

Herb gallwasp fauna of Iran (Hymenoptera: Cynipidae, Aylacini)

George MELIKA^{1,*} and Younes KARIMPOUR²

1. Pest Diagnostic Department, Plant Protection and Soil Conservation Directorate of County Vas,
9762 Tanakajd, Ambrozly setany 2, Hungary. E-mail: melikageorge@gmail.com

2. Department of Plant Protection, College of Agriculture, Urmia University,
Urmia, Iran. E-mail: y.karimpour@mail.urmia.ac.ir

* Corresponding author, G. Melika, E-mail: melikageorge@gmail.com

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Abstract. During a 5-year survey (2006-2010) of the herb gallwasp fauna of Iran a total of 21 gallwasp species (Hymenoptera: Cynipidae, Aylacini) in 6 genera were found, reared from different species of Asteraceae, Lamiaceae and Papaveraceae plants. Ten species, *Aulacidea hieracii*, *A. scorzonerae*, *A. tragopogonis*, *Aylax minor*, *A. papaveris*, *Barbotinia oraniensis*, *Isocolus centaureae*, *I. similis*, *Phanacis heteropappi*, *P. varians*, are new records for the fauna of Iran. With the exception of *Aulacidea irani* which was swept on flower heads of *Echinops* sp., all specimens were reared from galls collected on host plants. Keys to the species identification and detail data on species biology, distribution are given.

Keywords: Aylacini, Cynipidae, distribution, herb gallwasps, Iran.

Introduction

The gallwasps (Cynipidae), which comprises around 1300 species world-wide, are divided into two main trophic groups: the gall inducers and the gall-associated inquilines, which together make up six tribes, which from representatives of 4 tribes are known from Iran: Cynipini, Aylacini, Diplolepidini and Synergini. Recent studies on cynipid fauna of Iran were focused mainly on the oak gallwasps (Cynipini) and their cynipid inquilines (Synergini) (Melika & Stone 2001, Melika et al. 2004, Azizkhani et al. 2006, Tavakoli et al. 2008, Péntzes et al. 2009, Sadeghi et al. 2006, 2010). Very little is known about the herb gallwasp (Aylacini) fauna of Iran (Melika & Gharaei 2006, Tavakoli & Melika 2006, Melika & Karimpour 2008, Karimpour et al. 2008, Karimpour 2011).

The tribe Aylacini comprises a group of pleiomorphic genera of cynipid gall-inducers associated with herbaceous plants. Most of the representatives are associated with species of Asteraceae, some genera and species with Apiaceae, Lamiaceae, Papaveraceae, Rosaceae and Valerianaceae (Melika 2006). Galls of Aylacini are not as complex as in Cynipini or Diplolepidini; they are formed mainly in stems, flower heads, fruits and seeds. All Aylacini species are monovoltine, only sexual generations are known, without heterogeny or alternation of generations (Csóka et al. 2004).

The Aylacini has a holarctic distribution, with near 130 species in 18 genera, from which approximately 100 species are known from the Palaearctic region and 30 species from the Nearctic

(Burks 1979, Melika 2006).

This is the first study summarizing all the data on herb gallwasps of Iran.

Materials and methods

Different plants, with which the herb gallwasps are known to associate, were collected in different seasons from meadows and rangelands in different parts of Iran, mainly in Azerbaijan-e Gharbi (=West-Azerbaijan) (vicinities of Urmia) and Lorestan provinces. Collected plants were kept in glass boxes in the laboratory, they were checked weekly and the emerged wasps were preserved in 75% alcohol for further identification.

Results

During a 5-year survey (2006-2010) a total of 321 herb gallwasp specimens were reared which belong to 21 species from 6 genera of Aylacini (Cynipidae). With the exception of *Aulacidea irani*, which was collected from *Echinops* sp., all specimens were reared from galls collected from host plants. Below, keys to genera and species of Iranian Aylacini are given with data on each species.

Key to genera of Aylacini in Iran

(all tarsal claws are simple, without basal lobes)

1. Mesopleuron reticulate or ruguloso-reticulate; pronotum with indistinct submedian pronotal pits or with transverse narrow impression; head never broader than high in anterior view.....
.....*Phanacis*

