

The first report to record the parasitoids of the fall armyworm, *Spodoptera frugiperda* in Egypt

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Abstract

The fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), is a harmful pest of many plants. In Egypt, the presence of *S. frugiperda* in maize fields was reported in 2019. The aim of this study was to record the parasitoids of *S. frugiperda* in Egypt. The survey was conducted at Sohag and Qena governorates. Survey studies showed five parasitoids were recorded. In Sohag governorate, from the total samples of fall armyworm collected, four species of parasitoids emerged, three of them belonged to order Hymenoptera and one belonged to Diptera. Two of the Hymenopteran parasitoids were found in samples collected from Shandaweel district, *Dinarmus basalis* (Rondani, 1877) family Pteromalidae and *Cotesia ruficrus* (Haliday) family Braconidae. While the third is *Microplitis rufiventris* (Kokujev) family Braconidae was emerged from samples collected from El-Osyrat district. However, the dipteran parasitoid is *Exorista (Tachina) larvarum* (Linnaeus), which emerged from samples collected from Shandaweel district. In Qena governorate, one parasitoid species emerged *Chelonus intermedius* (Thomson) which was found in Abu Tesht district. Up to my knowledge this is the first record of the mentioned parasitoids on *S. frugiperda* in Egypt.

Keywords: *Spodoptera frugiperda*; Hymenoptera; Diptera; parasitoid; Survey; Egypt.

Introduction

The fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), is a harmful pest of many plants, among them corn, sorghum, cotton, and many kinds of grasses. It is distributed throughout North and South America (Sparks, 1979). Larvae of (FAW) had a wide range of hosts, in Brazil about 274 taxa of host plants are recorded. An additional 82 new host plant species were identified (Montezano *et al.*, 2018). The invasive pest *S. frugiperda* had

recorded in Africa for the first time in 2016 (Goergen *et al.*, 2016). However, in Egypt, the ministry of agriculture announced the presence of *S. frugiperda* in 2019 on maize plants in Aswan governorate (Dahi *et al.*, 2020). Using pesticides to control *S. frugiperda* is a usual work, using various insecticides and repeating the use of it in agricultural pest control, causes a lot of hazards. So, researchers seek to find alternatives to chemical control of insect pests helping to preserve health, wildlife, environment, and for economic concerns (Mattson *et al.*, 2000). Biological control strategies could be used to control *S. frugiperda* in integrated pest management program. Knowledge of species of natural biological control agents in native areas is necessary to make integrated management programs. Because of the efficiency and

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specificity in relation to the host, parasitoids consider one of the most important components of biological control of *S. frugiperda*. (Silva *et al.*, 2014). In these considerations, the present study aimed to record the parasitoids of *S. frugiperda* in Egypt.

Materials and Methods

A survey of native parasitoids of *S. frugiperda* was conducted from April–October 2020 in Sohag and Qena governorates, Egypt. To conduct this survey, samples of *S. frugiperda* larvae were collected from both governorates throughout summer season. Samples were taken from three districts of Sohag governorate i.e. El-Osyrat, Saqulta and Shandaweel and two districts of Qena governorate i.e. Nag-Hamadi and Abu Tesht. In each sample, a different *S. frugiperda* larvae instars were collected. The number of *S. frugiperda* larvae gathered and the number of plants inspected differed among fields. The larvae were gathered from plants of corn, sorghum and pearl millet, every larva placed into glass flasks of 4.6 x 10.0 cm, covered with fine gauze to prevent parasitoids to go through it. The larvae were fed under laboratory conditions with pieces of young corn plants and corn pieces replaced daily till pupation or until parasitoid emergence. The parasitoids that recovered from each larva

were recorded daily. and preserved in 75% ethyl alcohol. Parasitoids were identified by the department of insect taxonomy and surveying in the Plant Protection Research Institute, Agricultural Research Center, Egypt.

