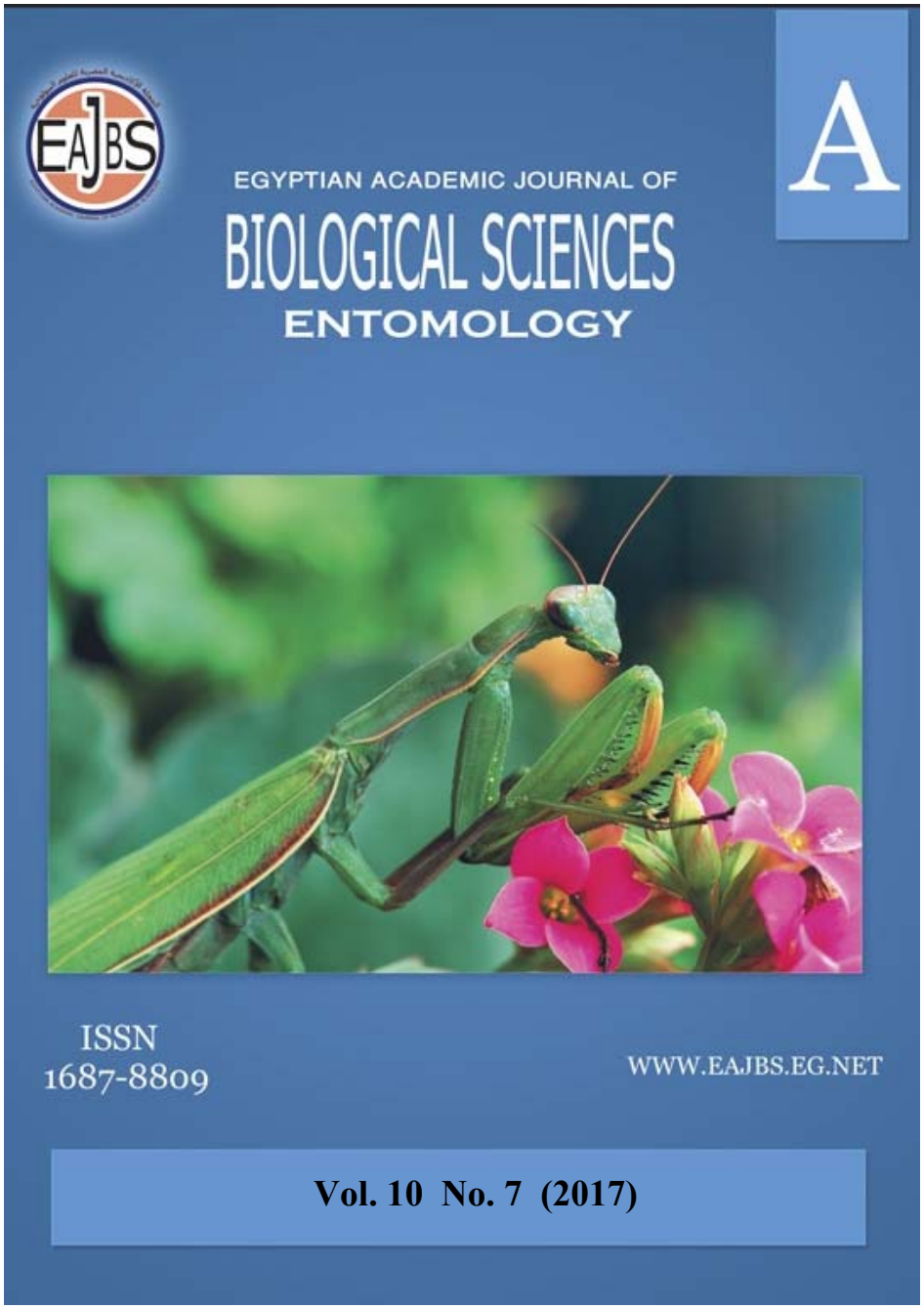

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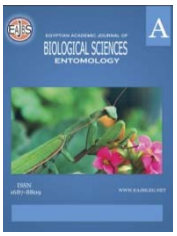

Leafhopper, *Jacobiasca lybica* (Bergevin And Zanon) (Hemiptera: Cicadellidae) On Okra Plants And Associated Parasitoids

