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A STUDY ON THE COVERING SETAE OF TWO JUMPING SPIDERS (ARANEAE: SALTICIDAE) IN TÜRKİYE

Yulduz SABUROVA [1], **Osman SEYYAR** [1,*], Hakan DEMİR [1], Fatma SEYYAR [1]

[1] *Niğde Ömer Halisdemir University, Biology Department, Niğde, Türkiye*

**** Corresponding Author:*** *osmanseyyar@hotmail.com*

ABSTRACT

Spiders exhibit a remarkable diversity of morphological and sensory adaptations, among which setae (hair-like structures) play a critical role. Setae are multifunctional, serving as mechanoreceptors, chemoreceptors, and thermoreceptors, enabling spiders to detect vibrations, air currents, chemical signals, and temperature changes in their environment. These structures are integral to prey capture, predator avoidance, and communication. Additionally, specialized setae, such as trichobothria, are highly sensitive to minute air movements, aiding in the detection of approaching prey or predators. Setae also contribute to locomotion, adhesion, and silk handling, highlighting their evolutionary significance. In this study, Scanning Electron Microscopy (SEM) was used to determine the morphology of the setae on the opisthosoma of *Salticus zebraneus* (C.L.Koch, 1837) and *Heliophanus kochii* Simon, 1868 species of the family Salticidae. As a result of the this study, it was revealed that *Salticus zebraneus* (C.L.Koch, 1837) has lanseolate type setae while *Heliophanus kochii* Simon, 1868 has spatulate type setae. This is the first study to determine the setae morphology of these two species distributed in Türkiye.

Keywords: Araneae, *Heliophanus kochii*, Salticidae, *Salticus zebraneus*, Setae morphology, Türkiye.

1 INTRODUCTION

Türkiye has a rich spider diversity due to its geographical location and diverse ecosystems. Serving as a bridge between Europe, Asia and Africa, Türkiye offers an ideal habitat for spider species with its different climatic zones and habitats. The spider fauna of Turkey includes many families such as Lycosidae (wolf spiders), Salticidae (jumping spiders), Araneidae (web spiders) and Theridiidae (comb-footed spiders). These species play important

ecological roles in both terrestrial and aquatic ecosystems, balancing predator-prey dynamics and contributing to biodiversity conservation. Recent research has focused on the taxonomy, ecology and behavior of spider species in Türkiye [1].

Spiders, belonging to the class Arachnida, are fascinating arthropods known for their intricate anatomy and remarkable adaptations. One of their most distinctive features is the presence of setae, or specialized hairs, that cover their bodies and appendages. These setae are not merely superficial; they play a crucial role in the spider's survival, aiding in sensory perception, locomotion, and even communication. Among the various types of setae, covering setae are particularly noteworthy. These fine, often densely packed hairs form a protective layer over the spider's exoskeleton, providing insulation, reducing water loss, and offering camouflage by breaking up the spider's outline. Additionally, covering setae can serve as a defense mechanism, deterring predators by making the spider appear larger or less palatable [2].

The outer part of the body of all spiders is covered by an exoskeleton made of chitin. On this exoskeleton are structures called setae, which perform various tasks. Setae are usually found on the abdomen, but can also be found on the prosoma, legs, palps and spinnerets. Linear setae are usually associated with a receptor cell and function as sensory organs or mechanoreceptors, while the scale-like ones are not associated with any receptor cell and only serve as a covering [3].

Among all spider families, at least one setae type was found in Anyphaenidae, Araneidae, Corinnidae, Gnaphosidae, Heteropodidae, Liocranidae, Lycosidae, Oxyopidae, Philodromidae, Pisauridae, Salticidae, Thomisidae and Uloboridae. Studies on the seta morphology of ground spiders revealed the presence of 10 different cover setae and it was stated that the diversity of these seta morphologies can be used in the classification of spiders at the genus and species level [4].

Members of the family Salticidae are one of the richest taxa of spiders in terms of biodiversity. This family have 689 genera and 6804 species in the world [5], while they are represented by 41 genera and 152 species in Türkiye [6], [7]. They are distributed in very different habitats all over the the world. The bodies of most members of this family are covered with cuticular setae (Figure 1). Although these cuticular setae are usually found the whole body but in some speciees they are localized only in a certain part of the body. It is assumed that setae serve functions such as thermoregulation, body defense and communication. Most Salticidae

members are known to have different colors and patterns. Setae play an important role in the appearance of these colors and patterns. These setae can be either single or multiple morphologies on jumping spiders. Generally, these setae can be grouped into 3 types: lanceolate, spatulate and plumose. Sometimes more than one setae morphology can be found in jumping spider with different colors on the body [8].

