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NOTES ON THE VANHORNIIDAE (HYMENOPTERA)

Mark Deyrup¹

ABSTRACT

The biology and taxonomy of *Vanhornia eucnemidarum* Crawford, a rare and specialized parasitoid of Eucnemidae, is reviewed. The position of the genus *Vanhornia* as a separate family is reaffirmed.

The family Vanhorniidae is one of the most obscure families of North American insects. The single genus includes only two species: *Vanhornia eucnemidarum* Crawford (1909), found in eastern North America, and *V. leileri* Hedqvist (1976), known only from Sweden. I estimate that fewer than 50 specimens of Vanhorniidae have been collected, though both species live in areas blessed with relatively large numbers of resident entomologists. The scarcity of specimens is probably due partly to the genuine rarity of the species and partly to their elusive habits; living specimens that I have observed practiced a combination of short flights and rapid runs (like some pompilids) that was frustrating to both net and fingers. Since the host of *V. eucnemidarum*, the eucnemid beetle, is of no economic importance, there is no practical need to study its rare parasitoid. Nonetheless, *V. eucnemidarum* is of great interest because it is one of our most peculiar Hymenoptera. The purpose of this note is to summarize the scattered information on *V. eucnemidarum* and contribute a few original observations.

Vanhornia eucnemidarum is known from Quebec west to Michigan and south to Georgia and Kentucky (Townes and Townes 1981). The type series was collected from "cells of larvae of the family Eucnemidae" by Van Horn at Silver Springs, Maryland, and one specimen collected on Plummer's Island, Maryland (Crawford 1909). Specimens have been reared from *Isorhipis ruficornis* (Say) (Champlain 1922, Brues 1927). My specimens are from Tippecanoe County, Indiana. Ten specimens, eight females and two males, were collected in June and July from a Malaise trap set up in a small wooded ravine. Two specimens, one male and one female, emerged 1 May 1981 from pupal cells of *Isorhipis ruficornis* in a dead sapling of *Acer saccharum* Marsh, brought indoors 2 April 1981. The complete larval skin of the host was found in the cell from which the male parasitoid emerged. The pupal cell had undoubtedly been constructed by the eucnemid, and was identical to those from which specimens of *I. ruficornis* emerged. There was no cocoon or visible lining in the cell. The male and female when placed together in a plastic container showed no interest in each other, but spent their time running back and forth over the sticks provided. The female showed ovipositing behavior as described below. The female lived for five days, the male four. In addition to these specimens, I have seen three specimens on dead beech and maple in dense forest in June 1981.

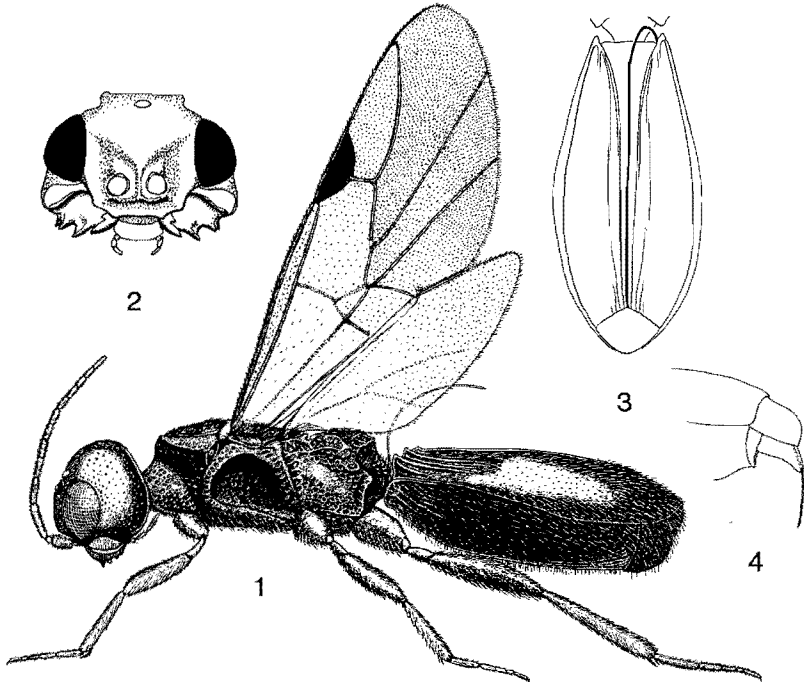
From a taxonomic standpoint it is fortunate that the venation of *V. eucnemidarum* clearly links it to the superfamily Proctotrupoidea, as this insect is otherwise apparently a mass of specialized character states. The most distinctive of these are the swollen temples; the exodont mandibles; the low attachment of the antennae; the prothoracic "neck;" the concave mesopleuron; the deeply pitted thorax; the long, fine, flexible, exerted ovipositor; the fused gastral tergites 1-4; the keeled and abruptly deflexed 5th