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ABSTRACT

The current study was conducted in 2016 at two locations; Sakha and El-Riad, Kafr El-Sheikh governorate. Okra plants were sown at rice borders, canals and dikes at Sakha Agricultural Research Station, and as a solid crop at El-Riad in an area of 1000 m2. At both locations, okra plants were naturally infested by the leafhopper, *Jacobiasca lybica* (Bergevin and Zanon) (Hemiptera: Cicadellidae). To determine the parasitoids associated with the leafhopper, okra leaves having the eggs and nymphs of the leafhopper were picked up. The eggs and nymphs were excluded and incubated into petri dishes to be monitored for the possible emergence of parasitoids. One leafhopper nymph, collected from okra in rice fields, was found to be parasitized by *Aphelopus* sp. (Dryinidae: Hymenoptera). The leafhopper eggs collected from okra in rice fields or solid okra, hatched for four egg parasitoids. Three species; *Anagrus* spp., *Anagrus atomus* L., *Stethynium* sp. are belong to Mymaridae, and one parasitoid, *Oligosita* sp. belong to Tricogrammatidae. *Anagrus* parasitoids were the most abundant, while other parasitoids were found in low populations. To study the population fluctuations of the leafhopper adults and associated parasitoid, *Anagrus* spp., yellow sticky traps were fixed close to okra plants at both locations. *J. lybica* exhibited three peaks of occurrence at each location, while the parasitoid exhibited three peaks on okra surrounding rice fields, and two peaks on solid okra. It was concluded that okra plants in rice fields received higher numbers of parasitoids than solid okra.

INTRODUCTION

Among vegetable crops cultivated in Egypt, okra (*Abelmoschus esculentus* L. Moench), which is a popular summer crop. The cultivated area in Egypt with okra was nearly 17,000 feddans that produced about 97,000 tons in 2012 cropping season (EMARS, 2013). It is a rich source of nutrients, including fibers and vitamins (Moyin-Jesu, 2007). The most widely produced okra cultivars in Egypt are known as Balady (Ibrahim, *et al* 2013). Insect pests are one of the main limiting factors for vegetable production (Satti and Nasr 2008**)**. The major okra pests are insect sucking pests (Satti and Nasr 2008, Abdel Hamed, *et al* 2011 and El-Fakharany, 2016), leafhopper, *Jacobiasca lybica* (*Empoasca lybica*), is an important insect pest.

Parasitoids; Mymaridae, Trichogrammatidae and Dryinidae were detected at variable levels, attacking mainly *J. lybica* on many host plants (Klerks and van Lenteren, 1991). Several leafhopper parasitoid species (Hymenoptera: Mymaridae, Trichogrammatidae and Dryinidae) have been experienced for their usefulness as biological control agents based on population growth rates, searching capacity and host preferences (Habib, *et al* 1972 and Cooper, 1993).

The genus *Anagrus* Haliday (Hymenoptera: Mymaridae) is one of cosmopolitan species, of Mymaridae, with 86 valid species described. Identification of *Anagrus* species is difficult because of their very small size. Thus, most of the earlier identifications require confirmation (Triapitsyn, 2015). The genus *Oligosita* have diverse egg parasitoids with about 94 described species (Ikram and Yousuf, 2016**)** and *Oligosita* is associated with many host leafhopper species (Virla, 2000 and Hayat, 2008.). The genus *Oligosita* Walker (Hymenoptera: Trichogrammatidae), as defined by Pinto and Viggiani (2004), contains 92 world species (Noyes, 2014) and 2 species from Egypt (Kryger, 1932 and Hendawy, 2001)

This genus has important egg parasitoids attacking Cicadellid insect pests (Hayat, 2008).

The mymarid, *Stethynium triclavatum* Enock, recorded of the Egyptian fauna (Triapitsyn 2002), was found attacking cicadellids (Huber, 1987, Noyes, 2002).

Guglielmino, *et al*. 2013 mentioned that the dryinid parasitoid, *Aphelopus wittei* Benoit in north Sudan parasitized *J. lybica*.

The current study was undertaken throughout 2016 at the Experimental Farm and Laboratory of Entomology Department of Rice Research and Training Center (RRTC) and at El-Riad destrect, Kafr El-Sheikh Governorate to survey and monitor the population fluctuations of okra leafhopper, *J. lybica* and associated parasitoids.

