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INSECT FORAGING ON *ACACIA RETINODES* VAR. *RETINODES* IN VICTORIA, AUSTRALIA

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Abstract. Collections of floral foragers on montane populations of *Acacia retinodes* represented 3 insect orders: Coleoptera, Diptera, and Hymenoptera. Sixty-eight of the 75 insects collected were Apoidea representing 3 native families (Anthophoridae, Colletidae, Halictidae) and the naturalized *Apis mellifera* (Apidae). Twelve taxa of Apoidea were identified on *A. retinodes* var. *retinodes*. Eighty percent of the insects (82% of the bees) carried pollen of at least 1 other sympatric plant mixed with the polyads of *A. retinodes* var. *retinodes*. A mean of 2 pollen genera were recorded per insect, with 1 bee carrying the maximum of 4. Compared with the insect fauna collected on *Acacia retinodes* var. *uncifolia*, the bees on var. *retinodes* showed a 25% greater taxonomic diversity and a 20% higher rate of polylectic (generalist) foraging.

Acacia retinodes is a large shrub, or small tree, that flowers during the summer in southeastern Australia and Tasmania. Populations in Victoria are divided into 2 varieties (Willis 1978): *Acacia retinodes* var. *retinodes* Schlect and *A. retinodes* var. *uncifolia* Black.

A. retinodes var. *uncifolia* is restricted to calcareous sand dunes along the coast. The extra-floral glands, located on the phyllodes (photosynthetic branches), do not secrete while the plant produces its bright yellow, spherical, and strongly scented inflorescences composed of nectarless florets. Although representatives of the orders Coleoptera, Diptera and Hymenoptera feed on the 16-grain polyads, native and naturalized Apoidea constitute the largest group of floral foragers. Sixty-three percent of the bees collected on var. *uncifolia* carry polyads mixed with the pollen of sympatric plant species in the families Compositae, Myrtaceae, and Solanaceae (Bernhardt 1983, Bernhardt et al. 1984).

A. retinodes var. *retinodes* has a much wider distribution inland than *A. retinodes* var. *uncifolia* (ranging as far south as Tasmania) but it offers the same floral rewards and attractants. Previous to this study nothing has been recorded concerning the floral foragers of var. *retinodes*. We have collected the floral foragers of var. *retinodes* far removed from the southern populations of var. *uncifolia*. It is now possible to identify the insect fauna of var. *retinodes* and to compare their taxonomic diversity and foraging habits against those insects associated with var. *uncifolia*.

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TABLE 1. Number of Apoidea captured on *Acacia retinodes* var. *retinodes* carrying pollen of *retinodes* alone or pollen of *retinodes* plus other species.

BEE TAXA	*retinodes* ONLY	*retinodes* + OTHERS
Apis mellifera Linn.	2	6
Callomelitta sp.		1
Euhesma sp.*	3	4
Exoneura sp.		2
Homalictus demissus (Cockerell)	1	
H. punctatus (Smith)		1
H. megastigmus (Cockerell)	1	
Hylaeus sp.		1
Lasioglossum (*Chilalictus*) spp.		6
La. (*Parasphecodes*) sp.	2	14
Leioproctus (*Euryglossidia*) sp.		2
Le. (*Leioproctus*) sp.	2	19
Totals	11	56

* 1 *Euhesma* sp. carrying no pollen not listed.

STUDY SITE

The Grampian Mts are the western extreme of the Great Dividing Range. Areas under observation were within the 164,000 ha of reserved forest under the Forests Commission (Elliot 1975). *Acacia retinodes* var. *retinodes* was common in poorly drained ravines and gulleys supporting dry sclerophyll forest and open-woodland–tall-shrubland communities. The study area was 250 km NW from the coastal populations of *A. retinodes* var. *uncifolia* (Bernhardt et al. 1984).

MATERIALS AND METHODS

Insects were collected from 6.I.1983 to 16.I.1983 between 0900 h and 1500 h on open inflorescences of *A. retinodes* var. *retinodes* found along the main tourist road and the Serra Road Track. Methods of collection and the removal and identification of pollen taxa follow Bernhardt & Walker (1984). It was not possible to distinguish between grains of the myrtaceous genera *Leptospermum* and *Melaleuca*.

RESULTS

The insects collected on *A. retinodes* var. *retinodes* represent 3 orders. The only Coleoptera collected was a single specimen of *Liparetrus discipennis* Guer. and it did not bear pollen.

Diptera were represented by 1 specimen each of the syrphids *Sphiximorpha breviscopa* (Saunders) and *Hardimyia elongata* (Hardy), 1 specimen each of Rhagionidae, Tachinidae, and 2 Sarcophagidae. One of the Sarcophagidae and the 1 Tachinidae were devoid of pollen. All of the other dipterans carried polyads of *A. retinodes* var. *retinodes* combined with the pollen of 1 plant genus in the study site.

Ninety percent of the insects collected were Apoidea. Twelve bee taxa were iden-

TABLE 2. Analysis of pollen loads combining polyads of *Acacia retinodes* var. *retinodes* with pollen of other angiosperms.

