Ecology, 77(2), 1996, pp. 630–638

ANT COMMUNITY STRUCTURE: EFFECTS OF PREDATORY ANT LIONS[1]

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Abstract. This study examined the responses of ground-foraging ants to larval ant lions (Neuroptera: Myrmeleontidae). In central Oklahoma, these sit-and-wait arthropod [illegible]

[illegible]

zone forms an effective "minefield" of predation for local ant assemblages. The density of ant-nest entrances and the number of pitfall-trap captures of ant foragers were significantly lower in the ant lion zone than in the adjacent forest or grassland. Differences in [illegible]

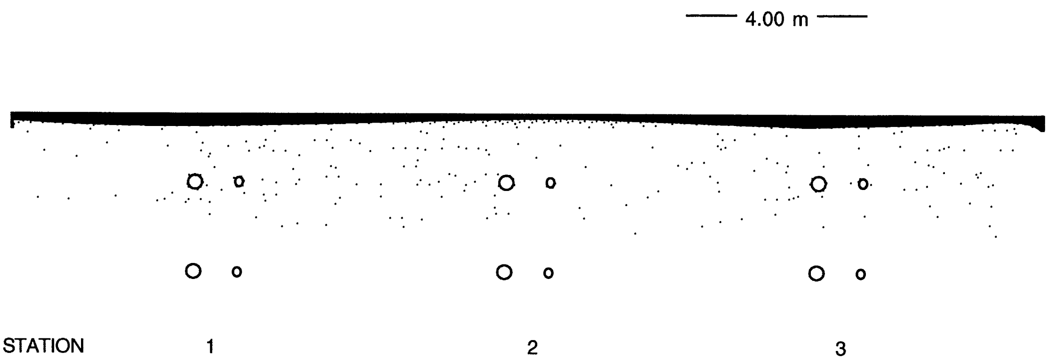


FIG. 1. Layout of pitfall traps. The black region represents the cliff ledge, and the shaded region represents the ant lion zone. At each cliff ledge, six stations were established, with large and small pitfall traps placed inside and outside the ant lion zone.

MATERIALS AND METHODS

Study sites

Ant assemblages were examined at three sandstone cliff ledges in Caddo County, Oklahoma. These sites support dense aggregations of larval ant lions (*Myrmeleon immaculatus* and *M. crudelis*) in a well-defined zone 1–2 m wide at the base of each cliff. High soil surface temperatures and disturbance from rainfall re-

small traps were placed both within and 1 m beyond the ant lion zone (Fig. 1). The permanent PVC sleeve allowed traps to be inserted and removed with almost no disturbance to the surrounding substratum.

At each trapping date, I removed the caps and inserted a large (38 mm diameter) or small (25 mm diameter) glass jar, rimmed with foam insulation. Each jar was filled to a depth of 25 mm with ethylene glycol, rankings would correspond with soil surface temperature at 1200, which was used as a simple thermal index to correlate with pitfall catches.

Statistical analysis of pitfall trap data

I analyzed species richness, total abundance, and [illegible]

mixed-model repeated-measures analysis of variance. The within-subjects factor was years (1989–1993) and the between-subjects factors were sites (Salyer East, Salyer West, Pugh Canyon), microhabitats (predators [illegible]

present, predators absent), and trap sizes (small, large). Stations (1–6) were nested within sites. All factors in the model were random except microhabitats, which was fixed. Data were logarithmically transformed [ln(n + 1)] before analysis to correct for non-normality. I deleted third-order and fourth-order interaction terms [illegible]

collected with a suction aspirator from tuna-fish baits, and then dropped from a height of 5 cm over a haphazardly chosen location at the midpoint of the ant lion zone. I followed each individual until it was captured by an ant lion larva, escaped to the front of the ant lion zone, or successfully reached the cliff base at the back [illegible]

as the proportion of those 10 workers that was successfully captured by ant lions. The probability of capture by an ant lion was measured for each prey species as (total number of ants captured per total number of ant [illegible]

lions encountered). An ant lion encounter was defined as an ant entering or partially entering an ant lion pit and eliciting a sand-throwing response from the predator. These experiments were conducted on several days in May and June of 1991. At that time in the year, the ant lion zone is dominated by second- and third-instar larvae [illegible]

25 kg of oven-dried sifted soil that was originally collected from the ant lion zone. The sand was arranged in a circular disk, 1 m in diameter and ≈3 cm deep. Into this patch, I introduced 30 second- and third-instar

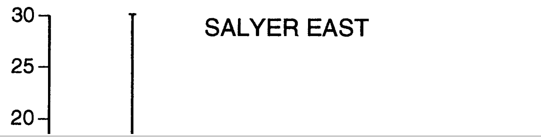


TABLE 1. Summary of analyses of variance for yearly pitfall trap catches (1989–1993). Each column represents a different response variable. S = total species number; N = total ant abundance. Other columns are for total abundance of particular species. Each row represents a different effect in the analysis of variance. Stations are nested within sites. Microhabitats are traps placed within and outside the ant lion zone (see Fig. 1). Degrees of freedom are indicated in parentheses. Significant effects are indicated by asterisks: * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. The linear contrast tests the hypothesis that pitfall catches were significantly different within and outside the ant lion zone.