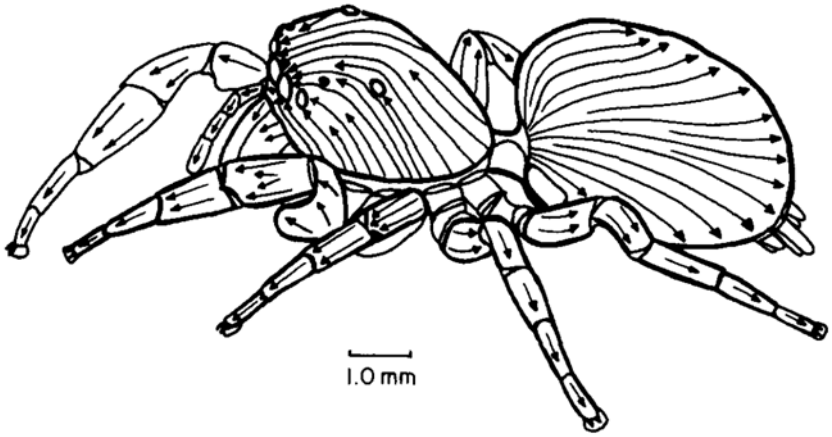

Figure 1. Orientation of setae on the body of a member of the family Salticidae [8].

The purpose of this study is to determine the setae morphology of *Salticus zebraneus* (C.L.Koch, 1837) and *Heliophanus kochii* Simon, 1868 species in the family Salticidae using Scanning Electron Microscopy (SEM).

2 MATERIAL AND METHOD

2.1 Collecting spider samples

Salticus zebraneus (C.L.Koch, 1837) and *Heliophanus kochii* Simon, 1868 specimens belonging to the family Salticidae were collected from the central campus of Niğde Ömer Halisdemir University during field studies in 2024. Spider specimens were collected from grassy areas or ground-level herbaceous plants using by sweeping with a sweep net (Figure 2). Also, these species specimens were collected from on soil, stones and bark by using hand collection method. 3-5 adult spider specimens of both species were collected from the university campus.

2.2 Scanning Electron Microscopic Examination

Scanning Electron microscope in the Central Research Laboratory of Niğde Ömer Halisdemir University was used to determine the setae morphologies of the species. Body parts

of both species, especially the abdomen, were placed on stacks and the surface of the specimens was coated using a Sputter Coater (Cressingto Auto 108). The surface morphology of the coated specimens was photographed using EVO LS 10 ZEISS device (Figure 3).

Figure 2. Sweep net for spider collection

Figure 3. Scanning Elecron Microscopy (Zeiss Marka evo 40)

3 RESULTS

The setae morphology of *Salticus zebraneus* (C.L.Koch, 1837) and *Heliophanus kochii* Simon, 1868 species belonging to the family Salticidae was revealed in this study. Using Scanning Electron Microscopy (SEM), it was determined that *Salticus zebraneus* (C.L.Koch, 1837) had lanceolate setae and *Heliophanus kochii* Simon, 1868 had spatulate setae (Figures 4 and 5).

