

COSMOPTERIX SALAHINELLA CHRÉTIEN (LEPIDOPTERA: COSMOPTERIGIDAE) A NEW RECORD LEAFMINER INFESTING OBOE CANE IN EGYPT

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Abstract

The blotch leafminer *Cosmopterix salahinella* Chrétien (= *C. phragmitidis* Amsel) (Lepidoptera: Cosmopterigidae) is a new record pest species on oboe cane, *Arundo donax* L., plants in Egypt. Samples were collected weekly from oboe cane plants grown in or at the banks of irrigation canals at Al-Aiat in Giza governorate from December 2001 to February 2002 and resumed by November 2002 till January 2003 as well as from August 2003 to January 2004. Aspects of biology, ecology and parasitism were determined. Infestation levels fluctuated greatly (45.7, 4.8 and 33.4%) were recorded occupied with 116, 100 and 110 mines/100 infested leaves in 2001-2002, 2002-2003 and 2003-2004, respectively. This leafminer had two generations and moths emerged during August-October and February-April. The highest rates of larval and pupal parasitism were 25.6 and 30.8% recorded in 2003-2004 opposed to 11.8 and 7.9 % in 2001-2002 with a general rate about 20% in all seasons. The most abundant species were *Pediobius* sp. and *Brachymeria* sp. accounting for about 47 and 50% of the total number of collected larval and pupal parasitoids in this study, respectively.

INTRODUCTION

The leafminer *Cosmopterix salahinella* Chrétien (= *C. phragmitidis* Amsel, 1935) is a new record attacking oboe cane or giant reed, *Arundo donax* L., plants grown in or at the banks of fresh and drainage canals at Al-Aiat in Giza governorate in Middle Egypt and Sakha in Kafr El-Sheikh governorate Middle Delta. Moths reared from oboe cane were submitted to identification by Dr. Sergey Yu. Sinev (Zoological Institute of the Academy of Sciences, St. Petersburg, Russia) in May 2002. Sinev (1997) reported a check list of 40 Palaearctic species of the genus *Cosmopterix* Hb. with notes on the geographic distribution and host plants. Caterpillars mine during the whole their life leaves of mono and dicotyledonous herbaceous, rarely shrub plants. Three species: *C. crassicervicella* Chrét on *Cyperus* sp. and *C. pararufella* Riedl on, *Saccharum officinarum* L., were recorded in Egypt and *C. salahinella* on *Phragmites australis* (Cav.) in Tunisia, Libya and Palestine (Sinev, 1997 and El-Serwy, 2004). Few authors contributed to survey other leafminers on different host plants in Egypt (Willcocks, 1924 and Hammad, 1956). Three species: *Bedellia somnulentella* (Zeller) (Lyonetiidae:

Bedelliinae) infested field bindweed, *Convolvulus arvensis* L.(Convolvulaceae), *Gypsonoma minutana* Hubner (Tortricidae) and *Phyllocnistis saligna* Zeller (Phyllocnistidae) infested willow, *Salix tetrasperma* Roxb., (Salicaceae) were recorded at Al-Aiat region (Unpublished data).

The present study aimed to obtain new information on aspects of its biology, ecology and parasitism on oboe cane at Al-Aiat region, Giza governorate.

MATERIALS AND METHODS

The present investigation was conducted on oboe cane, *Arundo donax* L., plants grown in irrigation canals at Al-Aiat in Giza governorate during 2001-2004 successive growing seasons. Hundred leaves on stand plants were visually examined weekly from December 2, 2001 to February 10, 2002 and resumed by November 25, 2002 till January 27, 2003 also from August 12, 2003 to January 20, 2004, collection of October 28, 2003 was unrecorded. On each examination date, the infested leaves (mined) were detached, collected in plastic bags and transferred to the laboratory and dissected by dissection microscope. Numbers of live, dead and parasitized larvae as well as pupae free or with parasitic exit holes and the empty pupal case were recorded. After examination, parasitized larvae with the immature parasitoids present as well as pupae or healthy larvae were placed into two plastic bags with the mined leaf pieces for rearing the live larvae and allow the emergence of parasitoids and moths. Daily inspection was made and the emerged parasitoids and moths were identified and recorded. At the end of emergence period, the dried leaf pieces were reexamined and the failed emerged moths and parasitoids were also identified and recorded.

