

**Orijinal araştırma (Original article)**

**Scanning Electron Microscopic (SEM) study of  
selected Tenuipalpidae (Acari: Prostigmata;  
*Pentamerismus*, *Aegyptobia*) from Turkey<sup>1</sup>**

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**Summary**

False spider mites (Acari: Tenuipalpidae) are flattened and red in color. They are distributed worldwide and considered as cosmopolitan pests. Some of the species are host specific, found on greenhouse plants as well as many other plants. Some of the tenuipalps, such as *Pentamerismus* sp., have been found on coniferous host plants and forest trees such as *Juniperus* sp. and *Thuja* sp. Tenuipalps puncture the epidermis of the host plants and suck out the juices with their needle-shaped mouth parts. Their damage causes leaves to turn brown and finally to wilt and die. This damage resembles that caused by spider mites. Although taxonomic characters are extensively used for the identification of tenuipalps, their ultrastructure is not sufficiently well studied.

False spider mite species were surveyed in recreational areas in Ankara, Turkey in 2008 and 2009. *Thuja* sp., *Juniperus* sp., and *Taxus* sp. were sampled and the mite species collected were identified using a light microscope. Their identification is difficult and will be discussed. The taxonomic characters of the identified species are illustrated using scanning electron microscope (SEM) micrographs. Four tenuipalp species belonging to two genera were identified: *Pentamerismus oregonensis* McGregor, 1949, *Pentamerismus taxi* (Haller, 1877), *Aegyptobia aletes* (Pritchard & Baker, 1958), and *Aegyptobia nr. cupressus* Baker & Tuttle, 1972. Some of their morphological features and world distributions are presented.

**Key words:** SEM, Tenuipalpidae, *Pentamerismus*, *Aegyptobia*, Turkey

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**Anahtar sözcükler:** SEM, Tenuipalpidae, *Pentamerismus*, *Aegyptobia*, Türkiye

## Introduction

False spider mites were described by Berlese in 1913. They are flat and red in color, distributed worldwide and considered as cosmopolitan pests. Some of the species are host specific; others are found in greenhouses, on ornamental plants and on a wide range of other plants. In Turkey some species of false spider mites of the genera *Pentamerismus* and *Aegyptobia* infest coniferous trees (Düzgüneş, 1965; Ozman & Cobanoğlu, 2001; Bayram & Çobanoğlu, 2007; Ozman-Sullivan et al., 2007; Sağlam & Çobanoğlu, 2010).

Although there are many reports on the Tenuipalpidae (Acari: Prostigmata) worldwide (Parsi & Khosreowshahi, 1990; Ripka, 1997, 1998; Rahmani et al., 2008). Welbourn et al. (2003) were identified *Brevipalpus californicus* (Banks) and *B. obovatus* Donnadieu by morphological technique. Wergin et al. (2000) used scanning (SEM) microscopy to show morphological characters on *Brevipalpus phoenicis* (Geijskes). It is little known them in Turkey (Düzgüneş, 1965; Uysal et al., 2001). *Cenopalpus pulcher* (Canestrini & Fanzago, 1876) and *Pseudoleptus zelihae* Pritchard & Baker, 1958 were reported for the first time from fruit trees in Turkey (Pritchard & Baker, 1958; Düzgüneş, 1965). *Brevipalpus obovatus* Donnadieu, 1875, was found on lemon trees in Mersin (Düzgüneş, 1952) and on tea (Ozman-Sullivan et al., 2007). *Brevipalpus phoenicis* (Geijskes, 1939) was found on *Thea* sp. (Düzgüneş, 1965) and on tea and hazelnut (Ozman & Cobanoğlu, 2001) and *Brevipalpus olearius* Sayed, 1950 was found on *Olea eurapea* L. in Adana (Düzgüneş, 1965). *Tenuipalpus granati* Sayed, 1946 was found on *Punica granatum* in İzmir; *Cenopalpus pritchardi* and *Cenopalpus bakeri* were identified in Turkey (Düzgüneş, 1967). Recently *Pentamerismus oregonensis* McGregor 1949, *Pentamerismus taxi* (Haller, 1877), and *Pentamerismus erythreus* (Ewing, 1917) were reported from coniferous plants in Turkey (Bayram & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010). Although taxonomic characters are extensively used for the identification of tenuipalpid, a thorough search for more usable characters has not been done which is the aim of this study. SEM studies were done on the following tenuipalpid species: *Pentamerismus oregonensis* McGregor, 1949, *Pentamerismus taxi* (Haller, 1877), *Aegyptobia nr. cupressus* Baker & Tuttle, 1972, and *Aegyptobia aletes* (Pritchard & Baker, 1958) from *Thuja* sp. and *Juniperus* sp. (Cupressaceae), the most important and preferred host plants of Tenuipalpidae in Turkey.

