Seed-Harvesting Ants in Tasmanian Dry Eucalypt Forests

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Abstract

The seed-harvesting ants inhabiting the dry coastal forests of eastern Tasmania were identified, and the diurnal and annual foraging activity was determined for each species. The foraging zone of those species near seed-shedding eucalypts was defined and compared to that of other ant species present.

Introduction

It has been estimated that seed-harvesting insects can reduce the number of seeds on the ground by up to 60% (Grose 1960). Seed predation by ants has been reported (Ashton 1979; Anderson 1987) and, in dry forests, several species are involved (Anderson and Ashton 1985). Removal of seed by these species may affect stocking levels in situations where establishment of regeneration relies on seed-tree systems.

This paper examines the ant species within the seedfall area of selected trees at Ansons Bay and compares them with the species found at two other dry forest sites. The activity periods of the seed-harvesting species are determined and an assessment of the proportions of all species has been made based on pitfall trap collection.

Methods

Study area

The main study site was in the Ansons Bay area (north-eastern Tasmania) but data were also obtained from sites at Goulds Country and Woodsdale (Figure 1). Selected attributes of the sites are shown in Table 1.

Pitfall traps

Pitfall traps were established at all sites. The Ansons Bay site was set up to determine the seed-harvesting ant species present whilst the other sites were used to record all ant species. Traps were located close to seed-bearing trees and were established as recommended by Greenslade (1973). Thus, an area was cleared around each trap and a period of settlement allowed to elapse before the traps were charged with 100 ml of a mixture of 30% ethanol and 5% glycerol in water. Waxed paper cups were sunk into pits, with a sleeve of 1 cm width at the lip–soil interface. A rain cover of an inverted, black plastic saucer supported by three wooden pegs was placed over each trap. At the Ansons Bay site, two rows of five traps were placed at intervals of 10 m. The two lines stretched away from a selected seed tree so that the nearest trap was 5 m away from the bole of the tree and the most distant was 45 m away. Traps were inspected monthly during the sampling period.

Seed traps

Seven seed traps were established during January at the Ansons Bay site, under two trees heavily laden with capsules. The traps consisted of plastic petri dishes with an opening cut in each side of the lid. They were charged with 1.5 g of raw *Eucalyptus amygdalina* seed and were established along trails belonging to *Anonychomymra* species and near a nest of *Pheidole tasmaniensis*. Hourly counts were made of the number of ants carrying seed in the traps, and

Table 1. Details of the three study sites.

Site	Ansons Bay	Goulds Country	Woodsdale
Grid reference	FQ 036 548	EQ 938 502	EN 552 896
1:100 000 sheet	Georges Bay	Georges Bay	Prosser
Forest type	Dry eucalypt	Dry eucalypt	Dry eucalypt
Annual rainfall (mm)	700	980	710
Elevation (m)	60	120	240
Monitored	1990/91	1987/88	1985/86

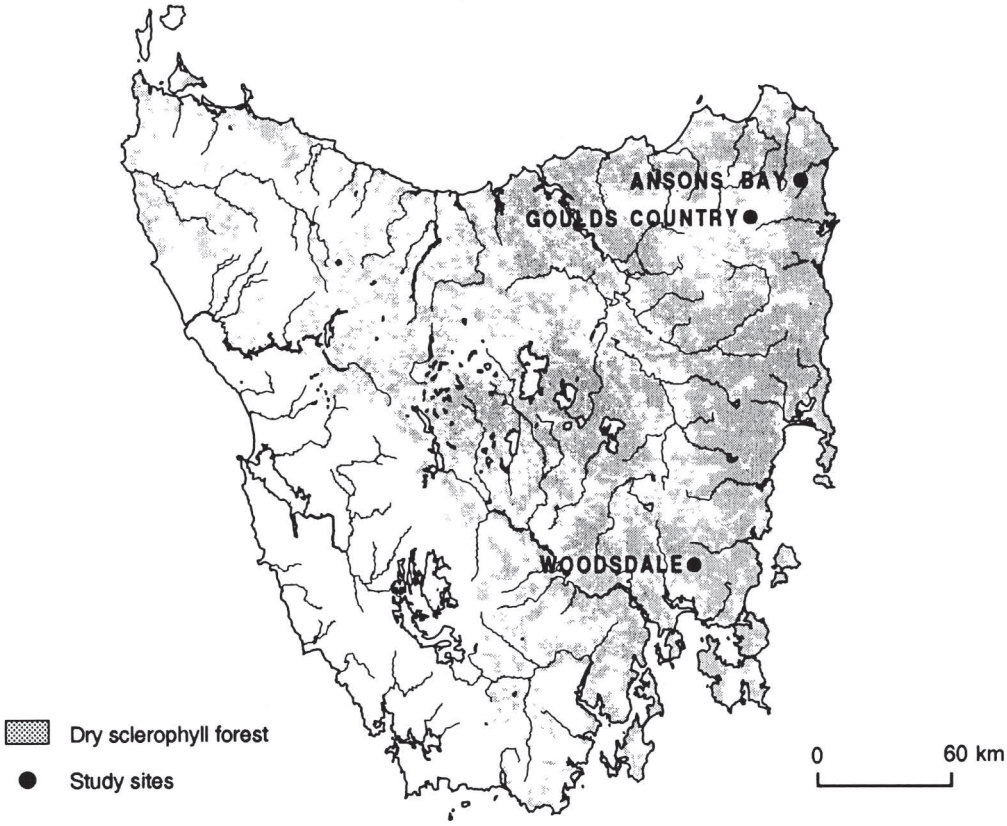

Figure 1. Location of study sites in dry sclerophyll forest.

recordings of temperature and relative humidity were taken at the same time.

