

## Zerconid mites (Acari: Mesostigmata: Zerconidae) of the Kazdağı National Park, Turkey, with altitude and habitat preferences of the species

Mehmet KARACA

Department of Electronic and Automation, Denizli Vocational School of Technical Sciences,  
Pamukkale University, Denizli, Turkey, E-mail: karacamehmet@pau.edu.tr

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**Abstract.** Between April 2019 and January 2020, field surveys were carried out in Kazdağı National Park (Turkey) and its vicinity to reveal the species diversity of zerconid mites. Different mite species, including zerconids, were collected from the research area and transferred to the “Pamukkale University Acarology Laboratory” for their identifications. As a result, 11 zerconid species, belonging to the genera *Prozercon* and *Zercon*, were found in the research area and its vicinity. All species are new records from the research area and Balıkesir Province. In addition, distribution of the zerconid species were presented both in Turkey and the world. Also, altitude and habitat preferences of the species were discussed.

**Key words:** fauna, zerconid mites, preference, Kazdağı National Park, Balıkesir, Turkey.

### Introduction

Members of the family Zerconidae are small mesostigmatic mites and they colonise in different habitat types, such as soil substrates, humus, decomposed litters, leaf mould, mosses, lichens etc., with some rare records from wood substrates, ant-hills, nests of small terrestrial mammals and birds (Mašán & Fend'a 2004). Their diets include eggs, larvae, nymphs of other mites and springtails, and also nematodes (Shereef et al. 1984, Martikainen & Huhta 1990).

Distributional records of zerconid mites are only globally available from the North Hemisphere, in which more than 400 species have been identified (Kaczmarek et al. 2020). So far, 122 species of the family have been recorded from Turkey (Urhan & Karaca 2019, Urhan et al. 2019, 2020), most of which are endemic to the country (Karaca et al. 2017a).

Kazdağı, also known as “Mount Ida” in ancient times, is located within borders of Balıkesir Province and in transition zone of Marmara and Aegean regions. This protected area was declared as a national park in 1994 and its acreage is nearly 21 thousand hectares. Deep valleys and canyons in the northern-southern directions, allow to be carried of sea effects to inner parts of national park, hence it has a rich vegetation and contains several endemic plant species (most known is Kazdağı fir, *Abies nordmanniana* subsp. *equi-trojani*) (Anonyms 2020).

The aim of this study is to contribute the Zerconidae fauna of Turkey and to add new data about species richness in Kazdağı National Park as one of the important protected areas in the country.

### Material and Methods

Different materials (plant litter, soil and moss samples), containing zerconid mites, were taken from various sites (especially from oak habitats) in Kazdağı National Park (Balıkesir Province) and its vicinity from April 2019 to January 2020. The mite individuals were collected from 277 sites (Fig. 1). The GPS information of sampling sites (coordinates and altitudes) was taken using a Garmin GPSmap 62s.

The collected samples were carried to the “Pamukkale University Acarology Laboratory” and put in Berlese-Tullgren funnels for extracting mites for 4–5 days, then preserved in 70% ethanol, cleared in 60% lactic acid, and finally mounted on microscope slides using

Hoyer's medium. The identifications of zerconids were done using a light-microscope (Olympus CX41) and their illustrations were drawn with DP25 camera attached to an Olympus BX50 microscope. All the specimens examined were deposited at PAU (the Acarology Laboratory of Pamukkale University, Denizli, Turkey). The idiosomal setation follows Lindquist & Evans (1965), with modifications for the caudal region as given by Lindquist & Moraza (1998) (Fig. 2). All the measurements and scale bars of the figures were presented as micrometers ( $\mu\text{m}$ ). Abbreviations of DN and PN were used for deutonymph and protonymph, respectively.

### Results

After examination of collected zerconid mites from the research area, five *Prozercon* and six *Zercon* species were identified. All the species were listed below, and some information about each species, e.g. length and width ranges of idiosoma, distributions of the species in Turkey and the world, and some remarks were given in alphabetical order herein. Measurements of at least 10 specimens for each species were taken while determining the size ranges.

Altitude and habitat preferences of each species were also presented and discussed herein.

Family **Zerconidae** Canestrini

Genus ***Prozercon*** Sellnick

Type species: *Zercon fimbriatus* Koch, 1839

Posterior parts of peritremal shields extending to setae R4–R5. Peritremal shields with two types of setae: r1 short, smooth or finely plumose, r3 short and smooth. No gap between peritremal shield and the edge of the podonotum. Adgenital shields and glands gv2 absent. Opisthonotum with seven or eight pairs of marginal setae. Anterior margin of ventrianal shield always with one pair of setae (Karaca et al. 2017b).

**1-*Prozercon demirsoyi*** Urhan & Ayyıldız, 1996 (Fig. 3A)

Length × width ranges of idiosoma: 327–347 × 238–250 (♀♀), 277–296 × 208–220 (♂♂), 277–307 × 201–221 (DN), 217–227 × 159–175 (PN).

Distribution in Turkey: Artvin, Giresun, İstanbul (Karaca 2015), Balıkesir (present study).

World distribution: Turkey (Urhan & Ayyıldız 1996).