MATERIALS AND METHODS

Survey and seasonal abundance of hopper natural enemies were carried out during summer season, 2016 at the Experimental Farm of Rice Research and Training Center (RRTC), and at El-Riad District.

1. Parasitoids of okra leafhopper, *Jacobiasca lybica* :

Okra leaves infested with *J. lybica* eggs were picked up in 2016 from the plants having the identical symptoms. The leafhopper eggs and nymphs were collected and kept into moistened petri dishes till the emergence of parasitoids. Eggs and nymphs of hoppers were collected and kept into Petri dishes lined with moistened filter papers and supplied with cuttings of okra plants for feeding nymphs. Parasitoids emerging from immatures were confined in 70 % ethyl alcohol. The parasitoids were counted and identified. Percentages of collected parasitoids were calculated throughout 15 May-27 November, 2016.

2. Population fluctuation of okra leafhopper, *Jacobiasca lybica* and their parasitoids:

Population fluctuations of the leafhopper, *J. lybica* and its egg-parasitoids were monitored using, 10 yellow sticky traps (21 x 29.5 cm) coated with a sticky material. Traps were fixed on a wooden pole with changeable heights equivalent to heights of okra plants during different growth stages. Traps were used for trapping *J. lybica* adults, and the egg-parasitoids, *Anagrus* sp. and *Oligosita* sp. Weekly samples were collected, examined and counted from Sakha and El-Riad Districts locations, Kafr El-Sheikh governorate. Insects that are attracted to this yellowish device include

important crop pests such as planthoppers and leafhoppers (Riley and Schuster, 1994, Reddy and Rajan, 2016 and Sen, *et al* 2016).

3. Parasitoid Identification:

Parasitoids were identified by the first author of the current study. The mymarid egg parasitoids, were identified according to Triapitsyn (2002), Huber, *et al* (2009) and Triapitsyn (2015) and dryinid parasitoid, *Aphelopus* sp. was identified according to Olmi (1984). *Oligosita* sp. was identified according to Doutt and Viggiani (1968). The parasitoids were mounted on glass slides and deposited in the personal collection of the first author at Biological Control Department, Rice Research and Training Center (RRTC), Kafr El-Sheikh, Egypt.

RESULTS AND DISCUSSION

1. Parasitoids of okra leafhopper, *Jacobiasca lybica* :

Data in Table (1) showed that 6 species of hymenopterous parasitoids belonging to 3 families were recorded (Fig. 1). These parasitoids could be divided into two groups. The first is egg parasitoids (5 species from 2 families), three Mymaridae (*Anagrus atomus* L., *Anagrus* sp. and *Stethynium* sp.), and two Trichogrammatidae (*Oligosita* sp.1 and *Oligosita* sp. 2). Parasitoids of *Anagrus* are the most abundant in the two locations. The second is nymphal parasitoid (1 species (*Aphelopus* sp.) belonging to family, Dryinidae). Hendawy (2001) recorded five hymenopterous species of egg-parasitoids attacking rice leafhoppers and planthoppers. *Anagrus* was studied in the Egyptian fauna by Soyka, 1950, Hendawy, 2001, Triapitsyn, 2004 and Shalaby and Hendawy 2007. Triapitsyn 2002, recorded *Stethynium triclavatum* Enock from Egypt. The dryinid parasitoid, *Aphelopus wittei* Benoit parasitized *J. lybica* in Sudan (Guglielmino, *et al*. 2013).

Table 1. Percent of hymenopterous parasitoids emerged from eggs and nymphs of *Jacobiasca lybica*, during okra season, 2016 at Sakha and El-Riad locations, Kafr El-Sheikh Goverorate.