Factor	S	N	*Monomorium minimum*	*Pheidole bicarinata*	*Pheidole dentata*	*Conomyrma flava*	*Crematogaster punctulata*	*Solenopsis* spp.
Site (2)								
Year (4)								
Trap size (1)					*			
Microhabitat (1)	*		*					
Site × year (8)						***		***
Site × trap size (2)						***		
Year × trap size (4)					*	*		
Trap size × microhabitat (1)							*	
Year × microhabitat (4)			*	*	**			***
Station [site] (3)								
Year × station [site] (4)					*	***		*
Trap size × station [site] (3)						***		
Microhabitat × station [site] (3)	*	**		***		***	*	***
Linear contrast: predators absent vs. present	***	***	***	***		***	***	***

tata) were lower in the presence of ant lions (Table 1). The difference in abundance of ants within and outside

Density of nest entrances

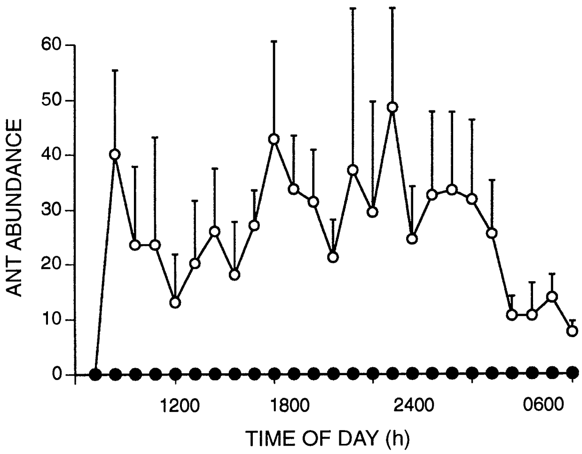
At Salyer West and Pugh Canyon, no ant nest en-

TABLE 2. Comparison of observed and expected ant species number from pitfall traps in the presence or absence of ant lion predators. The observed number of ant species in the presence of ant lions is shown, with the expected number in the absence of predators generated from rarefaction. Asterisks indicate species richness values that are >1.96 standard deviations from the expectation.

	Salyer East		Salyer West		Pugh Canyon	
Date	Predators absent	Predators present	Predators absent	Predators present	Predators absent	Predators present
Large pits:						
May 1989	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June 1989	4.43	4	8.82	10*	2.34	2
July 1989	3.33	3	5.94	6	2.87	4
July 1990	3.92	4	3.38	5	1.61	1
July 1991	4.27	3	1.00	1	0.00	0
July 1992	3.29	3	2.60	3	4.71	4
July 1993	5.95	6	4.45	6	1.47	1
Small pits:						
May 1989	2.87	4	5.60	5	2.52	3
June 1989	3.15	4	4.22	6*	1.86	3
July 1989	2.46	2	3.94	3	2.68	3
July 1990	3.70	3	4.15	5	3.06	5*
July 1991	1.00	1	0.00	0	1.00	1
July 1992	2.47	2	2.44	3	1.00	1
July 1993	6.00	5	1.70	3*	0.00	0

may have been absent from the ant lion zone *because* they were feeding at baits on the adjacent forest floor. To test this hypothesis, I repeated the experiment on 28 June 1991 with a different spatial array of replicates.

This spatial arrangement ensured that foraging responses in the ant lion zone were independent of foraging responses on the forest floor. I censused these baits for 6 h and obtained identical results to those of



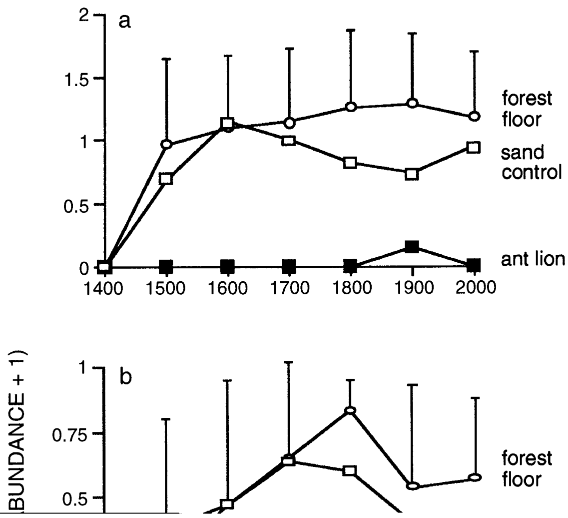


FIG. 5. Average number of ants per bait at tuna-fish bait stations placed within natural predator aggregations (●) and [redacted]

counter these adaptations and perhaps indicate rough

Hurlbert, S. H. 1971. The nonconcept of species diversity: a critique and alternative parameters. Ecology 52:577–585.