

NOTE

NOTES ON THE REPRODUCTIVE BEHAVIOUR OF SOME AUSTRALIAN SOLITARY WASPS (HYMENOPTERA: SPHECIDAE, *TACHYSPEX* AND *EXEIRUS*)

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Abstract

Information is presented on the nests of three species of *Tachyspex* and on the mate-locating behaviour of *T. pilosulus* Turner and *Exeirus lateritius* (Shuckard).

I report here my observations on the nesting behaviour of three species of *Tachyspex*, supplementing data provided by Evans *et al.* (1976) on some Australian members of the genus. In addition, I provide an account of the previously unstudied behaviour of males of *T. pilosulus* Turner and *Exeirus lateritius* (Shuckard). Specimens of the wasps and their prey have been deposited in the Australian National Insect Collection, CSIRO, Canberra.

Tachyspex walkeri Turner

A nest of this small *Tachyspex* was found on 20 July 1979 in a grassy area with small bare patches of sand in Townsville Common, Queensland. The female had constructed a branched tunnel, 7 cm long, leading to two cells, 4 cm deep. One cell contained four immature cockroaches (Blattellidae) stored upside down. One of the prey bore an egg attached to the base of a prothoracic leg and laid across the venter of the insect. The other cell was partly constructed when I captured the female and excavated the nest.

Tachyspex depressiventris Turner

Evans *et al.* (1976) described two nests of this species. I found a small nesting aggregation of the wasp near Cranbourne, Victoria in an area of inland heath that has been preserved by the Royal Botanical Society of Australia. The nesting site was a bare sandy bank on the edge of a path cut through the heath. Between 17 and 29 March 1979 I excavated eight nests, all of which ranged from 6-8 cm in length with a single cell per burrow located between 3-5 cm deep. There were one or two nymphal cockroaches, either *Balta patula* (Walker) or *Platyzosteria melandria* (Erichson), per cell. The prey were stored head into the cell, upside down in a linear non-overlapping series. Only cells with two prey contained an egg laid on the outermost prey on the venter of the insect in the position shown in Evans *et al.* (1976).

Provisioning females arrived at the nest entrance with the prey carried under the venter. When she alighted, the female retained the antennae of her victim in her mouthparts while her legs released its body (Fig. 1). She was then able to move slightly forward and open the closed burrow entrance with her forelegs before dragging the prey inside.

Tachyspex pilosulus

A single nest of this species was described by Evans *et al.* (1976). On 20 July 1979 I found two burrows within 5 m of each other at the same site in Townsville Common where *T. walkeri* was nesting. I discovered the first nest when I observed a female (about 1 cm in length) flying about 1 m above the ground with a large mantid nearly 5 cm in length dangling beneath her. The wasp held the prey near its head with her legs. After entering the nest with her victim she remained inside for some time and was captured 20 min later when she began to remove dirt from the entrance.

Her burrow branched a few centimetres along its length. It led to two cells, 9-10 cm from the entrance and 5-6 cm deep. The side tunnel to a fully provisioned cell was filled with dirt; the cell contained two mantids (5 and 2.5 cm long) of the genus *Tenodera*, which were placed head first into the elongate brood cell. The most recently captured specimen had an egg placed just under its 'chin'. The other cell was empty, having evidently been recently constructed.

The second nest had one cell only but the burrow was of similar dimensions to the first. The cell contained a single large mantid with an egg in place. The female was taken as she entered the nest without prey at 1500 h.

At least one male of *T. pilosulus* was present in the general vicinity of the nests and was seen perched on the ground at intervals during the afternoon of 20 July. I studied male behaviour in more detail at another location, the Gilbert River where it crosses the main route across the York Peninsula from Cairns to Normanton. The preferred habitat of males consisted of small sandy clearings in the often dense riverside vegetation. I watched several males in an open area with low sand banks deposited in a past flood. Only a few scattered grasses and small weeds grew on the banks.