RESULTS AND DISCUSSION

1-Biology: A leafminer was discovered infesting oboe cane in Al-Aiat region during the winter of 2001. Emerged adults were identified as *Cosmopterix salahinella* Chrétien,1907 (Cosmopterigidae) Synonym(s): *salahinella* Chrétien,1907, *rufella* Turati,1927, *phragmitidis* Amsel,1935 (Ahmet, 2007). Female moth Fig. 1 a, laid its eggs individually on the lower leaf surface near margin. The newly hatched larvae made three ventilation pores before penetration of the leaf. The initial mine widened by feeding larvae on the leaf tissue which became broad Fig. 1 b. At the terminal end of the blotch mine which are free from faeces, the full-grown larvae made an emergence slit before pupation inside the silky pupation chamber Fig. 1 c.

2- Level and intensity of infestation

Data in Table 1 show that infestation by *C. salahinella* fluctuated greatly. Averages of 45.7, 4.8 and 33.4% were recorded in 2001-2002, 2002-2003 and 2003-2004 seasons respectively, with a general average about of 28%. Infestation started at high and low levels of 42 and 1% in early December and late November, reached maximum of 83 and 16% after five and four weeks and decreased to 38 and 1% by early February and late January in the first and the second seasons, respectively. In August inspections of 2003, infestation started in relatively low level of 15%, reached a maximum of 76% in late September and declined to 1% in mid November, then increased gradually to reach 57% after a month but decreased again to 12% in the third week of January 2004. The number of mines per infested leaf can express intensity of infestation and ranged between 1-4 mines per infested leaf during the course of this study. The general averages were 116, 100 and 110 per 100 infested leaves in the three successive seasons, respectively, whereas the highest values 134 and 117 were attained in early January 2002 and mid October 2003 (Table 1).

3- Occurrence of larvae

Data in Table 2 indicate that alive larvae accounted for 92.2, 87.5 and 86.1 % of the total number of alive and dead larvae collected in 2001-2002, 2002-2003 and 2003-2004, respectively. Alive larvae were generally increased by the ovipositional activities of the emerged female moths, whilst decreased by developing the full-grown larvae to pupae in the different years. Alive larvae started in high and low numbers of 20 and 4 in early December, reached a peak of 77 and 13 after five and three weeks and declined to 1 in early February or late January in 2001-2002 and 2002-2003, respectively. It occupied with low numbers of pupae and moth emergence (= empty pupal case) ranged between 2- 5 and 6- 9 during early December – early January in 2001-2002, respectively. Pupae increased from 7 in late January to 27 in early February by decreasing alive larvae from 3 to 1 during this period and reached a maximum of 30 when all full-grown larvae were pupated in the next week. In 2002-2003 season, scarce numbers of pupae and empty pupal cases were recorded during the first half of January and during late November – the third week of December. The occurrence period of alive larvae prolonged from mid August to the third week of January with two peaks of 47 and 48 in late September and mid December in 2003-2004 season, respectively (Table 2). Pupae and moth emergence (= empty pupal case) followed the same pattern of incidence started in low numbers of 2 and 4 in early and late August and continued until the third week of January in 2003-2004, respectively. Pupae reached a peak of 25 in mid October.

4- Emergence of moths

Moths developed from active and overwintering full-grown larvae were emerged during August-October and February-April and weekly numbers of emerged adults in 2001-2002, 2002-2003 and 2003-2004 are represented in (Fig. 2). Moths emerged in a few numbers of 3 in late August, reached a peak of 21 in the third week of October and lowered to 10 in the next week in 2003. Whereas, those overwintering as full-grown larvae emerged in individual numbers of 1, 2 and 3 by the third week of February as well as one and two weeks later in 2002, 2003 and 2004, respectively. Peaks of 62 and 34 were attained in late March and early April, but declined to 17 and 3 after one and three weeks in 2002 and 2004, respectively. Moth emerged in scarce numbers until the third week of April 2003. The sex ratio of female : male was about 1 : 1 in all emergence seasons.

Majority (>58%) of adults were emerged during March.