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gastral tergite; and the grooved gastral sternites (Figs. 1-4). Mason (1983) has shown that gastral tergites 6-8 are much reduced and telescoped into the abdomen. Behaviorally *V. eucnemidarum* differs from representative proctotrupoids I have observed (Proctotrupidae, Scelionidae, Heloridae) in its running-and-flying locomotion and in the rapid up and down movements of the gaster.

The ovipositor of *Vanhornia* is one of its most interesting features. When not in use it is bent forward at the base so as to lie in a groove along the ventral side of the gaster (Fig. 4). This groove is not nearly long enough to accommodate the ovipositor, which is about the same length as the entire insect, and the tip of the ovipositor curves up at the base of the gaster to lie between the wings (Fig. 1). This can be seen in some dead specimens and was also observed in the live female that emerged in the laboratory. The ovipositor is probably held in place by projections on the propodeum and the first gastral segment (Fig. 4), but this mechanism was not clearly seen in the living specimen as the gaster was in constant movement. The ovipositor is 5.8 mm long and extraordinarily thin, about 0.05 mm. In spite of its slenderness, the ovipositor consists of the usual four valvulae, the outer two blunt and equipped with hairs, the inner two ending in stylets. Two apparent oviposition attempts were observed, during which the ovipositor was at a right angle to the body (Fig. 4) while its tip probed the cracks of the broken end of a stick containing eucnemids. The tip of the ovipositor is highly flexible, and its delicate probing resembled that of the tip of a moth's proboscis seeking nectar. Townes and Townes (1981) reported an observation of the ovipositor being passed along a crack in a hardwood log.

The functional morphology of the ovipositor is unknown, but it is probably not used in the same way as the long, wood-drilling ovipositor of certain Ichneumonidae and Braconidae. In these ichneumonoids the ovipositor is stiff and springy, and the pressure of the limber ovipositor against the wood appears (in my observations) to help drive the ovipositor into the wood. During drilling the ichneumonoid sheath splits to free the



Figs. 1-4. (1) Female *Vanhornia eucnemidarum*, actual length 5.8 mm; (2) frontal view of head of female; (3) Base of ovipositor during oviposition attempt; (4) ventral view of gaster of female.

ovipositor partially or entirely. In *V. eucnemidarum* the ovipositor is highly flexible. By use of a minuten pin the sheath can be split and the ovipositor extracted, but it is not known that the sheath separates during oviposition. A female immobilized (with a bit of modelling clay) on a microscope slide was able to repeatedly thrust the ovipositor a short way out of the tip of the sheath without separating the sheath. Mason's drawing (1983) of the ovipositor gives some idea of how this might be controlled by sliding the first valvifer inside the second.

The structure of the ovipositor and the observed behavior of females suggest that the host is attacked when it is an egg or a young larva that has not tunneled far into the wood. *I. ruficornis* itself has a long tubular ovipositor with which it inserts eggs deep into crevices of dead wood. If the egg is the stage attacked and the parasitoid has a long period before it begins to develop in the host, this would constitute a biological difference between the Vanhorniidae and the Proctotrupidae. If the host is attacked only as an egg or newly hatched larva, the brevity of opportunity provided for the parasitoid, combined with the concealment of the host, might help explain the rarity of *V. eucnemidarum*.

