

**FLEA BEETLES (COLEOPTERA: CHRYSOMELIDAE) OCCURRING ON
AMARANTHUS RETROFLEXUS L. IN ERZURUM PROVINCE, TURKEY, AND
THEIR POTENTIAL AS BIOLOGICAL CONTROL AGENTS**

İRFAN ASLAN, HIKMET ÖZBEK, AND ALEXANDER KONSTANTINOV

(İA, HO) Atatürk University, Agricultural Faculty, Department of Plant Protection, 25240 Erzurum, Turkey (e-mail: aslanir@hotmail.com); (AK) Systematic Entomology Laboratory, PSI, Agricultural Research Service U.S. Department of Agriculture, % National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0168, U.S.A. (e-mail: akonstan@sel.barc.usda.gov)

Abstract.—Species composition and abundance of flea beetles (Coleoptera, Chrysomelidae) associated with *Amaranthus retroflexus* L. (Amaranthaceae) were studied in Erzurum province, Turkey, to find potential candidates for biological control of this weed. Insects were collected by sweeping net and aspirator on plant foliage at eight localities four times during the growing season. During three years of exploration, ten species of flea beetles were collected *Chaetocnema breviscula* (Faldermann), *Ch. concinna* (Marsham), *Ch. hortensis* (Geoffroy), *Ch. tibialis* (Illiger), *Longitarsus longipennis* Kutschera, *L. pellucidus* Foudras, *Phyllotreta atra* (F.), *Ph. cruciferae* (Goeze), *Ph. nigripes* (F.), and *Ph. vittula* (Redtenbacher). In all localities *Ch. tibialis* was more abundant than other species. Simple feeding tests in petri dishes showed that only the *Chaetocnema* species were actually feeding on leaves of *Amaranthus retroflexus*. Analysis of flea beetle species associated with this plant shows that it is probably not native to Turkey.

Key Words: flea beetles, biological control, *Amaranthus retroflexus* L., *Chaetocnema*

Amaranthus retroflexus L. (Amaranthaceae), or redroot pigweed, occurs throughout much of the world, including Europe, North and South America, Asia, Africa and Australia. In North America it is common from Canada to Mexico, and from the Atlantic to the Pacific coasts (Spencer 1957). It is a summer annual, commonly found in cultivated lands such as fields, gardens, and orchards; fallow land, stream valleys, beaches and streambanks, prairie ravines, roadsides, fence rows, and waste places (Roland and Smith 1969). *Amaranthus retroflexus* is harmful to livestock because it affects the kidneys of swine when animals consume large quantities of fresh material (Wohlgemuth et al. 1987), and it is consid-

ered an important exotic weed in North America (King 1966). However, the native range of this plant is unclear. Some authors believe it was introduced into the United States in the early 18th century (King 1966) and later to Eastern Europe and Russia (Nikitin 1983), but Auld and Medd (1987) considered it to be native to North America. Different sources provide opposing ideas on the history of its distribution. For example, according to Haughton (1978) it is native to Spain, from which it was brought to the New World by conquistadors. Bermejo and González (1994) suggest that the same conquistadors transported it in the opposite direction, from South America to Spain.

Three amaranth species occur in Turkey,

Amaranthus blitoides S. Wats, *A. graecizans* L., and *A. retroflexus*. However, only the latter species is common in Erzurum Province (Baytop 1994). *Amaranthus retroflexus* grows from 15 cm to 100 cm tall and becomes particularly abundant in vegetable fields (Baytop 1994). For this reason it is considered one of the most serious weeds in Turkey (Baytop 1994) as well as in Europe. Therefore it was chosen for biological control research within the framework of European Cooperation in the Field of Scientific and Technical Research (Müller-Scharer 1993, Schroeder et al. 1993).

Most of the biological control efforts regarding *Amaranthus retroflexus* are concentrated on the group of leaf beetles called flea beetles. It is the largest group within leaf beetles and is distributed throughout the world. The adults feed on the foliage of herbaceous plants, bushes and trees from a wide range of angiosperm families, as well as some gymnosperms. Larvae live in soil, plant tissues, or leaves. Many flea beetles cause severe damage to cultivated plants (Onat 1993; Naibo 1974; Kostromitin 1978; Aslan and Özbek 1998, 2000), however many other species have been successfully used as biological control agents of noxious weeds (Konstantinov and Vandenberg 1996). Aslan et al. (1999) and Aslan and Warchalowski (2001) recorded 244 flea beetle species and subspecies belonging to 21 genera in Turkey. Of these species, 21 cause extensive damage to various weeds in the vicinity of Erzurum (Aslan and Özbek 1999). Relatively few flea beetle species are recorded on *Amaranthus retroflexus* in Europe (Doguet 1994, Cagan et al. 2000).

