

**Orijinal araştırma (Original article)**

**A review of the genus *Neoacanthococcus*  
Borchsenius (Hemiptera: Coccoidea:  
Eriococcidae) with a description of  
*Neoacanthococcus atlihani* sp. nov. in Turkey<sup>1</sup>**

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**Summary**

A new species of Eriococcidae (Hemiptera: Coccoidea), *Neoacanthococcus atlihani* Kaydan & Kozár sp. nov., collected on *Tamarix* sp. from Turkey is described and illustrated based on the adult female. A redescription and illustration of the adult female of *Neoacanthococcus tamaricicola* Borchsenius, 1948, are given, and a key for *Tamarix*-feeding eriococcids in the Palaearctic zoogeographic region is provided.

**Key words:** Eriococcidae, *Neoacanthococcus*, *Tamarix* sp., Turkey.

**Anahtar sözcükler:** Eriococcidae, *Neoacanthococcus*, *Tamarix* sp., Türkiye.

**Introduction**

The family Eriococcidae (felt scales) is the fourth richest, and presumably one of the oldest families of Coccoidea (Hoy, 1962, 1963; Miller & Kosztarab, 1979; Koteja, 1985; Miller & Miller, 1992; Foldi, 1997; Miller & Gimpel, 2000; Gullan & Cook, 2007). However, in comparison with most other scale insect families, our taxonomic knowledge on this family is far from complete. It has been postulated that this family or family group arose in temperate Antarctica during the Cretaceous period (Hoy, 1962) and the generic and species richness of eriococcids in the Southern Hemisphere also suggests a southern origin for the family (Williams 1984). With the exception of the work by Cook & Gullan

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(2004), the Eriococcidae have not been well explored on a world basis, so that the number of descriptions of new genera and species is continuously increasing (Miller & Gimpel, 2000; Ben-Dov et al., 2009; Kozár, 2009). Similar trends were shown earlier by Kozár & Drozdják (1986) for the Palaearctic region, from which 198 species of Eriococcidae are known now (Kozár, 2009).

The scale insect fauna of Turkey was studied first in detail by Bodenheimer (1953), who recorded six species of Eriococcidae. Since then no further studies were undertaken until Kaydan et al. (2001) recorded two eriococcid species new to the Turkish scale insect fauna from Middle Anatolia. Ülgentürk et al. (2003) have recorded 11 eriococcid species, nine of which were new for the Turkish fauna. In the last species list of Turkish scale insects (Kaydan et al., 2007), only 20 eriococcid species in three genera were among the 267 scale insect species recorded. More recently, Kaydan & Kozár (2008) have described two new genera (*Borchseniococcus* Kaydan & Kozár and *Kotejacoccus* Kaydan & Kozár), and two new species (*Borchseniococcus duzgunesae* Kaydan & Kozár and *Kotejacoccus turcicus* Kaydan & Kozár), and provided further faunistic data for this group (five new records of eriococcid species) from Eastern Anatolian region. Even more recently, Erkişçi et al. (2010) described a new felt scale from *Proteriococcus* genus on *Laurus nobilis* L. (Lauraceae). With these studies, the number of eriococcid species in Turkey reached 28. Thus, the frequency of new discoveries suggests that many new species are waiting to be discovered in Turkey. Recently an undescribed eriococcid species was discovered feeding on *Tamarix* in eastern Turkey, and this is the main subject of this paper.

*Tamarix* species (Tamaricaceae), commonly also called tamarisk, or salt cedar, are evergreen or deciduous shrubs or trees growing to 1–18 m in height and forming dense thickets (Baum, 1978). *Tamarix* is common especially in salty places and near watercourses in Turkey. Although 68 species (in eight families and 40 genera) of scale insects have been recorded on *Tamarix* species (Ben-Dov et al., 2009), there are only four eriococcid species. According to Myartseva (2000), 14 scale insect species (in four families and nine genera) have been recorded on *Tamarix* species in Middle Asia, where these plants are particularly abundant. Three of these scale insect species were eriococcids, namely *Acanthococcus orbiculus* Matesova, *A. gracilispinus* Borchsenius & Matesova and *Neoacanthococcus tamaricicola* Borchsenius. In Turkey, Kaydan et al. (2007) listed five scale insect species (in three families and five genera) on *Tamarix* species, but no eriococcid species had been recorded on salt cedars at that time.

