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The Alticini (Coleoptera: Chrysomelidae: Galerucinae) fauna of Davraz Mountain (Isparta): comments on host plant and altitude preferences with two new records for Turkish fauna

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Abstract: Forty-seven species belonging to 7 genera of Alticini are presented based on the investigations conducted on Davraz Mountain (Isparta). Host plant relationships of 24 species established from the area are listed. Brassicaceae, Scrophulariaceae, and Lamiaceae seem to be the most preferred host plant families among others. Three species from the genus *Longitarsus* Berthold — namely *L. baeticus* Leonardi, 1979; *L. foudrasi* Weise, 1893; and *L. tabidus* (Fabricius, 1775) — were sampled only from 1900 m and above on the mountain. Additionally, *Longitarsus brunneus* (Duftschmidt, 1825) and *Psylliodes laticollis* Kutschera, 1864 are given as new records for the Chrysomelidae fauna of Turkey.

Key words: Alticini, fauna, host plant, new records, Davraz Mountain, Turkey

1. Introduction

The flea beetles of tribe Alticini are a highly diverse group of leaf beetles comprising about 8000 to 12,000 species grouped in approximately 600 genera that are distributed worldwide (Biondi and D'Alessandro, 2012; Konstantinov et al., 2013; Nadein, 2013). Although it was treated as a separate subfamily in previous works and recent modern studies actively continue discussing Chrysomelidae phylogeny (Gomez-Zurita et al., 2007; Ge et al., 2011, 2012), the group is mostly classified as a tribe within the subfamily Galerucinae, and we follow this hypothesis in the present work. However, molecular data are still insufficient and need some further in-depth analyses due to the large number of unsampled genera. Knowledge about Turkish Alticini has increased considerably, and, according to the recent papers, the group is represented by 340 species belonging to 22 genera in Turkey, of which about 12% are endemic (Ekiz et al., 2013; Özdikmen et al., 2014).

Flea beetles are generally highly specialized phytophagous insects, most of the species being mono- or oligophagous (Biondi et al., 2013). Adult flea beetles feed mainly above the ground on various parts of higher plants, including leaves, roots, nonwoody stems, and rarely flowers (Konstantinov and Vandenberg, 1996). The remarkable diversity of the group is correlated with their extensive feeding habits. This distinct phytophagous diet, along with a worldwide distribution, lends alticines

considerable biogeographical, ecological, and economic importance.

Davraz Mountain, being an extension of the Taurus Mountains, is one of the important highlands of Turkey in terms of its zoogeographical location. Therefore, the aims of the present study are to list the Alticini species inhabiting Davraz Mountain, to give information about host plant associations of some species, to indicate species that especially occur in the alpine zone, and to add two more species to the current fauna of the Turkish Alticini.

2. Materials and methods

2.1. Study site

The study was carried out on Davraz Mountain in the province of Isparta, located in southern Turkey (Figure 1). Davraz Mountain is situated between the Mediterranean and Central Anatolia regions (37°47'N to 37°43'N, 30°41'E to 30°46'E) with altitudes ranging from 600 to 2635 m a.s.l. This position, like a corridor between the two geographical regions, has positive effects on both climate and floristic composition. Different vegetation types, including forest, shrub, steppe, and meadow, exist in the area.

Elevations of 1900 m and above of the mountain have alpine meadows lacking trees, dominated mainly by *Marrubium* and *Verbascum* spp. This region, lying between the tree zone and snow line, is treated as the alpine area. The subalpine area is just below this region, represented

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Figure 1. Location of Davraz Mountain.

by rare trees, scrubs, and moist meadows. The dominant vegetation of the Davraz Mountain includes populations of *Pinus nigra* subsp. *pallasiana*, *Juniperus oxycedrus* subsp. *oxycedrus*, *J. excelsa*, *Viola odorata*, *Saponaria officinalis*, *Medicago* spp., *Potentilla* spp., *Cirsium* spp., *Verbascum* spp., *Veronica* spp., *Lathyrus* spp., and *Crocus* spp. (Şan, 1997).