The goal of our study was to collect flea beetles occurring on *Amaranthus retroflexus* in Erzurum Province of Turkey, assess their abundance, and provide information on their distribution and host range. Presence or absence of flea beetles limited in their host range to *Amaranthus retroflexus* would add valuable data to the ongoing discussion on the native range of this weed.

MATERIALS AND METHODS

Erzurum Province is located in the Eastern Anatolia region of Turkey at the average altitude of 1,850 m. It is a montane country with a variety of climatic conditions. A continental climate with hot and relatively dry summer and cold snowy winter dominates the eastern and western parts of Erzurum province at the altitude of 1500–1900 m. Northeastern parts of the province with altitudes close to 700 m have a less continental climate.

Field surveys of flea beetles associated with *Amaranthus retroflexus* were carried out in the first week of June, July, August and September at eight localities in different climatic regions of Erzurum province. Insects were collected by sweep net and by aspiration from plant foliage of 20 randomly chosen plants. Collected insects were taken to the laboratory, where they were sorted and identified. At the same time, ten adults of each species were put in petri dishes with leaves of *A. retroflexus*. During the following ten days petri dishes were checked for leaf damage caused by feeding.

RESULTS

Adults of the following species were collected on *Amaranthus retroflexus*: *Chaetocnema breviscula* (Faldermann), *Ch. concinna* (Marsham), *Ch. hortensis* (Geoffroy), *Ch. tibialis* (Illiger), *Longitarsus longipennis* Kutschera, *L. pellucidus* Foudras, *Phyllotreta atra* (F.), *Ph. cruciferae* (Goeze), *Ph. nigripes* (F.), and *Ph. vittula* (Redtenbacher). *Chaetocnema* and *Phyllotreta* species were predominant in almost every locality.

Chaetocnema species were found in all observed localities. The most common among them was *Ch. tibialis* accounting for 78.8% of all flea beetles. In the northeastern towns of the province, Tortum, Oltu, Olur and Renkaya, *Ch. tibialis* and *Ch. concinna* were more abundant than in the eastern and western towns of the province. *Chaetocnema hortensis* and *Ch. breviscula* were more abundant in the eastern and western

Table 1. Number of *Chaetocnema breviscula* adults on *Amaranthus retroflexus* at different localities of Erzurum Province during 1998–2000.

Localities	1998				1999				2000			
	June	July	August	Sept.	June	July	August	Sept.	June	July	August	Sept.
Aşkale	11	14	17	2	5	12	17	1	15	12	11	2
Dumlu	2	1	7	1	2	5	4	2	6	5	7	0
Ilıca	9	7	8	2	8	4	9	1	11	6	12	4
Olur	2	0	5	0	3	1	3	1	1	3	2	0
Oltu	0	2	1	0	1	1	2	0	3	2	2	1
Pasinler	4	3	6	1	2	1	4	1	3	4	6	2
Çenkaya	0	2	1	0	1	0	3	1	3	0	2	0
Tortum	3	1	4	1	2	1	2	0	2	1	3	0

localities than in the northeastern parts of Erzurum Province. The number of *Chaetocnema* species collected in different localities of Erzurum Province is shown in Tables 1–4. *Phyllotreta* species were second in abundance after *Chaetocnema*, with *Phyllotreta atra* being the most abundant species of this genus (with 38.81% of individuals). *Longitarsus* species were least abundant with *L. pellucidus* being the most common species of this genus. The highest number of *L. pellucidus* was observed in Pasinler and Aşkale. Very few specimens of *L. longipennis* were found in some localities.

Laboratory tests showed that only *Chaetocnema* species (*Ch. breviscula* (Faldermann), *Ch. concinna* (Marsham), *Ch. hortensis* (Geoffroy), and *Ch. tibialis* (Illiger)) fed on *A. retroflexus*. The adults of other species did not feed on the leaves of *A. retroflexus*.

DISCUSSION

Chaetocnema tibialis is known to feed on amaranthus plants in Europe (Nonveiller 1960, 1978) and in Turkey (Aslan 1997). *Chaetocnema breviscula*, *Ch. concinna* and *Ch. tibialis* are serious pests of sugar beet (*Beta vulgaris* L.) both in Turkey (Aslan and Özbek 1998, 2000; Yıldırım and Özbek 1992) and in some European countries (Gruev and Tomov 1986, Neves 1983, Slavchev 1984, Rimsa and Konecny 1983, Cooke 1992, Mostovaya 1994). However, our survey showed large numbers of them actively feeding on *Amaranthus retroflexus* causing significant damage to the plant. *Chaetocnema hortensis* commonly feeds on Gramineae species in Turkey (Aslan 1997) and some European countries (Mohr 1966, Gruev and Tomov 1986). Our survey confirms that it also feeds on *Amaranthus retroflexus*. It is important to note that all

Table 2. Number of *Chaetocnema concinna* adults on *Amaranthus retroflexus* at different localities of Erzurum Province during 1998–2000.

