Report on OTS Field Problem II-11-1966

0506

Winter session, 1966. Finca La Pacifica, Cañas, Guanacaste, Costa Rica. Report on

"Ant and plant interactions". By Dr. Daniel Janzen

This field problem was conducted two miles south of the Rio Corobici (south margin of Finca La Pacifica), in a pasture on the west side of the Pan American Highway. This site is just north of Cañas, Guanacaste, Costa Rica.

While Cecropia X Azteca and Cordia X Azteca were briefly examined, the majority of the morning was spent working with Acacia Costaricensis and the three ants that live in its thorns (Pseudomyrmex belti, Pseudomyrmex spinicola, and Pseudomyrmex nigrocincta). Primarily, the alarm reaction of an entire colony, and the distribution of different ant species among the acacias were examined.

Alarm reaction.

Four control counts (four 15 second consecutive intervals) of ants crossing a line (imaginary) on the trunk were made, followed by five hard kicks at the base of the trunk, followed by 16 consecutive 15 second counts. Each group (four groups) did this to a colony of each species. The sums of the counts are included in the following table.

Interval		P. belti	P. spinicola	P. nigrocincta	Sum
1		10	12	15	37
2		5	4	11	20
3		10	4	8	22
4	control	3	2	13	18
5	disturbed	84	40	110	234
6		76	74	122	272
7		77	76	120	273
8		72	87	115	274
9		58	67	113	238
10		86	75	122	283
11		64	54	107	225
12		57	71	102	230
13		58	55	104	217
14		53	46	93	192
15		57	46	87	190
16		62	61	97	220
17		57	47	86	190
18		50	50	105	205
19		60	41	52	153
20		57	46	92	195

ALL NUMBERS ARE SUMMED ACROSS FOUR COLONIES

It is clear that there is an increased rate of ants passing a certain point on the tree when kicked. It is also clear that there is a gradual return toward the original low. If the counts had been continued for another 10 to 30 minutes, they would have been very close to the original control counts. Summing the curves across all three species removes some of the variance but not all, since the alarm reaction is common to all three species, but not the same in each. The increased rate of crossing the point is due to both a nearly tripled rate of running by the ants, and up to 50 % more ants coming out of the thorns. The colonies counted contained 5 to 10 thousand workers, based on previous counts of colony size that I have made. The trees examined were two to three years old, and in the 180 to 300 cm size range; it is evident that these many ants passing over a given point on the trunk of a tree of this size represents 500 to 1500 workers active on the surface of the tree. The general alarm reaction is d developed through many of the ants liberating an alarm odor (quite noticeable) which

can excite a neighboring colony downwind. As this material is carried away from the colony by the wind, with no further stimulus for its production by the workers, the colony gradually returns to its previous state of activity.

Relative abundance of the three species.

The three species of Pseudomyrmex found in the pasture are extremely similar in their general behavior and biology. However, there are slight differences in their ability to withstand a dry season, protect a tree of equal size from insect and plant damage, and establish a colony in the face of aggressive competition from queens of other species. First, the comparative density of the various species colonies in the pasture, islands of woody vegetation within the pasture, and the riparian vegetation surrounding the pasture was determined by a relatively complete census within a defined area. There were 200 colonies of the three species of Pseudomyrmex (and 8 trees occupied by Crematogaster which takes over after a Pseudomyrmex colony dies) distributed in the following manner in approximately 4 hectares.

	P. belti		P. nigrocincta		P. spinicola		Total
	#	%	#	%	#	%	#
Riparian	13	27	25	51	11	22	49
Islands	4	10	16	53	10	33	30
Open pasture	38	31	59	49	24	19	121
Total #	55		100		45		

It is evident that P. nigrocincta is the most abundant species in the area sampled. However, other pastures in the same area (within several kilometers) show quite different proportions of the three species. It must be noted that the acacia is a second growth species, one commonly a member of secondary succession. These pastures are frequently cleared and totally burned (at least every 3 to 8 years). If any one species was to gradually remove the other through direct competition by founding queens for young seedlings, it would take a number of successive generations of the ants as a colony on a given site for such competitive exclusion to take place--this would at best take 50 plus years and the successional stages in natural disturbance sites do not last this long (at a state where Acacia is a member of the community). It appears that competitive removal of all but one of the species in a given area could occur only in a natural disturbance site that was isolated from the inward flow of queens from other colonies in other successional stages.

There is however, absolutely no doubt that there is competition between queens of the same and different species for the seedlings. If one queen leaves its thorn for Beltian bodies or for nectar, another queen may enter the thorn and prevent the first from returning. The new queen ignores the brood of the previous occupant and starts her own colony. If the density of queens on young shoots is high, this continued succession of queens easily results in no new colonies. Once a colony is formed, the workers gradually remove the occupants of other thorns on the shoot; their efficiency, and ability to withstand the inroads of other young colonies, is a species specific character, as is the speed with which the colony reaches a size much that is can remove other queens and colonies from the shoot. This removal is accomplished through direct ant to ant fighting.

Thirty-one young seedlings or suckers in the 10 to 40 cm. size range were collected from the open pasture. The 180 thorns contained the following proportions of queens and other occupants:

P. belti		P. nigrocincta		P. spinicola		Empty	P. nigropilosa
#	%	#	%	#	%	#	#
7	14	8	70	8	16	68	12

P. nigropilos, is a species that does not protect the acacia and only lives in shoots that lack a colony of one of the first three Pseudomyrmex.

It is clear that the proportion of P. nigrocincta queens is higher in the seedlings than in the established colonies. There are several reasons for this, the main one being that P. nigrocincta maturing colonies grow faster than those of the other two, and produce more founding queens per unit time. However, the other aspect of importance in this system is that a P. belti colony is more effective at removing a P. nigrocincta colony of equal or even greater size than vice versa, and thus in the process of colony establishment the ratio of these two ants is modified.

It is of interest that as many as all three of the founding queen species may be found in a single young shoot. The pumbers of species per shoot were as follows: 0 species, 10; 1 species, 19; 2 species, 4; 3 species, 1. Thus it is that were no further queens to enter the system, at least 19 of the shoots would not be involved in interspecific competition in colony establishment. However, new queens are produced each day by all three species colonies; such colony establishment rate without interspecific competition would be the result of a balance between the probability that a different species of queen takes over a thorn and either them makes the species diversity on what the previous species composition was.

OTS ADVANCED ZOOLOGY COURSE
SCHEDULE
FEB.-MAR. 1966

February	1	Zoo and Museum
	2	Introduction
	3	"
	4	"
	5	Drive to Finca Taboga
	6	Finca Taboga
	7	" "
	8	" "
	9	" "
	10	" "
	11	" "
	12	" "
	13	" "
	14	" "
	15	" "
	16	" "
		Drive to Monteverde
	18	Monteverde
	19	"
	20	"
	21	"
	22	"
	23	
	24	"
	25	"
	26	"
	27	"
	28	Drive to San José
March	1	San José
March	2	Fly to Osa
	3	Osa
	4	"
	5	"
	6	"
	7	"
	8	"
	9	"
	10	"
	11	Fly to San José
	12	Project Write up
	13	Entrain to Los Diamntes
	14	Los Diamantes
	15	" "
	16	" "
	17	" "
	18	" "
	19	Entrain to San José
	20	Drive to Cerro de la Muerte
	21	Cerro de la Muerte
	22	" " " "
	23	" " " "
	24	" " " "
	25	Drive to San José
	26	Drive to Volcán Irazú
	27	San José Reports
	28	" " "
	29	" " "
	30	" " "