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NON-VISUAL PREY-CAPTURE IN *TRITE PLANICEPS*, A JUMPING SPIDER (ARANEAE, SALTICIDAE)[1]

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ABSTRACT

Jumping spiders, well known for their visually-mediated reactions, employ a distinctive set of responses when catching prey in daylight. It is shown here, however, that the jumping spider *Trite planiceps* readily seizes live house flies in the dark, and that such behaviour is probably accomplished by means of vibratory signals.

INTRODUCTION

Of all the families of spiders, the salticids or jumping spiders alone have achieved distinction by virtue of a unique and remarkable set of eyes (see review by Forster, in press, a) which they use to find their way about, escape from enemies, hunt and catch prey (Homann 1928, Crane 1949, Drees 1952, Gardner 1964, 1966, Forster, 1977a, b, 1979b), interact with conspecifics and court prospective mates (Crane 1949, Jackson, in press; Forster, in press, a).

The visual reactions of jumping spiders to prey consist of a series of events broadly categorized as Orientation, Pursuit and Capture (Forster 1977a) and mediated by different pairs of eyes (Homann 1928, Drees 1952, Land 1971, Forster 1979a). Further evidence that these spiders catch prey visually and hence only in daylight was provided by the 'red light' experiments of Jackson (1977) in which 33 adult *Phidippus johnsoni* were offered house flies in a situation where visible wavelengths shorter than 600 nm were excluded. None of the spiders caught flies despite their being within visual range nor were they seized upon contact, yet 15 min. later in white light 36% of them succeeded.

The present study shows, however, that when *Trite planiceps* Simon 1899, are offered house flies in the dark they are indeed able to seize them and that they probably do so by means of vibratory cues.

MATERIAL AND METHODS

Sixteen adult *Trite planiceps* spiders (mostly female) were collected from flax (*Phormium tenax*) in Taieri Beach Road, Dunedin, New Zealand. They were housed and

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maintained as described for previous studies (Forster 1977a, b). House flies were provided once a week and the present tests were conducted on a day on which they were normally fed.

Sixteen test containers were prepared as follows: a small hole (1 cm diam.) was cut in the lid of a clear plastic petri dish (9 cm diam.). A hollow opaque plastic stopper containing a chilled fly was taped over this hole and the opening closed with a strip of cardboard (1.5 x 5 cm). A spider was then placed in the petri dish and covered with the prepared lid (Fig. 1).

Tests were conducted in a photographic darkroom and containers were held here for 5 min. prior to testing to allow spiders to settle down after handling and flies to recover from refrigeration.

Flies were released into the lower compartment by withdrawing the cardboard strip, this being quite easily accomplished in the dark. Fifteen minutes later spiders were examined in safelight conditions (to minimise the chances of captures occurring as the lights went on).

In the second part of the investigation, 5 adult *T. planiceps* spiders (all female) were blinded by completely covering their eyes with black acrylic water-based paint (for details of method see Forster 1979a). They were placed in petri dishes overnight to allow full recovery from anaesthesia, and next day were offered live flies in these containers under subdued illumination to prevent flies from being too active.

As controls, freshly freeze-killed (1) intact and (2) squashed flies were offered to blinded and non-blinded spiders.

RESULTS

During the 15 min. dark period after flies were released into the spider compartments, a succession of 'buzzes' lasting for about 20 sec. was clearly audible. At the end of the test period, inspection revealed that 14 of the 16 spiders (88%) were already consuming their partially liquified victims. There seems little doubt that the 'buzzing' sounds indicated the seizure of flies by spiders. Because this result was unexpected however, the test was repeated, this time with an 80% capture rate.

Totally blinded spiders moved about very little in their containers even after 24 hr. but when they did, they walked slowly and hesitantly with much foreleg tapping. Upon the introduction of flies however, their activity increased quite markedly. They moved much

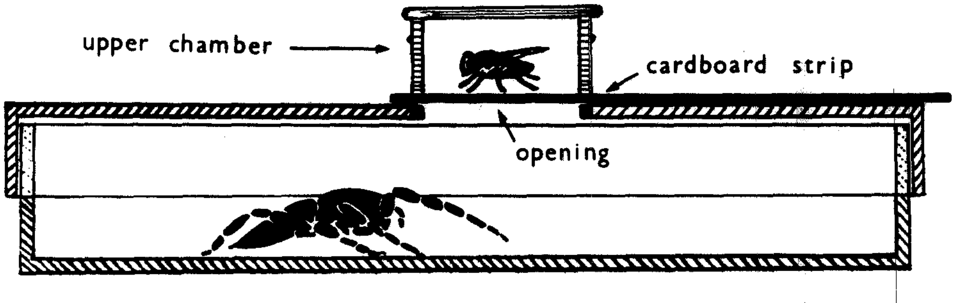

Fig. 1.–Section through a test container showing fly in upper chamber separated by strip of cardboard from spider in lower compartment. The tape (not shown) holding the upper chamber in place is at right angles to the cardboard strip which can then be slid gently out from beneath the fly, allowing it to drop into the compartment below.

faster, turning frequently but haphazardly in various directions. At the same time foreleg tapping changed to foreleg waving with these legs often being raised above their heads, sometimes in unison, at other times alternately.

