens*. *Psyche*, **76**: 375–381.  
 1984. Social organization of raiding and emigrations in army ants. *Advances in the Study of Behavior*, **14**: 81–126.
- RETTENMEYER, C. W.  
 1963. Behavioral studies of army ants. *University of Kansas Science Bulletin*, **44**: 281–465.
- RETTENMEYER, C. W., R. CHADAB-CREPET, M. G. NAUMANN, AND L. MORALES  
 1983. Comparative foraging by Neotropical army ants. In P. Jaisson, ed., *Social Insects in the Tropics*, vol 2, pp. 59–73. Université Paris-Nord, Paris.
- SCHNEIRLA, T. C.  
 1933. Studies on army ants in Panama. *Journal of Comparative Psychology*, **15**: 267–299.
- WILLIAMS, E. C.  
 1941. An ecological study of the floor fauna of the Panama rain forest. *Bulletin of the Chicago Academy of Science*, **6**: 63–124.
- YAMAUCHI, K., Y. ITÔ, K. KINOMURA, AND H. TAKAMINA  
 1987. Polycalic colonies of the weaver ant *Polyrhachis dives*. *Kontyu, Tokyo*, **55**(3): 410–420.



**Hindawi**

Submit your manuscripts at  
<http://www.hindawi.com>