- Mesopleuron with transverse striae; pronotum always with two distinct submedian pronotal pits, separated by carina; head broader than high in anterior view **2**
- 2.** R1 and Rs not quite reaching wing margin; radial cell of forewing entirely opened along margin **3**
- Rs almost reaching anterior margin of wing, R1 touching wing margin or continuing along wing margin; radial cell closed, partially closed or obsoletely closed **4**
- 3.** Mesopleuron with transverse striae, interspaces reticulate; head trapezoid in anterior view; galls in fruit capsules of *Papaver* **Barbotinia**
- Mesopleuron with transverse striae, interspaces smooth, shiny; head rounded in anterior view, never trapezoid; mesoscutum with more or less distinct transverse striae; galls on *Centaurea* and other Asteraceae **Isocolus**
- 4.** Radial cell opened along margin, R1 usually not reaching wing margin or if so, than continuing on short distance along margin; pronotum dorsally relatively short, submedian pronotal pits strongly transverse, narrowly separated; scutellar foveae small, coriaceous; galls on *Papaver* **Aylax**
- Radial cell closed or almost closed, R1 always more or less continuing along wing margin; pronotum dorsally always quite long; submedian pronotal pits and scutellar foveae different; galls on Asteraceae and *Salvia* (Lamiaceae) **5**
- 5.** Mesopleuron uniformly and entirely transversely striate; 2nd metasomal tergite with distinct patch of white setae anterolaterally; female antenna with 11 flagellomeres; notauli usually complete, reaching pronotum; wing margin with moderately long cilia; galls mainly on Asteraceae **Aulacidea**
- Mesopleuron partially transversely striate, partially alutaceous; 2nd metasomal tergite without patch of white setae anterolaterally; female antenna with 10 flagellomeres; notauli incomplete, wing margin without cilia; galls on *Salvia* **Hedickiana**

Genus *Aulacidea* Ashmead, 1897

Type species: *Aulax mulgediicola* Ashmead, 1896 (= *Aulax harringtoni* Ashmead, 1897). The genus can be easily distinguished from other Aylacini by the closed radial cell of the forewing and the uniformly transverse striation of the mesopleuron. Holarctic genus, with 29 world-wide known species (Melika 2006): 17 species are known from

Europe, three species are known from Tajikistan and Turkmenistan (Diakontschuk 1984, 1988), one species was recently described from the Far East of Russia (Melika 2004) and 7 species are listed for America north of Mexico (Burks 1979). A total of six species are known from Iran, and of these six species two are found nowhere else.

Key to *Aulacidea* species of Iran

(in all species known from Iran, the forewing margin with a moderately long cilia; the head always slightly broader or at least as broad as high in anterior view; the female antenna with 11-12 flagellomeres)

- 1.** F2 in female antenna nearly 2.0 times as long as F1; metascutellum medially 3.0-4.0 times as high as height of ventral impressed area; 2nd metasomal tergite with posterior band of punctures, occupying its half length, without distinct patch of dense setae anterolaterally; male antenna with 11 flagellomeres; galls in stems of *Acroptilon repens* **acroptilonica**
- F2 in female antenna nearly equal, shorter or slightly longer than F1; metascutellum medially nearly as high as height of ventral impressed area; 2nd metasomal tergite without posterior band of punctures, with distinct patch of dense setae anterolaterally; male antenna with 12 flagellomeres; galls in other plants **2**
- 2.** 3rd metasomal tergite entirely punctate **3**
- 3rd metasomal tergite with posterior band of punctures which usually extending to at most half length of tergite **5**
- 3.** Scutellar foveae transversely ovate, always broader than high, smooth, shiny; punctures on 3rd metasomal tergite uniformly dense and distinct; hypopygium large; galls in stems on *Scorzonera* **scorzoneriae**
- Scutellar foveae elongated, longer than broad, with wrinkles; punctures on 3rd metasomal tergite more sparse and weak anteriorly; hypopygium small; galls on *Tragopogon* **4**
- 4.** POL 1.7 times as long as OOL and 3.7 times longer than diameter of lateral ocellus; clypeus quadrangular, nearly as high as broad; pedicel in female antenna subglobose, only 1.25 times longer than broad; lateral propodeal carinae converging outwards in posterior 1/3; F1 in male antenna longer than F2, F2 shorter than F3; galls always at the base of *Tragopogon* flowers, never in stems **tavakolii**
- POL 1.2 times as long as OOL and 4.5-4.7 times as long as diameter of lateral ocellus; clypeus

rectangular, at least 2.0 times as broad as high; pedicel in female antenna elongate, 1.5 times as long as broad; lateral propodeal carinae nearly straight, slightly converging inwards posteriorly; F1 in male antenna slightly shorter than F2, F2 equal F3; galls in *Tragopogon* stems, often merge into large conspicuous lignified, hard swellings up to 40 mm in length, with rough surface

-*tragopogonis*
 5. Frons and interocellar area uniformly finely coriaceous, without punctures; lower face and gena with distinct radiating striae; mesoscutum without piliferous punctures; galls in stems of *Hieracium* spp.*hieracii*
 -- Frons and interocellar area uniformly finely coriaceous, with distinct piliferous punctures, lower face and gena with indistinct very minute radiating striae; mesoscutum with piliferous punctures; gall unknown*irani*

Aulacidea acroptilonica Tyurebaev, 1972

Gall. Spindle-like, lignified formations on the stem, 25-50 mm long and 20 mm in diameter. The gall size depends on the number of larval chambers (from 1 to 30). A single larval chamber nearly rounded, 3.0 mm in diameter, with smooth surface. Galls develop on all parts of the stem, from the ground-surface up to the flower (Kovalev & Diakontschuk 1986).

Host plant. *Acroptilon repens* (L.) DC. (Asteraceae) is the only known host plant; probably can induce galls on a closely related species, *A. australe* Iljin. (Kovalev & Diakontschuk 1986).

