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The Natural Occurrence of Insect Pollinators in an Avocado Orchard

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ABSTRACT

The natural occurrence of insect pollinators of avocado was studied during a three-year period at Westfalia, a large avocado estate near Tzaneen, South Africa. During this period 49 different insect species were recorded from avocado flowers. The most abundant and only pollinator of any apparent significance at Westfalia is the honey bee, although several alternative pollinators were identified that may be of significance if their population densities could be increased. It is suggested that further research be conducted on the potentially significant alternate pollinators, the entire complement of pollinators in other areas of South Africa, and on pollination of avocado in its country of provenance.

INTRODUCTION

An investigation into the insect pollinators that occur naturally in an avocado orchard was undertaken to contribute to an understanding of the pollination of avocado flowers. The study was designed to determine the identity and relative abundance of the insects that visit avocado flowers, and was conducted over a three-year period. The objectives of the study and the results for the previous two years were reported in earlier papers (Eardley & Mansell, 1993; 1994). Although the study time was far too short to obtain a detailed insight into this complex subject, it did provide an important indication of the situation prevailing at Westfalia and indicate aspects in which future research effort should be directed.

METHODS

Sampling was carried out in two orchards on the Westfalia Estate (23° 44' S, 30° 05' E) during a two-day period from 29-30 September 1994 and two similar periods during 1992 and 1993 (Eardley & Mansell, 1993; 1994). The sampling procedure was a repeat of that used during 1993 (Eardley & Mansell, 1994), and provided a total of 72 man-hours in the field for the three-year period.

The material collected and on which the results are based is in the National Collection of Insects, Plant Protection Research Institute, Pretoria.

RESULTS

The number of insects that visited the flowers, the total number of visits of each species during 1994, and a cumulative total for the three-year period are recorded in table 1. During the course of the study it became clear that temperature plays an important role in the daily activity of the insects, and that the effect of temperature is complicated by other parameters such as wind. Flies (Diptera) generally appeared in the morning and late afternoon, and bees and wasps were more common during the hottest part of the day. Most insects preferred blossoms in direct sunlight.

The behaviour of the various insect species on the flowers differs significantly, and this behaviour is important in their effectiveness as pollinators. Honey bees stick the pollen onto their hind legs, and only pollen that is accidentally attached to other areas on their bodies is available for pollination, making them poor pollinators (Westerkamp, 1991). This deficiency is aggravated by the habit bees have of keeping themselves well groomed, and by their large size, which makes it difficult for pollen grains to adhere to the bees' bodies and then to be deposited on the stigma of another small avocado flower. Small carpenter bees pack their pollen loosely between the hairs on the hind legs and underside of the body. All of their pollen is available for pollination, and their small size and habit of dragging their pollen-laden hind legs over the flowers apparently make them more effective pollinators. Some of the small calliphorid flies, such as *Stomorhinia,* also appear to be effective pollinators. The habits of other insects, such as certain hover flies that hover in front of the flowers and drink the nectar, renders them almost ineffectual as pollinators.

Table 1

List of insect species recorded on the blossoms of avocado and their relative abundance. The relative abundance is the total of each species recorded during the period indicated.

Order, family and scientific name	*Common name*	*Relative abundance*	
		1994	*1992–1994*
HYMENOPTERA			
Apidae			
Apis mellifera Linnaeus	Honey bee	355	1533
Anthophoridae			
Allodape microsticta Cockerell	Small carpenter bee	0	34
Braunsapis sp.	Small carpenter bee	2	2
Amegilla fallax (Smith)	Anthophorid bee	1	1
Halictidae			
Lasioglossum sp.	Halictine bee	3	9
Halictus (*Seladonia*) sp.	Halictine bee	0	1
Megachilidae			
Megachile prob. *semiflava* Cockerell	Leaf cutter bee	0	3
Sphecidae			
Larra sp.	Sphecid wasp	0	2
Philanthus sp.	Sphecid wasp	0	2
Formicidae			
Crematogaster sp. *castanea*-group	Ant	0	5
Camponotus cinctellus (Gerstaecker)	Ant	0	26
Vespidae			
Belonogaster sp.	Paper wasp	0	1
Polistes prob. *spilophorus* Schletterer	Paper wasp	0	1
Eumenidae			
Unidentified	Dauber wasp	1	1
Chrysididae			
Stilbum sp.	Cuckoo wasp	0	1
LEPIDOPTERA			
Nymphalidae			
Pseudacraea lucretia tarquinia (Trimen)	False chief	0	1

Table 1 (continued . . .)
List of insect species recorded on the blossoms of avocado and their relative abundance. The relative abundance is the total of each species recorded during the period indicated.