Results and Discussions

Shown in table (1), in Sohag governorate from the total samples of fall armyworm collected, four species of parasitoids were emerged, three of them belonged to order hymenoptera and one belonged to order diptera. Two of the hymenopteran parasitoids were found in samples collected from Shandaweel district, *Dinarmus basalis* (Rondani, 1877) family Pteromalidae (Fig.1) and *Cotesia ruficrus* (Haliday) family Braconidae (Fig.2). While, the third is *Microplitis rufiventris* (Kokujev) family Braconidae (Fig.3) was emerged from samples collected from El-Osyrat district. However, the dipteran parasitoid is *Exorista (Tachina) larvarum* (Linnaeus) family Tachinidae (Fig.4), which emerged from samples collected from Shandaweel district. In Qena governorate from the total samples of fall armyworm larvae collected, one parasitoid species was emerged, *Chelonus intermedius* (Thomson) family Braconidae (Fig.5) which was found in Abu Tesht district and no parasitoids emerged from the samples collected from Nag-Hamadi district.

Table (1). A partial taxonomic list of parasitoids of *S. frugiperda* in Egypt.

Order	Family	Scientific name
Hymenoptera	Pteromalidae	<i>Dinarmus basalis</i>
	Braconidae	<i>Cotesia ruficrus</i>
		<i>Microplitis rufiventris</i>
		<i>Chelonus intermedius</i>
Diptera	Tachinidae	<i>Exorista (Tachina) larvarum</i>

Table (2). Governorate, districts, crops, parasitoids and percent of *S. frugiperda* larvae parasitized by hymenopteran and dipteran parasitoids in Egypt.

Gov.	Districts	Crop	No. of larvae Collected	% of parasitism for each parasitoid				
				<i>C. intermedius</i>	<i>M. rufiventris</i>	<i>D. basalis</i>	<i>E. larvarum</i>	<i>C. ruficrus</i>
Sohag	El-Osyrat	Maize	108	0.00	7.40	0.00	0.00	0.00
	Shandaweel	Maize	81	0.00	0.00	4.94	1.23	1.23
		Sorghum Pearl Millet						
Saqulta	Maize	16	0.00	0.00	0.00	0.00	0.00	
Qena	Nag-Hamadi	Maize	50	0.00	0.00	0.00	0.00	0.00
	Abu Tesht	Maize	182	31.32	0.00	0.00	0.00	0.00

According to the percent of parasitism of each of the five collected parasitoids (Table 2), the most prevalent one was *C. intermedius* (31.32), followed by *M. rufiventris* (7.40) and *D. basalis* (4.94). However, *C. ruficrus* and *E. larvarum* were the least in percent of parasitism, they recorded 1.32% of parasitism for both of them. Up to my knowledge this is the first report of the mentioned parasitoids on *S. frugiperda* in Egypt.

Researchers have conducted many studies on surveying parasitoids of *S. frugiperda* and other lepidopteran pests in Egypt and other parts of the world, there was a partial agreement between their studies and the current study.

In Egypt, Hegazi *et al.*, (1977) surveyed the parasitoids of *Spodoptera littoralis* which belonged to the same genus of *S. frugiperda*. They found that five species were found to parasitize the immature stages of *S. littoralis* in cotton fields. These apparently all attacked the larvae and comprised *Chelonus inanus* (L.), *M. rufiventris* Kok., *Zele chlorophthalma* (Nees), *Euplectrus laphygmae* Ferriere and *Peribaea orbata* (Wied.) (*Strobliomyia orbata*). However, in turkey, Sertkaya *et al.*, (2004) found that the parasitoids attack *Spodoptera exigua* are *M. rufiventris*, *M. tuberculifer*, *Chelonus obscuratus*, *Meteor*

ictericus Nees, *A. ruficrus* (Haliday); *Sinophorus xanthostomus* and *Hyposoter didymator*. Ruiz-Najera *et al.*, (2007) recorded the parasitoids of *S. frugiperda* larvae which were *Rogas vaughani* Muesebeck, *R. laphygmae* Viereck, *Chelonus insularis* Cresson, *C. cautus* Cresson, *Glyptapanteles militaris* Walsh, *Neotheronia sp.*, *Ophion flavidus* Brulle, *Euplectrus plathypenae* Howard, *Archytas marmoratus* Townsend, *Lespesia archippivora* Riley, *Archytas sp.*, and *Winthemia sp.* *Megaselia scalaris*. Delvare and Rasplus, (2014) recorded a new genus of pteromalid, *Spodophagus lepidopterae* on *S. littoralis*.

