Salticid spiders in macadamia orchards in the Mpumalanga Lowveld of South Africa (Arachnida: Araneae)

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Spiders were collected over a 12-month period (July 1997 – June 1998) from three macadamia orchards in the Mpumalanga Lowveld of South Africa using dichlorvos as a knock-down spray. Of the 2778 spiders collected, 2020 (73 %) belonged to the Salticidae. The salticids were also the richest in species, with 17 species recorded of which four represented 61 % of all spiders collected. *Thyene coccineovittata* was the most abundant and represented 30 % of all the spiders collected, followed by *T. natalii* with 14 %, *Viciria alba* with 9 % and *Tusitala guineensis* with 8 %. These four species were present in all three orchards throughout the year.

Key words: abundance, agroecosystems, Araneae, macadamia, phenology, Salticidae, South Africa, spiders.

Although spiders are common predators in crops in South Africa (Van den Berg & Dippenaar-Schoeman 1991; Dippenaar-Schoeman et al. 1999) little attention has been given to their utilisation in pest control. The potential of using spiders in integrated pest management (IPM) may be underestimated because of the widely-held view that most spiders are polyphagous (Nyffeler et al. 1994a,b) and therefore unlikely to be effective in limiting pest populations. However, recent studies have shown that certain spider species do in fact take only a narrow range of prey (Dippenaar-Schoeman et al. 1996; Marc & Canard 1997). Even when many types of prey are accepted there may be distinct preferences for a particular prey species (Costello & Daane 1999). Another consideration is that although all spider species may not be equally effective in controlling outbreaks of pest species, they all form part of a complex predatory community and may be important in regulating pest species at low densities early in the season (Dippenaar-Schoeman 1976). This buffering effect of spiders may be important in keeping pests at endemic levels, making outbreaks less likely to occur in the first place.

Dippenaar-Schoeman et al. (2001) indicated that the Salticidae is the most dominant spider family in macadamia (*Macadamia integrifolia* Maiden & Betcke) orchards in Mpumalanga Province, South Africa. Salticids are known to prey on various pests attacking agricultural crops (Whitcomb & Bell 1964; Carroll 1980) and therefore have considerable potential as natural control agents. In this paper, the abundance, distribution and phenology of the more prevalent salticid species are discussed.

Materials and methods

The survey has been described in detail by Van den Berg et al. (1999) and Dippenaar-Schoeman et al. (2001). Briefly, it comprised two- to three-weekly collection in 1997/98 of spiders knocked down by dichlorvos from 10 randomly selected macadamia trees in each of three orchards at Nelspruit, Schagen and Glenwood, Mpumalanga Lowveld. Species were identified and the sex of each specimen was recorded. The material has been deposited in the National Collection of Arachnida (NCA) at the ARC - Plant Protection Research Institute, Pretoria.

Results

Numbers present

Of the total of 2778 specimens collected from the three orchards, 2020 (73 %) were salticids. Salticid species comprised 21 % (17) of the 80 spider species that were identified. Their distribution and abundance are presented in Table 1. Some specimens could not be identified to species level owing to the unresolved taxonomy of the family and some probably represent new species. Of the 17 salticid species recorded, nine were present in all three orchards. The Glenwood orchard with 15 species had the highest diversity.

Four of the salticid species accounted for 61 % of all spiders collected. *Thyene coccineovittata* was the most abundant and represented 30 % of the

Table 1. Salticidae species collected from three macadamia orchards in the Mpumalanga Lowveld, South Africa, from July 1997 to June 1998.

Taxon	G[a]	N[a]	S[a]	No. of individuals	% of all salticids	% of all spiders
Afraflacilla sp.	+	–	+	12	0.6	0.4
Goleba sp.	+	+	+	9	0.5	0.4
Habrocestum annae Peckham & Peckham, 1903	+	–	+	28	1.4	1.0
Heliophanus transvaalicus Simon, 1901	+	+	+	11	0.6	0.4
Hyllus argyrotoxus Simon, 1902	+	+	–	16	0.8	0.6
H. brevitarsus Simon, 1902	+	+	+	14	0.7	0.5
Meleon kenti (Lessert, 1925)	+	–	+	9	0.5	0.4
Mogrus sp.	–	+	–	1	0.1	0.1
Myrmarachne laurentina Bacelar, 1953	–	+	–	9	0.5	0.4
Phintella sp.	+	+	+	199	9.9	7.2
Portia schultzi Karsch, 1878	+	+	–	5	0.3	0.2
Thyene coccineovittata Simon, 1885	+	+	+	826	40.9	29.7
T. natalii Peckham & Peckham, 1903	+	+	+	394	19.5	14.2
Thyenula ogdeni (Peckham & Peckham, 1903)	+	+	–	12	0.6	0.4
Tusitala guineensis Berland & Millot, 1941	+	+	+	231	11.4	8.3
Viciria alba Peckham & Peckham, 1903	+	+	+	240	11.9	8.6
Undetermined	+	+	+	4	0.2	0.1
				2020	100	72.8

[a]G = Glenwood; N = Nelspruit; S = Schagen; + = present, – = absent.

total number of specimens, followed by *T. natalii* (14 %), *Viciria alba* (9 %) and *Tusitala guineensis* (8 %) (Table 1).

