NATIVE LEGUME SEED PREDATION, COLLECTION AND DISPERSAL MECHANISMS

by C.E. Portlock

The Australian ant fauna is among the richest and most varied in the world in individuals, species, and ecologic forms (Taylor, 1972). Over 1,500 species of vascular plants in Australia have ant-attracting structures (elaiosomes) on their seeds or fruit. These ant-attracting appendages aid in the dispersal of seeds. Only 300 species known from the rest of the world have these ant-attracting appendages.

Ants can be classified into three groups: non-collectors, elaiosome collectors, and general collectors. Non-collectors show little interest in diaspores. Myrmecia, Componotus, and the species Iridomyrmex purpureus were observed to be non-collectors (Berg, 1972).

Species that regularly collected diaspores without as well as with elaisomes are termed general collectors. The harvester ants are general collectors. They use the endosperm and embryo for food. In a study of the Western Harvester ant, Pogonomyrmex occidentalis, of Colorado, the maximum area cleared was 27.3 m^2/ha in an ungrazed area. This represented 0.3% of the total area (Rogers and Lavigne, 1974). Soil moisture increased because of the elimination of transpiring plants. Soil moisture was also higher within the vicinity of the nest. A few decorator ants, which utilize plant materials for special building purposes such as Chelaner and Pheidole, can also be classified as general collectors.

Typical elaisome collectors are selective in relation to plant diaospores and under optimal conditions will collect solely or predominantly those with aleisomes (Berg, 1972). Genera which were found to be aleisome collectors are Rhyditoponera, Iridomyrmex and Melophorus.

Pheidole, plant families whose seeds are regularly dispersed by ants are: Euphorbiaceae, Leguminosae, Rhomnaceae and Steruliaceae. Important genera are Hibbertia, Goodenia and Acacia. Most Australian elaiosomes are relatively dry and hard and firmly permanent. Most of them maintain their form and size indefinitely relative to the rest of the diaspore. The best developed Australian elaisomes with regard to their effect upon the ants are those of Caesia, Bossiaea, Tetratheca, Hibbertia, Monotoca and Opercularia.

Since our pot trials showing that legumes inhibit the growth of Phytophthora cinnamomi, I have been interested in the availability of

legume seed in the Northern Jarrah Forest. In soil sampling experiments that I and others have carried out, we have found a surprising lack in numbers of legume seed. Germination of clumps of fireweeds after a hot fire seemed to indicate some sort of collecting going on. Further soil sampling experiments indicated that numbers of legume seeds were greatest at 3 to 6 cm in the soil profile. Seeds were also found in samples as deep as 12 cm. Following this up, I made observations on three different species of ants and set up a few rough, preliminary experiments.

Most of my observations were made and experiments done at White Block on a hillside roughly 100 metres from the Wren Road gate into the Quarantine Area. On Monday, December 13, I first noticed seeds being dispersed by the Acacia strigosa study plant at White Block. This bush was estimated to have had 220 seed pods with an average of 5 seeds per pod; making roughly 1,100 seeds on the bush. It was an average sized bush in more of an open area than the other bushes. Three lines of five funnels (15 cm in diameter) were placed every ½ metre from the stem of the study plant.

RESULTS: Strigosa study plant (1,100 seeds estimate).

	R	%	L	Average	
0.5 m	10	9	10	9.6	10
1.0 m	5	4	5	4.6	5
1.5 m	2	2	3	2.3	2
2.0 m	0	2	0	0.6	1
2.5 m	0	0	0	0	0

Roughly

550	seeds	50%	of	the	seeds	fell	between	0. m - 0.58 m
275	"	25%	"	"	"	"	"	0.58 m - 1.08 m
110	"	10%	"	"	"	"	"	1.08 m - 1.58 m
55	"	5%	"	"	"	"	"	1.58 m - 2.08 m
0	"	0%	"	"	"	"	"	2.08 m - 2.58 m

There was also a sheet of cardboard put down at the study plant. The number of seeds dropped at particular distances were noted.

