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CODEN: IAASCA **ORIGINAL ARTICLE**

Identification Parasitoids of Leafminer flies in Sistan region –Iran

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ABSTRACT
T*his study* has been *carried out during 2009 and 2010 in Sistan (Iran) region, Parasitoids were collected from on leafminer* flies *that had attacked to cultivated plants and ornamental crops. In this study 200 samples were collected from 35 species host plant and among them eight genera and seven species of Eulophidae family were identified. Apotetrasticus Graham (Family: Eulophidae) was new to Iranian fauna. Also,* one *species of parasitoid wasp which was their activities hadn 't been reported* was *also identified.*
Key word: *Parasitoids, leafminers, Agromyzidae, Eulophidae, Sistan (Iran)*

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INTRODUCTION

Eulophidae family (Hymenoptera: Chalcidoidea) is one of the largest families of parasitic wasps containing over 4472 species placed in 297 genera [1]. Leafmining insects reduce plant metabolic activities and can lead to desiccation and premature fall of the leaves. Among the most serious leafmining pests are serpentine leafminers, which are flies in the family Agromyzidae. If leaves are seriously attacked, crops can be reduced or seedling plants even totally destroyed [2,3]. Many species of the families Braconidae and Eulophidae are important parasitoids of agromyzid leafminers.
Noyes [1] listed over 300 species of agromyzid parasitoids, and over 80 species that are known to attack various *Liriomyza* species. Sheng *et al* [5] studied the chalcidoid parasitoids of *Liriomyza sativae.* Eulophid wasps are the most common parasitoids recorded on leafminers worldwide [4], as well as the most successful agents used within biological control programs against agromyzids [6-9]. In this family, there are parasitoids of concealed larvae, including those of leaf-mining pests of economic importance on several vegetable and ornamental plants around the world. In Asia 41 species of parasitoids in four different families were found [9-11]. However, in general and under natural conditions, parasitism is usually low early in crop development and gradually increases as the crop matures [12]. The parasitoid *Diglyphus isae* is a primary ectoparasitoid capable of developing on at least 18 different agromyzid species [15]. Among the parasitoid complex of *Liriomyza* spp, *Diglyphus* is common for Iranian fauna which several parasitoid species are contain [14].
They play an important role in the biological control of serious insect pests in the field and many of them are employed successfully in biological control programs all over the world [13]. Parasitoids that we were unable to identify were sent to identification services, Schmalhausen Institute of Zoology in Ukraine.

MATERIALS AND METHODS

The survey on parasitoids of the vegetable leafminer was carried out during spring to winter in Sistan region, in 2009–2010. They parasited leafminer flies endoparasite and ectoparasit and then directly placed within plastic boxes covered with mesh for ventilation. After the collection parasitoides of leafminer flies, the host plants were transferred to the laboratory, inside the climatic chamber with a temperature of 25±1ºC and 65±5% RH, and were kept in the plastic containers (10 × 12 cm) covered with mesh on the upper side, for 1–2 weeks. Adults were caught by aspirator and gathered in test tubes containing 75 % ethanol. Illustrations were made using the Nikon SMZ645 stereomicroscope and Nickon Eclips E200

Microscope equipped with the Canon Ixus 100 IS digital camera. All the samples are preserved in the laboratory of Entomology, University of Zabol.

RESULTS

Eight species of Eulophidae belongs to eight general and three subfamilies were identified in association with 11 different species host plants. One new genus and also, one species of parasitoid wasp which was their activities hadn't been reported was also identified thatlisted below, are considered to be new record from Iran. This newly recorded genus is marked with an asterisk (*).

Sub Family: Tetrastichinae

Apotetrasticus (Graham, 1986)*

Material examined: 3♀, reared from *Phytoliriomyza dorsata* on *Gailardia gradiflora*, Zahac, 7 July 2009; leg.: Z.S.

Diagnosis: Female: Body dark; antenna brown to yellow, funicle is 4 segment and clava is 3 segment, funicle and clava with whorled long dark setae, antennifer is in middle of face (Because the sample was low we weren t prepared slides from the antennae); mesoscutum with median line, scutellum 2 midle suture, submedian lines usually distinct, notauli clear, their grooves striped and complete, axilla big and not lump, parastigma is separated of submarginal, submarginal is 4 dorsal hairs, postmarginal is smaller than Stigma, speculum is small and it has 1-2 hair .

Biology: unknown [16]

Host associations: This species was known as parasitoid of Lepidoptera and Coleoptera [17].

Distribution: Italian and California [17].

Aprostocetus (Westwood, 1833)

Material examined: 7♀ 2♂ reared from *Liriomyza congesta* on *Trigonella* sp, Zabol, 28 October 2009, 5♀, 1♂ reared from *Liriomyza congesta* on *Medicago sativae*, Zahac, 16 November 2009; leg.: Z.S.

Diagnosis: Female: Body dark brown, antenna brown; scap black, funicle is 3 segment and clava is 2 segment, funicle and clava with whorled long dark setae, antennifer is at the top of clypeus; mesoscutum with median line, Scutellum normally with 2 pairs of setae; submedian lines usually distinct; postmarginal vein is very small.