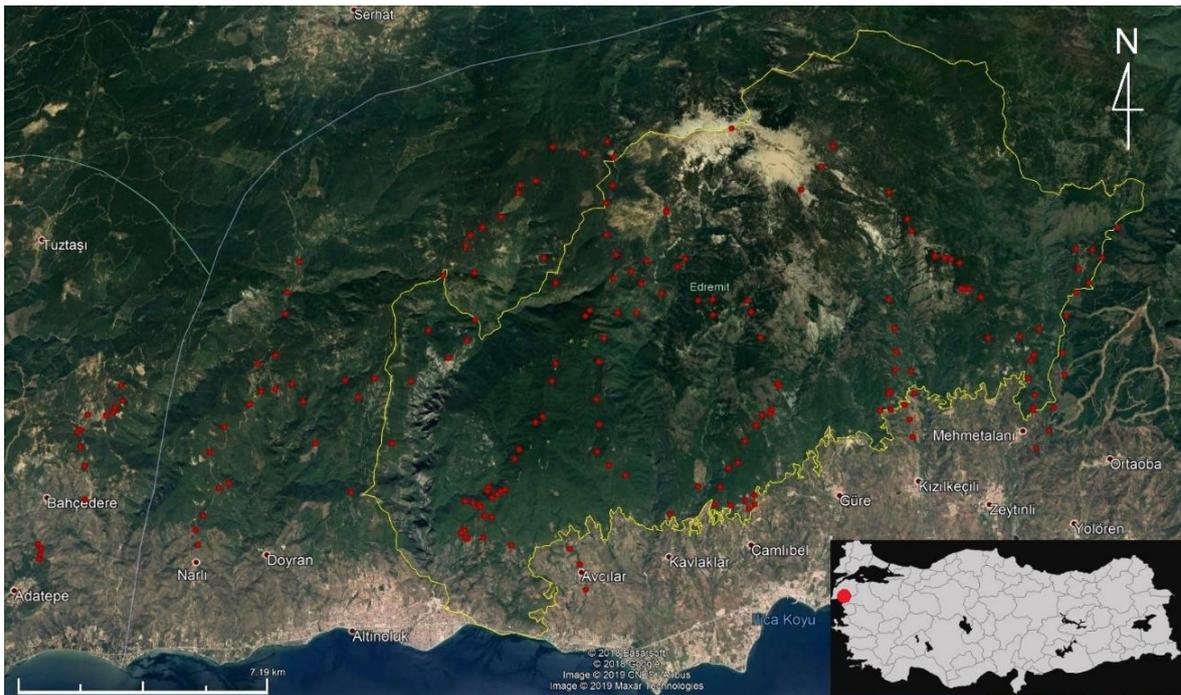


Figure 1. Localities of collected materials of zerconid mites in Kazdağı National Park and its vicinity (Yellow line shows the boundaries of Kazdağı National Park and red dots indicate sampling sites).

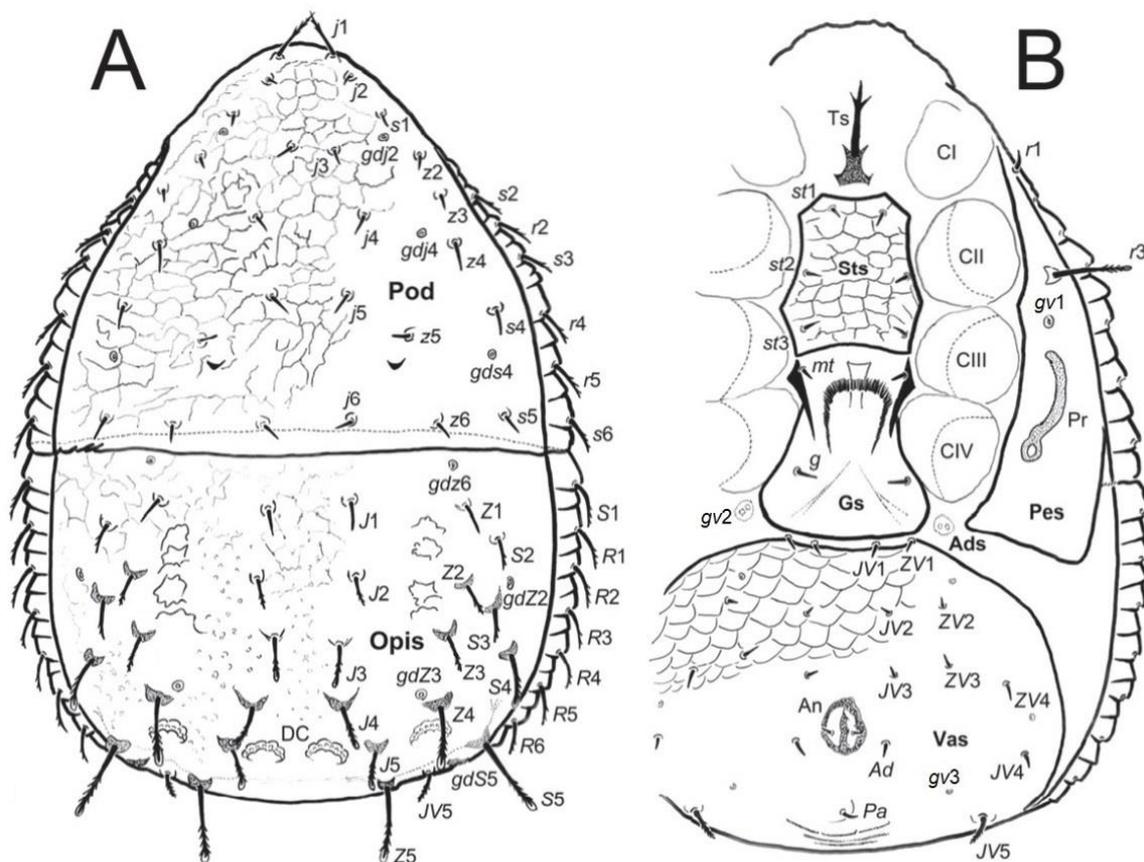


Figure 2. General view of a zerconid mite (genus *Zercon*, female) (not to scale): A) dorsal view, B) ventral view. Abbreviations: (**Pod**) podonotum, (*j1-6*, *z2-6*, *s1-6* and *r2-5*) podonotal setae, (*gdj2*, *gdj4* and *gds4*) podonotal pores, (**Opis**) opisthonotum, (*J1-5*, *Z1-5*, *S1-5* and *R1-6*) opisthonotal setae, (*gdz6*, *gdZ2*, *gdZ3* and *gdS5*) opisthonotal pores, (DC) dorsal cavities, (*r1* and *r3*) peritremal setae, (Ts) tritosternum, (Sts) sternal shield, (*st1-3*) sternal setae, (*mt*) metasternal seta, (Gs) genital shield, (*g*) genital seta, (CI-CIV) endopodal shields, (Ads) adgenital shield, (*gv1-3*) ventral pores, (Pr) peritreme, (Pes) peritremal shield, (Vas) ventroanal shield, (*JV1-3*) ventromediales setae, (*ZV1-3*) ventrointernaes setae, (*ZV4* and *JV4*) ventrolaterales setae, (An) anal orifice, (Ad) adanal setae, (Pa) post-anal seta (modified after Karaca 2019).