Phenology of dominant species

T. coccineovittata was present in high numbers in all three orchards (Table 1) throughout the year but peaked in February, April and August/September (Fig. 1). Males, females and juveniles were collected throughout the year in roughly comparable numbers, viz. females (32 %) males (29 %) and juveniles (39 %) (Table 2). The males peaked in September and February. Their numbers declined to a low with very few found in May and June. The number of females remained high and roughly constant from August to April, but declined to a low from May to July. Juveniles were present throughout the summer in high numbers, but declined during the winter months. *T. coccineovittata* is a medium-sized spider (8–11 mm in body length) yellowish cream with distinct black spots on the carapace and abdomen. It is widely distributed throughout Africa, including KwaZulu-Natal, Mpumalanga and the Northern Province (NCA database), and was one of the dominant salticids collected from citrus in South Africa (Dippenaar-Schoeman 1998).

T. natalii was the second most abundant species and was recorded throughout the year from all three orchards with peak abundance in February, April and September (Fig. 2), comprising 41 % females, 37 % males and 22 % juveniles (Table 2).

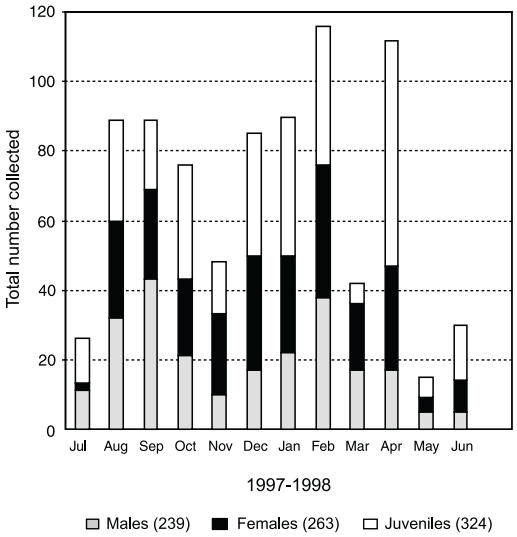

Fig. 1. Seasonal fluctuation of *Thyene coccineovittata* in macadamia orchards in the Mpumalanga Lowveld, South Africa.

Table 2. Total number of males, females and juveniles expressed as a percentage of the four most abundant Salticidae species collected from macadamia orchards in the Mpumalanga Lowveld, South Africa, from July 1997 to June 1998.

Taxon	Males		Females		Juveniles		Total
	Total	%	Total	%	Total	%	
Thyene coccineovittata	239	29	263	32	324	39	826
T. natalii	147	37	160	41	87	22	394
Viciria alba	59	25	75	31	106	44	240
Tusitala guineensis	100	43	48	21	83	36	231
Total	545	32	546	32	600	36	1691

Males were present from July to April in numbers that fluctuated somewhat from month to month and then declined to zero in May and June. Females were present throughout the year, with a peak in December and April and a decline during May to July. Juveniles were found from July to October and December to May, with a peak in March. *T. natalii* is a small salticid (5–7 mm), creamish yellow with black spots on the carapace and transverse bands on the abdomen. It is distributed through KwaZulu-Natal, Mpumalanga, Northern Province and the Eastern Cape (NCA database).

Juveniles of *V. alba* were abundant, representing 44 % of the population, compared to 31 % females and 25 % males (Table 2). Males were found only from September to January, with a peak in November (Fig. 3). Females were present from October to March, with a peak in December. Juveniles occurred throughout the year and peaked in September and October. *V. alba* is a medium-sized spider (9–11 mm). Colouration is similar to that of the two *Thyene* spp. but *V. alba* has distinct large black spots on the carapace. It has been recorded from KwaZulu-Natal and Zimbabwe (NCA database).

More males (43 %) of *T. guineensis* were collected than females (21 %) and juveniles (36 %) (Table 2). Male numbers fluctuated slightly from August to April and peaked in October (Fig. 4), with a decline to zero in May and June. Females were present throughout the year, peaking in October and March and declining to a low in July. Juveniles were collected throughout the year with peak numbers in August.

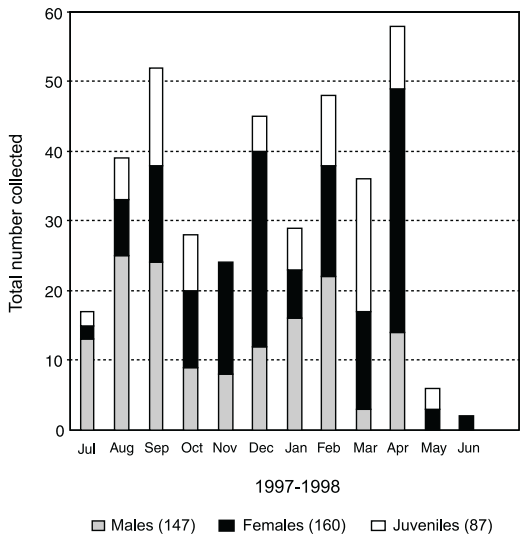

Fig. 2. Seasonal fluctuation of *Thyene natalii* in macadamia orchards in the Mpumalanga Lowveld, South Africa.