The other most notable feature of *Vanhornia* is the exodont mandibles (Fig. 2). Exodont mandibles are not common in insects, occurring in *Vanhornia*, in braconids of the subfamily Alysiniinae, and in some larval Eucnemidae, including *I. ruficornis*. Van Horn (1909) described the action of the mandibles of *Melasis pectinicornis* Melschheimer as saw-like, appropriate for the slit-like galleries that the larvae construct. Adult eucnemids which, like *Vanhornia*, need only escape from the pupal chamber, have normal mandibles. The adaptive significance of the exodont mandibles of *Vanhornia* therefore remains unknown, and it is difficult to connect these unusual mouthparts with those of the host unless one assumes that *Vanhornia* is descended from much flatter ancestors that completed their development in the larval galleries rather than the pupal cell of their host.

The Vanhorniidae appear to be a highly specialized offshoot of the primitive Proctotrupoidea. The most impressive proctotrupoid character of *Vanhornia* is the overall wing venation, which is strikingly similar to that of *Helorus paradoxus* (Provancher), though *Helorus* differs in having a distinctive detached CuA2 vein in the forewing. The venation of *Vanhornia* also resembles that of *Ropronia*, though the medial (first discoidal) cell of *Ropronia* is not triangular as it is in *Vanhornia*. These similarities in the venation of the Vanhorniidae, Roproniidae, and Heloridae apparently led Riek (1955) to combine all three families, along with the Monomachidae, in the family Heloridae. *Vanhornia* fails to fit into Riek's expanded definition of the Heloridae because *Vanhornia* has one-segmented trochanters and the antennae are situated low on the face, almost adjacent to the clypeus. More recently, Townes and Townes (1981) included *Vanhornia* in the family Proctotrupidae. The many distinctive features of *Vanhornia* are apparently interpreted as specialized, derived character states superimposed on a proctotrupid base. When these features are discounted, however, there are no morphological character states left that are shared only with the Proctotrupidae. The use of beetle larvae as hosts is a biological characteristic of *Vanhornia* shared only with the Proctotrupidae (if the Pelecinidae are excluded from the Proctotrupoidea), but this does not seem to be a strong link, especially if the method of parasitization is different.

It is easy to feel an intuitive reluctance toward placing an extraordinarily specialized organism in its own family, an action that usually implies the organism is not only specialized but also ancient. There is a tendency to feel that specialization is ultimately unadaptive in a changeable world, but in some instances specialization may be a refuge. It is difficult to avoid the impression that a number of small, highly specialized families of Hymenoptera, such as the Vanhorniidae, Heloridae, Roproniidae, Austroniidae, Pelecinidae, Evaniidae, and Aulacidae, are remnants that have held out against the evolutionarily aggressive ichneumonoids by a kind of entrenched specialization.

Thanks to the work of Crawford (1909), Townes and Townes (1981), and Mason (1983), the morphology of *V. eucnemidarum* is known in some detail, but a number of questions remain about the biology of this species. These questions deal with the function of the ovipositor and the mandibles, the general life history, and the position of the parasitoid pupa with respect to that of the dead host larva.

As a final enigma, a poignant historical oddity is associated with the Vanhorniidae. The type series was reared from eucnemids by R. W. Van Horn, a preparator working for A. D. Hopkins in the Bureau of Entomology. Van Horn developed an independent interest in larvae of Eucnemidae, and made a number of original observations which were published late in 1909. Among the comments of A. D. Hopkins appended to Van Horn's paper is the statement that on 9 February 1909, Van Horn set off for the local laundry with a bundle of washing under his arm and was never seen again. Were it not for this unfortunate disappearance we would undoubtedly know a great deal more about the biology of the eucnemids and their parasitoids; we have not progressed very impressively since 1909.

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