The Ultrastructural Analysis of Scales in Brachypera Capiomont, 1868 and Hypera Germar, 1817 (Coleoptera: Curculionidae: Hyperinae)

Authors: Erbey, Mahmut, and Candan, Selami

Source: Entomological News, 124(2) : 103-108

Published By: The American Entomological Society

URL: https://doi.org/10.3157/021.124.0205

THE ULTRASTRUCTURAL ANALYSIS OF SCALES IN *BRACHYPERA* CAPIOMONT, 1868 AND *HYPERA* GERMAR, 1817 (COLEOPTERA: CURCULIONIDAE: HYPERINAE)[1]

Mahmut Erbey[2] and Selami Candan[3]

ABSTRACT: The scales that are external morphological characters in *Brachypera* Capiomont, 1868 and *Hypera* Germar, 1817 (Curculionidae: Hyperinae) were examined using light and scanning electron microscope (SEM). Dried museum materials were used in this study. After softening the materials, abdomens were removed to reach elytra. Similarities and differences among the species are discussed. Although the scales look alike under the light microscope, they showed a rather different pattern with SEM. The fine structure of scales was shown to be useful for comparing species.

KEY WORDS: Curculionidae, *Brachypera*, *Hypera*, scales, morphology, SEM

The Hyperinae are currently divided into two tribes: Cepurini Capiomont, 1867, and Hyperini Marseul, 1863 (Skuhrovec, 2008). Alonso-Zarazaga and Lyal (2002) listed 22 genera in the tribe Hyperini occurring chiefly in the Palaearctic Region. The relationships between the genera and their status in the tribe Hyperini have never been satisfactorily resolved (Skuhrovec, 2008). The taxonomic status of three genera (*Donus*, *Brachypera* and *Hypera*) in the tribe Hyperini is here clarified and augmented. Differential morphological characters of the adults and larvae of the Hyperinae are not unambiguous and the taxonomic position within the family Curculionidae is still unresolved. The number of teeth of the mandible seems to be an especially important larval character at the genus level. The species of *Hypera* are well known both in larval and adult stages and both larval (four teeth on the mandible) and adult characters (surface of elytra with setae and scales) place it in *Donus* auct. (Skuhrovec, 2008).

In taxonomy of Curculionidae (Coleoptera), the several external morphologic characters like teeth, hairs, setae, scales, punctures and color have been used by many researchers (Caldara, 1984, 1990; Dieckmann, 1980; Erbey, 2010; Kuschel, 1995; Marvaldi and Lanteri, 2005; Morimoto, 1962; Ter-Minasyan, 1978, 1988; Sert, 1995; Skuhrovec, 2005, 2006, 2007, 2008; Thompson, 1992). In Curculionidae taxonomy, scales have been used as important characters (Hoffmann, 1954; Pesarini, 1980; Caldara, 1990; Erbey and Candan, 2013).

The aim of this study is to show the fine structure of scales in *Brachypera* Capiomont, 1868 and *Hypera* Germar, 1817 representing two tribes that can be used for separation. Separation can be best illustrated by utilizing the scanning electron microscope (SEM).

---

[1] Received on December 23, 2013. Accepted on April 22, 2014.

[2] Department of Biology, Faculty of Arts & Science, Ahi Evran University, Kırşehir, Turkey; E-mail: merbey023@gmail.com.tr

[3] Department of Biology, Faculty of Science, Gazi University, Ankara, Turkey; E-mail: scandan@gazi.edu.tr

Mailed on September 25, 2014

METHODS

Two species of *Brachypera* Capiomont, 1868 (*Brachypera dauci* and *B. lunata*) and six species of *Hypera* Germar, 1817 (*H. contaminata*, *H. farinosa, H. nigrirostris, H. plantaginis, H. postica* and *H. rumicis*) (Curculionidae: Hyperinae) were investigated. The specimens were selected from the museum materials that had been collected from central Anatolia in 2011. First, the specimens were retained in a pot for about 24 hours at 30° for softening. Then semielytra of the specimens were removed from the abdomens and cleaned through fine dissection. The samples were examined by light microscope. For examination with the SEM, elytra were dried and mounted with double-sided carbon tape on SEM stubs, coated with gold in a Polaron SC 502 Sputter Coater, and examined with a JOEL JSM 6060 SEM operated at 10 kV. We then investigated the surface morphology of scales under x1000 magnification. The classification that we used in this study is that of Skuhrovec (2008).