2.2. Sampling method and preparation

Field surveys were performed weekly from April to November in 2012 and 2013. Because the mountain is snow-capped during winter months until to April, for both study years samplings were started in late April and finished in early November. Adult flea beetles were collected from various plants using an entomological sweep-net and mouth aspirator. The authors tried to collect extensively from the widest possible area and all kinds of vegetation. In the study area, the maximum elevation for possible sampling was recorded as 2250 m. Therefore, samples were collected from the minimum and maximum elevations ranging between 1000 and 2250 m. In order to make meaningful comments, the altitudes were grouped into six categories.

Plants with leaves showing feeding marks were primarily examined. Plant species on which adult beetles were seen feeding constantly in field observations were considered to be potential host plants. To increase our confidence in the determination of true host associations, obvious damage levels on the vegetation and number of feeding adult leaf beetles observed were also taken into consideration. High population density of feeding beetles was accepted as the main factor in related host plant determination. Plants with feeding records with small numbers of beetles were ignored.

Collected beetles were taken to the laboratory to be mounted and labeled. All specimens were identified to species level under an Olympus SZ61 stereomicroscope. Drawings of the genitalia were made by using the program Adobe Illustrator CS6. Damaged host plants were also collected, preserved using standard methods, and sent to specialists for identification. Voucher specimens and host plants are deposited at the Biology Department of Süleyman Demirel University, Isparta.

3. Results

As a result of field studies conducted on Davraz Mountain and its surroundings during 2012 and 2013, a total of 1709 individuals belonging to 47 Alticini species and 7 genera were recorded (Table). *Longitarsus* was evidently dominant among the genera, comprising about 49% of all species gathered from the study area (Figure 2). The determined host plant associations of 24 species are also given in the Table together with related host families. Among the reported families, Brassicaceae, Scrophulariaceae, and Lamiaceae seem to be the most preferred ones, respectively.

One of the aims of this study was to detect species that occur only at limited elevations. Based on this, the study area was categorized into six subregions including different altitudes ranging between 1000 and 2250 m. Distribution of the number of species according to these elevation ranges is presented in Figure 3. Elevations between 1000 and 1600 m were mostly preferred by the species. Totally, 12 Alticini species were recorded from 1800 m and higher elevations: *Phyllotreta nigripes*, *Aphthona pygmaea*, *Altica lythri*, *Longitarsus aeneicollis*, *L. alferii*, *L. angelikae*, *L. baeticus*, *L. ballotae*, *L. foudrasi*, *L. pratensis*, *L. tabidus*, and *Chaetocnema tibialis*. Three of them, namely *L. baeticus*,

Table. List of flea beetles collected from Davraz Mountain with additional host plant and altitude information.

