



Aphids living on *Echinops* in Iran: *Turanoleucon jashenkoi* (Hemiptera, Aphididae) as a new record

Zahra Goodarzifar¹, Seyed Massoud Madjdzadeh¹ & Mohsen Mehrparvar²

¹ Department of Biology, Faculty of Sciences, Shahid Bahonar University of Kerman, Kerman, Iran.

² Department of Biodiversity, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran.

ABSTRACT. So far, three aphid species including *Aphis fabae* Scopoli, 1763, *Brachycaudus cardui* (Linnaeus, 1758) and *Paczoskia meridionalis* Holman, 1981 are reported on *Echinops* in Iran. In this study, two more aphid species were collected on *Echinops* in Iran: *Myzus persicae* (Sulzer, 1776) and *Turanoleucon jashenkoi* Kadyrbekov, 2002. The little-known aphid genus *Turanoleucon* and the species *T. jashenkoi* are reported here for the first time from Iran. The biometric data of apterous and alate viviparous females of Iranian population of *T. jashenkoi* are given from specimens collected from Fars province, Iran. The morphological differences between Iranian population and the original description of the species, i.e. Kazakhstan population, are discussed. An identification key to the apterous viviparous female aphids living on *Echinops* in Iran is provided.

Key words: Macrosiphini, fauna, taxonomy, distribution.

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Introduction

Echinops, commonly known as globe thistles, is a perennial flowering plant genus in the family Asteraceae with about 120 species in the world. They have spiny foliage and produce blue or white spherical flower heads. The plants of the genus are distributed from east Europe to central Asia and south to the mountains of tropical Africa (Brickell 2008). There are about 54 species reported from Iran (Mozaffarian 1998). So far, more than 20 aphid species are reported on *Echinops* worldwide (Blackman

& Eastop 2006; Holman 2009; Blackman & Eastop 2016), from which three species including *Aphis fabae* Scopoli, 1763, *Brachycaudus cardui* (Linnaeus, 1758) and *Paczoskia meridionalis* Holman, 1981 are also collected in Iran (Hodjat 1993). During the studies on aphid fauna of Iran since 2006, two more aphid species were collected on *Echinops*: *Myzus persicae* (Sulzer, 1776) and *Turanoleucon jashenkoi* Kadyrbekov, 2002, which the latter is reported here for the first time.

Corresponding author: Mohsen Mehrparvar, E-mail: mehrparvar@aphidology.com

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Material and methods

Specimens collected in this study are either preserved in ethanol 75% or slide mounted and deposited in the Aphid Collection of Aphidology Research Group, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran and in the insect collection of Department of Biology, Faculty of Sciences, Shahid Bahonar University of Kerman, Kerman, Iran. The specimens were identified using related resources (e.g. Holman 1981; Heie 1986, 1992, 1994, 1995; Blackman & Eastop 2006; Blackman & Eastop 2016).

Abbreviations used in the text are as follows: ANT, antennae length; ANTI, ANTI, ANTII, ANTIII, ANTIV, ANTV, ANTVIb, antennal segments I, II, III, IV, V, and the base of antennal segment VI, respectively; ANTI, III Base, basal diameter of antennal segment III; PT, processus terminalis; URS, ultimate rostral segment; 2HT, second segment of hind tarsus; and SIPH, siphunculus; ABD TERG, abdominal tergites.

Results

Aphis fabae Scopoli, 1763 (Aphididae: Aphidini)

Apterae are blackish, frequently with white wax markings. Body length is 1.5–3.1 mm (Blackman & Eastop 2006). *Aphis fabae* s.s. lives on a wide range of host plants including many agricultural crops (Blackman & Eastop 2007), and is cosmopolitan (Blackman & Eastop 2006). This polyphagous aphid species is distributed all over Iran and is associated with many plants including *Echinops* (Hodjat 1993). As reported for Europe, *A. fabae* seems to comprise various sibling species or subspecies according to its host plants or geographical regions in Iran (Hodjat 1985).

Brachycaudus cardui (Linnaeus, 1758) (Aphididae: Macrosiphini)

Apterae are shiny black dorsally and light green to yellowish or reddish ventrally. Body length is 1.9–2.3 mm (Blackman & Eastop 2006). This aphid is a myrmecophilous species that appears in dense ant-attended colonies on stems and leaves of many species of *Prunus* (primary host) and Asteraceae and Boraginaceae (secondary hosts). Based on Hodjat 1993, it alternates between *Prunus* and *Carduus* in the Alborz region. *Brachycaudus cardui* is also a common polyphagous aphid distributed in most parts of Iran (Hodjat 1993).