RESULTS

Under the light microscope

The scales of *Brachypera dauci* are like a series of roof tiles and the inner surface of some scales are empty and appear yellowish-white (Fig. 1a); in *B. lunata*, elytra are densely covered by rounded brown scales (Fig. 1b); the scales of *Hypera rumicis* are oblong or rectangular, and lightly yellow (Fig. 1c); in *H. plantaginis* the scales are separated to two projections like that of a fork, and are dark yellow (Fig. 1d); in *H. farinosa*, the scales also are separated weakly from the apical part like a fork, and are dark yellow (Fig. 1e); in *H. postica,* the scales are separated from near the basal part and appear yellowish-brown (Fig. 1f); in *H. contaminata* and *H. nigrirostris* the scale shape is simple and resembles a "V" (Figs. 1g-h).

Under the scanning electron microscope

The ultrastructure of scales that cover the body appear different from one another. In *Brachypera dauci*, the scales are oval and wide like a leaf, and the surface has many longitudinal processes that are densely chitinized, and the apical edge is serrated (Fig. 2a); in *B. lunata*, scales are almost oval, the apical parts are wide, the surface knit, and the scales are connected at their base by fibers which resemble a net (Fig. 2b); in *Hypera rumicis*, the scales are longitudinal, the apical edge is concave, and the surface has many longitudinal processes (Fig. 2c); in *H. plantaginis*, the scales resemble a tulip, widened basally and separated into two projections apically, and the surfaces of the scales have longitudinal processes (Fig. 2d); in *H. farinosa*, the scales are like a plate widened from the middle, and the apical edge of the scales have three projections (Fig. 2e); in *H. postica*, the scales also resemble two long projections (Fig. 2f); in *H. contaminata*, the scales separate into two main projections basally, and the surface has weak longitudinal processes (Fig. 2g); in *H. nigrirostris*, the scales separate into two projections basally, but the surface is smooth (Fig. 2h).