Parasitoid	Location	
	Sakha	El-Riad
Anagrus atomus L.	194 (44.80%)	102 (50.50%)
Anagrus sp.	126 (29.10%)	65 (32.18%)
Stethynium sp.	4 (0.92%)	0
Oligosita sp. 1	93(21.48)	35(17.33%)
Oligosita sp. 2	15 (4.46%)	0
Aphelopus sp.	1 (0.23%)	0
Total	433	202

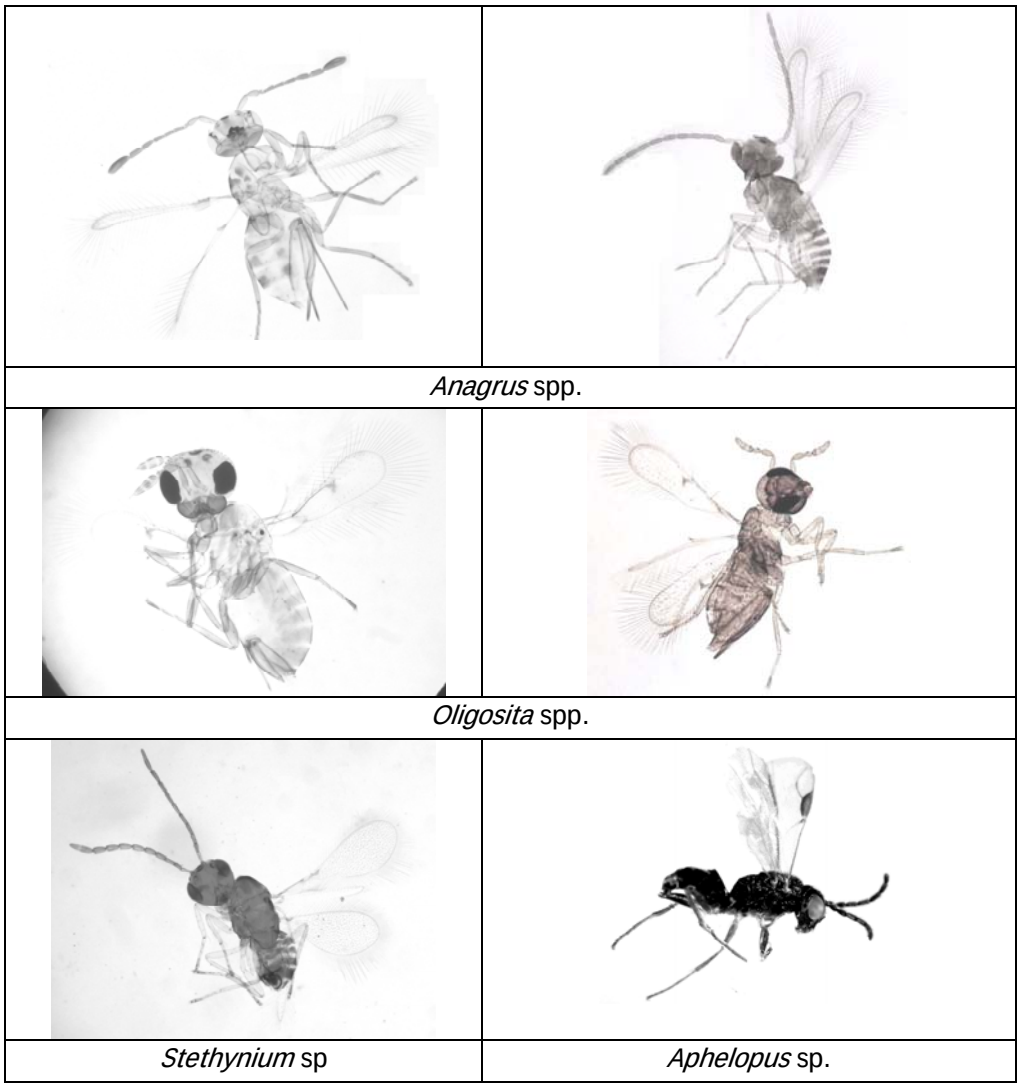

Fig. 1: *Jacobiasca lybica* parasitoids

2. Population fluctuation of okra leafhopper, *Jacobiasca lybica* and their parasitoids:

Population density of *J. lybica* on okra pants was relatively low, in both locations, up to beginning of June (Table 2). The insect exhibited three peaks of occurrence in each location. The peaks of Sakha location were 68, 149 and 179 adults/10 yellow sticky traps on mid – June, mid – September and first of November, respectively. The corresponding peaks at El-Riad were detected as 46, 89 and 131 adults on mid-July, first of October and first of November, respectively.