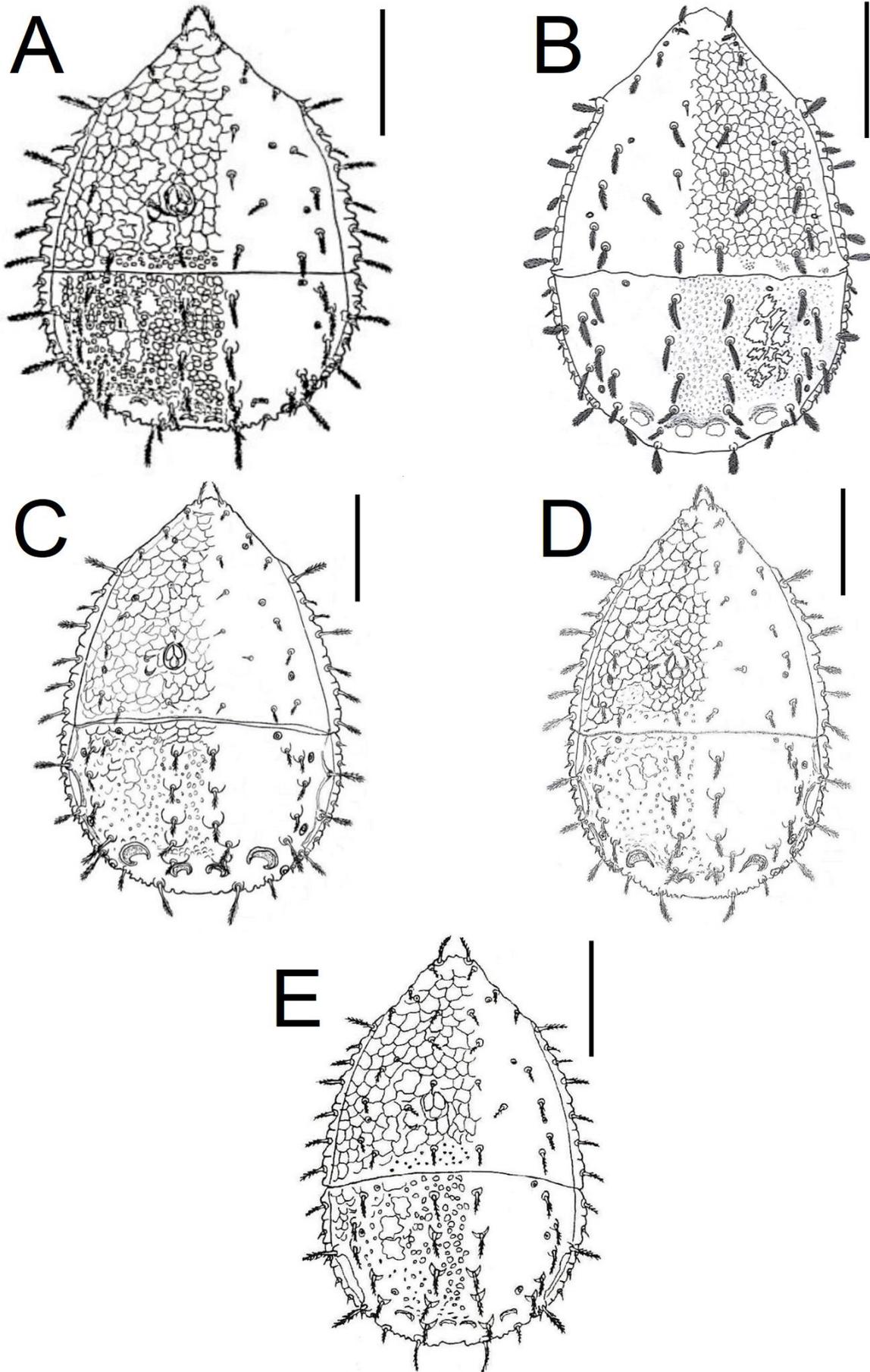


Figure 3. Dorsal views of *Prozercon* species (females): A) *P. demirsoyi*, B) *P. martae*, C) *P. miraci*, D) *P. sellnicki*, E) *P. yavuzi* (All scale bars equal to 100  $\mu$ m. Modified after Karaca & Urhan 2015a, Urhan 1998, Urhan & Ayyıldız 1996, Urhan et al. 2019, 2020).

**2-*Prozercon martae*** Ujvári, 2010 (Fig. 3B)

Length × width ranges of idiosoma: 302–335 × 215–238 (♀♀), 242–265 × 185–208 (♂♂), 272–295 × 185–206 (DN).

Distribution in Turkey: Çanakkale, Edirne, Tekirdağ (Karaca 2015), Balıkesir (present study).

World distribution: Croatia (Ujvári 2010a), and Turkey (Karaca 2015).

**3-*Prozercon miraci*** Urhan, Karaca & Duran, 2020 (Fig. 3C)

Length × width ranges of idiosoma: 332–360 × 225–238 (♀♀), 282–294 × 185–208 (♂♂), 257–288 × 185–203 (DN), 217–240 × 145–168 (PN).