5- Parasitism

The general rate of larval or pupal parasitism was about 20%, but were fluctuated greatly during the course of this study. Rates of larval parasitism were 11.8, 17.8 and 25.6% in 2001- 2002, 2002- 2003 and 2003-2004 seasons, respectively. Whereas, rates of pupal parasitism 7.9 and 30.8% were recorded in the first and the third seasons, respectively, but no pupal parasitic activity was found in the second one.

Parasitic activity by larval parasitoids started in low rates of 12 and 11.1% in December and reached its peak of 16.1 and 30% by January in 2001-2002 and 2002-2003, respectively, but decreased to 1.7% in February 2002 (Fig. 3). Incidence of parasitism started in low rate of 18.2% in August, reached a peak of 40.2% in October and decreased to 20.5% in January in 2003-2004.

Parasitic activity by pupal parasitoids started in low and high rates of 5.4 and 30.8% in December and August reached a peak of 25 and 52.4% in February and November in 2001-2002 and 2003-2004, respectively, but declined to 6% in January 2004 (Fig. 4).

Six new record parasitoid species (Hymenoptera: Chalcidoidea) were identified. Three of these, *Pediobius* sp., *Pnigalio* sp. (Eulophidae) and *Cotesia* (= *Microgaster* and *Apanteles*) *ruficrus* (Haliday) (Braconidae) were larval parasitoids. However, *Brachymeria* sp. (Chalcidae), *Diadegma oranginator* Aub. (Ichneumonidae) and *Norbanus* sp. (Pteromalidae) were pupal parasitoids, also, undetermined species of Torymidae was recorded. The most abundant larval and pupal parasitoid species were *Pediobius* sp. and *Brachymeria* sp. accounting for about 47 and 50% of the total d in this study, respectively (Table 3).

Wasps of *Pediobius* sp. emerged in early September and the third week of December and continued until early February and March in 2003- 2004 and 2001- 2002, respectively, whereas the emergence period occurred in the first half of February in the second season. Species of *Pediobius* are quite diverse, acting as primary and secondary parasitoids, utilizing eggs, larvae and/or pupae of species in the insect orders Coleoptera, Diptera, Hemiptera, Hymenoptera and Lepidoptera were reviewed by (Gates *et al*, 2005). It has been recorded on the shoot-fly, *Atherigona humeralis* (Wiedemann) Diptera: Muscidae) infested (Bermuda grass, *Cynodon dactylon* L.) at Sids in Beni Sueif governorate (El-Serwy, 2000). *Phygadeuon* sp. emerged from late August to late December 2003, but emerged in scarce numbers on late December and the third week of February in 2001- 2002. The emergence period of *C. ruficrus* lasted for five weeks beginning in late August and February and ending in late September and March in the third and the first seasons, respectively. Both species were recorded on the midrib larvae, *Cosmopterix pararufella* Reidl, infested sugarcane (*Saccharum officinarum* L.) at Aiat (El-Serwy, 2006). Wasps of *Brachymeria* sp. emerged in a few numbers during the last three weeks of February and from the third week of October to mid November in 2001-2002 and 2003-2004, respectively, whereas *D. oranginator* emerged in individual numbers during December and March in both seasons. The emergence period of *Norbanus* sp. prolonged from mid December to the third week of March, whereas the an individual of torymid was emerged in late March in 2003-2004. Species of *Brachymeria* Westwood are important primary parasitoid of Lepidoptera (including Noctuidae, *Heliothis* and Tortricidae, *Platynota*) (Wemer, 1976). The ichneumonid species was recorded on the sugar beet mining moth, *Scrobipalpa ocellatella* Boyd (Gelechiidae) in Egypt (El-Serwy, 2008). The pteromalid *Norbanus* sp. and the torymid *Podagrion* sp. were recorded on *C. pararufella* (El-Serwy, 2006).