In addition, the importance of the Tenuipalpidae among Turkey's mite fauna is becoming more apparent and their many different hosts are widespread among the varied ecosystems in Turkey.

## Material and Methods

Tenuipalpid mite species were collected mainly from the woody ornamental plants *Thuja* sp. and *Juniperus* sp. in Ankara during the growing seasons of 2008 and 2009. However, samples were also taken from other ornamental plant species. During these surveys, plant foliage was collected and the mites were extracted using Berlese funnels and were preserved in 70% alcohol. The mites were then cleared in lactophenol and mounted in Hoyer's fluid on microscope slides. After 2–4 weeks at 35 °C the slides were examined under a light microscope (Düzgüneş, 1980). For identification the following keys were used: Pritchard & Baker (1951, 1958), Zaher & Yousef (1969), Baker & Tuttle (1972, 1987), Chaudhri et al. (1974), Jeppson et al. (1975), Al-Gboory (1987), and Gutierrez et al. (1989). All measurements are in micrometers ( $\mu\text{m}$ ).

All species are deposited in the mite collections of the University of Ankara, Agricultural Faculty, Plant Protection Department, Ankara, Turkey. SEM studies were done by Lowruans Tiedt in South Africa.

For SEM, the samples were fixed in 70% alcohol and dehydrated in an alcohol series (70%, 80%, 90%, 100%, and 100%) for 30 min each. After dehydration, the samples were critical-point-dried, mounted on SEM stubs, and coated with gold/palladium (20 nm). The specimens were viewed under an FEI Quanta 200 ESEM using high-vacuum mode at 5–10 kV (personal communication).

## Results

Four tenuipalpid mite species belonging to two genera (*Aegyptobia* and *Pentamerismus*) were identified using morphological techniques by scanning electron microscope (SEM). The species studied were *Aegyptobia* nr. *cupressus*, *Aegyptobia aletes*, *Pentamerismus taxi* and *Pentamerismus oregonensis*.

### ***Pentamerismus* McGregor, 1949**

#### ***Pentamerismus oregonensis* McGregor, 1949 (Fig. 1 a, i)**

This species is oval, flat and bright red in color. This species was identified by using morphological and scanning electron microscopic techniques which was used for the first time for this group.

Measurements: Body length  $245.62 \pm 2.81$ , width  $166.465 \pm 1.76$  ( $n=10$ ). According to Baker & Tuttle (1987) the body length is 268–291 and width 171–177 (syntypes). Palpus has four segments, rostral shield is deeply notched distally, with broad lobes (Fig.1 c,d,e). Palp tibia with two setae, propodosoma emarginate anteriorly. All three pairs of propodosomal setae are setiform. Opisthosoma with two pairs of dorsosublateral setae (*c2* and *d2*) and six pairs of dorsolateral setae (Fig 1 a,b,f,h,i). Hysterosomal setae narrowly lanceolate (Fig 1 b,i).