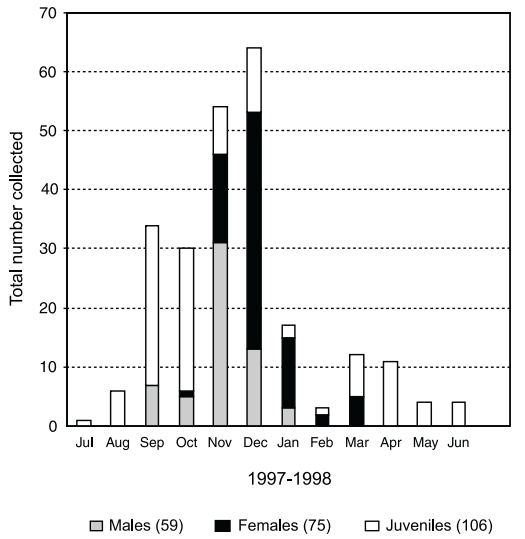

Fig. 3. Seasonal fluctuation of *Viciria alba* in macadamia orchards in the Mpumalanga Lowveld, South Africa.

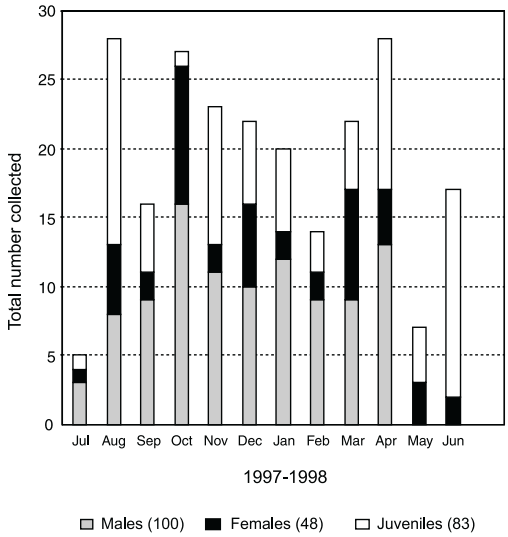

Fig. 4. Seasonal fluctuation of *Tusitala guineensis* in macadamia orchards in the Mpumalanga Lowveld, South Africa.

Discussion

Salticids are active, diurnal, free-running spiders found in a variety of microhabitats common in agroecosystems, not only on plants but also on the soil surface (Richmann & Jackson 1992). They make use of various strategies to catch their prey. A feature common to them all is intricate vision-guided prey detection made possible by their large anterior median eyes (Harland & Jackson 2000). Some species are active searchers and wander around on plant surfaces. Tactile chemoreceptors on their pedipalps are probably also important. Salticids typically adopt a stop-and-go gait, with the surface of the plant being tapped during pauses (Nyffeler et al. 1990). Once located, prey is actively pursued and leapt on. Even non-motile food sources such as insect or mite eggs may be recognised and consumed (Breene et al. 1993).

Most salticids are highly polyphagous, preying on a wide range of insects as well as arachnids (Carroll 1980; Edwards 1981). However, the diets of some salticids become restricted to a narrow prey spectrum when prey is abundant (Nyffeler et al. 1994a,b; Jackson & Pollard 1996). From the perspective of biological control it is significant that salticids are not limited to adult stages of insect and mites as prey, they also take the eggs, larvae and nymphs (Whitcomb 1974; Nyffeler et al. 1990).

Salticids have been observed to prey on a variety of important pest species in agroecosystems, including thrips, flies, midges, ants and mites (Whitcomb & Bell 1964; Carroll 1980). In feeding experiments conducted in Israel, salticids consumed on average 10.1 spider mites per day (Mansour et al. 1995). Van den Berg et al. (1987, 1992) observed salticid species of the genera *Myrmarachne, Hyllus* and *Thyene* preying on adult citrus psyllids in South Africa. Dippenaar-Schoeman et al. (1999) provided an account of the prey spectrum of salticids on cotton, which included bollworms, boll weevils, robber flies and mites, with salticids not only taking prey from the foliage but searching under bracts of flowers and bolls.

Although salticids are a common part of the predator complex in most agroecosystems, their species composition and numbers vary between crops and between regions. Salticids are, for example, the dominant family present on citrus in the Hazyview region in South Africa, accounting for 34 % of all spiders collected (Van den Berg et al. 1987, 1992). However, they are less abundant on cotton (Dippenaar-Schoeman et al. 1999) and strawberries (Dippenaar-Schoeman 1976). This emphasises the importance of preliminary surveys before predation-ecology studies can be considered.

Conclusion

A range of pest species occurs in macadamia orchards. The frequent build-up of pest populations makes control of these pests a major factor in the effective and economic production of most crops. This study has shown that spiders, and salticids in particular, occur in high numbers on macadamia where they may play an important role in a complex predator–prey community. However, before the salticids species discussed here can be considered for control programmes on macadamia in South Africa, more data on their biology, feeding behaviour and community structures are needed.

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