Reviewing the above mentioned results it could be concluded that infestation and mine density by the blotch leafminer *C. salahinella* on oboe cane plants were fluctuated greatly during this study. Infestation levels were about of 47% in 2001-2002, 5% in 2002-2003 and 33% in 2003-2004 with general average of 28%. It occupied with 116, 100 and 110 mines/ 100 infested leaves, respectively. The highest rate of infestation (83%) and mine density (134 mines/ 100 infested leaves) were recorded in early June 2002. Mines ranged between 1-4 per infested leaf. The leafminer had two generations during the course of this study. In mid August of 2003, larvae of the first generation occurs in low numbers, reached its peak in late September and declined to lower numbers after five weeks, whereas moths emerged in a few numbers by late August, peaked in the 3rd week of October and declined in

the next week. Whereas larvae of the second generation appears in low numbers in the third week of November in 2003 and early December in 2002 and 2001. Its occurrence continued until the 3rd, the 4th of January in 2004 & 2003 and a week later in 2002 reached the peak of its population in mid December and one and three weeks later, respectively. Moths, overwintering as full-grown larvae started emergencies by the 3rd week of February as well as one and two weeks later and its emergencies continued till the 1st, the 3rd and the 4th weeks of April in 2002, 2003 and 2004, respectively. This species emerged from late February to late June on (*Phragmites australis* (Cav.)) in Tunisia, Lybia and Palestine, whereas other species of this genus i. e. *C. zieglerella* (Hb.) emerged in late May- July on *Humulus lupulus* L., *H. japonicus* Sieb et Zucc. and *Boehmeria nippononivea* Koidz in many European and east far countries and both *C. crassicervicella* Chrét, emerged in spring and autumn on (*Cyperus* spp.) and *C. pararufella* Riedl, emerged in spring, summer and autumn in a year on (*Saccharum officinarum* L.) in Egypt (Sinev, 1997 and El-Serwy, 2005). The general rate of larval or pupal parasitism was about 20%, but was positively varied between the seasons sampled in this study. The highest rate of larval and pupal parasitism were 25.6 and 30.8 % were recorded in 2003-2004 season opposed to 11.8 and 7.9% in 2001-2002. The most abundant larval and pupa parasitoids *Pediobius* sp. and *Brachymeria* sp. were emerged in all seasons, except in the second seasons where pupal parasitoids disappeared.

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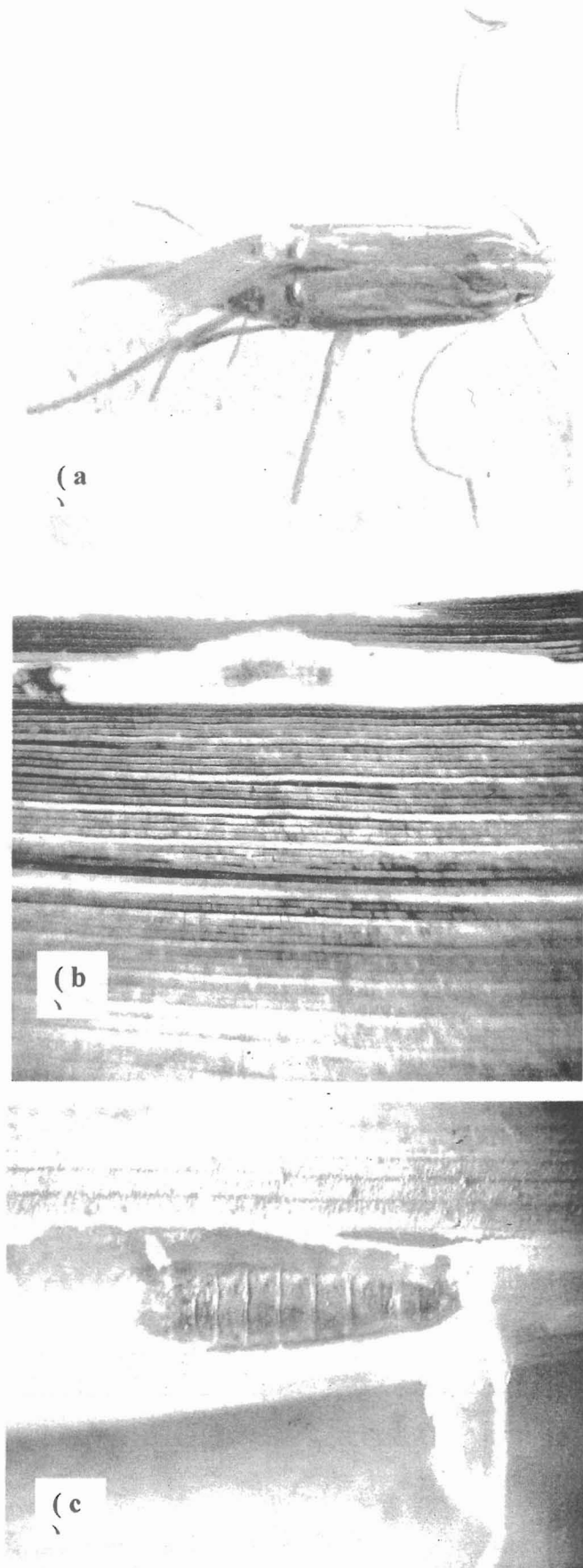