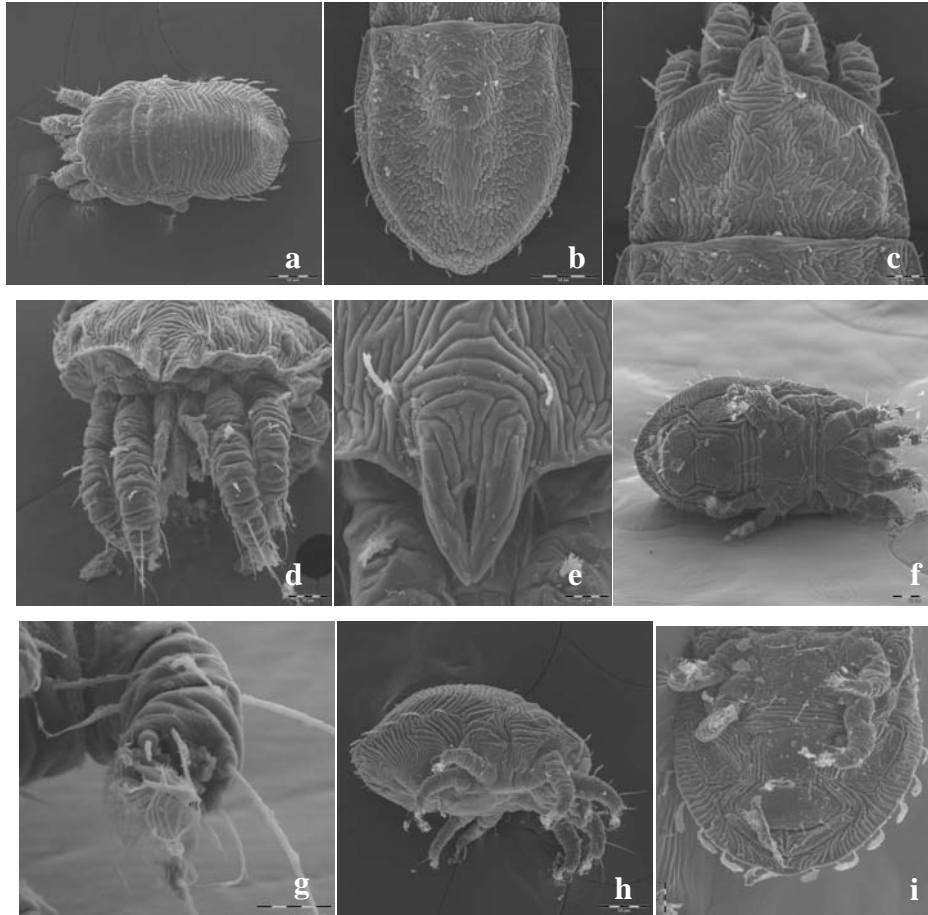


Figure 1. *Pentamerismus oregonensis* McGregor, 1949 a: A nymph; b: Hysterosoma; c: Propodosoma; d: Gnathosoma; e: Rostral shield; f: Latero ventral view; g: Pretarsus; h: Latero ventral view; i: Venter (Original).

Material examined: *Thuja orientalis* L. (30.06.2008), Ankara. It feeds on the needles of the trees and causing them to wilt (Fig. 2 a, b).

Host: *Cupressus* sp., *Juniperus chinensis*, *Juniperus* sp., *Libocedrus* sp., *Thuja plicata*, *Libocedrus decurrens* Torr., *Rhododendron* sp., *Chamaecyparis* sp. (Pritchard & Baker, 1958; Baker & Tuttle, 1987).

Distribution: England, Greece, Japan, Turkey and USA (Pritchard & Baker, 1958; Anonymous, 2007; Bayram & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010)

Comments: This species was reported from coniferous plants in Turkey (Bayram & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010) on *Juniperus* sp. and

*Cupressus* sp. in the USA and Japan (Pritchard & Baker, 1958), and also in England and Greece (Anonymous, 2007).

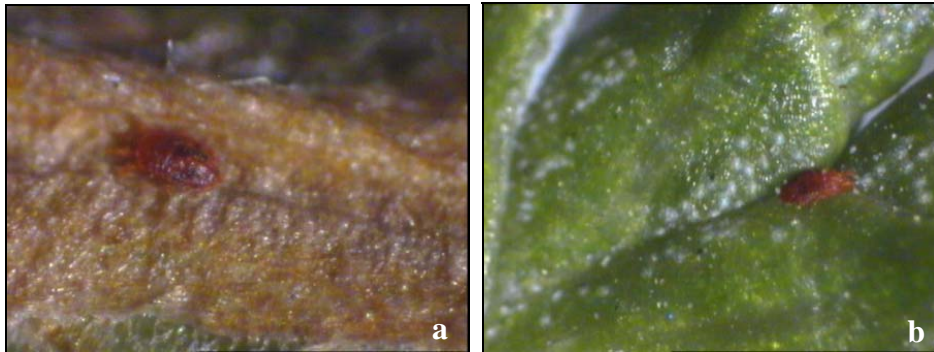


Figure 2. a: *Pentamerismus oregonensis* McGregor, 1949 female; b: *P. oregonensis* feeding on *Thuja orientalis* Linnaeus (Original).

### ***Pentamerismus taxi* (Haller, 1877) (Fig. 3 a, b)**

This species is oval and flat, also bright red in color. This species was identified only by using morphological techniques.