Flea beetle species	Recorded host plant(s)	Host plant family	Collected altitude(s)
<i>Phyllotreta</i> Chevrolat, 1837			
<i>P. atra</i> (Fabricius, 1775)	<i>Capsella bursa-pastoris</i> (L.) Medik	Brassicaceae	1275 m
<i>P. corrugata</i> Reiche, 1858	<i>Cardaria draba</i> (L.) Desv. <i>Diplotaxis tenuifolia</i> (L.) DC.	Brassicaceae	1000–1050 m
<i>P. erysimi</i> Weise, 1900	<i>Cardaria draba</i> (L.) Desv.	Brassicaceae	1000–1275 m
<i>P. fornuseki</i> Cizek, 2003			1000 m
<i>P. maculicornis</i> Pic, 1906	<i>Cardaria draba</i> (L.) Desv.	Brassicaceae	1125 m
<i>P. nigripes</i> (Fabricius, 1775)	<i>Cardaria draba</i> (L.) Desv.	Brassicaceae	1020–1944 m
<i>P. variipennis</i> (Boieldieu, 1859)	<i>Cardaria draba</i> (L.) Desv. <i>Diplotaxis tenuifolia</i> (L.) DC.	Brassicaceae	1000–1200 m
<i>P. vittula</i> (Redtenbacher, 1849)	<i>Cardaria draba</i> (L.) Desv.	Brassicaceae	1435 m
<i>Aphthona</i> Chevrolat, 1837			
<i>A. nigriceps</i> (Redtenbacher, 1842)			1650 m
<i>A. pygmaea</i> (Kutschera, 1861)	<i>Euphorbia</i> spp.	Euphorbiaceae	1125–1800 m
<i>A. warchalowskii</i> Fritzlar, 2001	<i>Euphorbia</i> spp.	Euphorbiaceae	1125 m
<i>Longitarsus</i> Berthold, 1827			
<i>L. aeneicollis</i> (Faldermann, 1837)	<i>Verbascum</i> sp.	Scrophulariaceae	1530–1800 m
<i>L. alferii</i> Pic, 1923	<i>Origanum onites</i> L.	Lamiaceae	1200–1800 m
<i>L. anchusae</i> (Paykull, 1799)	<i>Anchusa limbata</i> Boiss. & Heldr. <i>Anchusa undulata</i> L.	Boraginaceae	1125 m
<i>L. angelikae</i> Fritzlar, 2001			1800 m
<i>L. atricillus</i> (Linnaeus, 1761)	<i>Verbascum</i> sp.	Scrophulariaceae	1430–1650 m
<i>L. baeticus</i> Leonardi, 1979	<i>Verbascum</i> sp.	Scrophulariaceae	1944–2250 m
<i>L. ballotae</i> (Marsham, 1802)	<i>Marrubium globosum</i> Montbet & Aucher ex Bentham	Lamiaceae	1200–2250 m
<i>L. brunneus</i> (Duftschmidt, 1825)			1000–1435 m
<i>L. fallax</i> Weise, 1888			1000 m
<i>L. foudrasi</i> Weise, 1893	<i>Verbascum</i> sp.	Scrophulariaceae	1944 m
<i>L. gracilis</i> Kutschera, 1864			1650 m
<i>L. helvolus</i> Kutschera, 1863			1435 m
<i>L. karlheinzi</i> Warchalowski, 1972	<i>Phlomis armeniaca</i> Willd	Lamiaceae	1435–1530 m
<i>L. longipennis</i> Kutschera, 1863			1200 m
<i>L. luridus</i> (Scopoli, 1763)	<i>Mentha spicata</i> L. <i>Origanum onites</i> L.	Lamiaceae	1200–1650 m
<i>L. lycopi</i> (Foudras, 1860)	<i>Mentha spicata</i> L.	Lamiaceae	1200 m
<i>L. nigrofasciatus</i> (Goeze, 1777)	<i>Verbascum</i> sp.	Scrophulariaceae	1000–1650 m
<i>L. ochroleucus</i> (Marsham, 1802)			1200–1550 m
<i>L. pellucidus</i> (Foudras, 1860)			1650 m
<i>L. picicollis</i> Weise, 1900	<i>Verbascum</i> sp.	Scrophulariaceae	1000–1650 m
<i>L. pratensis</i> (Panzer, 1784)			1125–2250 m
<i>L. succineus</i> (Foudras, 1860)			1650 m
<i>L. tabidus</i> (Fabricius, 1775)	<i>Verbascum</i> sp.	Scrophulariaceae	1944–2250 m

Table. (Continued).

Altica Müller, 1764			
<i>A. lythri</i> Aubé, 1843			1800 m
Chaetocnema Stephens, 1831			
<i>C. aridula</i> (Gyllenhal, 1827)			1430–1530 m
<i>C. coyei</i> (Allard, 1863)			1230 m
<i>C. hortensis</i> (Geoffroy, 1785)			1400 m
<i>C. montenegrina</i> Heikertinger, 1912			1600 m
<i>C. tibialis</i> (Illiger, 1807)	<i>Amaranthus retroflexus</i> L. <i>Portulaca oleracea</i> L.	Amaranthaceae Portulacaceae	1000–1800 m
Dibolia Latreille, 1829			
<i>D. cynoglossi</i> (Koch, 1803)			1530–1650 m
Psylliodes Berthold, 1827			
<i>P. cuprea</i> (Koch, 1803)	<i>Capsella bursa-pastoris</i> (L.) Medik	Brassicaceae	1275 m
<i>P. instabilis</i> Foudras, 1860			1400 m
<i>P. isatidis</i> Heikertinger, 1912			1530–1550 m
<i>P. kiesenwetteri</i> Kutschera, 1864			1650 m
<i>P. laticollis</i> Kutschera, 1864			1200 m
<i>P. tricolor</i> Weise, 1888			1530 m

L. foudrasi, and *L. tabidus*, were collected only from the alpine zone including elevations between 1944 and 2250 m. The species that were found at almost all elevations in the study region without any special range preferences were *Longitarsus ballotae*, *L. pratensis*, and *Phyllotreta nigripes*.