The adult female of this newly recognized eriococcid species from Turkey shares a number of morphological features with the adult female of

*N. tamaricicola*, originally described off *Tamarix* (Borchsenius, 1949) but also found on *Polygonum* (Polygonaceae) (Hoy, 1963). Currently, *Neoacanthococcus* Borchsenius is a monotypic genus known only from Turkmenistan (Ben-Dov et al., 2009).

Thus, the aims of this work are to: (i) describe the new species of eriococcid collected on *Tamarix* sp. in the eastern part (Iğdır) of Turkey, (ii) revise the small genus *Neoacanthococcus* and (iii) prepare a key for eriococcid species living on salt cedars in the Palaearctic region.

## Material and Methods

The scale insect samples were collected from Iğdır in Eastern Turkey. Specimens were collected on pieces of the host plant, placed in a plastic bag and taken to the laboratory for examination. Specimens were prepared for light microscopy using the methods of Kosztarab & Kozár (1988). Morphological terms follow those of Williams (1985), Kosztarab & Kozár (1988), Foldi & Kozár (2007), Kozár et al. (2007), Hodgson & Trencheva (2008) and Kaydan & Kozár (2008). Measurements and counts were taken from all specimens of the new species. Data given in parentheses refer to the holotype; the size ranges provided are from measurements of all type specimens, including the holotype.

In the present paper, the generic concepts used are those of Borchsenius (1949), Danzig (1980), Tereznikova (1981), Kosztarab & Kozár (1988), Tang & Hao (1995) and Köhler (1998), which are based mostly on those of Signoret (1875).

For comparison, the original description and drawing of Borchsenius (1948), as well as the lectotype female of *N. tamaricicola* were studied (Type depository: St. Petersburg: Zoological Museum, Academy of Science, RUSSIA).

Both alcohol-preserved and slide-mounted materials of the new species have been deposited in the Plant Protection Department, Faculty of Agriculture, Yüzüncü Yıl University, Van, TURKEY (CCVT).

## Results and Discussion

### *Neoacanthococcus* Borchsenius, 1948

**Type species:** *Neoacanthococcus tamaricicola* Borchsenius, 1948

#### **Generic diagnosis:**

Body elongate oval. Antennae 7 segmented. Frontal lobes present. Anal lobes medium long, hardly sclerotized.

**Venter:** Labium 3-segmented; basal segment well developed with 2 pairs of setae; apical segment with 6 pairs of equally long, strong setae. Stylet loop long, reaching to level with area between metathoracic legs. Legs long, with tibia longer than tarsus; tibia with four setae (median seta absent), meso- and metathoracic coxae with spinulae, and metathoracic coxa also with small pores on femur; tarsus with 1 sensory pore; claw of all legs with denticle. Each trochanter with 2 pores (campaniform sensilla) on each side. Claw digitules shorter than claw. Claw and tarsal digitules hair-like, not capitate. Body setae short and hair-like; also with enlarged setae submarginally in one species. Multilocular pores each with 3 to 5 loculi, present throughout. Macrotubular ducts of one size. Both loculate pores and macrotubular ducts present in moderate numbers, most abundant submarginally but also scattered throughout and scattered over derm. Microtubular ducts with oval sclerotized orifice, few on margin. Cruciform pores absent.

**Dorsum:** Anal lobes well developed, dorsal surface of each lobe with 3 spine-like setae, ventral surface of each lobe with a long apical seta and one shorter subapical seta. Anal ring sclerotised well developed, with anal ring pores in one row and with 8 setae, each seta smaller or longer than diameter of ring. Body setae enlarged, of conical type, blunt at apex and curved slightly mainly distributed in rows across segments. Quinquelocular pores scattered on abdominal segments (generally in rows), thorax and head. Macrotubular ducts heavily sclerotized, some with inner gland ductule ending in a simple sclerotized hole; terminal gland simple. Microtubular ducts numerous, short with a small oval dermal orifice. Cauda present.

**Comment:** *Neoacanthococcus* genus differs from most of the genera of Palaearctic region by presence of discoidal pores on the dorsum. The genera having discoidal pores on the dorsum as *Greenisca* Borchsenius, *Kaweckia* Koteja, *Neokaweckia* Tang & Hao lives only on grasses, the *Ovaticoccus* Kloet has anal ring without pores and undeveloped anal lobes.