Biology. Majority of larvae overwintering in the gall, pupate in March-April; adults emerge by the end of April (Middle Asia) - beginning of May (Kazakhstan and Ukraine) (Zerova, Diakontschuk & Ermolenko 1988); part of adults in Iran emerge in early summer.

Distribution. Iran, Azerbaijan-e Gharbi province (vicinities of Urmia) (Melika & Karimpour 2008), Lorestan (Zalian) (Karimpour et al. 2008). Ukraine (southern part only), European part of Russia, Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan, Uzbekistan (Zerova, Diakontschuk & Ermolenko 1988, Kovalev & Diakontschuk 1986).

Taxonomic comments. Middle Asian populations of *A. acroptilonica* differ from those in Iran by possessing much lighter flagellomeres, legs and light brown metasoma. Specimens collected in southern part of Ukraine characterized by dark brown F1-F2, F1 and proximal flagellomeres usually slightly longer (Melika 2006).

Aulacidea hieracii (Linnaeus, 1758)

Synonyms. *Aulax graminis* Cameron, 1875, *Aulax artemisiae* Thomson, 1877, *Aulax foveigera* Thomson, 1877, *Aulax crassinervis* Thomson, 1877, *Aylax sabaudi* Hartig, 1840, *Aulacidea cacaliae* Belizin, 1959.

Gall. In stems, multilocular, differently shaped, large, hard and fuzzy galls; the stem is malformed. The gall develops on the stem or at the base of the leaf rosette, 40 mm long, 10-15 mm in diameter, usually spindle-like, sometimes rounded. During the development, leaves are coming out from it. The surface of the gall is covered with hairs. The gall losing its hairs after overwintering and the bases of hairs are visible only on a glabrous epidermis. The parenchyma of the gall soft, spongy, with rounded larval cells. The number of larval cells is decreasing towards the center of the gall. The gall is green when young and growing, turns brown when mature. The shoot above the gall is malformed, abnormally short. Sometimes galls develop on the leaves which are lying on the ground.

Host plant. *Hieracium murorum* L., *H. umbellatum* L., *H. verruculatum* Link, *H. viosum* Pall., *H. vulgatum* L. (Asteraceae).

Biology. Galls mature in autumn, larvae overwinter in the gall, adults emerge next spring, in May (Zerova et al. 1988).

Distribution. Iran, Lorestan (Ghelaie or Gharaei) and Azerbaijan-e Gharbi provinces (vicinity of Kelisä Kandi village, 37°29'N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia) -- a new record for Iran. Europe (Melika 2006), Far East of Russia (Kovalev 1965), Transcaucasus (Zerova et al. 1988).

Aulacidea irani Melika & Gharaei, 2006

Gall. Unknown.

Host plant. Unknown..

Biology. Adult wasps emerge from mid-May (Melika & Gharaei 2006) till beginning of June.

Distribution. Iran, Ilam (Melika & Gharaei 2006) and Azerbaijan-e Gharbi provinces (vicinity of Marmishü lake: 37°40'N, E44°48'E, 1570 m a.s.l., 42 km W Urmia) -- a new record for the province.

Aulacidea scorzonerae (Giraud, 1859)

Gall. A stem swelling-like gall, usually located under the flower head, sometimes in the lower part of the stem; spindle-like or cylindrical stem enlargement, 30-60 mm long, 10 mm in diameter; the surface with longitudinal ribs, like on the stem, sometimes the ribs are waved and distance between them larger, depending on the diameter of

the gall. In a longitudinal dissection, single 2 mm large larval cells are visible, which are located one near another. The number of larval cells is larger towards the periphery of the gall. The stem above the gall is shortened and the flower stops development (Melika 2006).

Host plant. *Scorzonera austriaca* Willd. (Asteraceae) (Ambrus 1974). Here we give a new host plant record, *S. calyculata* Boiss., which from the species was recently reared in Iran.

Biology. Adults overwinter in the mature galls and emerge in April.

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Kelisä Kandī village: 37° 29' N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia) - a new record for Iran. Austria, Russia, Hungary, Ukraine (Melika 2006).

***Aulacidea tragopogonis* (Thomson, 1877)**

Synonyms. *Aulax pigeoti* Kieffer, 1898.

Gall. Galls are in stems, small, egg-shaped with smooth surface; the stem is not malformed externally, however, very often galls merge into a large conspicuous lignified, hard swelling up to 40 mm in length, with rough surface (Melika 2006).

Host plant. *Tragopogon dubius* Scop., *T. maior* Jacq. (Kierych 1979), *T. majus* Jacq., *T. orientale* L., *T. porrifolius* L., *T. pratense* L. (Asteraceae) (Kierych 1979, Melika 2006).

Biology. Adults overwinter in the gall and emerge next spring, in April.

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Tāzehkand-e Qāterchī village, 37°39'N, 44°58'E, 1335 m a.s.l., 13 km SW Urmia and vicinity of Rashkän village, 37°19'N, 45°18'E, 1270 m a.s.l., 31.5 km SE Urmia) - a new record for Iran. Sweden, Spain, Romania, Poland, Great Britain, Denmark, Austria, France, Russia, Ukraine (Melika 2006).

