FATE OF *ACACIA COLLINSII* SEEDS

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Abstract: The fate of *Acacia collinsii* (Fabaceae) seeds, in terms of dispersal and predation, is not well known. We hypothesized that many seeds would be dispersed from the ground because vertebrate dispersers might be deterred by mutualistic ants defending fruits on the tree. Our observations and measurements at a pasture site near Palo Verde suggested that 10-20% of the ripe fruit fell to the ground per day. We found *A. collinsii* seeds in feces of deer and observed consumption by ants (in the field) and two species of captured mice (in the lab). Some entire seeds were also removed by army ants.

Key Words: dispersers, seed predation

INTRODUCTION

Acacia collinsii is a small tree with yellow brush flowers and legume fruits that open on the plant to reveal seeds surrounded by a sweet yellow pulp. *A. collinsii* is a mutualist with several species of ants. The tree provides the ants with shelter and nutrition in exchange for protection from herbivores and competing vegetation (Brown 1960, Janzen 1966). Acacia ants reduce aggressive behavior around flowers, which may enhance pollination (Baptista 1998). However, because the ants do not reduce aggressive behavior near fruits, dispersal may be diminished (Carey et al. 2005).

Our goal was to determine the fate of *A. collinsii* seeds. We hypothesized that many of the seeds would fall to the ground and be dispersed from there because vertebrate dispersers would be deterred from the trees by the defensive behavior of the mutualistic ants.

METHODS

We spent > 13 h at a pasture study area containing abundant *A. collinsii* trees, ca. 6 km SE of the OTS Palo Verde field station (within 100 m of the Dartmouth long-term *A. collinsii* study plot) on 13 and 14 January 2005. On the first day, we selected 11 *A. collinsii* trees and counted the numbers of yellow fruits on the ground, and those remaining in the tree. Ten fruits from each tree were randomly taken to determine the average number of seeds per fruit. We removed all fruits from under four of the trees so we could know on the second day how many had fallen during the night. Sheets were set up under one of the trees to catch fruits that fell and keep them off the ground away from animals. However during the night, the sheets were ripped off at the corners and carried away by an unknown animal.

On the second day we counted fruits under all of the trees again, to determine the change in fruits under each tree. We observed animal activity, including

birds and bats, between 0500 and 1130 noted animal signs.

At the field station, during the nights of 13 and 14 January, we baited Sherman traps with the fruits and peanut butter. We placed the captured rodents in containers with *A. collinsii* fruits. We also left ~30 fruits under *A. collinsii* surrounded by fluorescent tracking powder.

RESULTS

Fruits contained an average of 8.8 seeds (SD = 1.8). For the four trees for which we removed all the fruit underneath, 10-20% of the ripe fruit on the trees fell to the ground in a 12 h period (Table 1). From this we infer that a large portion of the overall seed production reaches the ground.

There was evidence of ground foraging on *A. collinsii* fruits under at least two trees (Table 1). We also observed 15 *A. collinsii* seeds carried intact by army ants for at least 5 m (although some army ants struggling under a load of two connected seeds dropped one or both). Other (smaller) ant species divided the seeds into small pieces. Ants ate most of the fruits and seeds we left in rodent traps or surrounded by UV powder, in some cases consuming a pile of over 30 fruits overnight. There was one trail of UV tracking powder, presumably by a rodent, based on size and nocturnal activity. Both mice we caught (a spiny forest pocket mouse and a house mouse) ate the fruits we provided within minutes, including seeds. We found two piles of deer excrement near the *A. collinsii* trees, containing an estimated 50-100 *A. collinsii* seeds each.

DISCUSSION

A. collinsii is a light-demanding tree (Janzen 1966) which presumably requires seed dispersal to reach colonizable sites. Based on our observations, we propose that most seed dispersal occurs after seed fall, because then dispersers do not have to contend with mutualistic ant defenders. Deer, and possibly other large mammals, may disperse the seeds long distances in their feces. Deer tend to feed in open areas which are suitable for *A. collinsii* colonization. A local guide claimed to have witnessed white-faced capuchin and howler monkeys taking fruits directly from the tree. Small and numerous seeds, like those of *A. collinsii*, may escape mastication and

Table 1. Number of ripe fruits under and on trees. Changes from first to second day. Fruits left under tree is the number left after we removed some to count seeds and removed all fruits from under trees 8-11.

Day	Tree number	1	2	3	4	5	6	7	8	9	10	11
1	Fruits on tree	43	180	55	109	56	41	108	81	72	30	46
1	Fruits under tree	39	25	17	40	24	8	30	28	30	14	19
1	Fruits left under tree	39	20	12	35	19	3	25	0	0	0	0
2	Fruits under tree on 2nd day	91	42	12	98	32	0	14	9	16	4	7
1 - 2	Net change under tree	52	22	0	63	13	-3	-11	9	16	4	7

pass through vertebrate guts unharmed (Janzen 1983).

We observed no bird or bat seed dispersal during our short observation periods to support the contention that birds and bats are the main seed dispersers (Janzen 1983).

Seed-fall makes seeds available not only to dispersers, but also to predators, including ants and mice. Both of which are capable of eating a large quantity of the seeds that fell to the ground. Army ants might be dispersers as well as predators since they remove seeds and may not always consume them.

Literature Cited

Baptista, A. I., et al. 1998. Avoiding ant-pollinator conflict on *Acacia collinsii.* Dartmouth Studies in Tropical Ecology, p. 1-3.

Brown, W. L. 1960. Ants, acacias and browsing mammals. Ecology, 41: 587-592.

Carey, C. C., E. C. Chow, J. E. Jun, D. J. Madigan and E. L. Sharp. 2005. Fruit and leaf patrolling by *Pseudomyrmex spinicola* in response to disturbance of *Acacia collinsii*. Dartmouth Studies in Tropical Ecology.

Janzen, D. H. 1966. Coevolution of mutualism between ants and acacias in Central America. Evolution, 20: 249-275.

Janzen, D. H. 1983. *Jacquinia pungens* in Costa Rican Natural History. University of Chicago Press: Chicago. p. 265.

Janzen, D. H. 1983. *Pseudomyrmex ferruginea* in Costa Rican Natural History. University of Chicago Press: Chicago. p. 764.

Addendum

We planted eight of the Acacia seeds found in the deer feces 5 – 20 mm deep in soil from La Selva Biological Station. Six of the seeds had sprouted and opened their first set of leaves within ten days, thus showing that acacia seeds are still viable after passing through the gut of a deer.