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The water scale insects of the mysterious family Carayonemidae (Hemiptera: Coccoidea)

Abstract - The family Carayonemidae (Hemiptera: Coccoidea) was established in 1986 for a neotropical species adapted to life in wet or aquatic habitats. So far, only four species belonging to the family, all neotropical, have been described. The phylogenetic affinities of the Carayonemidae, their specialised morphology and biology, and suitable collection methods are discussed.

Key words: Carayonemidae, Coccoidea, aquatic insects

INTRODUCTION

Members of the family Carayonemidae (Hemiptera: Coccoidea) show remarkable morphological adaptations related to their unusual habit of living in very wet conditions, such as very humid litter, swamps, or on hosts growing in water. Specimens of this family have never been seen or collected in the field because of their very small size and unusual lifestyles. So far only 4 species have been found, including 12 females and about 15 larval stages. The family Carayonemidae was established by C. Richard in 1986, based on one species, *Carayonema orousetti,* from South America (French Guyana). According to Richard (1986) and Kozár & Konczne Benedicty (2000), members of the family are widely distributed in Central and South America (Mexico, Costa Rica, French Guyana, Brazil, Peru). It is likely that more undescribed species will be discovered in this region, and it is possible that this or similar groups of scale insects will also be found in other parts of the world. This paper aims to bring the Carayonemidae to the attention of coccidologists and to discuss appropriate collection methods, in the hope that more samples will be collected in future.

DISCUSSION

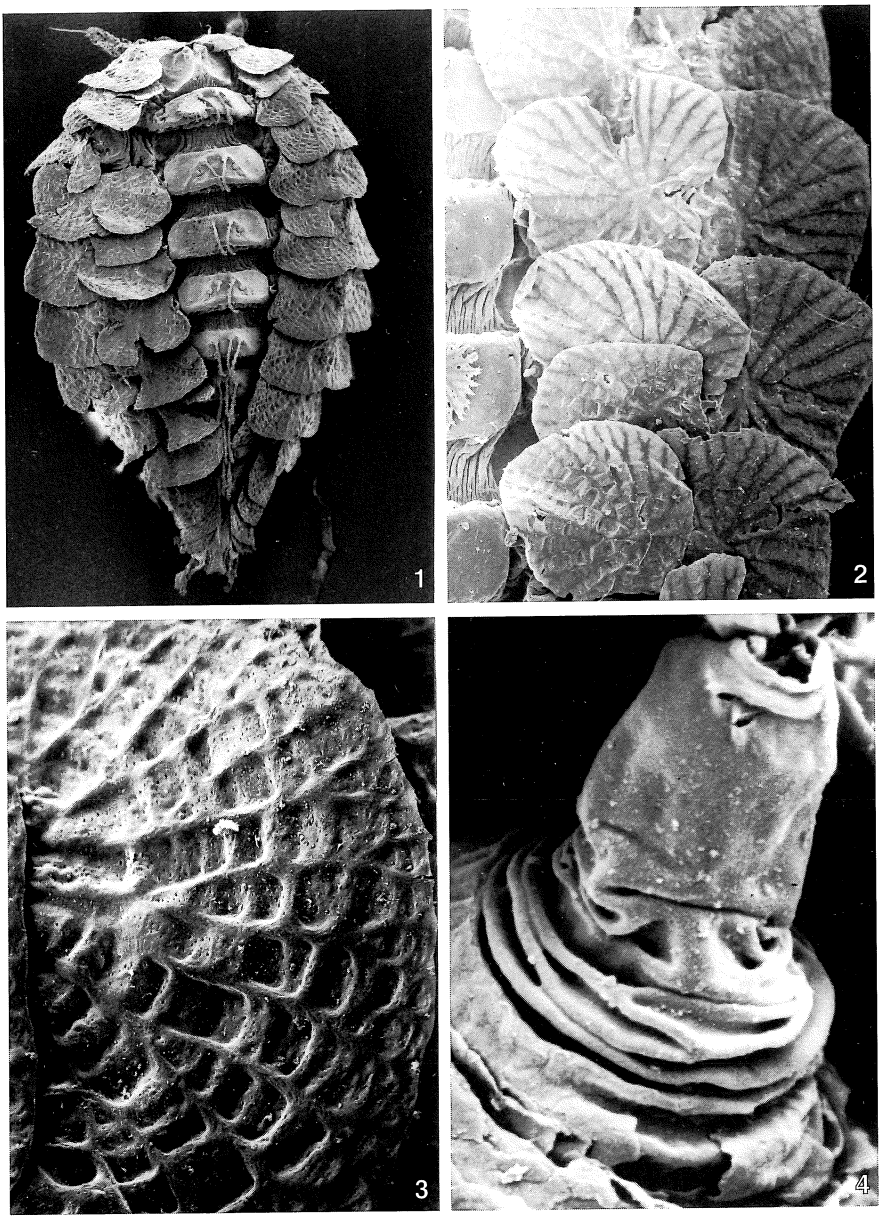
The well-developed anal ring with long setae found in the Carayonemidae suggests relationship to the Ortheziidae. However, the Carayonemidae are very different in

having thoracic and abdominal spiracles situated on the dorsum to form a periscope, with a long tube projecting upward. They resemble *Ortheziola* (Ortheziidae) in the apparent absence of secretions on the central area of the dorsum, and in having three-segmented antennae. Some other characters and their distribution patterns are shared with *Mixorthezia* (Ortheziidae); in some species of Carayonemidae, the tibia and tarsus are divided as in *Mixorthezia*. However, there are long anal lobes present, which are lacking in both the Ortheziidae and Margarodidae. The labium is short and simple. The most unusual morphological structures are: spiracles modified to form a periscope; large umbrella-like setae; and strongly developed frimbiate setae. The wax gland system is very reduced: only some bilocular pores are present - other types of pores and ducts are lacking. The ovisac pore band is absent, suggesting that members of the Carayonemidae are ovoviviparous.