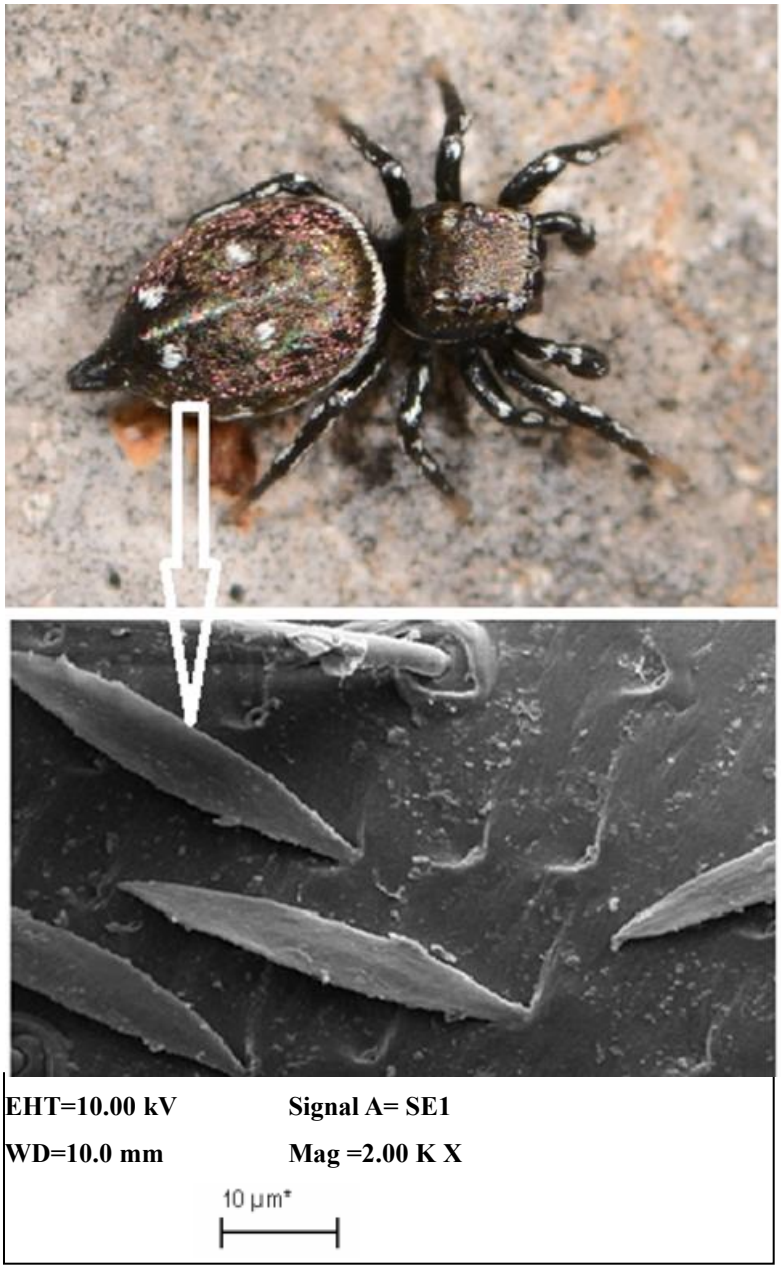

Figure 4. Spatulate setae of Heliophanus kochii Simon, 1868

Figure 5. Lanseolate type setae of Salticus zebraneus (C.L.Koch, 1837)

4 DISCUSSIONS AND CONCLUSION

The setae morphology of *Salticus zebraneus* (C.L.Koch, 1837) and *Heliophanus kochii* Simon, 1868 species belonging to the family Salticidae examined by Scanning Electron Microscopy were lanceolate and, spatulate respectively. The setae morphology of both jumping spider species *Salticus zebraneus* (C.L.Koch, 1837) and *Heliophanus kochii* Simon, 1868, was revealed for the first time in this study.

In the literature, *Salticus scenicus* (Clerck, 1757), a species close to *Salticus zebraneus* (C.L.Koch, 1837) whose setae morphology was studied in our study. The setae morphology of the *Salticus scenicus* (Clerck, 1757) was previously studied by Hill (1979) and our data are in accordance with this study. This situation shows that the setae morphology of the species of the genus *Salticus* is uniform and lanseolate morphology.

Studies on the covering setae of spiders have mostly been concentrated on members of the Salticidae, Oxyopidae and Gnaphosidae families. Considering the spider families studied, three main types setae are common in spiders, lanceolate, spatulate and plumose. Studies on the families Salticidae and Oxyopidae have suggested that seta morphology may be a taxonomic character for the classification of members of these families into genera and even species [1], [8]. The classification of genera and species of the family Salticidae is mostly based on the morphology of genital structures.

Proszynski recently attempted to analyse the relationship between Nearctic and Palaearctic salicid genera based solely on male and female genitalia [9]. Unfortunately, the genitalia of salticids are sometimes insufficient for the taxonomic separation of species and have led to the need for additional evidence to support phylogeny based on genitalia. The use of setae as an additional taxonomic character in genus and species descriptions of salicid spiders may help to establish phylogenetic relationships more clearly.

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Conflict of Interest Statement

There is no conflict of interest between the authors.

Statement of Research and Publication Ethics

The study is complied with research and publication ethics.

Artificial Intelligence (AI) Contribution Statement

This manuscript was entirely written, edited, analyzed, and prepared without the assistance of any artificial intelligence (AI) tools. All content, including text, data analysis, and figures, was solely generated by the authors.

Contributions of the Authors

Y. Saburova: Resources, Methodology, Research

O. Seyyar: Writing – original draft, Writing – review & editing, Visualization, Validation,

H. Demir: Writing – original draft, Visualization, Writing – review & editing

F. Seyyar: Resources, Methodology, Visualization.

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