Measurements: Body length  $271.63 \pm 3.09$ , width  $182.80 \pm 3.59$  ( $n=10$ ). Body is oval and flat shape. Color is bright red and it has a significant linear suture between its propodosoma and opisthosoma. Hysterosoma has six pairs of dorsolateral peg-like setae (Fig 3a, b).

Host: *Taxus baccata* L. (Fig. 3a); collected 30.06.2008.



Figure 3. a: *Pentamerismus taxi* (Haller, 1877) adult and eggs on *Taxus baccata* Linnaeus; b: *P. taxi* female (x10) (Original).

Distribution: Greece, England, Poland, Spain, Switzerland, Turkey, Ukraine and USA (Anonymous, 2007; Pritchard & Baker, 1951; Uysal et al., 2001; Sağlam & Çobanoğlu, 2010).

Comments: This species was collected from *Taxus baccata* L. (Uysal et al., 2001; Sağlam & Çobanoğlu, 2010) and from *Anemone coronaria* L. (Bayram & Çobanoğlu, 2007) in Turkey.

### ***Aegyptobia* Sayed, 1950**

#### ***Aegyptobia* nr. *cupressus* Baker & Tuttle, 1972 (Fig. 4 a, h)**

Measurements: Body length  $236.726 \pm 3.74$ , width  $130.695 \pm 1.82$  ( $n=10$ ). According to Baker & Tuttle (1972) the length of the body is 236, or including the rostrum is 294. Palpus has five segments. Propodosoma has three pairs of setae and all dorsal body setae are slender, lanceolate, serrate, and equal in length. Opisthosoma has four pairs of sublateral setae. Prodorsum striated, opisthosoma with longitudinal striae dorsomedially. Legs short and stout (Figs.4 a, h).

Host: *Juniperus* sp. (15.06.2008) in Ankara.

Distribution: Turkey and USA (Baker & Tuttle, 1972; Sağlam & Çobanoğlu, 2010).

Comments: This mite was collected from *Juniperus horizontalis* Moench in Ankara (Sağlam & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010) and from *Cupressus forbesii* Jeps. in California (Baker & Tuttle, 1972).

#### ***Aegyptobia* *aletes* Pritchard & Baker, 1958 (Figs. 5 a, c)**

Measurements: Body length  $255.35 \pm 7.66$ , width  $157.78 \pm 7.09$  ( $n=10$ ). Gutierrez et al. (1989) gives the body length as 240 and the greatest width as 140. All dorsal setae are lanceolate and finely serrate. Palpus has five segments. The dorsal integument is smooth with some small V-shaped grooves on the prodorsal and more marked perpendicular to the edges of the opisthosoma. Propodosoma has three pairs of setae. Opisthosoma has four pairs of sublateral setae. Prodorsum and opisthosoma slightly rugose. Dorsal setae lanceolate to spatulate (Figs. 5 a, c).