Another study in Egypt on genus of *Spodoptera* conducted by El-Husseini *et al.*, (2018) who recorded the main parasitoid species of *S. littoralis*, i.e. the braconid parasitoids, *C. inanus* (L.), *A. ruficrus* (Haliday), and *M. rufiventris* Kok.; the ichneumonid *Z. chlorophthalma* (Nees); and the tachinids *Exorista larvarum* (L.) and *Strobliomyia aegyptia* Vill., recovered from *S. littoralis* larvae and pupae, four of the previous parasitoids were recorded on *S. frugiperda* in the current study. Shylesha *et al.*, (2018) in India and Malaysia, found that *Glyptapanteles creatonoti*, is an important parasitoid of many lepidopterous pest and can parasitize in *S. frugiperda*.



Figure 1: *D. basalis* parasitoid



Figure 2 a: *C. ruficrus* parasitoid adult



Figure 2 b: *C. ruficrus* cocoons

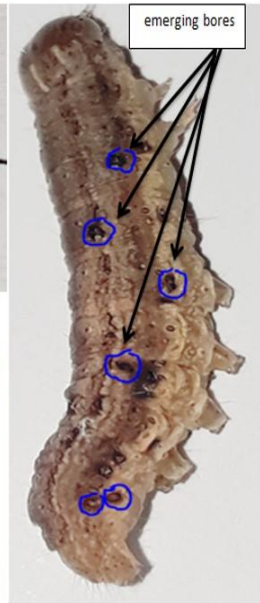


Figure 2 c: emerging bores of *C. ruficrus* parasitoid on *S. frugiperda* larvae



Figure 3 a: *M. rufiventris* parasitoid cocoon beside *S. frugiperda* larvae

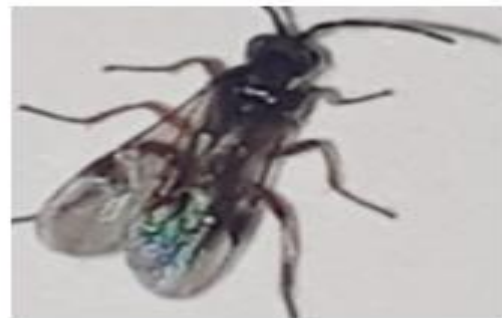


Figure 3 b: *M. rufiventris* parasitoid adult



Figure 3 c: *M. rufiventris* larvae



Figure 3 d: *M. rufiventris* cocoon after adult emerged



In Ghana and Benin, a survey of *S. frugiperda* parasitoids was conducted by Agboyi *et al.* (2020) they recorded ten parasitoids. They found that the most abundant parasitoids were *Chelonus bifoveolatus* and *Coccygidium luteum*. Caniço *et al.*, (2020) recorded five larval parasitoids for the invasive insect pest *S. frugiperda*. Koffi *et al.*, (2020) recorded natural enemies of *S. frugiperda*. They mentioned that among the natural enemies, 7 species were parasitoids: *Coccygidium luteum* (Brull), *Chelonus bifoveolatus* Szpliget, *C. icipe* Fernandez, *Bracon* sp. and *Meteoridea testacea* (Granger). All of them are hymenopteran. Also, they recorded two Dipteran parasitoids on of them is *Anatrichus erinaceus* Loew and the other is an identified. Navik *et al.*, (2020) in India, recorded the tachinid fly, *Exorista xanthaspis* for the first time parasitize the larvae of *S. frugiperda* collected from corn plants.

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