***Neoacanthococcus tamaricicola* Borchsenius, 1948 (Figure 1)**

**Material examined: Lectotype:** Adult female, TURKMENISTAN: Kara-Kala, Turkmenian Quarantine Inspection, on *Tamarix* sp., 08.x.1936. Type depository: St. Petersburg: Zoological Museum, Academy of Science, RUSSIA.

**Adult female**

**Live appearance:** Adult female body oval (Borchsenius, 1949)

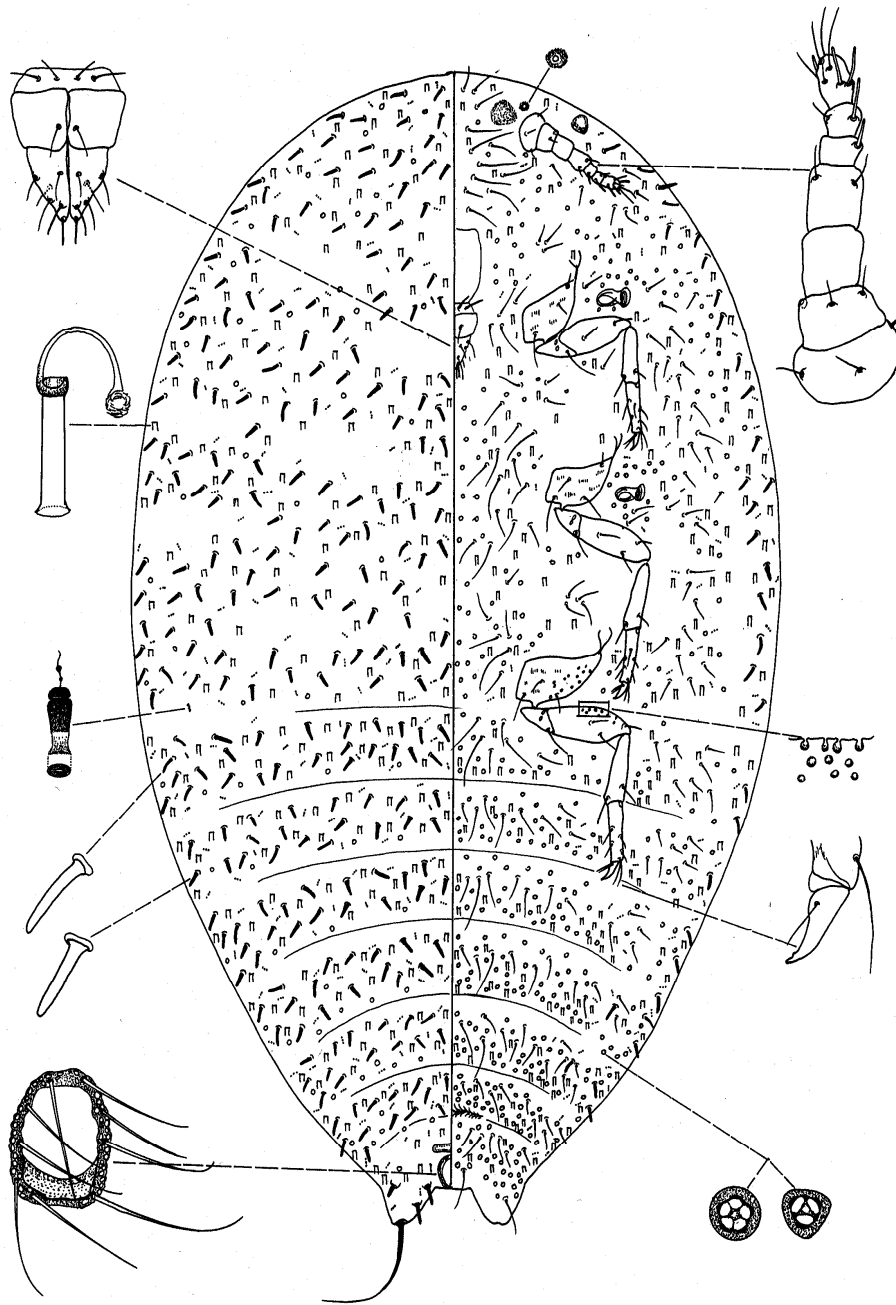


Figure 1. *Neacanthococcus tamaricicola* Borchsenius 1948.