Localities	1998				1999				2000			
	June	July	August	Sept.	June	July	August	Sept.	June	July	August	Sept.
Aşkale	12	7	15	2	15	12	17	2	13	21	12	2
Dumlu	15	8	17	1	16	19	25	5	11	9	27	0
Ilıca	11	5	16	4	8	14	23	3	8	12	21	3
Olur	32	22	37	2	15	11	29	8	23	15	32	5
Oltu	28	22	38	5	24	16	37	4	18	13	18	3
Pasinler	16	14	16	7	22	11	32	9	13	17	26	5
Çenkaya	25	18	32	7	24	33	28	5	22	15	27	4
Tortum	23	14	31	1	12	15	29	2	24	19	32	0

Table 3. Number of *Chaetocnema hortensis* adults on *Amaranthus retroflexus* at different localities of Erzurum Province during 1998–2000.

Localities	1998				1999				2000			
	June	July	August	Sept.	June	July	August	Sept.	June	July	August	Sept.
Aşkale	10	7	25	3	12	8	17	2	11	6	8	1
Dumlu	4	3	7	1	5	3	7	3	8	4	17	5
Ilica	13	7	12	4	8	7	9	2	5	3	11	6
Olur	0	2	5	1	2	1	3	4	3	6	8	2
Oltu	3	0	2	0	4	2	7	1	2	3	2	0
Pasinler	11	5	16	7	12	6	14	7	11	7	16	4
Renkaya	3	5	11	1	5	4	8	0	3	5	6	1
Tortum	0	2	5	0	2	4	9	1	2	8	5	2

aforementioned *Chaetocnema* species are widely polyphagous, feeding on plants from many families (Lopatin 1977). They also have wide geographic ranges throughout almost the entire Palearctic region (Konstantinov 1988).

The most common host plant of *Longitarsus longipennis* and *L. pellucidus* is *Convolvulus arvensis* (Gruev and Tomov 1986, Warchalowski 1996, Aslan 1997). Although commonly collected on *A. retroflexus* in Erzurum Province, they did not feed on this plant under laboratory conditions. Their presence on *A. retroflexus* is temporary and accidental. It happened only because of close coexistence of *Convolvulus arvensis* and amaranth. *Convolvulus arvensis* was often found climbing on *A. retroflexus* in many localities of Erzurum Province.

All *Phyllotreta* species generally feed on Cruciferae in Turkey (Aslan and Özbek 1988, 2000) and in Europe (Mohr 1966,

Gruev and Tomov 1986, Kostromitin 1978). *Phyllotreta vittula* is known as important pest of crucifers, as well as sugar beets, cereals (Naibo 1974), and maize (Szoëke 1997). All collected *Phyllotreta* species are widely oligophagous or polyphagous. In laboratory tests they did not feed on *A. retroflexus*.

None of the species collected on *Amaranthus retroflexus* in Erzurum seems suited for biocontrol of this weed, although they collectively cause significant damage to the plant. The same results were obtained by Cagan et al. (2000) for *Amaranthus* species in Slovakia.

One of the biological features of a plant native to any particular region is the presence of phytophages (flea beetles in particular) closely associated with the plant. The host ranges of these phytophages are narrow (narrowly oligophagous or monophagous) and their distribution is often limited

Table 4. Number of *Chaetocnema tibialis* adults on *Amaranthus retroflexus* at different localities of Erzurum Province during 1998–2000.

Localities	1998				1999				2000			
	June	July	August	Sept.	June	July	August	Sept.	June	July	August	Sept.
Aşkale	20	17	45	9	45	32	27	8	17	21	25	2
Dumlu	20	8	27	6	16	31	36	9	21	29	17	5
Ilica	23	11	20	7	18	24	29	7	15	19	22	6
Olur	40	29	57	12	27	15	31	9	31	33	36	5
Oltu	35	25	28	9	14	21	27	11	28	30	24	8
Pasinler	16	14	16	7	22	11	32	9	13	17	26	7
Renkaya	65	52	102	19	34	44	48	12	33	36	62	11
Tortum	30	21	41	10	26	28	29	5	22	29	33	9

to or does not exceed the range of the host plant. Absence of such oligophages or monophages on a given territory would suggest that it probably is not part of the native range of the plant. The fact that three years of exploration in Erzurum Province revealed no species of flea beetles specialized in feeding on *Amaranthus retroflexus* probably suggests that Erzurum Province of Turkey is not part of the native range of *Amaranthus retroflexus*.