Raw-seed piles

A set of seven piles of raw seed (2.0 g per pile) was set up on a compacted bush track at the Ansons Bay site across an established main trail of *Anonychomymra biconvexa*. The piles were placed 20 cm apart across the trail. The number of ants at each pile was recorded on the hour from 10 a.m. to 7 p.m. on 23 October 1990.

Results

Species diversity

Sixteen ant species were collected during the study, with the highest number being found

Table 2. Fifteen ant species found at Ansons Bay.

Subfamily	Number of individuals	Feeding habit[1]
Dolichoderinae		
[2]*Anonychomymra biconvexa* (Santschi)	242	omnivore
[2]*Anonychomymra nitidiceps* Andre	7	"
[3]*Anonychomymra* sp. 1	7	"
[3]*Anonychomymra* sp. 2	3	"
[3]*Iridomyrmex bicknelli bicknelli* Emery	7	"
Formicinae		
[3]*Notoncus hickmani* Clarke	3	"
Ponerinae		
[2]*Hypoponera decora* (Clark)	1	predator
[4]*Hypoponera* sp. 2	1	omnivore?
[2]*Rhytidoponera tasmaniensis* Emery	15	granivore
Myrmicinae		
Monomorium leae (Forel)	1	predator
Monomorium sp. 1	1	predator
[2]*Pheidole tasmaniensis* Mayr	3	granivore
Myrmecinae		
Myrmecia pyriformis F. Smith	13	predator
Myrmecia pilosula F. Smith	10	predator
Myrmecia sp. 1	2	predator
Total	316	

[1] From Taylor and Brown (1985)
[2] Seed harvesters
[3] Seed eaters
[4] This is an undescribed species whose feeding habit has not been documented.

at the Ansons Bay site (15 species, see Table 2). Seven species were collected from the Goulds Country site and 11 from the Woodsdale site.

Six species (Table 3) have been listed by Taylor and Brown (1985) as seed harvesters although only three, *Anonychomymra nitidiceps, A. biconvexa* and *Pheidole tasmaniensis,* were actually observed in seed traps in the trial. These three species physically removed raw seed from both seed traps and piles, and *P. tasmaniensis* was observed breaking open seed and feeding. One of the other known seed harvesters, *Rhytidoponera tasmaniensis,* is usually solitary in its activity and although not collected in seed traps in this study, was captured in pitfall traps, always within 15 m of seed-bearing trees.

In addition to the seed harvesters, four other species are known to eat seed (Taylor and Brown 1985, see Table 2), although it is not clear if the seed is taken to their nests.

Distance of foraging from base of seed tree

The layout of the pitfall traps allowed an assessment to be made of foraging distance by seed harvesters. Table 4 shows the presence of seed-harvesting ants compared to any other species distributed away from the base of seed-bearing trees. Seed harvesters were not

Table 3. Capture of seed-harvesting ants at three dry forest sites (+ indicates species collected in pitfall traps).

Ant species	Ansons Bay	Goulds Country	Woodsdale
Anonychomymra biconvexa	+	+	+
A. nitidiceps	+	+	+
Pheidole tasmaniensis	+	+	+
**Prolasius* sp.	-	-	+
**Rhytidoponera tasmeniensis*	+	-	-
**Hypoponera* sp.	+	+	-

* These species are known seed harvesters but were not observed in seed traps during this trial.

Table 4. Distance of seed-harvesting ants from seed trees, using the combined figures from two rows of traps.

Distance (m)	Seed harvesters	Non-harvesters
5	70	3
15	64	6
25	21	6
35	0	12
45	0	0
Total	155	27

collected further than 25 m from seed trees, with 86% within 15 m. They easily outnumbered non-harvesters across the 25 m distance.

Seed traps

Anonychomymra species entered, and established trails through the traps within several hours. Once trails were established, seed removal occurred for 6–7 hours per day (Table 5). Collecting activity did not commence much before midday and continued until evening, ceasing abruptly just before sunset. Traps charged with seed in the evening were not utilised nocturnally. Many ants passed through the traps without stopping or removing seed.

Pheidole tasmaniensis was active across the same period but was influenced by direct sunlight. Activity of this species was high while the nest area was in full sun but ceased when shaded by surrounding trees.

Hourly readings of temperature and relative humidity are shown in Table 5. These figures suggest that temperature may contribute towards regulating the activity of *Anonychomymra* species. However, the activity of these species does not appear to be directly effected by relative humidity.