Myzus persicae (Sulzer, 1776) (Aphididae: Macrosiphini)

Apterae appear in variable colors including green, pale yellowish-green, pink or reddish, rather uniformly colored. Body length is 1.2–2.1 mm (Blackman & Eastop 2006). It is a polyphagous species living on herbaceous plants of over 40 different plant families. Its origin is probably from East Asia which now has a worldwide distribution. This very well-known aphid species lives on numerous plants in all over Iran and it is a very serious agricultural pest which can transmit numerous plant viruses. Sexuales were collected from *Prunus persicae* and *Prunus dulcis* (Hodjat 1993). In the current study, the specimens were collected for the first time on *Echinops* in Iran from northern parts of Fars province, Noor-Abad, N 30°08′ E 51°24′, 900 m. a.s.l., 30 April 2009, Z. Goodarzifar; Mamasani, N 29°59′ E 51°37′, 1181 m. a.s.l., 05 May 2009, Z. Goodarzifar; Noor-Abad, N 30°05′ E 51°35′, 1064 m. a.s.l., 09 May 2009, Z. Goodarzifar.

***Paczoskia meridionalis* Holman, 1981
(Aphididae: Macrosiphini)**

Adult morphs of this species are rather large (3.10–4.15 mm), shining dark brown in color which mainly distributed in Eastern Mediterranean (Holman 1981). This species was described by Holman in 1981, who described and compared the morphology of different populations. He mentioned *P. meridionalis* as a southern vicarious species of *P. major* and stated that in this species there are some intraspecific variations. On the basis of these intraspecific variations between samples, Holman (1981) considered the presence of three groups: i) specimens from Lebanon and Israel on *Echinops* sp. and *Echinops viscosus*, ii) specimens from former Yugoslavia on *Echinops spinosissimus* and iii) specimens from Iran on *Echinops* sp.. This species was already collected from some localities in Iran including Shiraz (Ardakan-Shiraz Rd.) located in Fars province, south-west of Iran; Binalud Mountain, north of Gonabad, north-east of Iran (Hodjat 1993).

***Turanoleucon jashenkoi* Kadyrbekov, 2002 (Aphididae: Macrosiphini)
(Fig.1 A-H, Table 1)**

This aphid lives in sparse colonies on shoots of *Echinops* (Asteraceae) and not visited by ants. The sexual forms are not known yet.

Apterous viviparous females (based on 16 examined specimens): Body color in living specimens is dark brown. Color in specimens mounted on slide: head brown; antennae dark brown, basal part of ANTIII paler; URS and coxa dark brown; trochanter, anal and genital plates brown; fore femur brown and paler than mid and hind femora, basal part of femora paler; tibiae gradually become darker toward the apex from brown to dark brown; tarsi dark brown; SIPH and cauda dark brown but SIPH is darker than cauda; abdominal segments pale

without pigmentation; dorsal hairs arising from dark basal scleroites.

Morphological characters: Body oval-egg shaped, 3.21–3.98 mm long; head smooth; antennal tubercles are low with diverging inner sides; median tubercle distinct. Frontal hairs are long (0.071–0.095 mm) and thick. Antennae are six-segmented. The longest hair on ANTIII as long as basal width of ANTIII. ANTIII bearing (31)39–63 secondary rhinaria distributed on 63–87% of its length. URS long (0.33–0.36 mm) and pointed passing hind coxa, bearing 8–10 fine accessory hairs; first tarsal segment with 5–5 hairs. Dorsum membranous; dorsal hairs placed on small distinctly visible dark scleroites. Marginal tubercles are absent. Ante- and post-siphuncular sclerites in the base of the siphunculi are absent. SIPH 0.88–1.15 mm long and cylindrical, wide in the base, with 33–41% reticulation on apex. Siphunculus flanges are distinct. Cauda elongate (0.50–0.58 mm), tongue-shaped, with a weak constriction on the base and bearing 13–27 hairs. The proportional measurements are presented in Table 1.

Alate viviparous females (based on five examined specimens): Color in living specimens is similar in appearance to apterous viviparous females. Color in macerated specimens: ANTIII and thorax brown; abdominal segments pale with brown marginal pigmentations. Abdominal segment VIII with a brown transverse band. Wings pale with pale brown veins. Otherwise, like apterous viviparous females.