Four males, marked 5-6 July, patrolled home ranges in the study area; they appeared repeatedly along their patrol routes over periods of two to three days. One male had a roughly circular flight path of at least 24 m in circumference. The wasps flew from one perch to another, alighting on specific dirt clods, twigs or small plants. Marked individuals appeared at a given perch between 4-15 times ($\bar{X} = 9.3$) during six hour-long



FIG. 1—A female *Tachysphex pilosulus* with prey at her nest entrance. Note the position of the cockroach's antennae.

observation periods within 1050-1410 h, 5-7 July. The length of the stay at a perch was highly variable, ranging from a few seconds to as much as 9 min with a mean of about 94 s for 30 cases. Males made both "spontaneous" flights and pursuit flights out from and back to the perch. In "spontaneous" flights the male circled out, flying rapidly within a few centimetres of the ground and then returned within several seconds without interacting with any other insect. I recorded an average of 0.6 such flights per minute of perching time for 3 males ($N = 47$ min of perching time). Pursuit flights were triggered by the passage of butterflies, other Hymenoptera and male conspecifics within a short distance of the perch. Often males did not come back to their recent perch after a pursuit but sometimes they did. I recorded an average of 0.5 chases with return per minute of perching time for the same three males.

Chases of conspecific males occurred often because of the overlapping nature of the male's patrol routes. These pursuits did not involve contact and probably permitted the male to determine whether the pursued insect was a receptive conspecific female. On the other hand, I did sometimes see one male chase another from a perch near his own with the result that males rarely perched close together. I never saw any male-female interactions, but, judging from comparisons with other sphecids (Alcock *et al.* 1978), it is highly probable that males were patrolling routes in areas where receptive (recently emerged?) females might appear. Male behaviour may be analogous to the "trap-lining" flights of some bumblebees which patrol a long circuit in an effort to intercept receptive females (Alford 1975; Svensson in press).

Exeirus lateritius

This sphecid is a large cicada-hunting species whose nesting behaviour has been reviewed by Evans (1966). I observed the species in dry open eucalyptus forest in Warrumbungle National Park in northern N.S.W. from 25-28 December 1978. At least 12 active nests were located in an area approximately 10 m² set in a grassy clearing in the forest; several of the nests were in the initial phase of construction on 25 December.

During the four days of observation, some males appeared flying over the clearing in circles and figures of eight at a height of about 50 cm. Males were active from 0810-1805 h. They concentrated their flight paths in a 3 m² zone in the centre of the clearing, an area which had one prominent weed standing above the thick cover of low grasses. From 1-6 males might be present; individuals appeared to fly about for 5-10 min before departing to fly up into the trees about the clearing, where large numbers of cicadas were calling and where females were hunting their prey.