Fig.1. Adult (a), larva inside the blotch mine (b) and pupa (c) of *Cosmopterix*

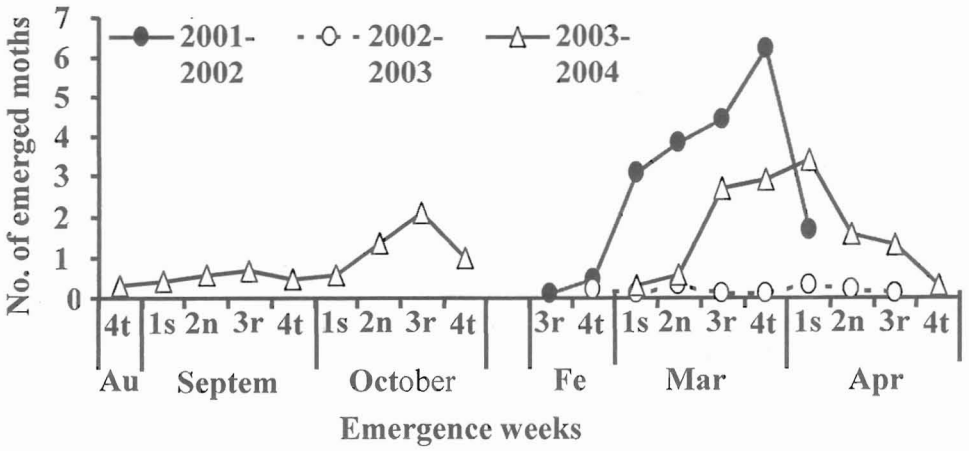


Fig. 2. Weekly no. of emerged *Cosmopterix salahinella* adults during August-April in 2001-2002, 2002- 2003 and 2003-2004 seasons.

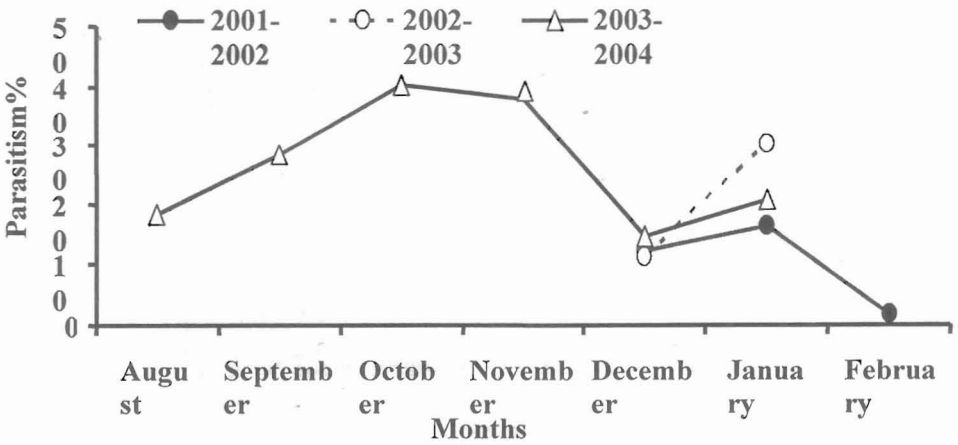


Fig. 3. Larval parasitism of *Cosmopterix salahinella* during August- February in 2001-2002, 2002- 2003 and 2003-2004 seasons.