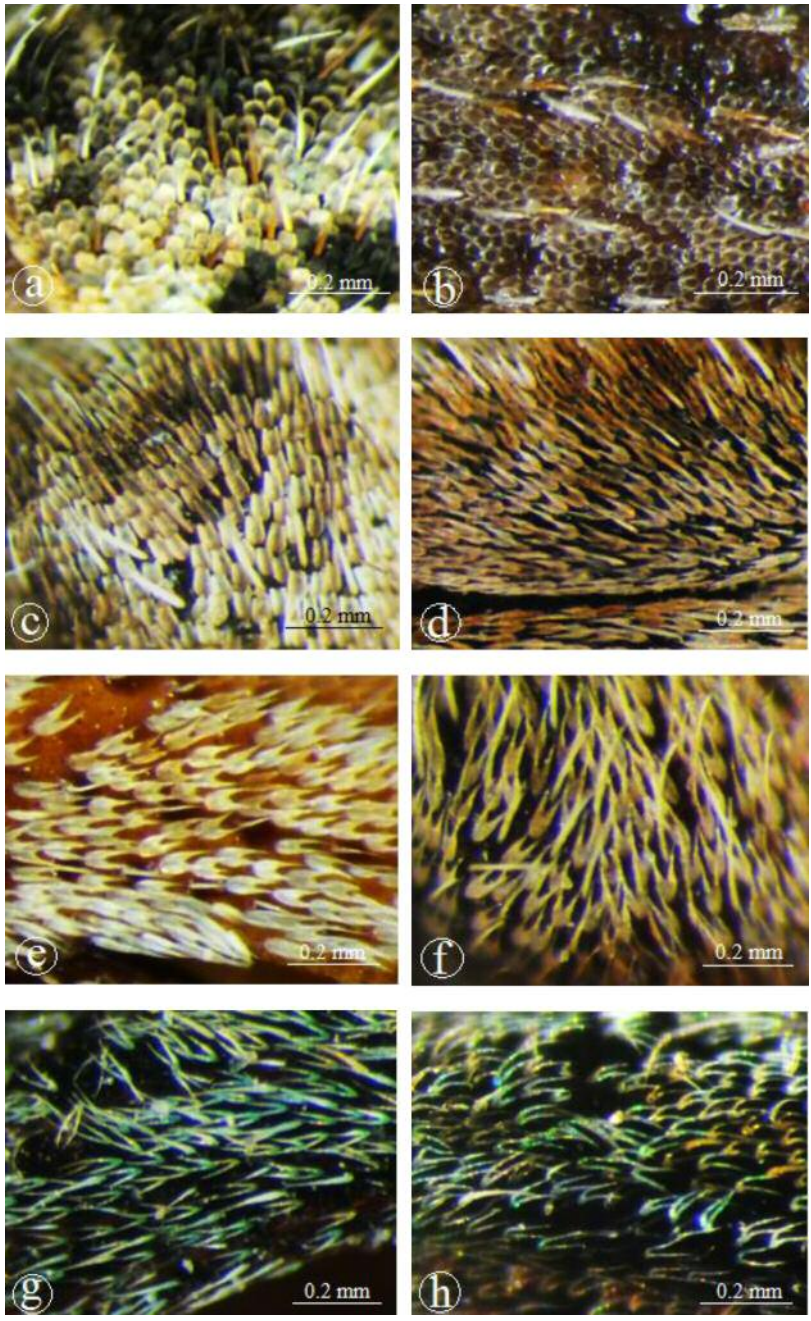

Fig. 1. Photos of scales in light microscope; a- *Brachypera dauci*, b- *B. lunata,* c- *Hypera rumicis*, d- *H. plantaginis*, e- *H. farinosa*, f- *H. postica,* g- *H. contaminata,* h- *H. nigrirostris.*