***Aulacidea tavakolij* Melika, 2008**

Gall. The gall is always formed at the base of flowers, bluntly conical; 10-15 mm in height and 9-13 mm in diameter. The gall is multilocular, containing 15-22 larval chambers (cells). The young growing gall is green, later yellow and turns to grayish-black when mature. The walls of the gall are semi-hard, even after the gall totally dries out.

Host plant. *Tragopogon longirostris* and *T. marginatus* Boiss. (Asteraceae) (Karimpour et al. 2008, Katilmiş & Kiyak 2011).

Biology. Galls are visible on the host by the end of spring and beginning of summer. The usual habitat is dry grassland under oak trees, mainly

Quercus brantii. Wasps emerge from the end of January until March - April.

Distribution. Iran, Lorestan, Shorab (Karimpour et al. 2008), and Azerbaijan-e Gharbi province (Qasemlü valley, vicinity of Shürü Kandī village), 37°18'N, 45°07'E, 1420 m a.s.l., 29 km SE Urmia) -- a new record for the province. Turkey (Katilmiş & Kiyak 2011).

Genus *Aylax* Hartig, 1840

Type species: *Cynips rhoeadis* Bouché, 1834 (= *Aylax papaveris* (Perris, 1840)). The genus *Aylax* comprises four species; two are associated with *Papaver*, one species, *A. hypaeoi*, with *Hypecoum* (Papaveraceae). Three species are known from Europe: *A. papaveris* (Perris), *A. minor* Hartig and *A. hypaeoi* Trotter; one species, *Aylax quinque-costatus* (Provancher) was described from Canada (Ontario); however, the status of this species is questionable (Burks 1979). Galls on *Papaver* and *Hypecoum*.

Key to *Aylax* species of Iran

1. Body with variable extension of reddish brown colour; female antenna with 11-12 flagellomeres; Rs not reaching margin of wing; 2nd metasomal tergite with patch of dense white setae anterolaterally; hypopygium very small in lateral view. Galls on fruits of *Hypecoum*.....*hypaeoi*
-- Body black; female antenna with 12 flagellomeres; Rs reaching margin of forewing; 2nd metasomal tergite with few short white setae anterolaterally; hypopygium large in lateral view. Galls in *Papaver* capsules.....**2**
2. Notauli indistinct in anterior 1/3; mesoscutum coriaceous; fruit capsule not enlarged and swollen, with multiple individual galls.....*minor*
-- Notauli distinct in anterior 1/3; mesoscutum coriaceous-rugose; multilocular galls in hypertrophised capsules.....*papaveris*

***Aylax hypaeoi* Trotter, 1913**

Synonyms. *Aylax spirorhynchusii* Diakontschuk, 1990.

Gall. Galls in fruits form a conspicuous swelling. Fruits of *Hypecoum* species are typically nodose, divided by transverse septa, thus galled fruits affect one or more seeded sections which are inflate considerably. The shape is oval or globular, slightly more elongated along the longitudinal axis. Each gall is 0.4-0.5 mm wide and 0.6-0.7 long. In each fruit 1-3 galls develop. Each individual gall has a single larval chamber separated from out

side by a thick wall.

Host plant. *Hypocoum geslini* L., *H. grandiflorum* L., *H. imberbe* Sibth and Sm., *H. pendulum* L. (Papaveraceae) (Nieves-Aldrey & Melika 2005, Karimpour 2011, Katilmiş & Kiyak 2011).

Biology. Males are very rare. Adults emerge from galls from the end of the winter in North Africa to early spring in Europe, at the time when the host plant starts flowering. Galls develop and mature in spring. Larvae overwinter inside the galls and pupate during the next winter or spring. The pupal stage of *A. hypyci* starts in late September and continuing until the beginning of November. The imago is formed in October -- November, overwinter in the gall and emerges in March-April next year (Stojanova & Draganov 2008, Karimpour 2011).

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Tāzehkand-e Qāterchī village, 37°39'N, 44°58'E, 1335 m a.s.l., 13 km SW Urmia) (Karimpour 2011). Turkey (Katilmiş & Kiyak 2011). The species was originally described from Tripoli (North Africa) and recorded from Algeria and Greece (Trotter 1913). After the synonymization of *A. spirorhynchusii* the distribution of *A. hypyci* extends to Transcaucases (Armenia) and Middle Asia (Turkmenistan) (Nieves-Aldrey & Melika 2005). Presumably occurs in southern part of Ukraine also, particularly in Crimea (Melika 2006).

Aylax minor Hartig, 1840

Gall. The gall is rounded, 2 mm in diameter, whitish yellow, attached to septa of the fruit capsule. Galls are often located so near to one another that they are malformed. Sometimes galls cover all septa in the capsule, however, the latter never malformed and swollen externally.

Host plant. *Papaver argemone* L., *P. rhoeas* L., *Papaver dubium* L., *P. hybridum* L. (Papaveraceae) (Ambrus 1974, Kierych 1979, Diakontschuk 2003).

Biology. Galls can be found from July, adults emerge next year in May.