Body elongate oval, 2.6 mm long and 1.4 mm wide. Antennae 7 segmented, length of segments (in  $\mu\text{m}$ ): I: 42, II: 39, III: 46, IV: 43, V: 20, VI: 20, and VII: 38; each segment with a few, strong hair-like setae; apical segment with apical seta 40  $\mu\text{m}$  long and with 3 sensory falcate setae, each about 26  $\mu\text{m}$  long; segment VI with 1 sensory falcate seta 28  $\mu\text{m}$  long; segment V with 1 sensory falcate seta 18  $\mu\text{m}$  long. Frontal lobes and sclerotized frontal tubercles present. Eyes situated on venter near margin. Anal lobes strongly developed, each with 3 enlarged setae plus with 2 microtubular ducts on dorsal surface; apical seta 150  $\mu\text{m}$ ; ventral subapical hair-like seta 60  $\mu\text{m}$  long.

**Venter:** Labium 161  $\mu\text{m}$  long. Legs well developed: lengths of segments and digitules of prothoracic legs (in  $\mu\text{m}$ ): coxa 91, trochanter 82, femur 173, tibia 149, tarsus 134 and claw 46; tarsal digitules 50, claw digitules 20; lengths of segments and digitules of mesothoracic legs (in  $\mu\text{m}$ ): coxa 103, with spinulae, trochanter 77, femur 185, tibia 173, tarsus 144 and claw 48, tarsal digitules 50, claw digitules 20; lengths of segments and digitules of metathoracic legs (in  $\mu\text{m}$ ): coxa 108, trochanter 91 (70–100), femur 180, tibia 175, tarsus 151 and claw 48, tarsal digitules 53, claw digitules 22. Metathoracic coxae with spinulae and translucent pores on ventral surface and also with pores on femur. Tibia each with 4 setae (median seta absent), tarsi each with 4 setae. Multilocular pores each 5–6  $\mu\text{m}$  in diameter and with 3–5 loculi, distributed in sparse rows on all abdominal and thoracic segments and also head. Diameter of anterior spiracular peritreme 43  $\mu\text{m}$ . Derm with a sparse covering of scattered flagellate hair-like setae. Enlarged setae situated on submargin in 2 or 3 rows. Macrotubular ducts of one size, each 5–7  $\mu\text{m}$  wide and 20–22  $\mu\text{m}$  long, distributed on submargin of abdominal segments, and scattered on thorax and head. Microtubular ducts present marginally but few, 5–6  $\mu\text{m}$  long. Cruciform pores absent.

**Dorsum:** Dorsal enlarged setae spine-like, long, each 18–31  $\mu\text{m}$ ; setae on thorax, head and anterior abdominal segments slightly larger than setae on posterior 2 or 3 abdominal segments; arranged in transverse bands across each body segment, rows irregular on head. Multilocular pores each 5–6  $\mu\text{m}$  in diameter and with 3–5 loculi, distributed sparsely on all abdominal and thoracic segments and on head. Macrotubular ducts each 5–7  $\mu\text{m}$  wide and 20–22  $\mu\text{m}$  long, scattered throughout dorsum, generally in segmental bands. Microtubular ducts, each 6  $\mu\text{m}$  long with oval dermal orifice, scattered over dorsum. Anal ring strongly sclerotized, 105  $\mu\text{m}$  long, and 75 wide, with 8 setae according to Borchsenius (1949), but studied paratype with 4 on one side and 5 on other side, each 62–100  $\mu\text{m}$  long, and with about 40 pores on inner side of ring in total; anal ring situated on margin of dorsum.

**Comment:** Danzig (1996) designated a lectotype for this species and we base the above description on this specimen.

***Neoacanthococcus atlihani* Kaydan & Kozár sp. nov. (Figure 2)**

**Material examined: Holotype:** Adult female, TURKEY, Iğdır- Tuzluca-Digor Road, N: 40° 07' 326", E: 043° 37' 720", 940 m altitude, on *Tamarix* sp., M.B. Kaydan, 31.viii.2005 (CCVT: 2237). Deposited in CCVT (TURKEY).

**Paratypes:** 13 adult females, same data as holotype (CCVT: 2237), 2 adult females, TURKEY, Iğdır- Tuzluca-Aralık Road, N: 39° 55' 724", E: 044° 24' 272", 830 m altitude, on *Tamarix* sp., M.B. Kaydan, 01.ix.2005 (CCVT: 2234). Paratypes are deposited in CCVT (TURKEY).

**Live appearance:** Adult females yellowish red; found at bifurcation of young branches, felt-like test not seen at collection date.