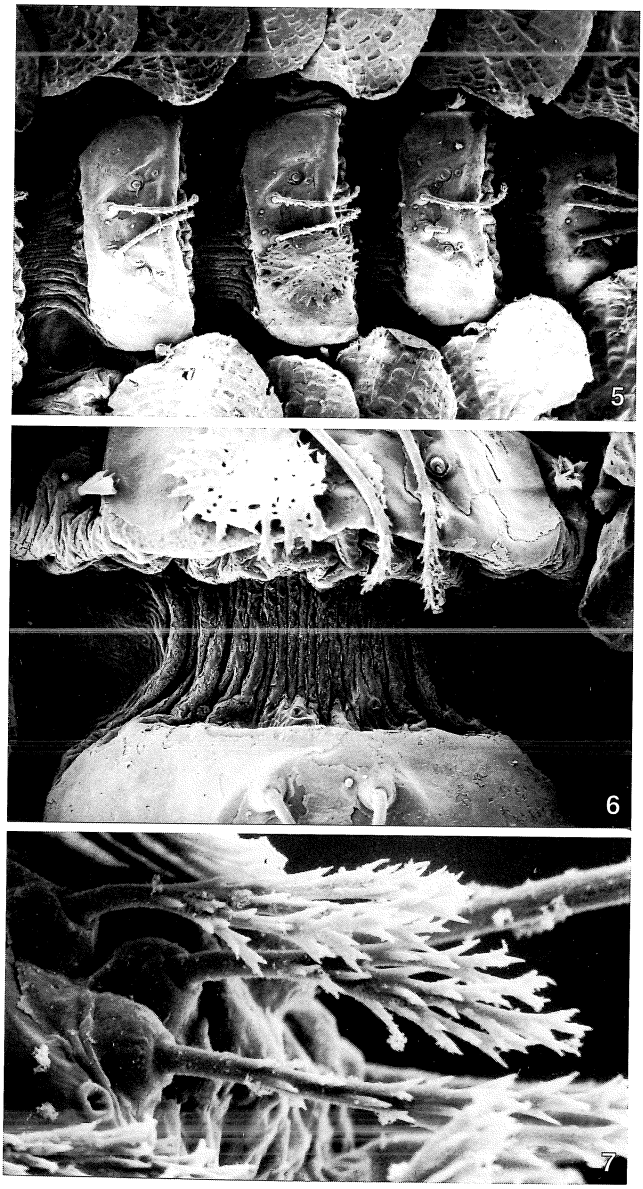
Some of the specialised structures were studied using a scanning electron microscope. Well-developed frimbiate setae occur on the medial area of dorsum and venter, covered by an amorphous substance. Strongly modified, umbrella-like setae that also produce a very thin coat of amorphous substance are present; these help the insects live in water or float on the water surface. The umbrella-like setae occur in two ranges, covering the margins; the surface of each seta shows numerous depressions with very small openings. Finally, the dorso-median area, from the head to the end of the body, is covered by strongly developed tergites interrupted by pleated areas of flexible cuticle bearing 2 small umbelliform setae. Each flexible area bears two large cicatrice-like structures, each secreting an amorphous substance; dense amorphous secretions were observed among the folds of flexible cuticle.

One of the studied species has three larval instars. The morphological characters of the larva were similar to that of the adult female, and did not provide any additional information to help understand the phylogenetic affinities of the Carayonemidae. Males were not found. With regard to host plants, possible hosts may be moss or similar plants, living in water on river banks and swamps, or the small superficial roots of plants growing in water.

What is the best method of collecting Carayonemidae? The long absence of this family from reference insect collections demonstrates that, by the usual method of collecting by visual survey, these small insects (about 1 mm long) are almost impossible to find, especially on the surface of the water or on wet plants. The Berlese trap, which is an efficient method of collecting Ortheziids or mealybugs, is not suitable for sampling this kind of plant material. In our survey from Neotropical Region, from thousand samples only four contained specimens of Carayonemidae. Perhaps we should try using special nets, such as those used to survey water bugs and water spiders, or we should examine collection materials of these groups.



Figs. 1-4 - Dorsal view of the adult female of *Foldicoccus monikae* Kozár & Konczné Benedicty, 2000 (Fig. 1). Large umbelliform setae in two ranges on margin and smallest on the middle part of each segment. x 180 (Fig. 2). Details of the large umbelliform setae. x 3600 (Fig. 3). Periscope-like dorsal thoracic spiracles. x 15000 (Fig. 4).



Figs 5-7 - Dorsal view of the adult female of *Foldicoccus monikae* Kozár & Konczné Benedicty, Dorso-median area with strongly developed tergites interrupted by pleated area of flexible cuticle. x 460 (Fig. 5). Details of the fig. 5. Each flexible area bears two large cicatrice-like structures. x 11000 (Fig. 6). Well developed fimbriate setae with a bilocular pore. x 3600 (Fig. 7).

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