Order, family and scientific name	*Common name*	*Relative abundance*	
		1994	*1992–1994*
Pieridae			
Belenois aurota (Fabricius)	Brown-veined white butterfly	0	26
DIPTERA			
Calliphoridae			
Chrysomya regalis Robineau-Desvoidy	Blow fly	0	5
Chrysomya sp.	Blow fly	1	1
Rhyncomya forcipata Villeneuve	Blow fly	4	22
Lucilia sp.	Blow fly	0	9
Rhinia apicalis (Wiedemann)	Blow fly	0	3
Stomorhina rugosa (Bigot)	Blow fly	0	11
Stomorhina lunata (Fabricius)	Blow fly	0	2
Stomorhina cribrata (Bigot)	Blow fly	0	4
Muscidae			
Musca domestica Linnaeus	House fly	2	30
Musca sp.	Muscid fly	0	19
Tachinidae			
Cylindromyia sp.	Tachinid fly	0	2
Dejeania bombylans (Fabricius)	Tachinid fly	1	1
Linnaemya sp.	Tachinid fly	1	1
Otitidae			
Physiphora clausa (Macquart)	Picture-winged fly	0	5
Syrphidae			
Ischiodon aegyptius (Wiedemann)	Hover fly	0	1
Phytomia incisa (Wiedemann)	Hover fly	0	8
Asarkina sp.	Hover fly	0	2
Allograpta calopus (Loew)	Hover fly	0	2
Paragus sp.	Hover fly	0	1
Allograpta fuscotibialis (Macquart)	Hover fly	0	3
Syritta fasciata (Wiedemann)	Hover fly	0	1
Eristalinus taeniops (Wiedemann)	Hover fly	0	9
Eumerus axinecerus Speiser	Hover fly	0	8
Allobaccha sp.	Hover fly	0	2
Tephritidae			
Metasphenisca longulior (Munro)	Fruit fly	0	2
Bombyliidae			
Undetermined	Bee fly	0	4
HEMIPTERA			
Reduviidae			
Rhinocoris sp.	Assassin bug	0	1
Pentatomidae			
Atelocera foveata Dallas	Stink bug	0	1

Table 1 (continued . . .)
List of insect species recorded on the blossoms of avocado and their relative abundance. The relative abundance is the total of each species recorded during the period indicated.

Order, family and scientific name	*Common name*	*Relative abundance*	
		1994	*1992–1994*
COLEOPTERA			
Coccinellidae			
Cheilomenes propinqua (Mulsant)	Ladybird	0	1
Chrysomelidae			
Undetermined	Leaf beetle	0	5
Lycidae			
Lycus sp.	Net-winged beetle	0	1
Total		368	1807

CONCLUSIONS AND RECOMMENDATIONS

The most common visitor to the avocado flowers at Westfalia is the honey bee which, due to its relative abundance, must be responsible for most of the pollination in the orchard. This, however, is not considered to be an accurate indication of the attractiveness of avocado flowers to the various insects that occur at Westfalia, because hives of honey bees were placed in the orchard and there is very little indigenous vegetation in the vicinity that could support a large population of alternative pollinators, such as small carpenter bees and calliphorid flies. These groups of insects are known to pollinate the flowers of other plants and have potential as pollinators of avocado.

Avocado blossoms are not highly sought-after by honey bees (A. du Toit, personal communication), and this was demonstrated during the study by the large number of honey bees on litchi flowers compared with relatively few on avocado flowers in close proximity to the litchi. Westerkamp (1991) advocates the use of more reliable alternative pollinators to avoid the disadvantages associated with using honey bees for the pollination of crops for which they are unsuitable. This study indicated that avocado has alternative pollinators. These alternative pollinators may prove to be more effective than the honey bee and may increase the rate of pollination if their population density could be increased. An increase in the use of alternative pollinators would also reduce the dependence of the avocado growers on a single pollinator.

One of the authors of this paper (M.W. Mansell) observed avocado trees growing near indigenous vegetation in the Lowveld and gained the impression that the flowers of these trees had a far greater complement of alternative pollinators than those at Westfalia, indicating the importance of maintaining indigenous vegetation near the orchard. The biology of the small carpenter bees, one of the most promising alternative pollinators, is well understood and their numbers can be increased by the provision of

artificial nest sites. The biology of the calliphorid flies, however, is poorly known and should be studied before any suggestions on how to increase their population density can be made.

The number and diversity of insects in the orchard decreased dramatically in 1994. This was apparently due to the cold winter. In a pollination management programme cold tolerance of the pollinators would have to be considered.

Alternative pollinators of avocado should be studied in other areas of the country, especially areas with an abundance of indigenous vegetation. Such studies would facilitate the choice of the most suitable alternative pollinator on which to base further research. Pollination of avocado should also be studied in its native country. This will give an indication of the type of insect that pollinates avocado in its natural habitat and could lead to the domestication and use of the indigenous pollinator in a pollination management programme.

REFERENCES

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