Because Davraz Mountain is snow-capped throughout winter and a big part of the spring season, it was difficult to follow effects of seasonal change on the species composition in the area. However, June, July, and August were generally efficient sampling months in terms of

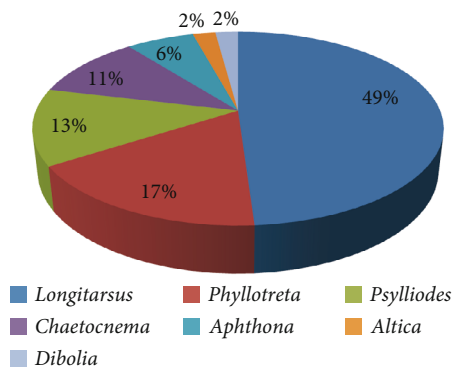


Figure 2. Percentages of flea beetle genera recorded from the study area in terms of species number.

both species and individual numbers. The most abundant species of the study area, according to total individual numbers, were *Longitarsus ballotae* (671), *Chaetocnema tibialis* (254), *Phyllotreta variipennis* (155), and *L. baeticus* (139), respectively.

Among the recorded 47 Alticini species, two of them were determined as new records for the Turkish fauna. General distributions of each species are given below together with habitat notes and remarks for additional information.

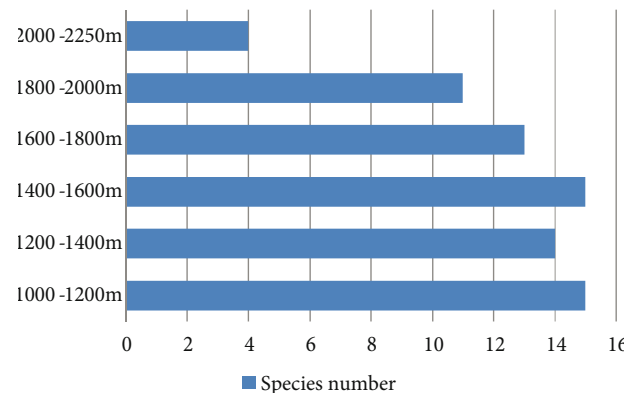


Figure 3. Distributions of the Alticini species numbers on Davraz Mountain with respect to different altitude ranges.

***Psylliodes laticollis* Kutschera, 1864**

Material examined: Davraz Mountain-Savköy district, 1200 m, 01.vi.2013, 1♂, 1♀.

General distribution: Middle, West, and South Europe, Northwest Africa, Macaronesia. It is treated as a European SW Palearctic element (Gruev, 2006; Löbl and Smetana, 2010).

Habitat information: The two specimens were collected by sweep-net from a moist area near a streamside. *Nasturtium officinale* R.Br. (Brassicaceae) is mentioned as its host plant in the literature (Čížek and Doguet, 2008).

Remarks: It is dark-blue with yellowish legs and darkened hind femora. Specimens are about 2.8 mm in length; they are morphologically similar to *Ps. napi*, but can be distinguished easily by the shape of the female spermatheca (Figure 4).

***Longitarsus brunneus* (Duftschmidt, 1825)**

Material examined: Davraz Mountain, 1435 m, 20.v.2012, 34♂♂, 15♀♀, 1430 m, 27.v.2012, 2♀♀, Büyükhacılar-Savköy district, 1000 m, 27.iv.2013, 2♀♀.

General distribution: Europe, Palearctic Asia (excluding Japan). It is treated as a Euro-Asiatic Palearctic element (Gruev, 2006; Löbl and Smetana, 2010).

Habitat information: Samples were collected from open areas near a roadside and from fields that lay fallow. A host plant could not be detected, but in the literature (Biondi, 1996; Čížek and Doguet, 2008), *Thalictrum* (Ranunculaceae) species are mentioned as host plants of *L. brunneus*.

Remarks: It is typically reddish-brown and about 2.0 mm in length; the elytral suture is sometimes darkened narrowly. Aedeagus and spermatheca are illustrated in Figure 5.

4. Discussion

Studies regarding leaf beetles and their host plant associations have increased recently in Turkey, as well as faunistic studies, and various host plant families have been reported (Çilbıroğlu and Gök, 2004; Gök and Çilbıroğlu, 2004; 2005; Aslan and Gök, 2006; Aslan et al., 2009). Lamiaceae, Brassicaceae, Scrophulariaceae, Boraginaceae, and Asteraceae were listed as mostly preferred host plant families in the aforementioned studies. The present study also agrees with previous host records. However, much more data will need to be accumulated from different regions in order to make detailed generalizations.