Foraging activity

Table 6 illustrates the time taken to locate seed sources by *A. biconvexa*. Although the main trail was always maintained, detours were established by 'scouts' after they found new piles of seed. One seed pile was never visited but another pile, 60 cm away from the main trail, became a major diversion, with a trail being established along which about half the ants in the column travelled.

Table 5. The number of Anonychomymra biconvexa *and* A. nitidiceps *associated with seed traps across a period of nine hours. Relative humidity (RH) and temperature (T) at the site are also shown.*

Time of day (hrs)	Number of ants (average of 8 traps)	RH (%)	T (°C)
1000	0	28.4	20.4
1100	0	31.8	21.1
1200	3	36.8	22.5
1300	5	30.3	23.4
1400	11	38.2	22.0
1500	11	37.1	19.9
1600	13	47.6	17.1
1700	9	50.2	16.4
1800	2	54.1	15.9
1900	0	59.3	14.7

Table 6. Location of seed piles by 'scouts' from the main trail of Anonychomymra biconvexa.

Pile number	Distance (cm)	Time of day (hours) 1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
1	60										
2	40										
3	20										
4	Trail										
5	20										
6	40										
7	60										

The central pile (pile 4) was exhausted every two hours after replenishment, with almost 8 g of raw seed being sorted and removed in eight hours. Pile 1 on the new trail had all seed removed within seven hours. The other piles were visited only occasionally and most seed was untouched when trail activity ceased. After five days, all viable seed from all piles, except pile 2, had been removed. Chaff and desiccated seeds were left in both piles and traps.

Anonychomymra biconvexa, the most common ant at the three sites, develops a series of interconnecting trails from a nest site to several trees within a 10 m radius of the nest. Trails lead up to the canopy of mature trees or to hollow branch stubs. Observation of ants returning down the trees failed to show any seed removal from the tree crown. Fragments of leaves and small twigs were transported down the tree and taken to the nest. Seed capsules on the ground were attacked and seed or individual capsules removed to the nest.

Monthly capture of *A. biconvexa* in pitfall traps during 1990/91 (Figure 2) suggests that peak activity occurs in spring–early summer (September to December) although some activity is apparent throughout the year. The number of individuals of other species captured was too low to show trends in annual foraging behaviour.

Discussion

This study shows that, in the dry forests sampled, ants of several species harvest viable eucalypt seed otherwise available for germination. Species of *Anonychomymra*,

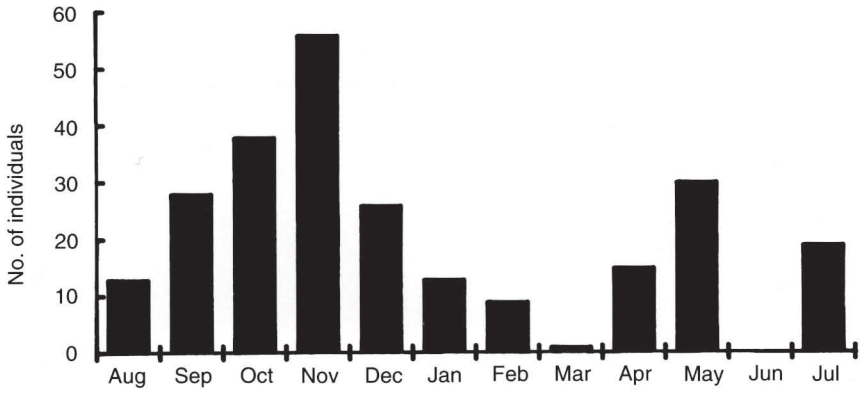

Figure 2. Annual foraging activity of Anonychomymra biconvexa *at the Ansons Bay site during 1990/91.*

especially *A. biconvexa*, were the most important harvesters. Large populations of these ants were present and they have highly visible litter and tree trails. Four species of *Anonychomymra* have been recorded previously from Tasmania, *A. macrocephalus* (Erichson), *A. mattiroloi* (Emery), *A. biconvexa* (Santschi) and *A. prociduus* (Erichson) (Taylor and Brown 1985) but only two of these species were recorded removing seed in this study. *Iridomyrmex bicknelli*, a related species, was present at two of the three dry sites but was not recorded at the Ansons Bay seed trials.

Once a seed source was detected by species of *Anonychomymra*, rapid seed removal occurred and establishment of secondary trails to those sources was sometimes made. The main reason for major trail establishment seems to be collection of material for the nest rather than for food. The number of trails connected to each nest varied and may be dependent on nest size or number of seed-bearing trees providing a food source.

Pheidole tasmaniensis occurred in small nests of up to 50 individuals. These very small ants (< 2 mm long) were not located more than 2 m from a nest site. Most nests were under old logs which are not densely distributed at the Ansons Bay site. For these reasons, this species may not contribute greatly to seed removal.

Of the other species collected which are known seed harvesters, *Rhytidoponera tasmaniensis* is regarded by Anderson (1988) as an important seed eater and is frequently an opportunist after disturbance by fire or logging. However, *R. tasmaniensis* was not observed to harvest seed in the unlogged forest examined in this study.

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