Body elongate oval, 2.16–3.48 (2.16) mm long and 1.08–2.32 (1.08) mm wide. Antenna 7 segmented, 280–295 (295)  $\mu\text{m}$ , length of segments (in  $\mu\text{m}$ ): I: 70–80 (50), II: 40–45 (40), III: 45–55 (55), IV: 55 (55), V: 22.5–35 (30), VI: 20–30 (20), and VII: 37–45 (45); each segment covered with a few, strong hair-like setae; apical segment with apical seta 45.0–47.5  $\mu\text{m}$  long; apical segment also with 3 sensory falcate setae, each 25–35  $\mu\text{m}$  long; segment VI with 1 sensory falcate seta 25.0–27.5  $\mu\text{m}$  long, segment V with 1 sensory falcate seta 20  $\mu\text{m}$  long (setae on apical segments of holotype all broken, description of antennae is given using paratypes). Frontal lobes present. Eyes situated on venter near margin. Anal lobes strongly developed, each with 3 enlarged setae, each 22.5–40.0  $\mu\text{m}$  plus 2 or 3 microtubular ducts on dorsal surface; apical seta 170 (160–212.5)  $\mu\text{m}$ ; ventral hair-like subapical seta 80 (70–75)  $\mu\text{m}$  long.

**Venter:** Labium 195–220 (200)  $\mu\text{m}$  long, 110–140 (140)  $\mu\text{m}$  wide, median setae on apex of labium 25–35 (30)  $\mu\text{m}$  long. Legs well developed; lengths of segments and digitules of prothoracic legs (in  $\mu\text{m}$ ): coxa 110–125 (125), trochanter 70–80 (75), femur 170–195 (195), tibia 130–160 (160), tarsus 140–155 (155) and claw 40.0–47.5 (45), trochanter + femur 250–270 (270), tibia + tarsus 270–300 (300), tarsal digitules 52.5–62.5 (55), claw digitules 17.5–25.0 (20); lengths of segments and digitules of mesothoracic legs (in  $\mu\text{m}$ ): coxa 120–130 (125), trochanter 75–90 (75), femur 180–190 (190), tibia 160–190 (170), tarsus 140–170 (160) and claw 45–50 (45m, trochanter + femur 260–280 (280), tibia + tarsus 310–350 (325), tarsal digitules 50–60 (50), claw digitules 17.5–25.0 (20); lengths of segments and digitules of metathoracic legs (in  $\mu\text{m}$ ): coxa 140–170 (150), trochanter 70–100 (75), femur 180–205 (190), tibia 180–190 (185), tarsus 160–185 (170) and claw 45–50 (50), trochanter + femur 270–290 (280), tibia + tarsus 350–390 (360), tarsal digitules 55–60 (60), claw digitules 17.5–22.5 (17.5). Meso- and metathoracic coxae each with spinulae on ventral surface and translucent pores on metathoracic coxa and femur. Tibiae each with 4 setae (median seta absent), tarsi each with 5 setae. Length of spiracles 95 (80–100)  $\mu\text{m}$ ; diameter of spiracular peritreme 40–45

(40)  $\mu\text{m}$ , posterior spiracles slightly larger than anterior. Derm with a sparse covering of scattered flagellate hair-like setae, each 17.5–137.5  $\mu\text{m}$  long. Enlarged setae, situated on submargin in 2 or 3 rows, each 17.5–25.0  $\mu\text{m}$  long. Multilocular pores each 6.0–7.5  $\mu\text{m}$  in diameter and with 3–5 loculi, distributed in sparse bands on all abdominal and thoracic segments and head. Macrotubular ducts of one size, each 6–9  $\mu\text{m}$  wide and 12.5–20.0  $\mu\text{m}$  long, present on submargin of posterior abdominal segments, and scattered elsewhere on abdomen, thorax and head. Microtubular ducts sclerotized, with oval orifice, present on margin but scarce, 6.0–7.0  $\mu\text{m}$  long; cruciform pores absent.