Distribution. Iran, Lorestan, Shorab -- new record for Iran. Europe (Diakontschuk 2003, Melika 2006) and Turkey (Katilmiş & Kiyak 2011).

Aylax papaveris (Perris, 1839)

Synonyms. *Cynips rhoeadis* Bouché, 1834.

Gall. Mainly in fruit capsules, occasionally in the stem. The individual galls are like in *A. minor*, but they never form a conglomerate of gall and the infested fruit capsule is never elongated, swollen. As a result of galling, the duration of plant life is

shorter and ripening occurs earlier, the poppy seeds turn brown and shrivel (Melika 2006).

Host plant. *Papaver dubium* L., *P. rhoeas* L., *P. somniferum* L. (Papaveraceae). For the first time recorded from *P. argemone* L. in Iran.

Biology. Adults emerge next year in May. In Iran adults emerge in April.

Distribution. Iran, Azerbaijan-e Gharbi province (Qasemlū valley, vicinity of Shīrū Kandī village, 37°18'N, 45°07'E, 1420 m a.s.l., 29 km SE Urmia) -- a new record for Iran. Europe and Israel (Melika 2006).

Genus *Barbotinia* Nieves-Aldrey, 1994

Type-species: *Aylax oraniensis* Barbotin, 1964. *Barbotinia* closely related to *Aylax*; in both genera the pronotum relatively short medially, submedian pronotal pits transverse and indistinctly separated. *Barbotinia* differs from *Aylax* in that the head is trapezoid, the malar space relatively long; scutellar foveae are large and rounded, nearly as long as broad; the mesopleuron with short irregular striae, reticulate in between them; the radial cell completely opened along the margin; R1 hardly reaching the wing margin; 2nd metasomal tergite without antero-lateral patch of setae. The genus comprises a single species, *Barbotinia oraniensis* (Barbotin), known to induce galls in fruit capsules of *Papaver* species (Papaveraceae).

Barbotinia oraniensis (Barbotin, 1964)

Gall. Galls in fruit capsules, irregularly spherical, 2.0–3.0 mm in diameter. Usually 2–3 galls developing in one fruit capsule, rarely only one or more than 3. The infested capsule is swollen, malformed externally, caused by the hypertrophy of plant tissues.

Host plant. *Papaver dubium* L., *P. hybridum* L., *P. rhoeas* L. (Nieves-Aldrey 2001, Diakontschuk 2003). For the first time recorded also from *P. argemone* L. in Iran.

Biology. Galls start to develop in April, mature in June; adults emerge next spring. *Parnips nigripes* (Barbotin, 1964), a figitid parasitoid, recently placed in a new subfamily Parnipinae (Figitidae), is frequently associated with *B. oraniensis* in Europe (Ronquist & Nieves-Aldrey 2001) and here for the first time is recorded for Romania and Iran (authors).

Distribution. This is the first record from Iran, Azerbaijan-e Gharbi province (Qasemlū valley, vicinity of Shīrū Kandī village, 37°18'N, 45°07'E, 1420 m a.s.l., 29 km SE Urmia). Mediterranean region,

mentioned also from Algeria (Barbotin 1964). Spain, France and Italy (Nieves-Aldrey 2001a), Ukraine (Melika 2006), Romania (new data, authors).

Genus *Hedickiana* Nives-Aldrey, 1994

Type species: *Aulacidea levantina* Hedicke, 1928. The genus was erected for a single species, *H. levantina* (Hedicke), originally described within *Aulacidea*. In common with *Aulacidea*, *Hedickiana* exhibits a closed (or partially closed) radial cell, but it can be distinguished from *Aulacidea* as follows: the mesopleuron not clearly transversely striate and partially irregularly reticulate; the mesoscutum with distinct large piliferous punctures; 2nd metasomal tergite without a patch of setae anterolaterally, induces galls on *Salvia* only.

Hedickiana levantina (Hedicke, 1928)

Gall. The gall is rounded, elongated, spindle shaped or ovoid, usually on stems and branches in a form of a stem swelling, encircling the stem, 10–45 mm long, 8–17 mm in diameter. The surface of the young light-green or yellowish-green growing gall is felt-like, with very dense short hairs, with some weak longitudinal ribs. Mature galls turn yellowish brown to grayish, hard, lignified the spongy parenchyma also turn hard, like a cork. Larval chambers usually nested along the periphery of the gall, more or less perpendicularly to the axis of the stem. Multilocular (Melika 2006).

Host plants. *Salvia syriaca* L. and *S. triloba* L. (Lamiaceae).

Biology. Larvae overwintering in the gall and adults emerge next spring. In Iran adults emerge in April.

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Kelisä Kandī village, 37°29'N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia), Eastern Azarbaijan (Karimpour et al. 2008). Armenia, Crete, Israel, Jordan, Syria, Ukraine (Melika 2006, Nieves-Aldrey & Massa 2006).