Distribution in Turkey: Manisa (Urhan et al. 2020), Balıkesir (present study).

World distribution: Turkey (Urhan et al. 2020).

Remark: This is the second report of this species from Turkey.

**4-*Prozercon sellnicki*** Halašková, 1963 (Fig. 3D)

Length × width ranges of idiosoma: 308–340 × 215–236 (♀♀), 268–284 × 185–206 (♂♂), 258–285 × 181–212 (DN), 209–238 × 137–171 (PN).

Distribution in Turkey: Aydın, İzmir, Manisa (Urhan et al. 2019), Balıkesir (present study).

World distribution: Croatia, Czechia, Germany, Latvia, Poland, Slovakia, Ukraine (Karaca & Urhan 2019), and Turkey (Urhan et al. 2019).

Remark: The protonymphs of *P. sellnicki* were found for the first time in Turkey.

**5-*Prozercon yavuzi*** Urhan, 1998 (Fig. 3E)

Length × width ranges of idiosoma: 327–351 × 225–251 (♀♀), 277–295 × 198–215 (♂♂), 261–291 × 193–214 (DN), 211–228 × 146–180 (PN).

Distribution in Turkey: Aydın, Denizli, İstanbul, Muğla (Karaca 2015), Balıkesir (present study).

World distribution: Crete, Greece (Ujvári 2008, 2011), and Turkey (Urhan 1998).

Remark: Considering the distribution records of this species, it may be found in the western Mediterranean, Aegean and along the Marmara coastline in Turkey, and also some Greek islands in the Aegean Sea.

**Genus *Zercon* Koch**

Type species: *Zercon triangularis* Koch, 1836

Peritremal shields end in blunt at the posterior part of coxae IV, with two types of setae: *r1* short and smooth, *r3* long, feathered, or spiny. A gap located between peritremal shield and the edge of the podonotum with weak sclerotization. Adgenital shields present, with 2–5 opening valves. Opisthonotum with seven or eight pairs of marginal setae. Anterior margin of the ventrianal shield with one or two pairs of setae (Karaca et al. 2017b).

**6-*Zercon carpathicus*** Sellnick, 1958 (Fig. 4A)

Length × width ranges of idiosoma: 418–461 × 355–398 (♀♀), 319–358 × 265–298 (♂♂), 331–378 × 295–327 (DN), 258–271 × 203–237 (PN).

Distribution in Turkey: Bursa, Kırklareli, Tekirdağ (Urhan 2007, Karaca & Urhan 2016), Balıkesir (present study).

World distribution: Latvia, Poland, Romania, Slovakia, Ukraine (Mašán & Fend'a 2004), and Turkey (Urhan 2007).

**7-*Zercon colligans*** Berlese, 1920 (Fig. 4B)

Length × width ranges of idiosoma: 328–384 × 245–278 (♀♀), 318–350 × 225–267 (♂♂), 312–342 × 234–257 (DN), 272–301 × 164–187 (PN).

Distribution in Turkey: Afyonkarahisar, Artvin, Aydın, Çanakkale, Denizli, Edirne, Erzurum, Giresun, İstanbul, Kırklareli, Kütahya, Tekirdağ, Uşak (Karaca & Urhan 2016, Urhan & Duran 2019), Balıkesir (present study).

World distribution: France, Iran, Italy, Russia, Sweden, Swiss, Turkey (Karaca & Urhan 2016, Karaca et al. 2017).

Remark: This species has a wide spread in Turkey and may be found in all directions of the country. In the female specimens, length differences can be observed especially at the opisthonotal seta S4. Whether the size of this seta is short, medium or long may lead to confusion in diagnoses of *Zercon colligans*, *Z. hispanicus* Sellnick, 1958 and *Z. marinae* Ivan & Călugăr, 2004. Although these species, which are all found in Turkey, are greatly similar morphologically, there are slight differences among them. On the other hands, *Z. hispanicus* is distributed from Spain and Israel (Błaszak 1979), and *Z. marinae* is found in Romania (Ujvári & Călugăr 2010). It is thought that it will be beneficial to investigate the differences between these species on molecular basis rather than morphological characters in the future.

**8-*Zercon delicatus*** Urhan & Ekiz, 2002 (Fig. 4C)

Length × width ranges of idiosoma: 501–541 × 345–387 (♀♀), 377–421 × 245–281 (♂♂), 381–411 × 258–290 (DN).

Distribution in Turkey: Afyonkarahisar, Artvin, Kütahya, Uşak (Urhan & Ekiz 2002, Urhan & Duran 2019), Balıkesir (present study).

World distribution: Turkey (Urhan & Ekiz 2002).

**9-*Zercon denizliensis*** Urhan, 2011 (Fig. 4D)

Length × width ranges of idiosoma: 443–481 × 305–347 (♀♀), 341–388 × 268–307 (♂♂), 381–411 × 258–290 (DN), 311–331 × 198–217 (PN).

Distribution in Turkey: Afyonkarahisar, Denizli, Kütahya, Uşak (Urhan 2011, Urhan & Duran 2019), Balıkesir (present study).

World distribution: Turkey (Urhan 2011).

**10-*Zercon osmaneliensis*** Urhan, 2008 (Fig. 4E)

Length × width ranges of idiosoma: 403–431 × 295–313 (♀♀), 318–341 × 218–238 (♂♂), 321–350 × 222–240 (DN), 290–305 × 208–216 (PN).

Distribution in Turkey: Bilecik, Tekirdağ (Urhan 2008, Karaca & Urhan 2016), Balıkesir (present study).

World distribution: Turkey (Urhan 2008).

**11-*Zercon yusuifi*** Urhan, 2010 (Fig. 4F)

Length × width ranges of idiosoma: 358–409 × 294–318 (♀♀), 308–331 × 215–243 (♂♂), 315–341 × 234–260 (DN), 283–311 × 205–233 (PN).