On the other hand, *Anagrus* spp. displayed three peaks at Sakha and two peaks at El-Riad with higher population density at the first location than at the second one. A similar situation was found with *Oligosita* spp., as three peaks were caught at Sakha , ranging between 12-43 adults/10 traps, compared to two peaks at El-Riad, 12-14 adults/10 yellow sticky traps.

It is worth mentioning that population density of *Oligosita* spp. was higher than that of *Anagrus* spp. at Sakha location during November. This could be explained that okra plants at Sakha, were surrounded by rice fields, where the parasitoid attacks leaf and plant hopper occurring in rice fields. Egg parasitoids are

the most important natural enemies of leafhoppers (Freytag, 1985). Several species of *Anagrus* are important egg parasitoids of several leafhoppers and planthoppers (Triapitsyn and Beardsley 2000). Genus *Oligosita* attack different host Auchenorrhyncha in various habitats (Pinto and Viggiani 2004).

Table 2. Population fluctuation of *Jacobiasca lybica* adults, and the egg parasitoids, *Anagrus* spp. and *Oligosita* sp. /10 yellow sticky traps in okra plants at two districts; 2016.

Date	Sakha			El- Riad		
	J. lybica	*Anagrus* spp.	*Oligosita* spp.	*J. lybica*	*Anagrus* spp.	*Oligosita* spp.
May15	23	4	0	15	3	0
Jun. 1	31	6	2	19	12	4
15	68	13	5	23	14	1
Jul. 1	42	26	12	36	14	2
15	49	16	3	46	17	3
Aug. 1	82	23	7	28	26	2
15	97	37	25	29	16	3
Sept. 1	101	30	12	61	5	12
15	149	34	15	79	15	8
Oct. 1	119	45	26	89	20	5
15	80	32	43	75	18	9
Nov. 1	179	21	35	131	19	10
15	118	16	22	96	16	14
27	109	5	18	75	5	12
	1247	308	225	802	200	85

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ARABIC SUMMARY

نطاط الأوراق *Jacobiasca lybica* علي نباتات الباميا و الطفيليات المصاحبة له

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تم إجراء البحث خلال عام ٢٠١٦ بمنطقتين بمحافظة كفر الشيخ (محطة البحوث الزراعية بسخا ومنطقة الرياض). ففي المنطقة الأولى (سخا) زرعت الباميا علي حواف (قنوات و بتون) حقول الأرز. والمنطقة الثانية بمركز الرياض حيث كانت الباميا منزرعة بصورة منفردة في مساحة ١٠٠٠ متر مربع. لوحظ إصابة نباتات الباميا المنزرعة بكلا المنطقتين بنطاط الأوراق *Jacobiasca lybica*. و بدراسة الطفيليات المصاحبة لهذا النطاط، جمعت الأوراق المصابة ببيض و حوريات هذا النطاط وتمت مراقبتها داخل أطباق بتري لحين خروج الطفيليات، وتبين الآتي: خرج الطفيل *Aphelopus* sp. (Dryinidae: Hymenoptera) من إحدى حوريات النطاط. كما تم حصر أربعة أنواع من طفيليات البيض تم تسجيلها في كلا المنطقتين. ثلاثة منها تتبع عائلة Mymaridae و هى *Anagrus* spp., *Anagrus atomus* , *Stethynium* sp. ، وطفيل واحد يتبع عائلة Trichogrammatidae و هو *Oligosita* spp.. كانت أعداد الطفيل من الجنس *Anagrus* هي الأكثر وفرة. ولدراسة تقلبات التعداد للحشرات الكاملة من النطاط و طفيل البيض المصاحب له *Anagrus* spp. ، تم وضع المصائد الصفراء اللاصقة أسبوعيا لتسجيل أعداد كل من الحشرة و الطفيليات في كلا المنطقتين، و كان للآفة ثلاث ذروات للتعداد في المنطقتين مصحوبة بثلاث ذروات لتعداد الطفيل في منطقة سخا و ذروتين بمنطقة الرياض. وتبين من هذه الدراسة أن نباتات الباميا المحاطة بحقول الأرز كانت غنية بالطفيليات عنها في حقول الباميا المنفردة، و يمكن أن يعزي ذلك إلي وجود حشرات نطاطات الأوراق الأخرى بكثرة في حقول الأرز، و بالتالي زادت نسبة الطفيليات علي نباتات الباميا الموجودة علي حواف حقول الأرز.