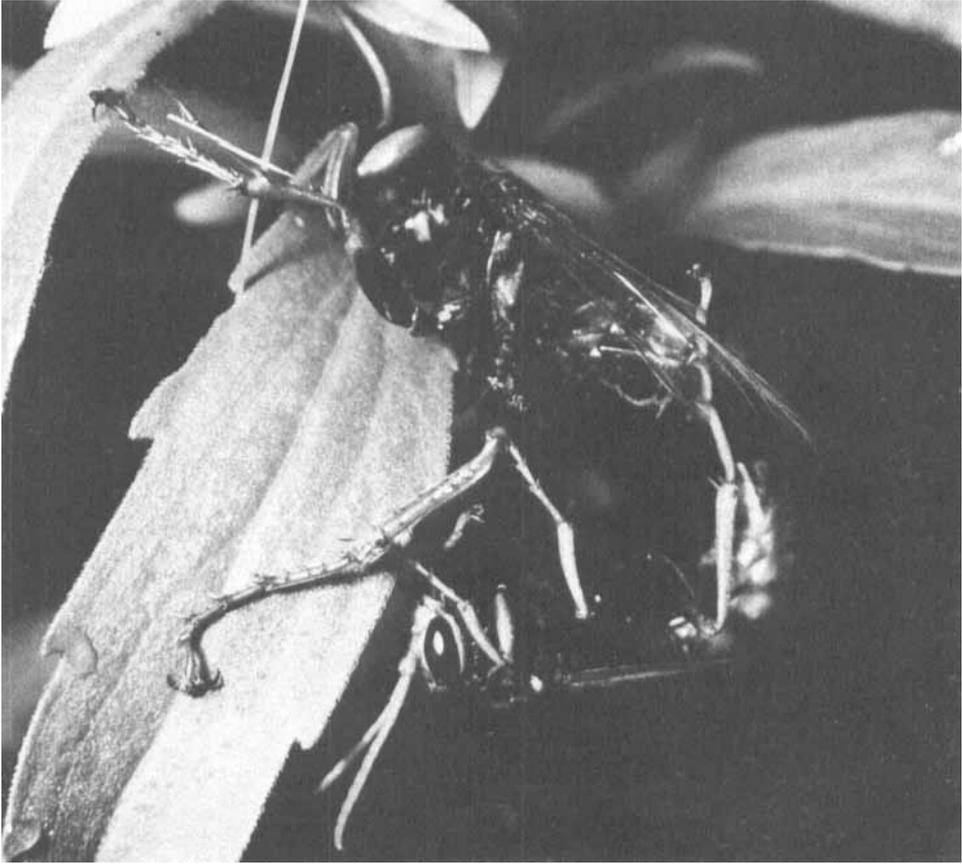


FIG. 2—A copulating pair of *Exeirus lateritius*.

The patrolling males swirled about and chased each other when two or more were present, but these interactions appeared no more aggressive than male pursuits of passing females engaged in the search for cicadas. Males also chased an orange and brown nymphalid butterfly that was active in the area. Occasionally a male alighted briefly on the prominent weed.

Three males, captured in the clearing and given distinctive colour dots on the dorsum of the thorax, all appeared repeatedly to patrol at least one day subsequent to marking; one male was seen on three consecutive days.

On 26 Dec at 1640 h I observed a female struggling to climb a grass stem in the centre of the clearing. The wasp seemed to have emerged (recently?) with a wing defect that made it impossible for her to fly. The female subsequently moved to the prominent weed and remained there overnight. At about 0800 h the next morning, the female crawled onto the upper surface of a leaf on the weed and basked there. Patrolling males first appeared at 0810 h and several passed close to the female without responding over the next 30 min. At 0840 h a male detected the female, pounced upon her back and with no courtship twisted his abdomen about to effect copulation. The male then turned to face away from the female and attempted to fly off with her—without success as the female refused to depart. The male then adopted the position shown in Fig. 2 and remained *in copula* for 26 min. After leaving his mate, the male returned repeatedly to pounce upon the female. In addition another marked male also landed upon her several times. The female refused to mate again and eventually she was collected as she crawled on the ground unable to fly.

It is perhaps surprising that males do not attempt to defend territories in the emergence area, as is true for males of the North American cicada-killers, *Sphecius speciosus* (Drury) and *S. grandis* (Say) (Lin 1963; Alcock 1975). In *Sphecius*, however, males defend open areas which contain high density of visible emergence holes (from these sites relatively many males have already emerged at the time of territorial establishment and therefore numbers of the later-emerging females are likely to appear in these locations). I was unable to detect the emergence holes of *E. lateritius* under the dense grass cover of the clearing. If the male wasps have the same difficulty they may be unable to locate superior sites to defend against competitors. Under these circumstances non-aggressive patrolling of the general emergence site and adjacent areas could provide individuals with better opportunities to encounter receptive females. Discussion of the ecological correlates of patrolling versus territorial behaviour in male wasps and bees can be found in Alcock *et al.* (1978).

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References

- ALCOCK, J. (1975).—The behaviour of western cicada killer males, *Sphecius grandis* (Sphecidae, Hymenoptera). *J. nat. Hist.* **9**: 561-566.
- ALCOCK, J., BARROWS, E. M., GORDH, G., HUBBARD, L. J. KIRKENDALL, L., PYLE, D. W., PONDER, T. L. and ZALOM, F. G. (1978).—The ecology and evolution of male reproductive behaviour in bees and wasps. *Zool. J. Linn. Soc. Lond.* **64**: 293-326.
- ALFORD, D. V. (1975).—“Bumblebees”. Davis-Poynter: London.
- EVANS, H. E. (1966).—“The Comparative Ethology and Evolution of the Sand Wasps”. Harvard University Press: Cambridge, Mass.
- EVANS, H. E., MATTHEWS, R. W., and PUIAWSKI, W. (1976).—Notes on nests and prey of four Australian species of *Tachysphex* Kohl, with description of a new species (Hymenoptera: Sphecidae). *J. Aust. ent. Soc.* **15**: 441-445.
- LIN, N. (1963).—Territorial behaviour in the cicada killer wasp *Sphecius speciosus* (Drury) (Hymenoptera: Sphecidae). *Behaviour* **20**: 115-133.
- SVENSSON, B. G. (In press).—Patrolling behaviour of bumble bee males in a subalpine/alpine area, Swedish Lapland. *Zoon* **7**:

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