Distribution in Turkey: Afyonkarahisar, Kütahya, Uşak (Urhan 2010, Urhan & Duran 2019), Balıkesir (present study).

World distribution: Turkey (Urhan 2010).

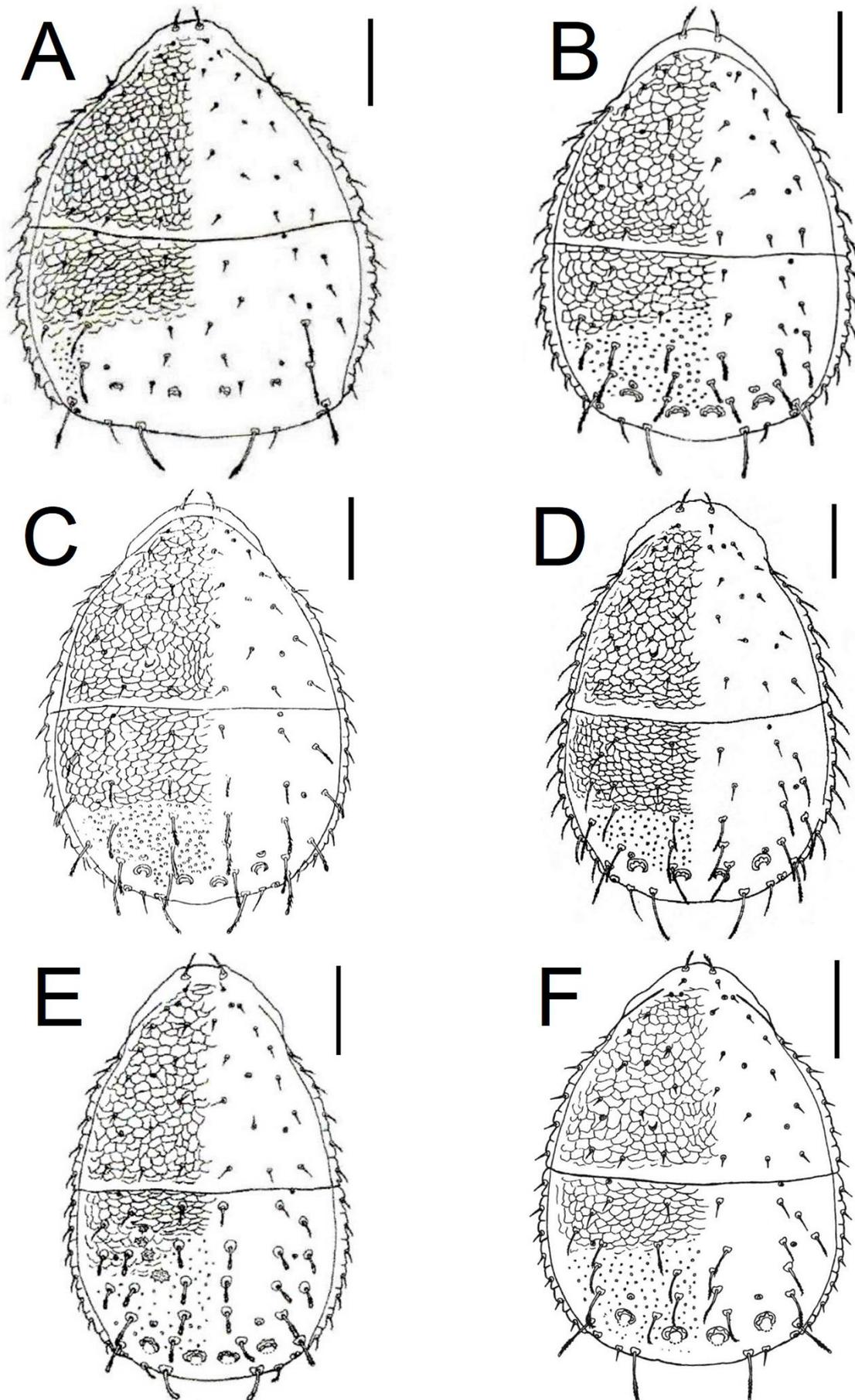


Figure 4. Dorsal views of *Zercon* species (females): A) *Z. carpathicus*, B) *Z. colligans*, C) *Z. delicatus*, D) *Z. denizliensis*, E) *Z. osmaniensis*, F) *Z. yusufi* (All scale bars equal to 100  $\mu\text{m}$ . Modified after Urhan 1995, 2007, 2008, 2010, 2011, Urhan & Ekiz 2002).

Table 1. Altitude preferences of zerconid mites in the Kazdağı National Park.

Species / Altitudinal ranges	Prozercon					Zercon					
	<i>demirsoyi</i>	<i>martae</i>	<i>miraci</i>	<i>sellnicki</i>	<i>yavuzi</i>	<i>carpathicus</i>	<i>colligans</i>	<i>delicatus</i>	<i>denizliensis</i>	<i>osmaneliensis</i>	<i>yusufi</i>
0-100		✓			✓						
100-200		✓			✓		✓				
200-300	✓	✓			✓		✓				
300-400	✓	✓	✓				✓				
400-500	✓		✓	✓			✓			✓	
500-600	✓		✓	✓						✓	
600-700	✓		✓	✓			✓			✓	
700-800				✓		✓	✓			✓	✓
800-900	✓		✓			✓	✓			✓	
900-1000	✓		✓	✓		✓	✓			✓	✓
1000-1100	✓			✓		✓	✓	✓		✓	✓
1100-1200						✓	✓	✓	✓		✓
1200-1300	✓					✓		✓	✓		✓
1300-1400	✓					✓	✓	✓	✓		✓
1400-1500	✓						✓	✓	✓		✓
1500-1600							✓		✓		
1600-1700							✓		✓		
+1700									✓		

Table 2. Habitat preferences of zerconid mites in the Kazdağı National Park.

