ANTS, EXTRAFLORAL NECTARIES AND ELAIOSOMES ON A PIONEER SPECIES

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Introduction

Adenanthos cygnorum (Proteaceae) is the major pioneer shrub species of deep acid sands in southwestern Australia. It forms almost monospecific stands following extensive soil disturbance, especially after clearing for urban development.

Preliminary investigations showed that this species has a) extrafloral nectaries (EFNs) on the tips of many of its leaves which are visited by ants, and b) elaiosome bodies on its fruits which are attractive to ants. At maturity, the fruits are shed but are retained in the cup of surrounding leaves. It was therefore hypothesised that the EFNs on A. cygnorum serve to attract ants to visit the plant (Bentley 1977) and in so doing locate the elaiosome-bearing fruits. The fruits are then carried by the ants to their nests (Bond and Slingsby 1983) where they are stored until brought to the surface by soil disturbance.

Results and Discussion

At the study site (15 km south of Perth, Western Australia), few ants visited the juvenile plants lacking EFNs, in contrast to the numbers visiting the adult plants with EFNs (Table 1). All 17 species of ant

Table 1. Numbers of major ant species per m^3 canopy of Adenanthos cygnorum on juvenile (lacking EFNs) and adult plants (with EFNs)

	Diceratoclinea sp.	Polyrachis sp.	Rhytidoponera sp.
Juvenile	0.9 ± 0.9	0.3 ± 0.6	1.3 ± 1.9
Adult	19.9 ± 11.3	4.7 ± 2.7	15.8 ± 12.6

Means ± standard deviations for 6 plants scored at weekly intervals over 12 weeks.

located on the adult plants moved systematically over the branches and fed at each EFN encountered. Ten of the ant species were observed to remove fruits via the elaiosome when these were encountered on the plant and a further two species did so in the laboratory. The transport of fruits from foliage to nests up to 8 m away was followed on three occasions. Digging 8 cm beneath the entrances to 6 of 7 nests unearthed 12 soil-stored fruits and 16 germinants all lacking elaiosomes.

When placed among the leaves, >90% of elaiosome-bearing fruits were removed within 4 days (Table 2), whereas <7% were removed on plants surrounded by tanglefoot^R (which prevented non-flying insects reaching the plant). The latter were apparently dislodged by wind. There was even an indication that the fruits were removed more readily from the plant than from the ground, but the reverse was true for the tanglefoot-treated plants. In one study the common seed harvester ant, Rhytido-

ponera sp., traversed fruit-producing sites on the plant an average of 7.4 times per min over a total of 10 min observations during a summer day. The presence of husks in place of some experimental fruits on the ground suggested predation by parrots.

Table 2. Harvesting of fruit of Adenanthos cygnorum placed on or under the canopy, with or without a ring of tanglefoot around the plants

Day	1	2	3	4	5
Under canopy					
+ tanglefoot	45	40	36	35	30
- tanglefoot	45	17	15	14	13
On plant					
+ tanglefoot	45	42	42	42	42
- tanglefoot	45	18	7	5	4

Elaiosome-bearing fruits were placed in 3 lots of 5 on or under 3 plants per treatment.
All values for day 5 significantly different at <5% level with X^2 test.

It is clear that there is a functional relationship between the occurrence of EFNs and elaiosome-bearing fruits on A. cygnorum: most of the ants that feed at the nectaries also transport fruits encountered on the plant to their nests. What is the significance of rapid removal from the plant rather than delayed removal of fruits that are finally available for transport from the ground? The seed is highly nutritious (50.6% protein, unpubl.) and favoured by granivorous birds and rodents. The Laughing Dove (introduced) is a regular feeder on fruits under the canopy of A. cygnorum at the study site, while 2 species of bronzewing pigeons, 2 parrots and 4 quails are recorded from the sandy soils of southwestern Australia (Pizzey and Doyle 1980). Six rodent seed-eater species are known from the same area (Watts and Aslin 1981). It is concluded that rapid removal of fruits from the plant by ants precludes predation, especially of fruits fallen to the ground. This results in maximum storage of seed in the soil and ensures mass regeneration of A. cygnorum after disturbance.

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