Distance	Seeds
.50 - .60	6
.60 - .70	7
.70 - .80	3
.80 - .90	7
.90 - 1.00	11
1.00 - 1.10	6
1.10 - 1.20	3
1.20 - 1.30	5
1.30 - 1.40	10
1.40 - 1.50	2
1.50 - 1.60	1

From this one study plant there appears to be two peak distances at which seeds are dispersed: 0.9 - 1.00 and 1.30 - 1.40.

On the same day, December 13, 1976 at 1400 hours a Melophorus D28 ants nest was first sighted actively gathering seed. Further observations pinpointed a daily seed collecting activity period from 1300 to 1600 hours. During the morning activity period 0900 - 1100 hours no seed collecting was observed. Seeds were taken into the nest at a conservative average of 1 every three minutes. Using this average, one ants nest in one day can take in roughly 180 seeds. Seeds were seen being taken into the nest on December 13 and December 17. On January 3, 1977, a new nest .45 metres away from the original was actively gathering seed. The old nest was not active and was dug up. The soil was sieved and the seeds recovered.

Melophorus Nest 1

	65 Ba	33 As	0-3 cm
	15 Ba	25 As	3-6 cm
	8 Ba	4 As	6-9 cm
	7 Ba	11 As	9-12cm
TOTAL	95 Ba	73 As	

There were often pairs of nests observed quite close together which seems to indicate one move of nest a year. The Number 2 Melophorus ants nest was observed to have a few insect carcasses, body parts, and in one instance a dead Componotus ant was seen carried into the number 2 nest. Melophorus nests appear out of nowhere when seeds

begin dropping, and disappear three months later. They do not reappear until the next years seeds begin dropping. The distances that Melophorus ants were observed carrying seeds to their nests were 2.7, 2.1, and 2.8 metres away. One Lelophorus nest had 2 Bossiaea seeds outside the nest and the closest Bossiaea seed-bearing plant was 7.3 metres away.

From various ants nests dug up it became apparent that the later in the season that they were sampled for seed, the fewer seeds were recovered from them. In particular, the number of seeds on the surface dropped greatly over time. For example:

		FEBRUARY					MAY			
		0-3	3-6	6.9	9-12		0-3	3-6	6-9	9-12
Rhyditoponera	1	181	79	24	12	5	16	6	6	4
Marradong Road	2	58	25	68	12	6	3	3	7	4
Dieback Rehabilitation	3	33	39	30	1	7	1	3	2	0
Area	4	28	22	21	20	8	2	7	2	2

Roughly -

December 18	Rhyditoponera	No. 1	200 A.p. seeds
		No. 2	450 A.p. seeds
January 6	Rhyditoponera	No. 1	130 A.p. seeds
		No. 2	200 A.p. seeds

Another observation made during the processing of the data was that the deeper you get the greater the percentage of undamaged seeds.

The question of seed predation comes up here. Various species of birds and insects are suspect. From October 8 to January 10, 1976, I monitored the forest floor with pitfall traps. Weekly visits to change the traps at White Block enabled observations of various bird species. The most predominant of these was the Bronzewing Pigeon. It was not observed in the area until December 1976 and thereafter at least one pair every week was observed in the area. Five were spotted on one occasion.

From the 32 pitfall traps, 16 in an open area and 16 in an adjacent mixed legume area it became apparent that there is a greater diversity of individual insect species in legume areas. The fireweeds represented in the legume area in order of dominance were Acacia strigosa, Bossiaea aquifolium, Acacia pulchella and Mirbelia dilatata. There is also an influx of species richness during seeding.

Species Richness

Number of individual insect species trapped per week

	mixed legume	open	totals	seeds in traps
October 8 - October 15	5	4	9	0
October 15 - October 22	6	5	11	0
October 22 - October 28	8	3	11	0
October 28 - November 4	9	3	12	0
November 4 - November 12	7	2	9	0
November 12 - November 19	7	4	11	0
November 19 - November 26	7	6	13	0
November 26 - December 4	10	7	17	0
December 4 - December 13	6	6	12	0
December 13 - December 20	9	6	15	8 Strigosa 5 Bossiaea
December 20 - December 27	6	4	10	7 Bossiaea 5 Strigosa
December 27 - January 3	4	7	11	0
January 3 - January 10	6	5	11	0