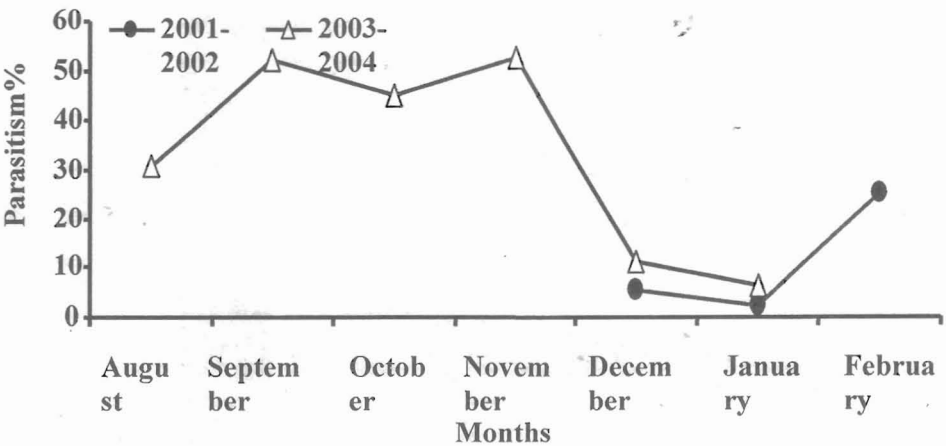


Fig. 4. Pupal parasitism of *Cosmopterix salahinella* during August- February in 2001-2002, 2002- 2003 and 2003-2004 seasons.

Table 1. Percentage of infested leaves and total no. of mines by *Cosmopterix salahinella* on oboe cane during August- January in 2001- 2004 seasons.

| Collection date | | Infested leaves % | | | Total no. of mines | | |
|--|-----|-------------------|-----------|-----------|--------------------|-----------|-----------|
| Month | Day | 2001-2002 | 2002-2003 | 2003-2004 | 2001-2002 | 2002-2003 | 2003-2004 |
| August | 12 | | | 16 | | | 18 |
| | 19 | | | 2 | | | 2 |
| | 26 | | | 43 | | | 47 |
| September | 2 | | | 33 | | | 38 |
| | 9 | | | 61 | | | 64 |
| | 16 | | | 53 | | | 64 |
| | 23 | | | 48 | | | 52 |
| | 30 | | | 76 | | | 84 |
| October | 7 | | | 42 | | | 44 |
| | 14 | | | 48 | | | 56 |
| | 21 | | | 32 | | | 34 |
| | 28 | Uncollected | | | | | |
| November | 4 | | | 18 | | | 19 |
| | 11 | | | 1 | | | 1 |
| | 18 | | | 4 | | | 4 |
| | 25 | | 1 | 33 | | 1 | 38 |
| December | 2 | 42 | 6 | 21 | 51 | 6 | 22 |
| | 9 | 63 | 2 | 55 | 70 | 2 | 61 |
| | 16 | 70 | 2 | 57 | 74 | 2 | 62 |
| | 23 | 55 | 16 | 21 | 64 | 16 | 21 |
| | 30 | 33 | 0 | 50 | 39 | 0 | 53 |
| January | 6 | 83 | 9 | 20 | 111 | 9 | 23 |
| | 13 | 56 | 11 | 22 | 66 | 11 | 23 |
| | 20 | 16 | 0 | 12 | 17 | 0 | 12 |
| | 27 | 17 | 1 | | 18 | 1 | |
| February | 3 | 30 | | | 34 | | |
| | 10 | 38 | | | 40 | | |
| Average | | 45.7 | 4.8 | 33.4 | 53.0 | 4.3 | 38.3 |
| General average of mines/100 infested leaves | | | | | 116 | 100 | 110 |

Table 2. Total no. of collected larvae, pupae and empty pupal cases of *Cosmopterix salahinella* during August- February in 2001- 2004 seasons.