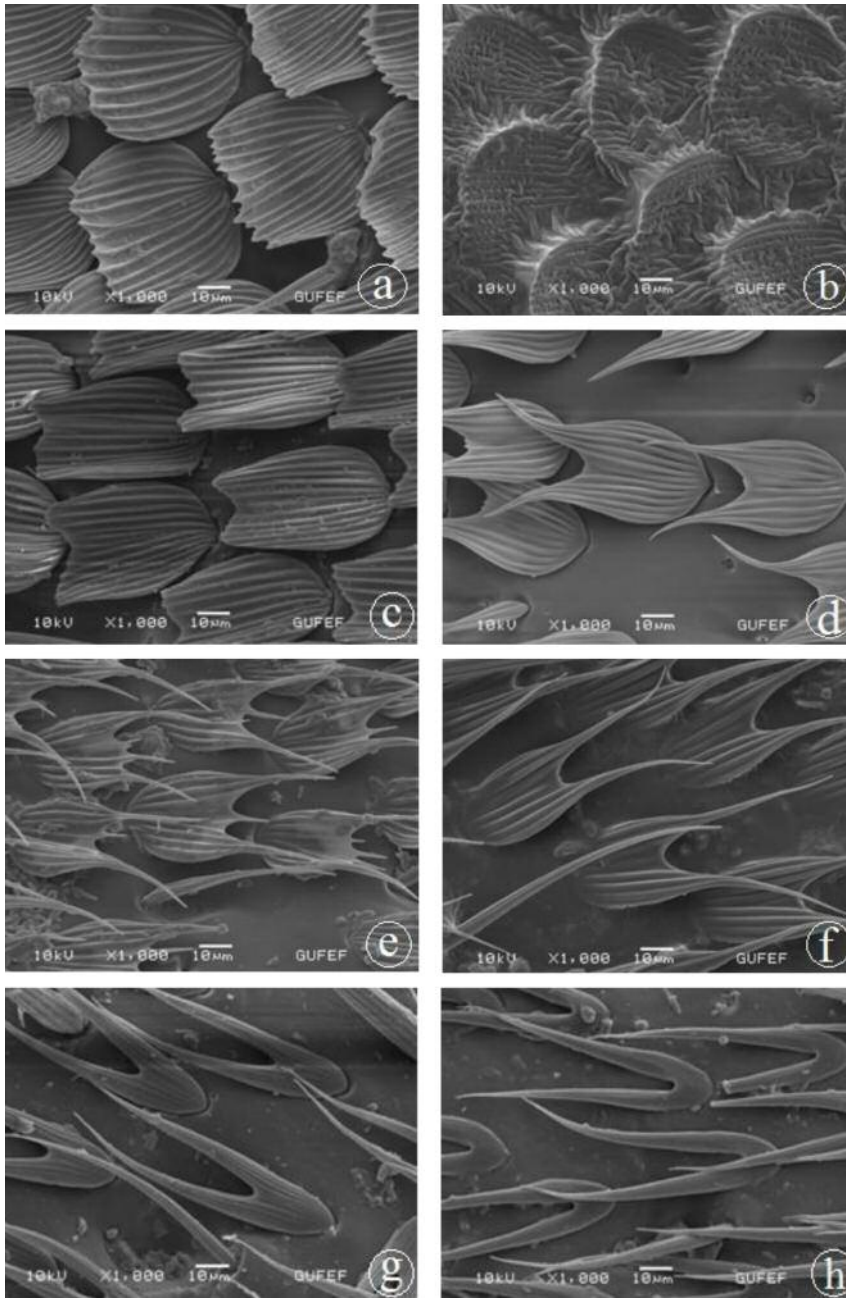

Fig. 2. SEM photos of scales at x1000 magnification; a- *Brachypera dauci*, b- *B. lunata,* c- *Hypera rumicis*, d- *H. plantaginis*, e- *H. farinosa*, f- *H. postica,* g- *H. contaminata,* h- *H. nigrirostris.*

DISCUSSION

In this study, the scales of species in *Brachypera* Capiomont, 1868 and *Hypera* Germar, 1817 (Coleoptera: Curculionidae) were examined with light and scanning electron microscope in order to determine the differences and similarities among them. Under the light microscope, the shape and the color of scales appear similar, especially those of *Brachypera dauci* and *B. lunata* (Figs. 1a, b); *Hypera plantaginis*, *H. farinosa* and *H. postica* (Figs. 1d, e, f); *H. contaminata* and *H. nigrirostris* (Figs. 1g, h) are similar in terms of shape and color of the scales.

Under SEM (x1000 magnifications), surface morphology of scales are clearly different for all species. In *Brachypera dauci* and *B. lunata*, although the scales are similar in light microscope, the ultrastructure of scales was different. In *Hypera*, the scales in all species, except *H. rumicis*, resembled a fork that either separated medially (*H. plantaginis*, *H. farinosa* ad *H. postica*) (Figs. 2d, e, f) or basally (*H. contaminata* and *H. nigrirostris*) (Figs. 2g, h). However, there are distinct differences between the species.

Several authors have used the structures of scales in Curculionidae (Coleoptera). Hoffmann (1954) gives morphology of the scales in several species of *Hypera* genus. But, drawings are too simple to be taxonomically sufficient. Because specimens when examined under a light microscope have ambiguous characteristics, it is important to use an alternate method of comparing species. Pesarini (1980) describes several species of *Phyllobius* (Entiminae) genus and also Caldara (1990) describes several species of *Tychius* (Curculioninae) genus with light microscope, but they refer simply to general morphology. Erbey and Candan (2013) describe scales with light and scanning electron microscope in four species of *Tychius* genus. They stated that the morphology (the shape and the color) of scales are similar under the light microscope, but under the scanning electron microscope, the surface morphologies of scales have many differences.

As a result, although appearing similar under the light microscope, there are differences when the elytra are examined under SEM. Electron microscopy, micrography illustrates the details which help to separate similar species morphologically. We think that electron microscope micrography can be used in many groups where the scales resemble each other in terms of shape and color.