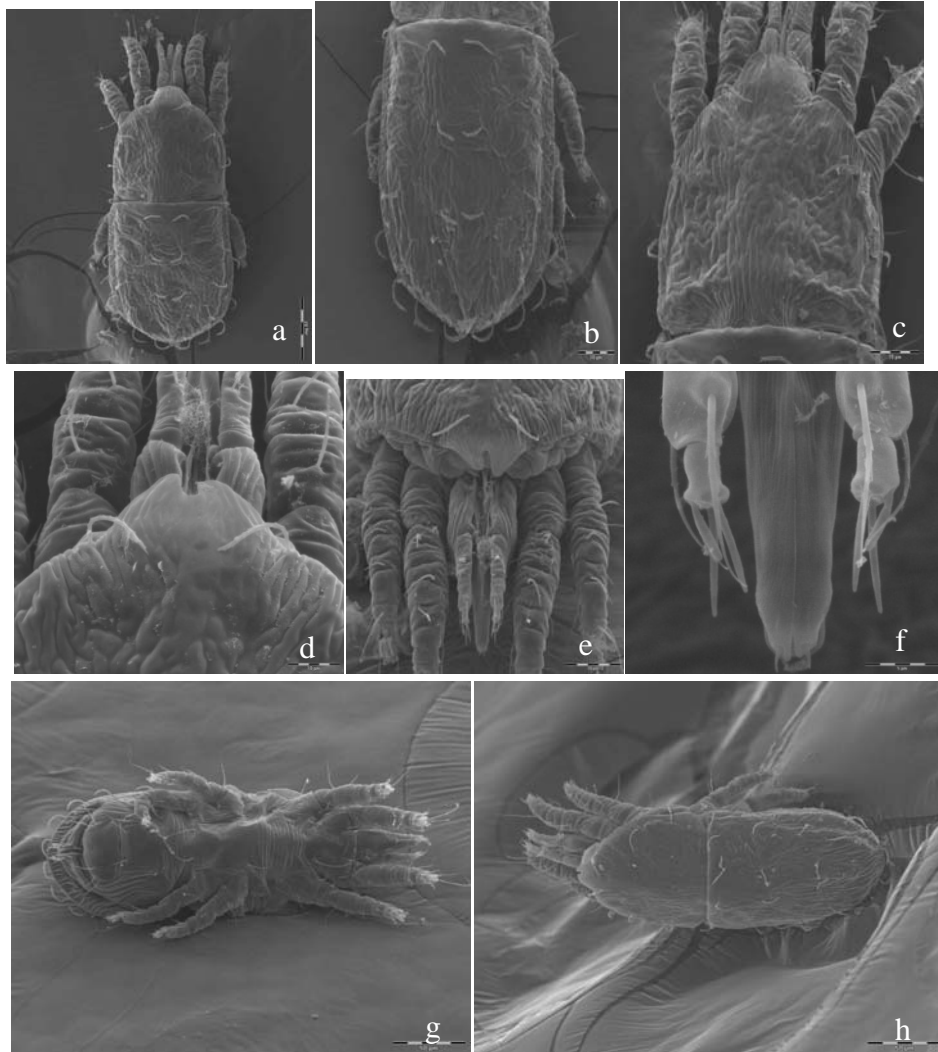


Figure 4. *Aegyptobia* nr. *cupressus* Baker & Tuttle, 1972 a: dorsal view; b: hysterosoma; c: propodosoma; d: rostral shield; e: gnathosoma; f: palpus and chelicerae; g: latero ventral view; h: dorso lateral view (Original).

Host: *Juniperus* sp., collected 15.07.2008.

Distribution: Turkey, USA (Pritchard & Baker, 1958; Sağlam & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010).

Comments: This species was previously collected from *Pinus* sp. and *Thuja orientalis* and was reported in the USA, Japan, and Turkey (Pritchard & Baker, 1958; Bayram & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010). This mite was collected on *Thuja orientalis* L. and *Juniperus virginiana* L. in Ankara (Sağlam & Çobanoğlu, 2007; Sağlam & Çobanoğlu, 2010).

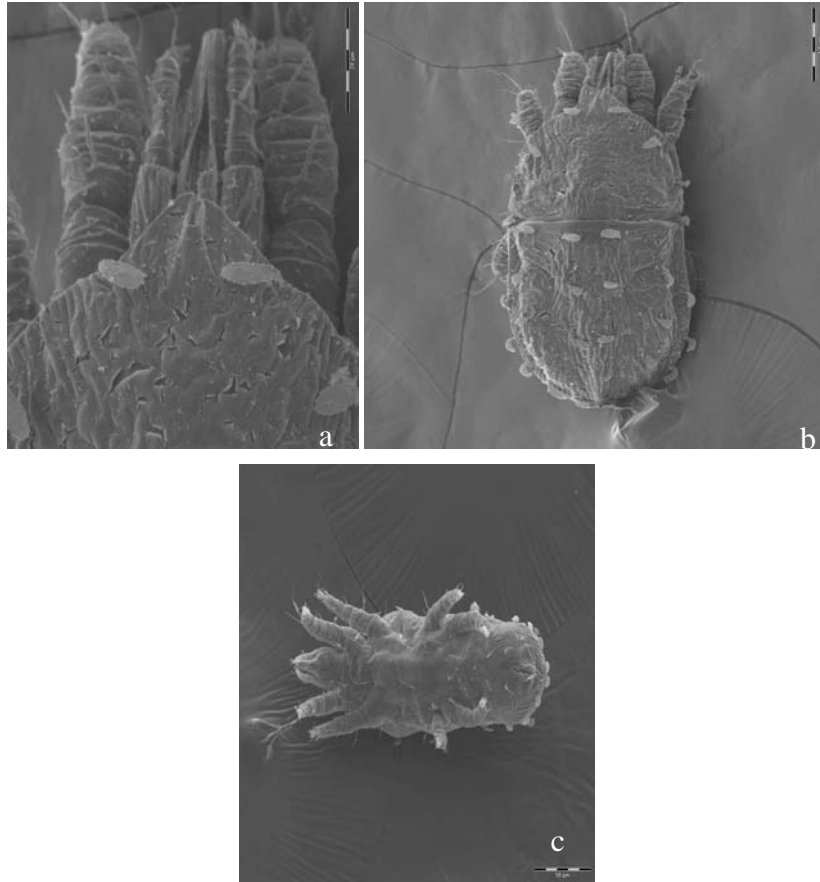


Figure 5. *Aegyptobia aletes* Pritchard and Baker, 1958 a: propodosoma; b: dorsal view; c: latero ventral (Original).