ACKNOWLEDGMENTS

We thank E. E. Grisell and A. L. Norrbom (Systematic Entomology Laboratory, Washington, DC) and C. Staines (Department of Systematic Biology, Smithsonian Institution, Washington, DC) for reviewing this manuscript and providing valuable suggestions.

LITERATURE CITED

- Aslan, İ. 1997. Erzurum İ Alticinae (Coleoptera, Chrysomelidae) Türleri Üzerinde Faunistik ve Sistemik Bir Araştırma. Doktora Tezi, Atatürk Üniversitesi Fen Bilimleri Enstitüsü. 215 pp.
- Aslan, İ. and H. Özbek. 1998. Erzurum'da sebzelerde zarar yapan yaprak böcekleri (Coleoptera, Chrysomelidae). 2. Sebze Tarımı Sempozyumu, 28–30 September 1998, Tokat, pp. 335–340.
- . 1999. Erzurum İli'nde bazı yabancı otlarda beslenerek önemli derecede zarar veren yaprak böcekleri (Coleoptera, Chrysomelidae). Türkiye 4. Biyolojik Mücadele Kongresi Bildirileri, 26–29 January 1999, Adana, pp. 75–86.
- . 2000. Cruciferae Familyası İçerisinde Yer Alan Bazı Sebzelerde Zararlı Olan *Phyllotreta* (Coleoptera, Chrysomelidae), Alticinae) Türleri, Kısa Biyoloji ve Zararları. III. Sebze Tarımı Sempozyumu, 11–13 September 2000, Isparta, pp. 203–207.
- Aslan, İ. and A. Warchalowski. 2001. New records of the subfamily Alticinae (Coleoptera, Chrysomelidae) for the Turkish fauna. Journal of the Entomological Research Society 3(1–2): 1–4.
- Aslan, İ., B. Gruev, and H. Özbek. 1999. A Preliminary Review of the Subfamily Alticinae (Coleoptera, Chrysomelidae) in Turkey. Turkish Journal of Zoology 23(4): 373–414.
- Auld, B. A. and R. W. Medd. 1987. Weeds, an Illustrated Botanical Guide to the Weeds of Australia. Inkata Press, Melbourne Sidney. 255 pp.
- Baytop, T. 1994. Türkçe Bitki Adları Sözlüğü. Türk Dil Kurumu Yayınları: 578. 508 pp.
- Bermejo, J. E. H. and A. L. González. 1994. Processes and causes of marginalization: the introduction of American flora to Spain. pp. 261–272. In Bermejo, J. E. H. and J. León, eds. Neglected Crops. 1492 from a Different Perspective. FAO Plant Production and Protection Series No 26. 341 pp.
- Cagan, L., M. Vrablova, and P. Toth. 2000. Flea beetles (Chrysomelidae: Alticinae) species occurring on *Amaranthus* spp. in Slovakia. <http://www.agr.hr/JCEA/Issues/jcea1-1/fbsa-fulltext.htm> Journal Central European Agriculture 1(1): 14–25.
- Cooke, D. A. 1992. Pests of sugar beet in the UK. Agricultural Zoology Reviews 5: 97–137.
- Doguet, S. 1994. Coléoptères Chrysomelidae, Vol. 2 Alticinae. Faune de France 80. Fédération Française des Sociétés naturelles. Paris. 697 pp.
- Gruev, B. and V. Tomov. 1986. Fauna Bulgarica 13, Coleoptera, Chrysomelidae, Part II. Chrysomelinae, Galerucinae, Alticinae, Hispinae, Cassidinae. In Aedibus Academia Scientiarum Bulgaricae. 388 pp.
- Haughton, C. S. 1978. Green Immigrants: Plants that Transformed America. Harcourt, Brace, Jovanovich, New York and London. 450 pp.
- King, L. J. 1966. Weeds of the World. Biological Control. London. Leonard Hill. Interscience Publishers, Inc. New York. 526 pp.
- Konstantinov, A. S. 1988. Landscape and zonal features in the distribution of *Chaetocnema* species (Coleoptera, Chrysomelidae) in the European part of the USSR and the Caucasus. Vestnik Zoologii 6: 44–47.
- Konstantinov, A. and N. Vandenberg. 1996. Handbook of Palearctic flea beetles (Coleoptera: Chrysomelidae: Alticinae). Associated Publishers Gainesville. 1(3): 238–439.
- Kostromitin, V. B. 1978. Damage by crucifer flea beetle. Zashchita Rastenii 7: 3–7.
- Lopatin, I. 1977. Leaf-beetles (Chrysomelidae) of Middle Asia and Kazakhstan. Nauka, Leningrad, 268 pp.
- Mohr, K. H. 1966. Chrysomelidae, pp. 95–299. In Freude, H., K. W. Harde, and G. A. Lohse (Goecke and Evers, eds.), Die Kafer Mitteleuropas Krefeld. Vol. 9.
- Mostovaya, R. N. 1994. Distribution by habitats of the chief pests in a rotation. Sakharnaya Svekla 9: 13–14.
- Müller-Scharer, H. 1993. Biological control of weeds in crops: a proposal of new COST action, pp. 181–185. In Maitrise des adventices par voie non chimique. IFOAM Conference, Dijon.
- Naibo, B. 1974. Damage by the flea beetle *Phyllotreta vittula* Redt. on maize. Revue de Zoologie Agricole et de Pathologie Vegetale 73(2): 70–72.
- Neves, E. F. 1983. On the insects fauna of sugar beet in Portugal. Boletim da Sociedade Portuguesa de Entomologia 2(37): 77–94.