Species/ Habitats (soil)	Prozercon					Zercon					
	<i>demirsoyi</i>	<i>martae</i>	<i>miraci</i>	<i>sellnicki</i>	<i>yavuzi</i>	<i>carpathicus</i>	<i>colligans</i>	<i>delicatus</i>	<i>denizliensis</i>	<i>osmaneliensis</i>	<i>yusufi</i>
Chestnut									✓		✓
Cypress	✓			✓			✓				
Fern							✓				
Fig											
Hawthorn	✓		✓	✓			✓	✓	✓		✓
Ivy		✓	✓	✓	✓		✓				
Juniper	✓			✓		✓	✓			✓	✓
Milkvetch	✓						✓	✓	✓		✓
Moss	✓		✓		✓	✓	✓	✓	✓	✓	
Mulberry											
Oak	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oleander											
Oleaster-leafed pear	✓							✓	✓		
Olive		✓			✓		✓				
Pine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Poplar							✓				✓
Rockrose	✓		✓	✓	✓		✓		✓		
Strawberry tree		✓	✓				✓				
Sycamore	✓						✓				
Walnut							✓				

#### Altitude preferences of zerconid mites in the Kazdağı National Park

The species of zerconid mites were collected at the altitude from 65 to 1720 m a.s.l. All samples were taken from suitable forestland areas. Sampling sites were divided according to 100 meters elevation ranges. The altitudinal distribution results of the species were marked in Table 1. Also, the results of similar studies about the altitudinal preferences of zerconid mites were given which have been carried out previously in Turkey.

#### Habitat preferences of zerconid mites in Kazdağı National Park

In the research area, samplings of zerconid mites were carried out in 277 different localities and the following 20 habitats were noted: chestnut (*Castanea sativa*), cypress (*Cupressus sempervirens*), fern (unspecified), fig (*Ficus carica*), hawthorn (*Crataegus monogyna*), ivy (unspecified), juniper (*Juniperus communis*), milkvetch (*Astragalus* sp.), moss (unspecified), mulberry (*Morus alba*), oak (*Quercus cerris*, *Q. coccifera*, *Q. frainetto*, *Q. infectoria*, *Q. petraea*, *Q. pubescens* and *Q. trojana*),

oleander (*Nerium oleander*), oleaster-leaved pear (*Pyrus elaeagrifolia*), olive (*Olea europaea*), pine (*Pinus brutia* and *P. nigra*), poplar (*Populus* sp.), rockrose (*Cistus* sp.), strawberry tree (*Arbutus andrachne*), sycamore (*Platanus orientalis*) and walnut (*Juglans regia*). Habitat preferences of each species were presented in Table 2.

## Discussion

The majority of studies on zerconid mites both in Turkey and the world are focused on systematic researches. Therefore, ecological studies have received less attention (Mašán & Fend'a 2004, Kahveci et al. 2006, Urhan et al. 2008), although they are very important.

According to the altitudinal ranges of collection of the species (Table 1), it is understood that some species have a restricted distribution (*P. martae*, *P. yavuzi* and *Z. delicatus*), of which, *P. martae* and *P. yavuzi* occur only at lower altitudes (0–400 m a.s.l.). In contrast, *Z. delicatus* and *Z. denizliensis* only occur at over 1000 m a.s.l. However, some species have a wider range of altitudes in the research area (*P. demirsoyi*, *Z. carpathicus*, *Z. colligans*, *Z. denizliensis*, *Z. osmaniensis* and *Z. yusuifi*), which means that most of them have no clear altitudinal preference. In accordance with the estimates, it seems that the amounts of organic or inorganic matters and temperature in microhabitats of the species may be effective for their altitudinal preferences. However, to make clearer and definitive inferences, more specific ecological studies on this issue is needed to be considered.

On the other hand, some similar studies about altitudinal preferences of zerconid mites were conducted in the provinces of Giresun, İstanbul and Inner Aegean region (Karaca & Urhan 2015b, Duran & Urhan 2017, Urhan & Duran 2019). The first of this was held in Giresun Province (Karaca & Urhan 2015b). In that study, materials of zerconid mites were collected between 0 to 2000 m a.s.l. and as a result 19 zerconid species (eight *Prozercon* and 11 *Zercon*) were found. However, there is no clear distinction in terms of altitudinal preferences among *Prozercon* and *Zercon* species. In addition, three species reported here in that study (*P. demirsoyi*, *Z. colligans* and *Z. denizliensis*) were also found in the Kazdağı National Park. Specimens of *P. demirsoyi*, *Z. colligans* and *Z. denizliensis* were found at 0–1100 m a.s.l., 0–2000 m a.s.l. and 0–500 m a.s.l., respectively. In the second above-mentioned research, which was held in İstanbul Province (Duran & Urhan 2017), totally 17 zerconid species (nine *Prozercon* and eight *Zercon*) were collected from a limited elevation range (0–300 m a.s.l.) with. In addition, two species reported in that study (*P. yavuzi* and *Z. colligans*) were also found here in the Kazdağı National Park. Here, we found *P. yavuzi* and *Z. colligans* at the altitudes of 200–300 and 0–300 m a.s.l., respectively. In the third above-mentioned research, which was held in the Inner Aegean region (Aydınkarahisar, Kütahya and Uşak Provinces) (Urhan & Duran 2019), a total of 44 zerconid species (10 *Prozercon* and 34 *Zercon*) were collected from an extensive elevation range (0–2100 m a.s.l.). In addition, seven species reported in that study (*P. yavuzi*, *Z. carpathicus*, *Z. colligans*, *Z. delicatus*, *Z. denizliensis*, *Z. osmaniensis* and *Z. yusuifi*) were also found here in the Kazdağı National Park, among them *Z. colligans* was found in a wide range of alti-

tudes (500–2100 m a.s.l.), the altitude ranges (m a.s.l.) of other species are as follows: *P. yavuzi* (600–700), *Z. carpathicus* (700–1500), *Z. delicatus* (800–900), *Z. denizliensis* (900–1400), *Z. osmaniensis* (800–1000) and *Z. yusuifi* (1100–1800).