### Discussion

Members of the family Tenuipalpidae are important crop pests, very small in size, and their presence is usually detected only after the damage is already caused. It is very important to identify tenuipalpid species correctly in order to effectively control them. The aim of the study was to facilitate the SEM morphological identification of the Tenuipalpidae. Knowledge of the Tenuipalpidae of Turkey remains fragmented. Previous works on the Tenuipalpidae in Turkey are limited and this is the first time that identification has been made using both morphology and SEM.

Four tenuipalpid species (*Aegyptobia nr. cupressus* Baker & Tuttle, 1972, *Aegyptobia aletes* Pritchard & Baker, 1958, *Pentamerismus taxi* and *Pentamerismus oregonensis* McGregor, 1949) were found during this study and three species were examined under a Scanning Electron Microscope (SEM) to



search for characteristics that could be more useful in their identification. These species all cause severe damage to *Juniperus* sp., *Thuja* sp. and *Taxus baccata* L.

The importance of the Tenuipalpidae in Turkey is gradually becoming more apparent; they already infest a wide range of host plants in various Turkish ecosystems. The study of the morphological structure of the Tenuipalpidae is important because the members of this family have wide geographic distributions and wide ranges of hosts.

Some morphological characters in use at the moment can be difficult to interpret, like the dorsal ornamentations of the genus *Brevipalpus*. Wergin et al. (2000) used scanning (SEM) microscopy to show morphological characters on many different mites' species.

Therefore the aim of the study was to search for more and possibly more distinct characters by using the SEM.

## Özet

### **Bazı Tenuipalpidae (Acari: Prostigmata; *Pentamerismus*, *Aegyptobia*) türlerinin taramalı elektron mikroskobu (SEM) yardımıyla incelenmesi**

Yassı akarlar olarak da bilinen tenuipalpidlerin vücutları (Acari: Tenuipalpidae) yassı ve kırmızı renklidir. Bu familyaya bağlı bireyler dünyada oldukça yaygındır. Tenuipalpid bireylerinin bir kısmı türe özgü olup seralarda ve birçok farklı familyaya ait bitkilerde beslenmektedirler. Bazı *Pentamerismus* cinsine bağlı türler *Juniperus* sp. ve *Thuja* sp. gibi coniferler üzerinde bulunmaktadır. Epidermiste bitki özsuynunu emerek zarar oluştururlar. Bitkilerde beslenmeleri sonucu kahverengi renk değişikliği, ardından ise ölüm görülmektedir. Bu zarar şekli kırmızı örümcek zararı ile karıştırılabilir. Her ne kadar tenuipalpid teşhisinde morfolojik karakterler kullanılsa da, yeterli ultrastructure çalışması bulunmamaktadır.

Yassı akarların tespiti için 2008 ve 2009 yıllarında Ankara park ve bahçelerine sürveyler düzenlenmiştir. *Thuja* sp., *Juniperus* sp. ve *Taxus* sp. bitkilerinden örnekler alınmıştır. Bu bitkilerin üzerinde bulunan akarlar stereomikroskop altında toplanmıştır. Toplanan örneklerin taramalı elektron mikroskobu (SEM) kullanılarak fotoğrafları çekilmiş taksonomik karakterlerinden teşhisleri yapılmıştır. Bunlardan hem morfolojik hem de SEM yöntemi ile yapılan teşhislerde *Pentamerismus* ve *Aegyptobia* cinsleri içerisine giren toplam 4 tür tespit edilmiştir. Bunlar *Pentamerismus oregonensis* McGregor, 1949, *Pentamerismus taxi* (Haller, 1877), *Aegyptobia aletes* (Pritchard & Baker, 1958) ve *Aegyptobia nr. cupressus* Baker & Tuttle, 1972 (Tenuipalpidae)'dur. Bu çalışmada bu türlerin bazı morfolojik özellikler ile dünyadaki dağılımları sunulmuştur.

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