| Collection date | | No of collected larvae, pupae and empty pupal cases during: | | | | | | | | | | | |
|-----------------|-----|---|-------|-------|-------------------|-----------|-------|-------|-------------------|-----------|-------|-------|-------------------|
| month | Day | 2001-2002 | | | | 2002-2003 | | | | 2003-2004 | | | |
| | | Larvae | | Pupae | Empty pupal cases | Larvae | | Pupae | Empty pupal cases | Larvae | | Pupae | Empty pupal cases |
| | | Dead | Alive | | | Dead | Alive | | | Dead | Alive | | |
| August | 12 | | | | | | | | | 12 | 4 | 2 | 0 |
| | 19 | | | | | | | | | 0 | 1 | 1 | 0 |
| | 26 | | | | | | | | | 6 | 12 | 18 | 4 |
| September | 2 | | | | | | | | | 2 | 12 | 8 | 1 |
| | 9 | | | | | | | | | 7 | 20 | 2 | 6 |
| | 16 | | | | | | | | | 4 | 39 | 2 | 5 |
| | 23 | | | | | | | | | 0 | 31 | 3 | 4 |
| October | 30 | | | | | | | | | 1 | 47 | 14 | 2 |
| | 7 | | | | | | | | | 3 | 6 | 16 | 3 |
| | 14 | | | | | | | | | 1 | 7 | 25 | 2 |
| November | 21 | | | | | | | | | 0 | 1 | 9 | 5 |
| | 4 | | | | | | | | | 2 | 5 | 3 | 0 |
| | 11 | | | | | | | | | 0 | 1 | 0 | 0 |
| | 18 | | | | | | | | | 0 | 4 | 0 | 0 |
| December | 25 | | | | | 0 | 0 | 0 | 1 | 0 | 29 | 1 | 0 |
| | 2 | 2 | 20 | 2 | 6 | 0 | 4 | 0 | 2 | 3 | 10 | 0 | 3 |
| | 9 | 5 | 54 | 1 | 1 | 0 | 2 | 0 | 0 | 5 | 46 | 1 | 1 |
| | 16 | 7 | 58 | 0 | 4 | 0 | 1 | 0 | 0 | 5 | 48 | 0 | 2 |
| | 23 | 2 | 48 | 0 | 5 | 1 | 13 | 0 | 1 | 3 | 18 | 0 | 0 |
| January | 30 | 1 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 40 | 0 | 0 |
| | 6 | 6 | 77 | 5 | 9 | 1 | 2 | 1 | 0 | 4 | 16 | 0 | 0 |
| | 13 | 2 | 48 | 1 | 1 | 2 | 5 | 2 | 0 | 2 | 16 | 1 | 0 |
| | 20 | 1 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 1 |
| February | 27 | 3 | 3 | 7 | 0 | 0 | 1 | 0 | 0 | | | | |
| | 3 | 0 | 1 | 27 | 0 | | | | | | | | |
| | 10 | 1 | 0 | 30 | 0 | | | | | | | | |
| Total | | 30 | 355 | 76 | 26 | 4 | 28 | 3 | 4 | 67 | 416 | 107 | 39 |

Table 3. Weekly no. of emerged larval and pupal parasitoids of *Cosmopterix salahinella* during August- March 2001- 2004.