According to Table 2, generally, it is found that many species spread in more than one habitat, however some species were observed in fewer habitats. Also, none of the species were not found in fig, mulberry and oleander habitats. As the elevation values (Table 1), *Z. colligans* had not only the wide range of altitudes, but also the widest distribution in habitats. Moss, oak and pine habitats harbor many species. According to the results, it is predicted that zerconid species have various habitat preferences. Like the altitude preferences, detailed researches are also needed to clarify the reasons for the habitat preferences in zerconid mites.

Although zerconid mites were classified in 46 different genera in the Holarctic region (Kaczmarek et al., 2020), only two of them (*Prozercon* and *Zercon*) were known from Turkey. As a result of systematic studies carried out to date, 122 different species of zerconids have been identified in Turkey (Urhan & Karaca 2019, Urhan et al. 2019, 2020). These numbers indicate that zerconid mites have been well studied in Turkey, in contrary of some other countries in Europe and the Middle-East (Huhta 2016, Huhta & Ujvári 2015, Javan et al. 2018, Kaczmarek et al. 2020, Karaca et al. 2017b, 2018, Kavianpour et al. 2018, Kotschán 2006, Ujvári 2009, 2010b, 2011, 2013). It is expected that surveying on zerconid mites in some other parts of Turkey, especially in the Black Sea, Mediterranean, Eastern Anatolia and Southeast Anatolia regions, can not only lead to find further new species and new records of the family from Turkey, but also clarify their distributions and ecological niches or habitats of each species.

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## References

- Anonyms (2020): Kaz Dağları Milli Parkı <<https://kazdagi.tabiat.gov.tr>, accessed at: 2020.07.01.> [In Turkish]
- Błaszak, C. (1979): Systematic studies on the family Zerconidae. IV. Asian Zerconidae (Acari, Mesostigmata). Acta Zoologica Cracoviensia Krakow 24: 3–112.
- Duran, E.H., Urhan, R. (2017): Zerconid mites in İstanbul (Acari, Zerconidae), with four new record for the Turkish fauna. Turkish Journal of Zoology 41(5): 931–939.
- Huhta, V. (2016): Catalogue of the Mesostigmata mites in Finland. Memoranda Societatis Fauna Flora Fennica 92: 129–148.
- Huhta, V., Ujvári, Z. (2015): *Zercon bothnicus*, a new species of Zerconidae (Acari: Mesostigmata) from Finland. Acarina 23(1): 69–73.
- Javan, S., Karaca, M., Urhan, R. (2018): *Zercon ostovani* sp. nov. (Acari: Mesostigmata: Zerconidae) from Iran. Turkish Journal of Zoology 42(5): 596–600.
- Kaczmarek, S., Marquardt, T., Jangazieva, B. (2020): *Zercon utemisovi* sp. n. - a new species of Zerconidae (Parasitiformes, Mesostigmata) from Kazakhstan