Biology: Hosts are very variable, most of them associated with galling arthropods
such as Cecidomyiidae, Cynipidae and Eriophyidae, Also on Chrysomelidae, Curculionidae (Coleoptera), Agromyzidae, Tephritidae (Diptera), Coccidae (Hemiptera), Gracillariidae, Lasiocampidae, Lymantriidae, Lyonetiidae, Pyralidae, Tischeriidae, Tortricidae, Yponomeutidae, Pieridae (Lepidoptera) and Anguinidae (Nematoda).

Distribution: Cosmopolitan. **This is a new record for the fauna of Iran.**

Family: Eulophidae

Sub Family: Eulophinae

Diglyphus isaea (Walker, 1838)

Material examined: 1♀ 2♂ reared from *Chromatomyia horticola* on *Helianthus annus,* Hirmand, 28 October 2009; 8♀ 5♂ reared from *Chromatomyia horticola* on *Brassica rapa*, Zabol, 28 October 2009; 5 ♀ reared from *Chromatomyia horticola* on *Silybum* sp, Zabol, 27 February 2010; 2♀ reared from *Chromatomyia nigra* on *Triticum aestivum*, Hamoon plain , 28 May 2010; 25 ♀ reared from *Liriomyza Congesta* on *Melilotus sativae*, Zahac, 22 March 2009; leg.: Z.S.

Host associations: *Liriomyza* sp. (Dip.: Agromyzidae) [14, 18].

Diagnosis: female: Body black to green shining; antenna dark brown, scape cylindrical in lateral view, funicle 2 segmented, clava 3 segmented; pronotum triangle shaped in dorsal view, mesoscutum with incomplete notauli, scutellum with parallel submedian grooves; postmarginal vein as long as stigmal vein, cubital vein strongly curved at base, speculum not seen.

Distribution: Afrotropical, Pacific, Oriental and Palearctic regions [19] and can be considered as a cosmopolitan species because introductory releases have been carried out in the United States, Canada and New Zealand [1].

Diglyphus poppoea (Walker, 1838)

Material examined: 18♀ 12♂ reared from *Chromatomyia horticola* on *Brassica rapa* - *Cucumis sativus*, Zahac, 22 March 2009; leg.: Z.S.

Diagnosis: female: Body black to green shining; antenna dark, funicle 2 segmented, clava 3 segmented; scutellem similar to *Diglyphus isae* ; postmarginal vein as long as stigmal vein, cubital vein and stigma is thicker, speculum rather narrow and it has a low hair .
Host associations: *Agromyza ambigua* Fallén (Dip., Agromyzidae) [20].
Distribution: Canary Islands, Czech Republic, Finland, Germany, Hungary, Italy, Moldova, Morocco, Netherlands, Portugal, Russia, Spain, Sweden, Switzerland, England, Scotland, Wales, Yemen [21].

Hemiptarsenus zilahisebessi (Westwood, 1833)
Material examined: 4♂ reared from *Calycomyza humeralis* on *Triticum aestivum*, Hamoon plain, 28 May 2010; leg.: Z.S.
Diagnosis: Female: body brown with shiny metallic colouring; scape extends beyond level of vertex, scape completely dark, funicle 4 segmented, basal 3 segments of funicle branched in males; postmarginal vein longer than stigmal vein; mesosoma elongated and dorso-ventrally flattened, scutellum without submedian or sublateral grooves ; propodeum medially with 2 subparallel carinae diverging posteriorly and with distinct plicae.
Biology: Parasitoid of Lepidoptera, Coleoptera, Diptera and Hymenoptera, some species attack spider eggs often as secondary parasitoid.
Host associations: *L. bryoniae* (Kaltenbach), *L. congesta* and *L. trifolii*, *Liriomyza sativae* (Dip.: Agromyzidae) [18]; *Hypurus* sp. (Curculionidae: Coleoptera) and *Stigmella* sp. (Nepticulidae: Lepidoptera) [1].
Distribution: Bulgaria, China, Egypt , France, Poland, Turkey [15] and South Korea [22].

Pediobius metallicus (Walker, 1846)
Material examined: 2♀ reared from *Calycomyza humeralis* on *Triticum aestivum*, Hamoon plain, 28 May 2010, 15♀ reared from *Chromatomyia horticola* on *Melilotus indicus*, Zahac, 13 March 2010; leg.: Z.S.
Diagnosis: Female: Body dark green; antenna dark, funicle 4 segments and clava 1 segment, antenna segments cover of less long hairs; propodeum medially with 2 subparallel carinae diverging posteriorly and with distinct plicae ; petiole in most species with ventrally pointed extension.
Biology: Parasitoid of Lepidoptera, Coleoptera, Diptera and Hymenoptera, some species attack spider eggs often as secondary parasitoid. **Host range is new.**
Distribution: Word wide.

