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## SCIENTIFIC CORRESPONDENCE

# Pretending to be a predator: Wasp-like mimicry by a salticid spider

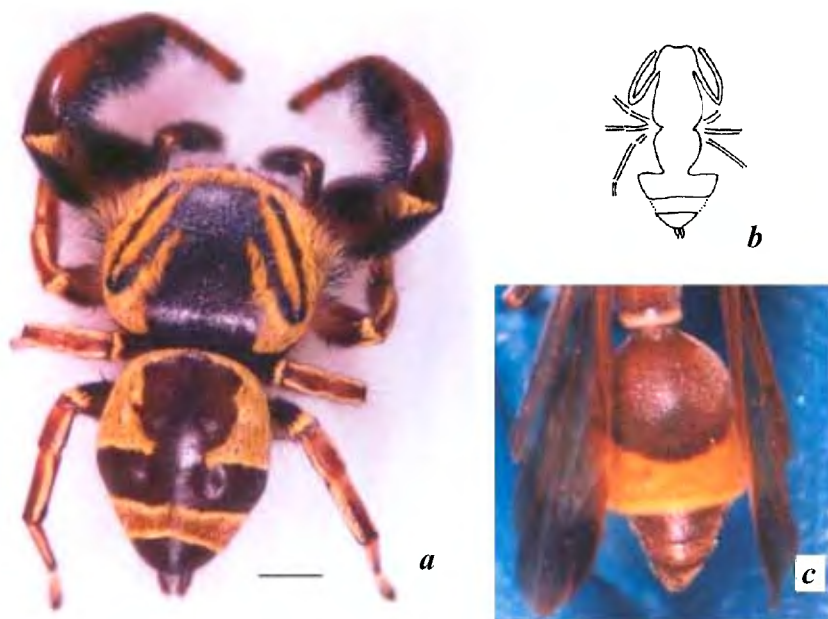
Prey–predator interactions often elicit life-saving adaptations in the prey. While some predators have evolved methods for efficient prey catching, many prey species have evolved methods to protect themselves. Mimicry is one of them. Batesian mimicry is characterized by the occurrence of traits in an animal that make them appear unpalatable. Camouflages of various kinds are known. However, occurrence of traits mimicking the predator's features itself is unknown. Here we report such a case in a spider belonging to family Salticidae (jumping spiders).

Spiders do camouflage like other objects or animals, including ants, twigs, bird droppings and bark of a tree. The crab spider *Misumena vatia* (Thomisidae) can change its colour from yellow to white and vice versa<sup>1</sup> to hunt efficiently. Spiders (Araneae) and members of Hymenoptera do interact, and the mimicry of a major group of Hymenoptera – ants, by spiders is well documented. Some members of the family Salticidae and Clubionidae are ant mimics and 28 ant-mimicking spiders of the genus *Myrmarachne*

(Salticidae) are reported from India<sup>2</sup>. The body segments of such mimics are structured to give an appearance of a three-segmented (head, thorax and abdomen) body pattern from a typical two-segmented (cephalothorax and abdomen) arachnid body plan. Apart from the body segments, the Chelicerae are also modified for mimicking. Some of them are known to co-exist with ants. Thus they protect themselves, as ants have very few predators. Wasps, which are another major group of Hymenoptera, are important predators of spiders. Wasps belonging to families Sphecidae and Pompilidae, provide spiders to their developing larvae as food<sup>3</sup>. Pompilidae lay eggs on one spider, which becomes the larval host, while Sphecidae provides 10–40 paralysed spiders, which are often immature forms, in their larval cell. Immature spiders are hunted and stored in the larval cells possibly because of the small size that allows them to be carried and due to their abundance. We have observed such larval cells of a Sphecidae wasp which is yet to be identified by us, often occupying pre-existing cavities or discarded poly-

ethylene tubing (3–4 mm diameter), to contain 10 to 22 immature salticid spiders belonging to two or three genera (*Plexippus*, *Phidippus* and *Metaphidippus*). Observations on 14 such cells have revealed immature forms of Salticidae only and no other spider family. The paralysed preys show signs of blood circulation as cardiac activity could be observed under a stereomicroscope, and sporadic leg movements could also be seen. The larva of the wasp can be seen wriggling inside these spiders. The older forms come out of the dead prey. Identification of prey species is inconclusive as they are immature specimens. The preference to Salticidae members, however, is striking. Thus, some wasp species exclusively hunt young salticids.