	NO. INSECTS WITH POLLEN OF THE FOLLOWING TAXA*						
	retinodes	BUS	CM	EUC	ML	PRL	UM
Diptera							
Ceriodes breviscopa	1			1			
Hardimyia elongata	1			1			
Rhagionidae	1				1		
Sarcophagidae	1				1		
Hymenoptera							
Apis mellifera	6	1		4	2		
Callomelitta sp.	1				1		
Euhesma sp.	4			1	3		
Exoneura sp.	2			2	1		
Homalictus punctatus	1			1			
Hylaeus sp.	1		1		1		
Lasioglossum (*Chilalictus*) spp.	6		2	4	5	1	1
Lasioglossum (*Parasphecodes*) sp.	14		1	8	8		
Leioproctus (*Euryglossidia*) sp.	2			1	2		
Leioproctus (*Leioproctus*) sp.	19	1	2	14	13		2
Totals	60	2	6	37	38	1	3

* BUS = *Bursaria spinosa* var. *spinosa* Cav. (Pittosporaceae); CM = mixed Compositae (*Hypochaeris, Brachycome, Helichrysum*); EUS = *Eucalyptus* (Myrtaceae); ML = *Melaleuca* spp. and/or *Leptospermum juniperinum* Sm. (Myrtaceae); PRL = *Prostanthera lasianthos* Labill. (Labiatae); UM = unidentified monocot.

tified, representing 3 native families (Anthophoridae, Colletidae, and Halictidae) and the naturalized species *Apis mellifera* (Apidae). The most commonly collected bees belong to *Leioproctus* and *Lasioglossum.* All bees, excluding 1 *Euhesma* sp., carried polyads or a mixture of polyads and pollen of other species (Table 1).

Bees were active from 0930 h until 1300 h on bright sunny days. Activity was often delayed by morning rains or overcast skies, so some insects were captured as late as 1500 h. The harvesting of polyads by *Apis mellifera* and solitary Apoidea followed the previous descriptions of Bernhardt et al. (1984) and Bernhardt & Walker (1984).

Flies and bees examined carried, on average, 2 pollen genera on their bodies (SD = 0.8, range 0–4 pollen genera). Only 1 specimen of *Lasioglossum* (*Chilalictus*), captured on 14.I.1983, carried 4 taxa: *A. retinodes* var. *retinodes, Eucalyptus* sp., *Leptospermum juniperinum,* and an unidentified monocot.

Leioproctus (*Leioproctus*) sp. and *Lasioglossum* (*Parasphecodes*) sp. carried the widest variety of pollen genera (Table 2). The majority of bees carried polyads mixed with pollen of 1 or more of the myrtaceous genera: *Eucalyptus, Melaleuca,* or *Leptospermum* (Table 2).

DISCUSSION

Over a period of 10 days, 25% more bee taxa were collected from var. *retinodes* than were captured on var. *uncifolia* in 3 months (Bernhardt 1983, Bernhardt et al. 1984). In fact, var. *retinodes* has the most diverse bee fauna of any Australian *Acacia* to date (Bernhardt 1983, Bernhardt et al. 1984, Bernhardt & Walker 1984). Fewer taxa in the orders Coleoptera and Diptera were collected on var. *retinodes* than had been collected on var. *uncifolia* (Bernhardt et al. 1984).

The 2 varieties of *A. retinodes* share 3 families of Apoidea (Apidae, Colletidae, and Halictidae). Furthermore, *Leioproctus* (Colletidae) and *Lasioglossum* (Halictidae) dominate the Apoidea collections from both *Acacia* varieties. No Megachilidae were taken on var. *retinodes* and no Anthophoridae were collected on var. *uncifolia* (Bernhardt et al. 1984).

Approximately 20% more of the bees collected on var. *retinodes* carried mixed loads of polyads plus other pollen genera compared to bees collected on var. *uncifolia.* While only 3 or 4 genera of plants were identified on bees collected on var. *uncifolia* in mid-January, more than 7 genera were recovered from bees collected on var. *retinodes* over the same time period (Bernhardt et al. 1984).

The Grampians represent an area that offers far more ecological diversity than the southwestern coast of Victoria (Churchill & de Corona 1972). The superior number of bee taxa collected on var. *retinodes* is explained on the basis of the assumed larger numbers of microhabitats available in the Grampians compared to coastal calcareous dunes. More pollen genera appear on the bodies of bees collected on var. *retinodes,* as the Grampians is more floristically diverse than the southwestern coast (Churchill & de Corona 1972). Furthermore, var. *retinodes* is not a dominant component of the Grampians flora as var. *uncifolia* is on the coast (Bernhardt et al. 1984). Competition with a wider variety of plants combined with a lower density of var. *retinodes* populations explains, in part, the increased trend in polylecty (generalist foraging) by "acacia" bees in the Grampians.

It is assumed that as the number of bee taxa increases, polylecty should decrease, as oligolecty (specialist foraging) reduces interspecific competition for floral foods (Moldenke 1976, Michener 1979). For Australian "acacia" bees, though, the opposite switch in foraging behavior predominates and the bees of *A. retinodes* var. *retinodes* follow a previously described trend (Bernhardt 1983, Bernhardt et al. 1984, Bernhardt & Walker 1984). Narrow polylecty (sensu Michener 1979) is greater in the bees visiting summer flowering varieties of *A. retinodes* than in bee taxa associated with *Acacia* spp. flowering in late winter or early spring. Nectarless inflorescences of *Acacia* (Vogel 1976) offer polyads for larval food, but the collecting bee must seek chemical energy from another source. The number of pollen genera on an "acacia" bee species is directly proportional to the number of nectariferous angiosperms flowering in the same habitat.

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