Genus *Isocolus* Förster, 1869

Type species: *Diastrophus scabiosae* Giraud, 1859. The genus *Isocolus* is defined mainly on the basis of the forewing characters: R1 and Rs are not reaching the anterior margin, the radial cell clearly opened or partially closed; cilia on wing margin absent or very short. Currently 23 palaeartic species of *Isocolus* are known. Without exception, all known *Isocolus* species induces galls on Asteraceae (Compositae), although the majority induce galls

in flower heads of *Centaurea* species, while others induce stem galls (Melika 2006). Six species are represented in the Aylacini fauna of Iran, which from 3 species were described from Iran and currently known only from this country.

Key to *Isocolus* species of Iran

1. 2nd metasomal tergite with anterolateral patch of white dense setae; galls in stems of *Serratula*.....
.....*karimpouri*
- 2nd metasomal tergite without anterolateral patch of setae, without or with only few scattered setae..... 2
2. 2nd metasomal tergite smooth, without punctures or with only very indistinct superficial sparse micropunctures in posterior 1/3, occupying 1/3 of metasoma length in dorsal view... 3
- 2nd metasomal tergite with distinct punctures in posterior 1/2 to 2/3..... 4
3. Mesoscutum delicately coriaceous-striate, striae in posterior 1/2-1/3 not transversely orientated, not raised over surface; lower face with sparse white setae and strong irradiating striae; median mesoscutal line absent; scutellar foveae rounded, indistinctly delimited posteriorly; pronotum and mesoscutellum dark brown; galls in flowerheads of *Carthamus tinctorius* and *C. oxycanthus*.....
.....*tinctorius*
- Mesoscutum with distinct transverse striae, raised above surface; posterior half of internotauli area with very weak transverse interrupted striae, distance between them nearly equal to width of a stria; median mesoscutal line absent or in a form of short triangle; pronotum and mesoscutellum black; galls in flowerheads of *Centaurea* spp.*centaureae*
4. R1 continuing prolong wing margin, 1/3 of radial cell closed; galls in flowerheads of *Centaurea behen*.....*beheni*
- R1 not reaching wing margin, radial cell opened; galls in other species of *Centaurea* and *Cirsium*.....
..... 5
5. Internotauli area and parapsides in posterior 2/3 with strong, raised shiny striae, interspaces finely coriaceous, 2.0 or more times longer than width of striae; areolet absent or very indistinct; galls in flowerheads of *Cirsium* and *Centaurea*.....
.....*cirsii*
- Mesoscutum with more delicate, interrupted and less raised transverse striae, distinct in posterior 1/2-2/3, especially in internotauli area; areolet distinct; galls in stems of *Centaurea*.....
.....*similis*

Isocolus beheni Melika & Karimpour, 2008

Gall. Galls are scattered between scales at the base of the flower head, grayish, monolocular, lignified, 2.2–3.0 mm long and 1.5–2.0 mm in diameter; elliptical, with slightly rough surface, thin-walled, scattered at the base of the flower head. The flower head is not malformed externally. Usually more than one larval cell develops within one flower head (Karimpour et al. 2008).

Host plants. *Centaurea behen* L. (Asteraceae).

Biology. Galls were collected in early August, adult wasps emerged in laboratory conditions by the end of August. It is possible that in the nature the adult wasps overwinter in the gall and emerge only next spring.

Distribution. Iran, Azerbaijan-e Gharbi province (Qasemlū valley, vicinity of Shīrū Kandī village, 37°18'N, 45°07'E, 1420 m a.s.l., 29 km SE Urmia) (Melika & Karimpour 2008).

Isocolus centaureae Diakontschuk, 1982

Synonyms. *Isocolus minutus* Diakontschuk, 1982.

Gall. Galls are between scales in the flower head, grayish, monolocular, lignified, elliptical, and narrowed till the apex, with slightly rough surface, thin-walled, 2.0×1.0 mm, galls when mature, freely falling out; the flower head is not malformed externally (Melika 2006).

Host plant. *Centaurea diffusa* Lam., *C. pseudo-maculosa* Dobroc, *C. squarrosa* (Boiss.) (Asteraceae) (Melika 2006). In Iran for the first time was recorded from *Centaurea solstitialis* L.

Biology. Adults emerge from early May till late June (Diakontschuk 1982). In Iran adults emerge in April.

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Arablū village, 37°24'N, 45°15'E, 1280 m a.s.l., 20.5 km SE Urmia, a new record for Iran). Ukraine, Turkmenistan, Kazakhstan (Melika 2006).

Isocolus cirsii Diakontschuk, 1987

Gall. Galls are located at the base of flower head, monolocular, with lignified hard walls, 3.0 mm in diameter; up to 28 galls can develop in one flower head.

Host plant. *Cirsium arvense* (L.) Scop., *C. ukrainicum* Bess., *C. vulgare* (Savi.) Ten., *Onopordum* sp., *Centaurea behen* L. (Asteraceae) (Melika 2006, Melika & Karimpour 2008). For the first time recorded also from *Centaurea pseudoscabiosa* Boiss. & Buhse.

Biology. In Iran adults emerge in May; for Ukraine a longer emerging period was given, from

late April until June-August (Diakontschuk 1987).

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Kelisā Kandī village, 37°29'N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia), Lorestan (Karimpour et al. 2008, Melika & Karimpour 2008). Ukraine (Melika 2006).