**Dorsum:** Marginal dorsal setae spine-like, long, each 27.5–37.5  $\mu\text{m}$ , not forming a marginal row and not strongly differentiated from dorsal setae; other dorsal setae conical, spine-like, each seta 17.5–27.7  $\mu\text{m}$  long, those on thorax, head and anterior abdominal segments slightly larger than setae on posterior 2 or 3 abdominal segments; arranged in transverse rows across each body segment, rows irregular on head. Multilocular pores each 7.0–7.5  $\mu\text{m}$  in diameter and with 5 loculi, distributed in sparse bands on all abdominal and thoracic segments and on head. Macrotubular ducts, each 8–10  $\mu\text{m}$  wide and 20–25  $\mu\text{m}$  long, scattered throughout dorsum, generally in segmental bands. Microtubular ducts, each 6.0–7.5  $\mu\text{m}$  long with oval dermal orifice, scattered over dorsum. Anal ring strongly sclerotized, with 17–27 pores on each inner side, 90 (90)  $\mu\text{m}$  in diameter, with 8 setae, each 85–125  $\mu\text{m}$  long; anal ring situated on margin of dorsum. Cauda present, not well seen.

**Comment:** The adult female of *N. atlihani* is remarkable for a species in the family Eriococcidae in having the following combination of character states: (i) many quinquelocular pores on dorsum, including in bands on abdominal segments, (ii) short hair-like claw digitules, (iii) claw and tarsal digitules not capitate (iv) large number of enlarged marginal setae on venter and dorsum, (v) only one ventral subapical seta on each anal lobe, (vi) four setae on each tibia, and (viii) apical segment of labium with 6 pairs of setae. *N. atlihani* resembles *N. tamaricicola* in having most of the above mentioned features but differs from *N. tamaricicola* by having: (i) a larger number of marginal setae on the venter and dorsum, (ii) enlarged setae on abdominal segment VII numbering fewer than 20 (25 in *N. tamaricicola*), (iii) much larger number of quinquelocular pores on dorsum, and (iv) larger legs and labium. *N. atlihani* is similar to *Proteriococcus gracilispinus* and *P. orbiculus*, both of which live on *Tamarix* spp., in having: (i) hair-like claw and tarsal digitules, (ii) an oval orifice to the microtubular ducts, (iii) four setae on each tibia, (iv) frontal lobes and (v) an anal cauda. However *N. atlihani* differs from both of the above species, in having (characters of *Proteriococcus* in brackets): (i) quinquelocular pores on dorsum (absent), (ii) one subapical setae on each anal lobe (two), and (iii) only





Figure 2. *Neoacanthococcus atlihani* Kaydan & Kozár sp. nov. 2010.

spine-like setae on dorsum (two kinds of setae - both hair-like and spine-like setae on dorsum).

**Etymology:** The new species is named in honor of Prof. Dr. Remzi ATLIHAN, who has made valuable entomological studies in Eastern Anatolia in Turkey.

**Key for eriococcid species feeding on *Tamarix* spp.**

1. - Quinquelocular pores on dorsum present.....2
  - Quinquelocular pores on dorsum absent .....3
2. - Enlarged setae on dorsum of abdominal segment VII numbering more than 25; total number of quinquelocular pores on segments VII–VIII numbering fewer than 15 .....*Neoacanthococcus tamaricicola* Borchsenius
  - Enlarged setae on dorsum of abdominal segment VII numbering fewer than 20; total number of quinquelocular pores on segments VII-VIII numbering more than 30 .....*Neoacanthococcus atlihani* sp. nov.
3. - Anal ring with 5 or more pairs of setae ,.....
  - .....*Proteriococcus gracilispinus* (Borchsenius & Matesova)
  - Anal ring fewer than 5 pairs of setae ..... 4
4. - Anal ring with 4 pairs of setae; (it is a mistake from Bazarov's key) coxa with numerous small pores.....*Proteriococcus orbiculus* (Matesova)
  - Anal ring with 3 pairs of setae; coxa with large oval pores.....
    - .....*Proteriococcus pamiricus* (Bazarov)

**Özet**

***Neoacanthococcus* Borchsenius cinsinin (Hemiptera: Coccoidea: Eriococcidae) revizyonu ve cinse ait yeni bir tür *Neoacanthococcus atlihani* sp.nov.'nin tanınması**

Çalışmada *Tamarix* sp. üzerinden toplanan Eriococcidae (Hemiptera: Coccoidea) familyasına ait yeni bir eriococcid türü, *Neoacanthococcus atlihani* Kaydan & Kozár sp. nov., ergin dişiler esas alınarak tanınmış, cinse ait diğer bir tür olan *Neoacanthococcus tamaricicola* Borchsenius,1948'nin yeniden tanınması yapılmıştır. Ayrıca Palaeartic Zoocoğrafik Bölge'de *Tamarix* spp. üzerinde beslenen eriococcid türlerinin teşhis anahtarı oluşturulmuştur.

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