- with notes on *Zercon karadaghensis* Balan, 1992. International Journal of Acarology 46(1): 52–59.
- Kahveci, A.Ö., Urhan, R., Katılmış, Y. (2006): Honaz Dağı Milli Parkı'nda (Denizli) toprak akarlarının (Acari) dikey dağılımı. Çankaya University Journal of Arts and Sciences 5: 31–38. [In Turkish]
- Karaca, M. (2015): Systematic studies on zerconid mites (Acari, Mesostigmata, Zerconidae) of Thrace Region (Turkey). Unpublished Ph. D. thesis, Pamukkale University, Institute of Sciences, Department of Biology, Denizli. [In Turkish]
- Karaca, M., Urhan, R. (2015a): A new record of zerconid mites (Acari, Mesostigmata, Zerconidae) from the Thrace region of Turkey. Turkish Journal of Zoology 39(1): 188–190.
- Karaca, M., Urhan, R. (2015b): The diversity of zerconid mites (Acari, Zerconidae) in Giresun province, with a new record for the Turkish fauna. Opuscula Zoologica Budapest 46(2): 199–209.
- Karaca, M., Urhan, R. (2016): Five new species of *Zercon* C. L. Koch, 1836 (Acari: Zerconidae) from northwestern Turkey. Zootaxa 4127(1): 31–59.
- Karaca, M., (2019): *Zercon kadiri* sp. n., a new oligophagous mite from Eastern Anatolia (Acari: Mesostigmata: Zerconidae). Zoology in the Middle East 65(3): 261–267.
- Karaca, M., Urhan, R. (2019): Species list of zerconid mites (Acari: Mesostigmata: Zerconidae) of Czech Republic. 5th International Conference on Engineering and Natural Sciences, 12–16 June, Prague, Czech Republic, Book of Proceedings, pp. 36–40.
- Karaca, M., Urhan, R., Duran, E.H., Kızılkaya, E. (2017a): Endemic zerconid mites of Turkey (Acari: Mesostigmata: Zerconidae). pp.32. In: 3rd International Congress on Zoology and Technology, 12–15 July 2017, Afyonkarahisar, Turkey.
- Karaca, M., Ordoukhanian, C., Ahadiyat, A., Urhan, R. (2017b): New occurrences of zerconid mites (Acari: Zerconidae) from Iran, with checklist and a key to the Iranian species. International Journal of Acarology 43(8): 603–611.
- Karaca, M., Urhan, R., Ahadiyat, A. (2018): Species list of the Iranian Zerconidae (Acari: Mesostigmata). pp.76 p. In: 4th International Symposium on EuroAsian Biodiversity, 3–6 July 2018, Kiev, Ukraine.
- Kavianpour, M., Karaca, M., Karimpour, Y., Urhan, R. (2018): A new species and new distribution records of *Zercon* C. L. Koch, 1836 from Iran (Acari: Mesostigmata: Zerconidae). Zoology in the Middle East 63(4): 363–370.
- Kontschán, J. (2006): Some zerconid mites (Acari: Mesostigmata: Zerconidae) from Kosovo (Serbia-Montenegro) with description of *Zercon kosovina* sp. nov. Zootaxa 1276: 47–53.
- Lindquist, E.E., Evans, G.O. (1965): Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). Memoirs of the Entomological Society of Canada 47: 1–64.
- Lindquist, E.E., Moraza, M.L. (1998): Observations on homologies of idiosomal setae in Zerconidae (Acari: Mesostigmata), with modified notation for some posterior body setae. Acarologia 39: 203–226.
- Martikainen, E., Huhta, V. (1990): Interactions between nematodes and predatory mites in raw humus soil: a microcosm experiment. Revue D'ecologie Et de Biologie Du Sol 27(1): 13–20.
- Mašán, P., Fend'a, P. (2004): Zerconid mites of Slovakia (Acari, Mesostigmata, Zerconidae). Slovak Academy of Sciences, Institute of Zoology, Bratislava.
- Shereef, G.M., Afifi, M.A., El Bishlawy, S.H.O. (1984): Description, life cycle and feeding habitats of *Zercon adalicus* n. sp. (Acari, Gamasida, Zerconidae). Bulletin of Faculty of Agriculture, Cairo University 35: 1765–1774.
- Ujvári, Z. (2008): Zerconid mites (Acari: Mesostigmata: Zerconidae) from Crete, Greece, with description of two new species. Opuscula Zoologica Budapest 39: 99–108.
- Ujvári, Z. (2009): Contribution to the Mesostigmata fauna of Slovenia (Acari: Mesostigmata: Zerconidae et Macrochelidae). Acta Entomologica Slovenica 17(2): 115–124.
- Ujvári, Z. (2010a): Zerconid mites (Acari: Mesostigmata: Zerconidae) from Croatia with description of four new species. Journal of Natural History 44: 1671–1696.
- Ujvári, Z. (2010b): First records of zerconid mites (Acari: Mesostigmata: Zerconidae) from Albania, with description of three new species. Opuscula Zoologica Budapest 41(1): 57–75.
- Ujvári, Z. (2011): Six new species of *Prozercon* Sellnick, 1943 (Acari, Mesostigmata, Zerconidae) from Greece, with remarks on the genus. Zootaxa 2785: 1–31.
- Ujvári, Z. (2013): Two new species of *Prozercon* Sellnick, 1943 (Acari, Mesostigmata, Zerconidae) from Bulgaria. International Journal of Acarology 39(3): 263–271.
- Ujvári, Z., Čalugár, A. (2010): New zerconid mite species (Acari: Mesostigmata: Zerconidae) from Romania. Acta Zoologica Academiae Scientiarum Hungaricae 56: 235–255.
- Urhan, R. (1995): Systematic investigations on zerconid mites (Acari, Mesostigmata, Zerconidae) of Artvin Province. Unpublished Ph. D. thesis, Atatürk University, Institute of Sciences, Department of Biology, Erzurum. [In Turkish]
- Urhan, R. (1998): Some new species of the family Zerconidae (Acari, Mesostigmata) from Turkey. Journal of Natural History 32: 533–543.
- Urhan, R. (2007): *Zercon carpathicus* Sellnick, 1958 (Acari: Zerconidae), a species of mite new to the Turkish fauna. Zoology in the Middle East 41: 105–108.
- Urhan, R. (2008): Two new species of *Zercon* C. L. Koch (Acari, Mesostigmata, Zerconidae) from Turkey: *Zercon longisetosus* sp. n. and *Zercon osmaniensis* sp. n. Turkish Journal of Zoology 32: 217–224.
- Urhan, R. (2010): Two new species of *Zercon* (Acari: Zerconidae) from Turkey. Biologia 65(1): 92–98.
- Urhan, R. (2011): Two new species of zerconid mites (Acari, Mesostigmata) from Honaz Mountain National Park (Turkey). Turkish Journal of Zoology 35(2): 163–174.
- Urhan, R., Ayyıldız, N. (1996): Two new species of the genus *Prozercon* Sellnick from Turkey (Acari: Zerconidae). Genus 7(3): 569–580.
- Urhan, R., Duran, E.H. (2019): Zerconid mites (Acari, Zerconidae) in Inner Aegean Region, with a new record for the Turkish fauna. Zootaxa 4568(2): 323–336.
- Urhan, R., Ekiz, A.N. (2002): Systematic studies on zerconid mites (Acari: Gamasida: Zerconidae) of Turkey. Acta Zoologica Academiae Scientiarum Hungaricae 48(3): 225–235.
- Urhan, R., Karaca, M. (2019): A new species of the genus *Zercon* (Acari, Mesostigmata, Zerconidae) from Kastamonu, Turkey. Acarological Studies 1(1): 3–10.
- Urhan, R., Duran, E.H., Karaca, M. (2019): *Prozercon sellnicki* Halašková, 1963: A new record of zerconid mites (Acari, Zerconidae) for the Turkish fauna. International Journal of Scientific and Technological Research 5(12): 260–264.
- Urhan, R., Karaca, M., Duran, E.H. (2020): Description of *Prozercon miraci* sp. nov. (Acari: Mesostigmata: Zerconidae) from Coastal Aegean Section in Turkey, with a key to the Turkish species. Acarological Studies 2(1): 18–23.
- Urhan, R., Katılmış, Y., Kahveci, A.Ö. (2008): Vertical distribution of soil mites (Acari) in Dalaman (Muğla Prov.-Turkey). Munis Entomology and Zoology, 3(1): 333–341.