Isocolus karimpouri Melika & Tavakoli, 2008

Gall. Galls are in stems. Galled stems are without external deformation. Inside the stem slightly elongated (up to 3.5–4.0 mm) galls are formed, with a thin wall which is not detachable from the inner tissues of the stem; larval chambers are located along the axis of the stem, never across; in the cavity only one larva is located.

Host plant. *Serratula cerinthifolia* (Sm.) Boiss. (Asteraceae).

Biology. Adults emerge in late April, supposedly overwintering in the larval cell in the plant.

Comments. There are no other *Isocolus* species, known to induce such a galls. Some Aylacini species, *Panteliella fedtschenkoi* (Rübsaamen, 1896), *Aulacidea phlomica* Belizin, 1959, and *Phanacis phlomidis* Belizin, 1959 induce such kind of galls in stems of *Phlomis tuberosa* (Lamiaceae), however, the larval cells (chambers) in the dry stems are free-rolling; its outer wall is separated from the tissues of the stem, even after the gall is mature (Karimpour et al. 2008).

Distribution. Iran, Azerbaijan-e Gharbi province (Qasemlū valley, vicinity of Shīrū Kandī village, 37°18'N, 45°07'E, 1420 m a.s.l., 29 km SE Urmia) (Karimpour et al. 2008).

Isocolus similis Diakontschuk, 1982

Galls. Galls are in a form of swellings at the base of flower heads.

Host plants. *Centaurea breviceps* Iljin (Asteraceae). In Iran for the first time was reared from *C. pseudoscabiosa* Boiss.

Biology. Adults emerge in mid May (Diakontschuk 1982).

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Kelisā Kandī village, 37°29'N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia). Ukraine (only in the steppe zone) (Diakontschuk 1982).

Isocolus tinctorius Melika & Gharaei, 2006

Gall. Galls are scattered at the base of the flower head. Two types of galls' location were found. Few galls are formed in the ovary, which is deformed, after the larva hatched from the egg and gradually modifying it into a cylindrical whitish gall, with thick wall and rounded tip and after-

wards the growing of the ovary is stopped. As the larva grows, the width of the gall increases and becomes nearly similar to a healthy seed. The gall, when mature becomes dark brown to blackish. This type of the gall is very rare. Majority of galls are on brackets. Each flower head contains only one gall, very rarely two. Each bracket has only one gall. The location of galls on brackets varies – from the base to the tip, but more frequently they are formed on the upper part of brackets. Galls at the base of brackets are elongate, elliptical and green when young, with very hard and smooth wall, 3.0–6.0 mm in length and 1.2–1.9 mm in diameter. After maturing, similarly to the flower head, they are become yellow. Galls on free parts of brackets are rounded, spherical, 1.0–2.0 mm in diameter, or somewhat elongated (2.1–3.5 mm long and 1.5–2.0 mm in diameter); green, with smooth, very hard and thick wall (Melika & Gharaei 2006).

Host plant. *Carthamus tinctorius* L. (Asteraceae) (Melika & Gharaei 2006). For the first time recorded from *C. oxycanthus* M. Bieb.

Biology. Wasps emerge in late May–June (Melika & Gharaei 2006).

Distribution. Iran, Ilam province (Melika and Gharaei 2006), Azerbaijan-e Gharbi province (vicinity of Tāzehkand-e Qāterchī, 37°39'N, 44°58'E, 1335 m a.s.l., 13 km SW Urmia; a new record for the province). Distributed in Iraq as well (Abdul-Rassoul 1980).

Genus *Phanacis* Förster, 1860

Type species: *Phanacis centaureae* Förster. Synonyms: *Gillettea* Ashmead, 1897, *Timaspis* Mayr, 1881, *Aylacopsis* Hedicke, 1923, *Parapanteliella* Diakontschuk, 1981, *Pseudophanacis* Diakontschuk, 1981. *Phanacis* is easily distinguishable from other genera of Aylacini by the absence of submedian pronotal pits and the reticulate sculpture of the mesopleuron. The genus has a palaeartic distribution with two species, *Phanacis hypochoeridis* and *P. taraxaci*, accidentally introduced to North America. The first species was also introduced to South Africa. Twenty five species of *Phanacis* are known from the Palaeartic. Only the sexual generation is known, all species are monovoltine. All *Phanacis* species, with a few exceptions, are associated with Asteraceae, usually galls are in a form of small larval cells, hidden in the plant stem, without causing any deformation externally (Melika 2006). Currently 4 species are known from Iran, two of these species (*P. irani* and *P. lorestanicus*) were de-

scribed from this country and are only known to exist in Iran.