Morphological characters: Body oval-egg shaped, 3.51–3.68 mm long; Frontal hairs are long (0.064–0.067 mm) and thick. ANTIII bearing 67–77 secondary rhinaria distributed on 88–92% of its length. SIPH with 35–37% reticulation on apex. Cauda elongate (0.46–0.48 mm), tongue-shaped, bearing 22–24 hairs. Otherwise, like apterous viviparous females. The proportional measurements are presented in Table 1.

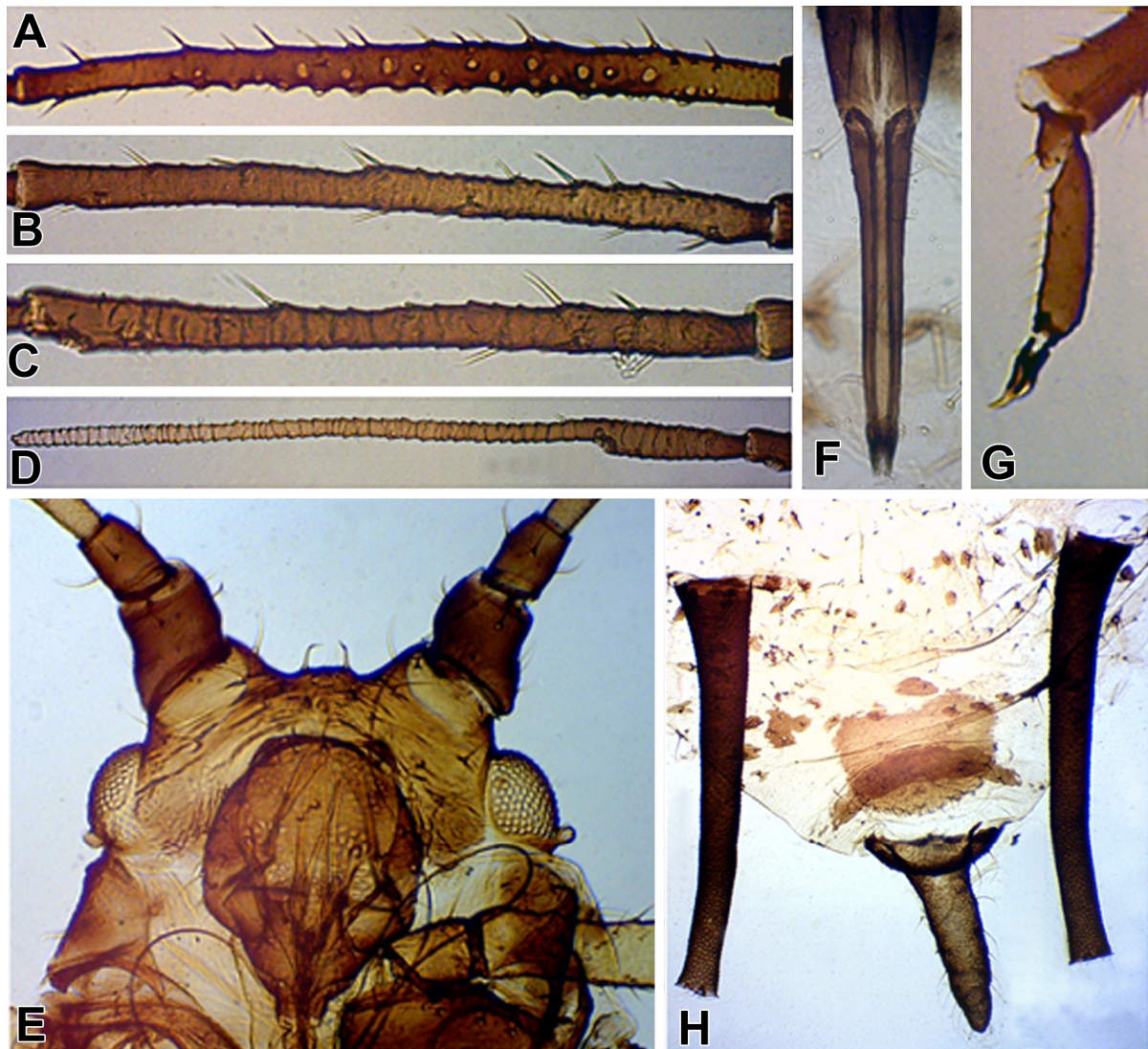


Figure 1. *Turanoleucon jashenkoi* Kadyrbekov, 2002, Apterous viviparous female, A. Antennal segment III (ANTIII); B. Antennal segment IV (ANTIV); C. Antennal segment V (ANTV); D. Antennal segment VI (ANTVI); E. Ventral surface of head; F. Ultimate rostral segment (URS); G. Hind tarsi; H. Cauda and siphunculus (SIPH).