| Emergence weeks | | Weekly no. of emerged | | | | | | | | | | | | | |
|-----------------|------|-----------------------|-----------|-----------|---------------------|-----------|-------------------|-------------------|------------------------|-----------|-----------------------|-----------|---------------------|----------------------------------|-----|
| | | Larval parasitoids | | | | | | Pupal parasitoids | | | | | | | |
| | | <i>Pediobius</i> sp. | | | <i>Pnigalio</i> sp. | | <i>C. ruficus</i> | | <i>Brachymeria</i> sp. | | <i>D. oringinator</i> | | <i>Norbanus</i> sp. | Undetermined species (Torymidae) | |
| Month | Week | 2001-2002 | 2002-2003 | 2003-2004 | 2001-2002 | 2003-2004 | 2001-2002 | 2003-2004 | 2001-2002 | 2003-2004 | 2001-2002 | 2003-2004 | 2003-2004 | 2001-2002 | |
| August | 4th | | | 0 | | 4 | | 4 | | | | | | | |
| | 1st | | | 3 | | | | 2 | | | | | | | |
| September | 2nd | | | 0 | | | | 4 | | | | | | | |
| | 3rd | | | 1 | | | | 2 | | | | | | | |
| | 4th | | | 0 | | | | 3 | | | | | | | |
| October | 2nd | | | 0 | | 13 | | | | | | | | | |
| | 3rd | | | 7 | | 17 | | | | 3 | | | | | |
| | 4th | | | 17 | | | | | | 12 | | | | | |
| November | 2nd | | | 2 | | | | | | 1 | | | | | |
| | 1st | | | 1 | | | | | | | | 2 | | | |
| December | 2nd | | | | | | | | | | | | 2 | | |
| | 3rd | 1 | | | | | | | | | | | | | |
| | 4th | | | | 1 | 1 | | | | | 1 | | | | |
| January | 1st | | | | | | | | | | | | | | |
| | 2nd | 1 | | | | | | | | | | | | | |
| | 3rd | 4 | | 2 | | | | | | | | | | | |
| February | 4th | 0 | | 1 | | | | | | | | | 3 | | |
| | 1st | 0 | 1 | 6 | | | | | | | | | 1 | | |
| | 2nd | 3 | 2 | | | | | | 3 | | | | 0 | | |
| | 3rd | 3 | | | 1 | | | | 2 | | | | 2 | | |
| | 4th | 1 | | | | | 2 | | 1 | | | | 2 | | |
| March | 1st | 2 | | | | | 4 | | | | 1 | | 3 | | |
| | 2nd | | | | | | 2 | | | | | 2 | 1 | | |
| | 3rd | | | | | | 3 | | | | | | 1 | | |
| | 4th | | | | | | 1 | | | | | | | 1 | |
| Total | | 15 | 3 | 40 | 2 | 35 | 12 | 15 | 6 | 16 | 2 | 4 | 15 | 1 | |
| Grand total | | 58 | | | 38 | | 27 | | 22 | | 6 | | 15 | | 1 |
| % | | 47.1 | | | 30.9 | | 22.0 | | 50.0 | | 13.6 | | 34.1 | | 2.3 |

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تسجيل جديد لصناعة أنفاق الأوراق *Cosmopterix salahinella* Chrétien التي تصيب الغاب في مصر

سمير عوض السروي

معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقي- جيزة.

سجلت صناعة أنفاق الأوراق *Cosmopterix salahinella* Chrétien من فصيلة Cosmopterigidae - رتبة حرشفية الأجنحة كأفة جديدة على الغاب في مصر. أخذت عينات أسبوعية من نباتات الغاب النامية في وعلى جانبي قنوات الري بمنطقة العياط في محافظة الجيزة من ديسمبر ٢٠٠١ وحتى فبراير ٢٠٠٢ وأستؤنفت في نوفمبر ٢٠٠٢ وحتى يناير ٢٠٠٣ ثم من أغسطس ٢٠٠٣ وحتى يناير ٢٠٠٤ لدراسة جوانبها الحيوية، البيئية والتطفل. أشارت النتائج المتحصل عليها إلى أن معدل الإصابة تذبذب كثيرا وبلغت ٤٥,٧، ٤,٨ و ٣٣,٤% أما كثافة الأنفاق المقابلة فكانت ١١٦، ١٠٠ و ١١٠ نفق لكل ١٠٠ ورقة مصابة في مواسم ٢٠٠١-٢٠٠٢، ٢٠٠٢-٢٠٠٣ و ٢٠٠٣-٢٠٠٤ على التوالي. كان لصناعة الأنفاق جيلين خرجت فراشاتها خلال أغسطس- أكتوبر و فبراير- أبريل. بلغت أعلا نسب لتطفل اليرقات والعدارى ٢٥,٦ و ٣٠,٨% في موسم ٢٠٠٣-٢٠٠٤ في مقابل ١١,٨ و ٧,٩% في موسم ٢٠٠١-٢٠٠٢ وبمعدل عام حوالي ٢٠% لكل المواسم. وجد أن *Pediobius* sp. و *Brachymeria* sp. أكثر الطفيليات شيوعا يمثلا حوالي ٤٧ و ٥٠% من الأعداد الكلية لكلا من طفيليات اليرقات والعدارى والتي تم جمعها خلال تلك الدراسة، على التوالي.