We have collected two male specimens of a salticid, which we identify as *Rhene danielli* (Tikader) (Figure 1a) based on the description of a male holotype by Tikader<sup>4</sup>. The specimens are 5.4 mm long with the cephalothorax measuring 2.2 mm and the abdomen measuring 3.2 mm in length. The noteworthy feature is the presence of a pattern outlined by yellow



**Figure 1.** *a*, Mature *Rhene danielli* (Tikader), male, displaying a pattern resembling major morphological features of a wasp. *b*, An outline of the pattern seen on the dorsal side of *R. danielli* illustrates the wasp-like features of the mimic. *c*, The dorsal side of a paper wasp (Vespidae) is shown to compare the yellow band seen on the wasp and a similar band is seen on the abdomen of *R. danielli*. Scale: 1 mm.

hairs on the thorax and abdomen of the spider that has dark brown cuticle (Figure 1 *a*, *b*). Tikader<sup>4</sup> describes the hairs to be white in colour, possibly because his observations were made on a specimen preserved in alcohol. Photomicrographs in the present study were made from freshly collected specimen as preservatives bleach the pigments. On the cephalothorax, the pattern resembles the head and thorax region of a hymenopteran. The head-like pattern is comparable to the hymenopteran head in outline. Arising from near the 'neck' of the pattern, a brown streak made out by the surrounding hair courses backwards, touches the posterior eyes that are placed far behind on the thorax, and loops forward close to its path and touches the anterior region of the cephalothorax near the anterolateral eyes. This pattern imitates the wings of Hymenoptera, which at rest are held in a similar position. Presence of a narrow pedicel connecting the thorax and the abdomen is a characteristic feature of wasps. The pattern on *R. danielli* (Tikader) is designed to provide this outline. The yellow band that is seen on the abdomen of many wasps (Figure 1 *c*) is clearly

imitated by the band of yellow hair on the abdomen. As salticid spiders are jumpers, they have relatively stout legs. The yellow hair provides a margin on either side of the second, third and fourth legs and visually reduces the thickness of the legs. The ant-mimicking salticids bear long and thin legs to make them look like ants. Due to thinner legs the ant-mimics are less efficient jumpers. *R. danielli* (Tikader) seems to have overcome this by using hairs to make the leg appear thin. In a sitting position, with its legs held close to the body the legs appear to emerge from the 'thorax' of the wasp-like mimic. The femurs of legs 2 to 4 do not bear the hairy margin. The spinnerets at the posterior end provide a structure comparable to the sting of the wasp. *R. danielli* often moves about in the open and can be viewed by the hunting wasp from any angle. The pattern may appear to be an inverted wasp-like image if viewed from the anterior side. However, from the posterior it clearly mimics a wasp. The advantage of such an orientation of the mimic would be to protect the spider from the predator that approaches it from the rear. If approached

from the front, the well-developed visual system of the salticid, for which salticids are reputed, will detect the predator and elicit avoidance. Many salticids do have eye-like spots on the dorsal abdomen, misleading the predator into believing the posterior of the animal to be the anterior. Some of the salticids belonging to the genus *Plexippus*, *Phidippus*, *Metaphidippus* that are hunted by the wasp are caught by it with relative ease and immobilized as observed by us in the field.

Insects have compound eyes that form a mosaic image. Processing of information extracts significant cues from the environment for pattern recognition<sup>5</sup> and the wasp-like pattern on the dorsal side of *R. danielli* (Tikader) should suffice to provide the features of a wasp to deter and elicit evasion from the predator. The ventral side of salticids and most hunting spiders is less ornate in terms of colour and design. The orb-weavers, as they are suspended in air on their webs, are visible from both sides only while the dorsal side of the hunting spiders is exposed.

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