Remarks: Iranian population of *T. jashenkoi* has morphological differences with the original description of the species which occurs in Kazakhstan. Iranian population has longer body, frontal hairs, URS and cauda, and lesser extent of reticulation on SIPH. They have more secondary rhinaria on ANTIII,

which occupy more length of ANTIII than in Kazakhstan population. The proportions of frontal hairs to basal diameter of ANTIII, PT to ANTIVb and SIPH to Body length are larger in Iranian population than Kazakhstan population, but the proportion of URS/Cauda is smaller (see Table 1).

Materials examined: Totally 16 apterous viviparous females and five alate viviparous females were examined; (ARG00008), Iran: Fars province, Ardekan, N30°17'E51°58', 2612 m. a.s.l., 09 June 2008, Z. Goodarzifar.

Key to the apterous viviparous female aphids living on *Echinops* in Iran

1. SIPH without polygonal reticulation 2
 - SIPH with a subapical zone of polygonal reticulation 4
2. Cauda short, helmet-shaped; spiracular apertures large and rounded; dorsal abdomen with a solid dark shield *Brachycaudus cardui*
 - Cauda tongue- or finger-shaped, longer than its basal width in dorsal view; spiracular apertures reniform; dorsal abdomen without a solid dark shield 3
3. SIPH pale, slightly clavate; head with spicules; ANT tubercles well developed; ABD TERG 1 and 7 without marginal tubercles..... *Myzus persicae*
 - SIPH wholly dark, as dark as cauda; head smooth; ANT tubercles weakly developed. ABD TERG 1 and 7 with marginal tubercles; dorsal abdomen with dark cross-bands on ABD TERG 7 and 8 *Aphis fabae*
4. ANT tubercles well developed; crescent-shaped antesiphuncular sclerites present *Paczoskia meridionalis*
 - ANT tubercles low; antesiphuncular sclerites absent..... *Turanoleucon jashenkoi*

Discussion

Some morphological differences were found between the specimens of *T. jashenkoi* described by Kadyrbekov (2002)

and the specimens that were collected from Iran in this study (see Table 1). Since aphid's morphology depends greatly on the environment, it could be supposed that these differences derive from different environmental conditions and geographical distribution (e.g. Madjd-zadeh & Mehrparvar 2009). These two factors are among the most important aspects that contribute to the differentiation between populations (Madjd-zadeh & Mehrparvar 2009) and even species.

Beside these, there are some morphological similarities between *T. jashenkoi* (both Iranian and Kazakhstan populations) and the only other nominal *Turanoleucon* species, i.e. *T. mitjaevi* Kadyrbekov, 2002. The latter species was described from *Cousinia*, a similar thistle-like plant growing in similar habitats.

Since feeding on different host plants could be the source of morphological differences between aphid populations (e.g. Madjd-zadeh *et al.* 2009; Mehrparvar *et al.* 2012), it is likely that these two species are indeed one. Nothing is known about the host preferences or specificity of members of this little-known aphid genus, and in fact, the distinction between *T. jashenkoi* and *T. mitjaevi* is also based on characters that overlapping in value and are strongly influenced by the environment. Therefore, one might justifiably concludes that these two species are possibly one species, however this needs to be tested using a multivariate or molecular analysis to confirm this hypothesis. The hypothesis of a single species would of course need to be tested with collecting more samples, and ideally with host transfer experiments.

Table 1. Biometric data of *Turanoleucon* species. The data of *T. mitjaevi* and Kazakhstan population of *T. jashenkoi* are based on the original description by Kadyrbekov (2002).