Flies colliding with the rear or lateral regions of the spider's body provoked withdrawal but not escape or turning responses as would have been the case in the spider's normal non-blinded state. However, flies which ran between the spider's forelegs or which were held there with forceps were immediately seized. At once flies began struggling, and emitted high frequency wing vibrations, activities which usually ceased after 20-30 sec., presumably when the venom took effect.

Blinded spiders did not accept freshly killed (1) intact or (2) squashed flies as prey when held with forceps, presented between their forelegs and brought into contact with the chelicerae. If such flies were left overnight in containers with spiders, whether blinded or non-blinded, intact flies were never accepted but squashed flies were generally eaten, in one test by 79% of non-blinded spiders. The consumption of flies by *T. planiceps* is easily verified because either their skeletal remains are discarded as a crushed ball or they are dismembered, with legs and wings then becoming scattered about the container.

DISCUSSION

Intact flies were seized by *T. planiceps* spiders in the dark, or when blinded, only when they were alive, suggesting that captures are not induced by chemical or tactile cues but by some other property of the living prey. Evidently squashed flies which were eaten differed in this respect; presumably spiders recognized the chemical substances emanating from extruded tissues and fluids, a proposal supported by earlier studies (see Kaestner 1968) which suggested that salticids can detect the presence of crushed flies beneath moist filter paper.

'Dark' conditions precluded the use of vision in the capture of prey and blinded spiders exhibited none of the usual reactions performed by spiders when catching flies in daylight. The most probable sensory modality involved in such captures is that of vibration, clearly effective only at very close range. Active flies running between the forelegs of a hungry spider probably generate air-borne vibratory signals which evoke a series of motor actions resulting in prey seizure. Of course we should not discount the possibility that such a mechanism also operates in the final stages of visual prey-capture.

Foreleg-waving by blinded spiders in the presence of active flies further supports the view that air-borne vibration is being generated by flies and detected by them, but at distances greater than 1 to 2 cm spiders are unable to determine the direction of such signals nor do they make any attempt to close the gap between them and the source of such signals.

Crane (1949) proposed that many salticids make use of vibration in courtship while Forster (1979b and in press, a) showed, by transition-frequency analysis, that foreleg-waving in *Trite auricoma* plays little part in visual communication during courtship displays. One possibility advanced in those investigations was that this posture serves to pick up non-courtship, environmental information such as vibration. The present observations add weight to such a role for foreleg-waving while studies of *T. auricoma* spiderlings show that these same movements increase in frequency and intensity when their prey (winged *Drosophila*) are out of sight (Forster 1977a).

One might well ask why such visually competent animals possess a means of catching prey in the dark, particularly when jumping spiders in general are assumed to rest at night. It is not known of course whether other salticid species can also catch prey under such conditions but *T. planiceps* are unusual in that they do not make nightly web shelters. This means that without the barrier afforded by a silk retreat, nocturnal insects may run into them and thus be captured. Such an event, however, would merely supplement the usual quota caught in daylight.

However, a more likely explanation relates to their survival in the cool overcast winters experienced at low altitudes in New Zealand. High altitude salticids, for example, spend the winter months under snow and have evolved mechanisms by which they cope with long periods without food (Forster, unpubl. obs.). *Trite planiceps*, on the other hand, spend much of the winter sheltering within the dim recesses of rolled-up flax leaves and need sustenance from time to time (Forster and Forster, 1973, 1976, Forster 1977b and in press, b). With a non-visual, energy-conserving tactic at their disposal they would be able to catch an occasional fly or moth at times when low light levels preclude the use of their visual response sequences.

These findings also raise questions about the mode of prey-capture employed by those salticid species living in the dense, damp, evergreen forests of New Zealand and, more particularly, in the thick layers of leaf litter which lie beneath. Here, these spiders spend their lives in an environment buffered against the extremes of temperature and one into which the sunlight rarely penetrates. Can their reliance on vision in prey-capture (and courtship) be as great as in most of the jumping spiders we know, or do they depend more on vibration and perhaps even other sensory systems to carry out these basic tasks?

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