Key to *Phanacis* species of Iran

(all *Phanacis* species known from Iran, the female antenna with 11–12 flagellomeres, the male antenna with 11–13 flagellomeres; the radial cell of the forewing closed or partially closed)

1. Pronotum measured along dorsomedian line 2.0–2.2 times as short as greatest length measured on outer margin; mesoscutellum in lateral view strongly humped anteriorly, arised above mesoscutum.....2
- Pronotum measured along dorsomedian line usually 3.0 times as short as greatest length measured on outer margin; mesoscutellum in lateral view without hump anteriorly, not elevated over mesoscutum.....3
2. R1 going along wing margin and reach at least to 3/4 of radial cell length or radial cell closed; central elevated area of lower face without deep punctures; female metasoma longer than high in lateral view, longer than head+mesosoma; F1 of male antenna without placodeal sensilla; stem swelling-like galls on *Lactuca*.....*lorestanicus*
- R1 reach to half length of radial cell; central elevated area of lower face with distinct deep punctures; female metasoma nearly as long as high in lateral view, shorter than head plus mesosoma; F1 of male antenna with placodeal sensilla; stem swelling-like galls on *Lactuca*.....*irani*
3. Pedicel nearly equal in length to F1; F2 shorter than F1; forewing margin with very short or without cilia, radial cell closed at most to half length of radial cell; galls in stems of *Centaurea*.....*varians*
- Pedicel at least 1.3 or more times longer than F1; forewing margin with long, distinct cilia; galls in stems of *Centaurea*.....*heteropappi*

Phanacis heteropappi Diakontschuk, 1988

Gall. Larval chambers nested in the stem, without visible external swelling or malformation.

Host plant. *Heteropappus canescens* (Nees) Novopokr. (Asteraceae) (Diakontschuk 1988). For the first time recorded from *Centaurea solstitialis* L. in Iran.

Biology. In Iran adults emerge in April, in Turkmenistan emergence is in May (Diakontschuk 1988)

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Arablū village, 37°24'N, 45°15'E,

1280 m a.s.l., 20.5 km SE Urmia; a new record for Iran). Earlier was known only from Turkmenistan (Diakontschuk 1988).

Phanacis irani (Tavakoli & Melika, 2006)

Gall. Galls usually occur on branches, located at an acute angle to the main stem, mainly on the upper shoots. Usually the galls are situated on the end of a branch. The gall is a spindle-like, globular or ovate, elongate lignified stem-swelling, with average 25–30 mm in length, the largest diameter 12–16 mm; multilocular, green when young, turn to yellow or greyish white when mature, after drying the colour is white. The parenchyma is spongy, however, outside the gall is hard.

Host plant. *Lactuca orientalis* Boiss. (= *Scariola orientalis* (Boiss.) (Asteraceae) (Tavakoli & Melika 2006).

Biology. The gall develops very rapidly, starting to grow in late spring, mature in June and adults emerge in late June and can be found until August (Tavakoli & Melika, 2006).

Distribution. Iran (Lorestan, Brujerd, Zalian, Ghelaie; Hamedan Province, Gamasiab; slopes of Alborz Mountains, Damavand, around Tehran in the Lar Valley (Tavakoli & Melika, 2006); Azerbaijan-e Gharbi province (vicinity of Kelisā Kandī village, 37°29'N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia.). The host plant is distributed also in Syria, Israel and Jordan. So, it is quite possible that this gallwasp species can be found there as well. Further sampling in similar habitats is required to establish its true distribution.

Phanacis lorestanicus (Tavakoli & Melika, 2006)

Gall. This species induces galls which are hard to distinguish from those of *P. irani* (see the gall description above).

Host plant. *Lactuca orientalis* Boiss. (Asteraceae).

Biology. The same as in *P. irani*. Both species were reared from galls collected on the same plants.

Distribution. Iran (Lorestan, Brujerd, Zalian, Ghelaie) (Tavakoli & Melika 2006).

Phanacis varians Diakontschuk, 1980

Synonyms. *Phanacis* (*Pseudophanacis*) *culmicola* Diakontschuk, 1981, *Phanacis* (*Pseudophanacis*) *orientalis* Diakontschuk, 1981, *Phanacis* (*Pseudophanacis*) *stepicola* Diakontschuk, 1981.

Gall. In a form of typical small larval cells inside the stem, without external deformations, as it is typical for many *Phanacis* species (Melika 2006).

Host plant. *Centaurea adpressa* L. and *C. orientalis* L. (Asteraceae) (Melika 2006). For the first time recorded from *C. pseudoscabiosa* Boiss. & Buhse in Iran.

Biology. Adults emerge in May.

Distribution. Iran, Azerbaijan-e Gharbi province (vicinity of Kelisā Kandī village, 37°29'N, 45°01'E, 1600 m a.s.l., 2.5 km SW Urmia; the first record for Iran). Ukraine (Melika 2006).

Discussion

Currently 21 species of herb gallwasps from 6 genera (*Aulacidea*, *Aylax*, *Barbotinia*, *Hedickiana*, *Isocolus* and *Phanacis*) are known from Iran. The occurrence of 10 species of herb gallwasps in Iran, *Aulacidea hieracii*, *A. scorzonerae*, *A. tragopogonis*, *Aylax minor*, *A. papaveris*, *Barbotinia oraniensis*, *Isocolus centaureae*, *I. similis*, *Phanacis heteropappi*, and *P. varians* is given for the first time. No doubt, further sampling will increase the number of known herb gallwasp species in Iran.

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