Morph	Characters	<i>Turanoleucon mitjaevi</i>	<i>Turanoleucon jashenkoi</i> (Kazakhstan population)	<i>Turanoleucon jashenkoi</i> (Iranian population)
Apterous viviparae	Body length	2.21–3.24	2.34–2.55	3.21–3.98
	Frontal hairs	0.067–0.073	0.062–0.078	(0.071) 0.076–0.095
	Frontal hairs / ANTIII Base	1.5–1.7	1.6–1.8	(1.54) 1.75–2.22
	ANT/Body length	0.84–0.97	0.77–0.83 (1.04)	0.73–0.82
	ANTIII/ANTIV	(1.66)1.70–1.98	1.65–1.85	1.60–1.94
	ANTIII/ANTVI	1.28–1.55	0.98–1.25	1.14–1.33
	PT/ANTVIb	3.3–4.3	3.0–3.7	3.56–4.28
	PT/ANTIII	0.51–0.62	0.60–0.85	0.59–0.71
	URS/2HT	1.95–2.15	1.93–2.10 (2.40)	1.94–2.25
	URS/Cauda	0.72–0.89	0.82–1.05(1.13)	0.62–0.74
	SIPH/Body length	0.29–0.36	0.25–0.28	0.28–0.33
	SIPH/Cauda	1.9–2.4	2.0–2.6	1.93–2.18
	Reticulated zone on SIPH (%)	35–43	40–45	33–41
	Rhin. on ANTIII	28–49	9–28	(31) 39–63
	Rhin. distribution on ANTIII (%)	57–75	35–60	63–87
	No. hairs on URS	10	9–10	8–10
	No. hairs on Cauda	14–20	13–19	13–27
Alate viviparae	Body length	2.68–3.46	2.34–3.15	3.51–3.68
	Frontal hairs	-	-	0.064–0.067
	Frontal hairs / ANTIII Base	-	-	1.42–1.47
	ANT/Body length	0.85–0.96	0.82–1.00	0.80–0.81
	ANTIII/ANTIV	1.64–1.81	1.45–1.91	1.61–1.85
	PT/ANTIII	0.61–0.77	0.58–0.76	0.56–0.71
	ANTIII/ANTVI	1.05–1.32	1.04–1.35	1.14–1.38
	PT/ANTVIb	4.0–4.3	3.6–3.9	3.44–4.27
	URS/2HT		1.82–2.10	1.82–2.06
	SIPH/Body length	0.27–0.32	0.27–0.31	0.28–0.29
	SIPH/Cauda	-	-	2.14–2.29
	Reticulated zone on SIPH (%)	-	35–40	35–37
	URS /Cauda	0.82–0.97	-	0.68–0.76
	No. hairs on Cauda	17–23	-	22–24
	Rhin. distribution on ANTIII (%)	90	90	88–92
	Rhin. on ANTIII	57–77	44–66	67–77
	Rhin. on ANTIV	0–4	-	0
	Rhin. on ANTV	-	-	0

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شته‌های گیاهان جنس *Echinops* در ایران: معرفی *Turanoleucon jashenkoi* (Hemiptera, Aphididae) به عنوان گزارش جدید

زهرا گودرزی فرا^۱، سید مسعود مجدزاده^۱، محسن مهرپرور^{۲*}

^۱ گروه زیست شناسی، دانشکده علوم، دانشگاه شهید باهنر کرمان، کرمان، ایران

^۲ گروه تنوع زیستی، پژوهشکده علوم محیطی، دانشگاه تحصیلات تکمیلی صنعتی و فناوری پیشرفته، کرمان، ایران

* پست الکترونیکی نویسنده مسئول مکاتبه: mehrparvar@aphidology.com

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چکیده:

تا کنون سه گونه شته شامل *Aphis fabae* Scopoli, 1763, *Brachycaudus cardui* (Linnaeus, 1758) و *Paczoskia meridionalis* Holman, 1981 از روی گیاهان جنس *Echinops* در ایران گزارش شده‌اند. در این پژوهش دو گونه شته دیگر از روی این گیاه جمع‌آوری شدند: *Myzus persicae* (Sulzer, 1776) و *Turanoleucon jashenkoi* Kadyrbekov, 2002 جنس کمتر شناخته شده *Turanoleucon* و گونه *T. jashenkoi* برای اولین بار از ایران گزارش می‌شوند. داده‌های بیومتری ماده‌های بدون بال و بالدار جمعیت ایرانی *T. jashenkoi* از نمونه‌هایی که از استان فارس در ایران جمع‌آوری شدند به دست آمد. تفاوت‌های مورفولوژیک بین جمعیت ایرانی و توصیف اصلی گونه، که شامل جمعیت قزاقستان می‌شود مورد بحث قرار گرفت. کلید شناسایی شته‌های ماده بدون بال که روی گیاه *Echinops* در ایران زندگی می‌کنند نیز ارائه شده است.

واژگان کلیدی: Macrosiphini، فون، تاکسونومی، پراکنش.