Sympiesis acalle (Forster, 1856)
Material examined: 5♀ reared from *Liriomyza trifolii* on *Cucumis sativus*, Zabol, 28 October 2009; leg.: Z.S.
Diagnosis: Female: Body dark, abdomen brown ; funicle 3 segment and Clava 3 segment and in finally is sharp; notauli clear, grooves is unknown, axilla is small and less raised, scutellum has middle carina and there are two grooves in the sides ; parastigma Is connected by a curve to the vessel submarginal, submarginal has many dorsal hair .
Biology: Unknow on Agromyzidae but in the research reared from genus of *Liriomyza* sp. **Host range is new.**
Distribution: Central Europe, North West Italy, Turkey, Czechoslovakia, Hungary, Italy, Russia and Spain [23].

Neotrichoporoides szelenyii (Girault, 1913)
Material examined: 2♀ 3♂ reared from *Liriomyza trifolii on Cucumis sativus - Lactuca serriola*, Zahac, 18 April 2010; leg.: Z.S.
Diagnosis: Female: Body yellow ; genal suture below eye with triangular; antenna of female with 4 discoid anelli, funicle 3 segment and Clava 3 segment and in finally is sharp, other segments usually strongly elongate ; pronotum conical, mesoscutum without longitudinal median groove, length of scutellum no more than its width, subequal to length of mesoscutum .
Biology: Many species of the genus are trophically associated with Diptera (Diopsidae, Anthomyiidae, Lonchaeidae and Muscidae) especially on stems of Poaceae.
Distribution: Palearctic, Africa and Neotropical Regions [22].

Sub Family: Entedoninae
Neochrysocharis formosus (Westwood, 1833)

Material examined: 5♀ reared from *Liriomyza trifolii* on *Cucumis sativus* - *Lactuca serriola*, Zahac, 23 April 2009, 2♀ reared from *Calycomyza humeralis* on *Triticum aestivum*, Zahac, 27 February 2010, 17 ♀ reared from *Liriomyza sativae* on *Malva sylvestris*, Zabol, 5 April 2009; leg.: Z.S.
Diagnosis: Female: body dark (Figure ..); antenna typically strongly flattened, funicle with capitate big sensillae rounded apically, funicle 2 segmented; clava 4 segmented and apical segment very small and narrow (Figure …); mesoscutal midlobe with 4 setae, notauli straight and incomplete (Figure ..); fore wing usually with a single line of setae extending apically from stigma, submarginal vein with 2 dorsal setae, postmarginal vein subequal or a little shorter than stigmal vein, 2 seta in submarginal (Figure ..); mesopleuron with transepimeral sulcus weakly curved or straight, arching posteriad (Figure ..).
Biology: Solitary larval endoparasitoid of lepidopterous and diptereous leafminers.
Host associations: *Liriomyza sativa* and *L. trifolii* (Dip.: Agromyzidae) [14]; *Phyllocnistis citrella* (Lep.: Gracillariidae) [18].
Distribution: Cosmopolitan.

DISCUSSION

This study which has been carried out during the years 2009 - 2010, eight genera and eight species of parasitoids were collected of on five genera and eight species leafminer flies. one genus to be new recorded from Iran. *Sympiesis acalle* that their host range on leafminer flies haven't been reported in up to now. Among parasitoid genera first *Diglyphus* and then *Neochrysocharis* have the largest percentage to parasitoids of leafminers. *Apotetrasticus* (Sub family: Tetrastichinae) for the first time were collected on genus *Phytoliriomyza dorsata* in Iran. By conducting this research, some information about hosting domain and geographical region of some species and potential has been obtained in Sistan region.
Diglyphus Walker is the most abundant and important parasitoids of leafminer flies (Family: Eulophinae). Two species *Diglyphus isaea* and *Diglyphus poppoae* were collected from Sistan region. *Neochrysocharis* Westwood is the second important genus of Eulophidae. of genus *Neochrysocharis* two species *Neochrysocharis longiventris* and *Neochrysocharis formosus* have been reported for Iranian fauna. *Neochrysocharis formosus* (Subfamily: Entedoninae) was obtained from the current study. These species has a wide distribution and this is specific parasitoid dipterous genus *Liriomyza* in Sistan region. This genusreported on the Lepidoptera of leafminer Gracillaridae genus *Phyllonorycter* in Fars Province [24]. *Aprostocetus* Westwood has been identified on *Aprostocetus caudatus* as monotype. They are the primary species and phytophage in the family Eulophidae and have parasitized leafminer flies *Liriomyza congesta* and *Melanagromyza cunctans* in Sistan region. So far 16 species of this genus have been reported in Iran so far [25]. *Apotetrasticus* Graham hasn't been reported because of warm and dry weather. This genus is endoparasitoid. So far three species has been identified of this genus in the world: *Apotetrasticus contractus*, *Apotetrasticus postmarginalis*, *Apotetrasticus sericothorax. Neotrichoporoides* Girault has one generic name to the same name; they parasited more leafminer genus of *Liriomyza*. *Sympiesis acalle* was reported first in year 2009 Iranian fauna [26]. This species was reported on diptera genus of *Agromyza* and Lepidoptera of family Gracillariidae from northern Fars and there were early endoparasitoid second larval stage of leafminer flies [27]. *Hemiptarsenus* Westwood have been reported only two species to the names *Hemiptarsenus zilahisebessi* and *Hemiptarsenus wailesellae* of Tehran and Fars region [28].

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