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CODEN: IAASCA **ORIGINAL ARTICLE**

Checklist of Agromyzid Leafminers (Diptera: Agromyzidae) in Sistan region - Iran

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ABSTRACT
Here, we present information about the eulophid parasitoids of the agromyzid leaf miner in Sistan region. Samplings were perfumed during 2009-2010 from various cultivated and non-cultivated host plants at different localities. The infested leaves were clipped from the host plants and placed inside the rearing boxes and then subsequently transferred to the laboratory condition, where they were kept until emergence of the adult parasitoids. In total, we collected 200 samples of eleven host plants from which nine species of the eulophids belong to eight genera were identified that among them one genus is newly recorded from Iran. The list of species presented as follows: Apotetrasticus sp. on Phytoliriomyza dorsata (Siebke, 1864)/Gaillardia gradiflora; Aprostocetus sp. on Liriomyza congesta (Becker, 1903)/Trigonella sp. and Medicago sativae; Diglyphus isaea (Walker, 1848) on Chromatomyia nigra (Meigen, 1830)/Triticum aestivum; on Chromatomyia horticola (Goureau, 1851)/ Helianthus annus, Silybum sp. and Brassica rapa; Diglyphus poppoea Walker, 1848 on Chromatomyia horticola (Goureau, 1851)/Brassica rapa and Cucumis sativus; Hemiptarsenus zilahisebessi Erdös, 1951 on Calycomyza humeralis (Von Roser, 1840)/Triticum aestivum; Neochrysocharis formosus (Westwood, 1833) on Liriomyza trifolii (Burgess, 1880)/Cucumis sativus and Lactuca serriola; on Calycomyza humeralis (Von Roser, 1840)/Triticum aestivum; on Liriomyza sativae (Blanchard, 1938)/Malva sylvestris; Neotrichoporoides szelenyii (Erdös, 1951) on Liriomyza trifolii (Burgess, 1880)/Cucumis sativus and Lactuca serriola; Pediobius metallicus (Nees, 1834) on Calycomyza humeralis (Von Roser, 1840)/Triticum aestivum; Sympiesis acalle (Walker, 1848) on Liriomyza trifolii (Burgess, 1880)/ Cucumis sativus.*
Keywords: *Agromyzid Leafminers, Diptera, Sistan region*

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INTRODUCTION

Member of the family Agromyzidae are of the world's most destructive pests of vegetables and ornamentals in agricultural fields and greenhouses [1-3]. Agromyzids are typically phytophagous, with larvae living in tissues of living plants. Larvae undermine in the mesophyll tissue and may thereby reduce the quality and yield [4,1]. They can cause direct damage to the photosynthetic tissue of host plants because of larval leaf mining. The esthetic damage can also be occurring because of oviposition and feeding punctures produced by adult females [5]. They are pests of economic relevance of numerous vegetables and field crops throughout the world. Several species are particularly causing extensive damage to a wide range of host plants under both field and greenhouse conditions [5-7]. Many factors induce leafminer outbreaks, but the loss of natural enemies due to widespread use of insecticides is one of the most important. They are often difficult to control exclusively with application of insecticides due to high levels of resistance. Furthemore, the extensive and indiscriminate application of insecticides in greanhouses may cause environmental pollution, the risk of pesticide residue, negative impact on natural enemies, and development of resistance [8-10]. Therefore, Biological control with insect parasitoids is an alternative or compatible option in leafminer management [3,11,12].

Parasitoids are the major group of natural enemies of leafminers, and they have played a very important role in leafminer suppression in natural ecosystems or cultivated areas with reduced insecticide use [3]. The Leafminer parasitoids have extensively been investigated and evaluated in many countries [12, 3, 13]. They are mostly belong to three families of Hymenoptera including Braconidae, Eulophidae and Pteromalidae, among them family Eulophidae with over 4500 species, considered as the most abundant

parasitoids of the leafminers families throughout the world. Several eulophid species were successfully used as biological control agents of the agromyzid leafminers [13,12].
The sporadically published paper were mostly including the studies on fauna and host associations [14-16] as well as biology and ecology of the important parasitoid species [17-21]. The goal of present study was to determine the parasitoids of agromyzid leafminers in Northern part of Sistan & Balushitan province, as well as their host associations.

MATERIALS AND METHODS

Samplings were carried out irregularly from different locations at Sistan region during the period of 2009–2010. The plant materials by the mining agromyzid larvae were collected in the various cultivated and non-cultivated host plants. The infested plant materials were carefully cut off and placed inside the plastic boxes (10 cm in diameter and 12 cm in height) covered with mesh on the upper side due to ventilation. The respective host plants were labeled and herbarized for identification at later date. The rearing boxes were then transferred to laboratory, and kept inside the climatic chamber, under the constant conditions with the temperature of 25±1ºC and 65±5% RH. Samples were kept for about 2–3 weeks expecting of emergence of the adults leafminers and their parasitoids. The emerging insects were caught by an aspirator and gathered in the test tubes containing of 75% ethanol. All specimens were labeled and sorted subsequently for further examination and identification.