- Nikitin, V. V. 1983. Weedy plants of the flora of the USSR. Leningrad. Nauka. 451 pp.
- Nonveiller, G. 1960. Stetni buvaki kulturnog i drugog korisnog bilja Srbije (Halticinae, Fam. Chrysomelidae, Coleoptera). Institut za zastitu bilja, Beograd, pp. 37–43.
- . 1978. Les Altises de Serbie et Leurs Planteshotes (Chrysomelidae; Coleoptera). 1. Le genera *Chaetocnema* Steph. Recueil des travaux sur la faune d'insectes de la Serbie, t.2, de l'Academie Serbe des Sciences et des Arts, Beograd, pp. 91–111.
- Onat, G. 1993. Türkiye'de pancar zararlısı olarak tespit edilen böcekler. *Reker Dergisi* 87: 57–62.
- Popov, P. 1972. Insect pests of medicinal crops in Bulgaria, III Coleoptera. *Rastaniev'dini Nauki* 9(5): 167–175.
- Rimsa, V. and I. Konecny. 1983. Sugar beet seedling pests and diseases: present and future control in Czechoslovakia. 10th International Congress Brighton, England, 20–25 November 1983. Plant Protection for Human Welfare, p. 1208.
- Roland, A. E. and E. C. Smith. 1969. The flora of Nova Scotia. Halifax, NS. Nova Scotia Museum. 746 pp.
- Schroeder, D., H. Müller-Scharer, and C.S. A. Stinson, 1993. A European weed survey in 10 major crop systems to identify targets for biological control. *Weed Research* 33(6): 449–458.
- Slavchev, A. 1984. Protection of sugar beet against pests. *Rastiteina Zashita* 32(2): 20–23.
- Spencer, E. R. 1957. All About Weeds. Dover Publications, Inc., New York. 333 pp.
- Szoeke, K. 1997. Damage of millet flea beetle on spring barley and maize. *Novenyvedelem* 33(1): 33–34.
- Warchalowski, A. 1996. Übersicht der westpalaarktischen Arten der Gattung *Longitarsus* Berthold, 1827 (Coleoptera: Chrysomelidae: Halticinae). *International Journal of Invertebrate Taxonomy* (Supplement), Wroclaw, Poland, BS. 266 pp.
- Wohlgemuth, K., G. J. Schamber, A. R. Misek, and J. D. Crenshaw. 1987. Pigweed is toxic to pigs. *North Dakota Agricultural Experiment Station. Bulletin* 44(4): 21–22.
- Yıldırım, E. and H. Özbek. 1992. Erzurum Şeker Fabrikasına bağlı şeker pancarı üretim alanlarındaki zararlı ve yararlı böcek türleri. Türkiye II. Entomoloji Kongresi, 28–31 Ocak 1992, Adana, pp. 621–635.



Aslan, Irfan, Özbek, Hikmet, and Konstantinov, Alexander S. 2003. "Flea beetles (Coleoptera: Chrysomelidae) occurring on *Amaranthus retroflexus* L. in Erzurum Province, Turkey, and their potential as biological control agents." *Proceedings of the Entomological Society of Washington* 105, 441–446.

View This Item Online: <https://www.biodiversitylibrary.org/item/54811>

Permalink: <https://www.biodiversitylibrary.org/partpdf/55345>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Smithsonian

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: Entomological Society of Washington

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.