LITERATURE CITED

Alonso-Zarazaga, R. S. and C. H. C. Lyal. 2002. A World Catalogue of Families and Genera of Curculionoidea (Insecta: Coleoptera). Zootaxa. 63: 1-37.

Caldara, R. 1984. Revision della *Sibinia* palearctiche (Coleoptera, Curculionidae). Memorie della Societa Entomologica Italiana. 63: 24-105.

Caldara, R. 1990. Revision taxonomica della specie paleartiche del genere *Tychius* Germar (Coleoptera: Curculionidae). Memorie della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano. 25: 53-218.

Dieckmann, L. 1980. Beitrage zur Insektenfauna der DDR: Coleoptera-Curculionidae (Brachycerinae, Otiorrhynchinae, Brachyderinae). Beitrage zur Entomologia. Berlin. 30: 145-310.

Erbey, M. 2010. Taxonomic and morphologic studies on the family Curculionidae (Coleoptera) of Bolkar Mountains. Doctorate thesis, Institute of Science, Gazi University. Ankara. 1-462.

Erbey, M. and S. Candan. 2013. Fine structure of the scales of *Tychius* Germar, 1817 (Coleoptera: Curculionidae) species. Acta Zoologica Bulgarica. 65: 413-416.

Hoffmann, A. 1954. Fauna de France, Coleopteres, Curculionides, deuxieme partie. Paris. 59: 487-1208.

Kuschel, G. 1995. A phylogenetic classification of Curculionoidea to families and subfamilies. Memoirs of the Entomological Society of Washington. 14: 5-33.

Marvaldi, A. E. and A. A. Lanteri. 2005. Key to higher taxa of South American weevils based on adult characters (Coleoptera: Curculionidea). Revista Chilena de Historia Natural. 78: 65-87.

Morimoto, K. 1962. Comparative morphology and phylogeny of the superfamily Curculionoidea of Japan. Journal of the Faculty of Agriculture. 11: 331-373.

Pesarini, C. 1980. Le specie paleartiche occidentalli della tribü Phyllobiini (Coleoptera: Curculionidae). Bolletino Zoologia Agraria e di Bachicoltura. Ser. II, 15: 49-230.

Sert, O. 1995. The taxonomic studies on Curculionidae (Coleoptera) family in Central Anatolia (Turkey). Institute of Science, Hacettepe University, Ankara. 1-184.

Skuhrovec, J. 2005. Descriptions of larvae of the tribe Hyperini (Coleoptera: Curculionidae): I. Mature larvae of the nominotypical subgenus *Hypera*. Acta Societatis Zoologicae Bohemicae. 68 (2004): 245-280.

Skuhrovec, J. 2006. Descriptions of larvae of the tribe Hyperini (Coleoptera: Curculionidae): II. Mature larvae of the subgenera *Antidonus*, *Eririnomorphus*, *Dapalinus* and *Boreohypera* of the genus *Hypera*. Entomologica Basiliensia et Collectionis Frey. 28: 365-396.

Skuhrovec, J. 2007. Descriptions of larvae of the tribe Hyperini (Coleoptera: Curculionidae): III. Mature larvae of the genus *Donus*. Zootaxa. 1606: 1-28.

Skuhrovec, J. 2008. Taxonomic changes within the tribe Hyperini (Coleoptera: Curculionidae), Acta Entomologica Musei Nationalis, Pragae. 48(2): 677-690.

Ter-Minasyan, M. E. 1978. Weevils of the subfamily Cleoninae in the fauna of the USSR. tribe Lixini. Zoological Instutite, Academy of Sciences of the USSR. 1-166.

Ter-Minasyan, M. E. 1988. Weevils of the subfamily Cleoninae in the fauna of the USSR tribe Cleonini, classifications of the fauna USSR. Zoological Instutite, Academy of Sciences of the USSR, Nauka Press, Leningrad. 155: 1-234.

Thompson, R. T. 1992. Observations on morphology and classification of weevils (Coleoptera, Curculionidea) with a key to major groups. Journal of Natural History. 26: 835-891.