RESULTS

Eight species of daeEulophi belongs to eight genera 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 *Gailardia gradiflora* on *Phytoliriomyza dorsata*, Zahac, 7 July 2009; leg.: Z.S.

Biology: unknown [22]

Host associations: This species was known as parasitoid of Lepidoptera and Coleoptera [23].
Distribution: Italian and California . [23]

Aprostocetus (Westwood, 1833)**.**

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

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

Host associations: *Liriomyza* sp. (Dip.: Agromyzidae) [16]

Distribution: Afrotropical, Pacific, Oriental and Palearctic regions [24] and can be considered as a cosmopolitan species because introductory releases have been carried out in the United States, Canada and New Zealand.

Diglyphus poppoea (Walker, 1838)
Material examined: 18♀ 12♂ reared from *Brassica rapa* - *Cucumis sativus* on *Chromatomyia horticola*, Zahac, 22 March 2009; leg.: Z.S.

Host associations: *Agromyza ambigua* Fallén (Dip., Agromyzidae)[15].
Distribution: Canary Islands, Czech Republic, Finland, Germany, Hungary, Italy, Moldova, Morocco, Netherlands, Portugal, Russia, Spain, Sweden, Switzerland, England, Scotland, Wales, Yemen.

Hemiptarsenus zilahisebessi (Westwood, 1833)
Material examined: 4♂ reared from *Triticum aestivum* on *Calycomyza humeralis*, Hamoon plain, 28 May 2010; leg.: Z.S.
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) [16]; *Hypurus* sp. (Curculionidae: Coleoptera) and *Stigmella* sp. (Nepticulidae: Lepidoptera)
Distribution: Bulgaria, China, Egypt, France, Poland, Turkey and South Korea [14].

Pediobius metallicus (Walker, 1846)
Material examined: 2♀ reared from *Triticum aestivum* on *Calycomyza humeralis*, Hamoon: chah nime, 28 May 2010, Hamoon plain, 15♀ reared from *Melilotus indicus* on *Chromatomyia horticola*, Zahac, 13 March 2010; leg.: Z.S.
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 *Cucumis sativus* on *Liriomyza trifolii*, Zabol, 28 October 2009; leg.: Z.S.
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.

Neotrichoporoides szelenyii (Girault, 1913)
Material examined: 2♀ 3♂ reared from *Cucumis sativus* - *Lactuca serriola* on *Liriomyza trifolii*, Zahac: , 18 April 2010; leg.: Z.S.
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 [14].

Sub Family: Entedoninae
Neochrysocharis formosus (Westwood, 1833)
Material examined: 5♀ reared from *Cucumis sativus* - *Lactuca serriola* on *Liriomyza trifolii*, Zahac, 23 April 2009, 2♀ reared from *Triticum aestivum* on *Calycomyza humeralis*, Zahac, 27 February 2010, 17 ♀ reared from *Malva sylvestris* on *Liriomyza sativae*, Zabol, 5 April 2009; leg.: Z.S.

Biology: Solitary larval endoparasitoid of lepidopterous and diptereous leafminers.
Host associations: *Liriomyza sativa* and *L. trifolii* (Dip.: Agromyzidae); *Phyllocnistis citrella* (Lep.: Gracillariidae)[15]
Distribution: Cosmopolitan.

DISCUSSION

Diglyphus are one of the most important parasitoids attacking the leafminers Liriomyza spp. Investigations on the fauna associated with the agromyzid always showed one or more species of leafminers being parasitized by Diglyphus species [2].

Diglyphus spp. have been shown to be a promising control component in the pest management strategy for *Liriomyza* spp. [25].

It has been recommended that, due to the prevalence and often general nature of leafminer parasitoids, effort should be put into understanding and conserving indigenous leafminer parasitoids rather than relying solely on the introduction of exotic parasitoids [3]. New data about occurrence of the leafminer parasitoids, raises the possibility of implementing biological control in the regions where the leafminers decreasing the quantity and quality of the yeilds, or even making cultivation impossible However, studies on the biology and ecology of each species and also on the techniques for their economic mass production are required. Members of Neochrysocharis are highly polyphagous parasitoids of leafmining, leafrolling, leaf tying Lepidoptera, leafmining Diptera, Hymenoptera, and Coleoptera, as well as other phytophagous insects [23].

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