Elevations of 1900 m and upwards to the snow line can be treated as the alpine zone for Davraz Mountain. This zone includes meadows and open areas dominated mainly by *Marrubium* and *Verbascum* spp. without any trees. *Longitarsus baeticus*, *L. foudrasi*, and *L. tabidus* were collected only from this zone. This may suggest that these species are specialized to the alpine zone, or, more probably, they occurred there because their host plants were abundant in this zone.

Longitarsus represents the dominant genus in all elevations of the study region. This is not surprising

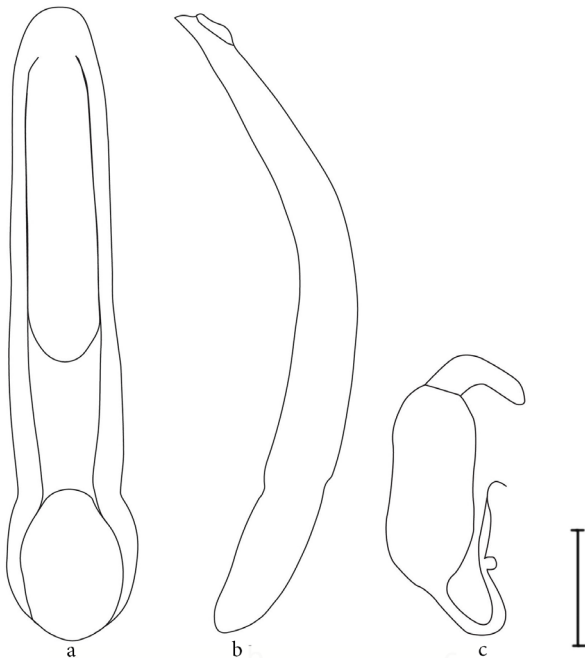


Figure 4. *Psylliodes laticollis* Kutschera: a) aedeagus ventral view, b) aedeagus lateral view, c) spermatheca. Scale bar = 0.2 mm.

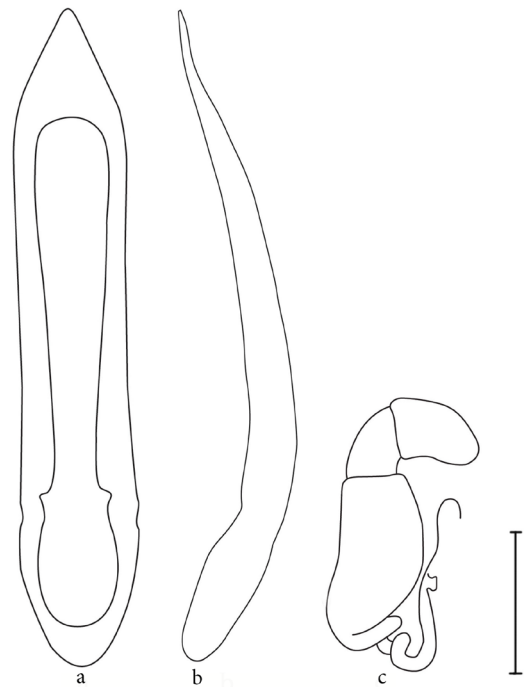


Figure 5. *Longitarsus brunneus* (Duftschmidt): a) aedeagus ventral view, b) aedeagus lateral view, c) spermatheca. Scale bar = 0.2 mm.

because it has a wider range of habitat and host plant preference than most other Alticini genera (Furth, 1980). Based on the specific food habits of the Alticini, it is known that the diversity of this group is closely related with the vegetation structure and composition (Aslan, 2010). Thus, the presence of the host plants in the study region, and especially the rich herbaceous vegetation, is of primary importance.

Severe climate conditions, the low average temperature, and widely uniform herbaceous cover were the possible factors responsible for the low species richness found on Davraz Mountain. However, the present study adds two

more species to the Alticini fauna of Turkey, and with one more recent contribution (Aslan et al., 2014), the accurate number reaches 343 species. Additionally, *Chaetocnema aridula* (Gyllenhal, 1827) is just added to the Alticini fauna of Isparta Province.

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