J. Plant Protection and Pathology, Mansoura Univ., Vol. 1 (6): 319 - 330, 2010

ECOLOGICAL STUDIES ON LEPIDOPTEROUS STEM BORERS ASSOCIATED WITH THE MAIN GRAMINACEOUS WEEDS AND CROPS AT KAFR EL-SHEIKH REGION

Metwally, M. M.
Biological Control Dept. Agric. Research Center, Plant Protection Institute, Sakha, Egypt.

ABSTRACT

The present investigation was carried out at Kafr El-Sheikh region during 2008 and 2009 to survey lepidopterous stem borers on the main graminaceous weeds as well as on the botanically-related economic crops. Graminaceous weeds were found to harbor several lepidopterous stem borers at Kafr El-Sheikh region. Common reed (*Phragmites australis* Trin), harbored *Sesamia nonagrioides* Lef., *Mythimna crenulata* Hampson., and *Chilo luteellus* Mosts., Torpido grass, (*Echinochloa stagninum* Beauv.), harbored *Sesamia wiltshirei* Rungs and *Chilo agamemnon* Bles., while mat sedge (*Cyperus alopercoides* Rottb.), harbored *Eldana saccharina* Walk.

During the course of the current study three stem borers (*Sesamia cretica* Led., *Chilo agamemnon* Bles. and *Ostrinia nubilalis* Hubn.) were recorded on the main graminaceous crops; sugarcane, rice and maize. These borers hibernated from November to April and were active during other months of the year.

Lepidopterous stem borers can be placed in three categories according to time of dormancy: 1- Borers active all the year round and has no dormancy, *e.g. S. nonagrioides*, 2-Borers which aestivate in summer, *e.g., M. crenulate* and *S. wiltshiere* and 3-Borers which hibernate in winter, *e.g., C. agamemnon, C. luteellus, S. cretica, E. saccharina* and *O. nubilalis*.

INTRODUCTION

The main graminaceous weeds at Kafr El-Sheikh region namely; 1- Common reed, *Phragmites australis* Trin, 2- Torpido grass, *Echinochloa stagninum* Beauv. and 3- mat sedge, *Cyperus alopercoides* Rottb. (Zaki, 1991). They are aquatic, perennials and reproduce vegetative. Therefore, they grow wildly and commonly in shallow ditches and canals and on banks of deep canals. They cause little irrigation and drainage problems which can easily be overcome by periodic mechanical removal and do not usually grow amongst plants of economic crops.

Several investigators in Egypt (Jepson, 1954; Selmi, 1964 and El-Tantawy, 1973) have reported the common reed as a host for *S. cretica* which is known as a main pest of maize and sugar cane. The latter author has further reported that Torpido grass is also a host for *S. cretica* and that the three weeds: common reed, tropido grass and mat sedge act as hosts for *C. agamemnon* which is a main pest of rice, maize and sugar cane.

In Egypt, graminaceous plants, particularly sugarcane, rice, *Echinochloa stagninum* and *Acorus calamus* L. plants, continued to carry the infestation until the end of the season and the hibernating larvae were found in all of these plants (Awadallah ,1972). Abd El-Rahman *et al.* (1983) recorded five species of stem borers on the considered weeds this finding contradicts reports of various authors.

In Kenya, most cereal stem borers of maize and sorghum are gradually polyphagous and have several graminaceous and other wild hosts (Khan *et al.* 1997).

In the pest few decades, increased minimum temperature have allowed several lepidopterous species to move from low elevations sites to colonize sites at higher elevations that previously may have been too cold and/or dry for their survival (Hill *et al.*, 2002). This movement has been decreased for a number of stem borer species including *E. saccharina* (Getu *et al.*, 2001; Talali *et al.*, 2002; Tefera, 2004 and Webster *et al.*, 2005).

This work is important in order to ascertain whether these weeds actually contribute to propagation of pests of economic crops. Preliminary dissection of the considered weeds have shown them to harbor lepidopterous stem borers other than *S. cretica* and *C. agamemnon*. Therefore, the present work was undertaken to survey and identify lepidopterous stem borers on the considered weeds as well as on the botanically related economic crops, *i.e.,* rice, maize and sugar cane and the population of the borers on these weeds was estimated.

MATERIALS AND METHODS

1. Experimental field

The study was carried out at Kafr El-Shiekh region during 2008 and 2009. The experimental field was chosen to suit the purpose of the study. It was a ditch (about 4 feddans in area) at Sakha Agriculture Research Station. Containing common reed and mat sedge, a passing by shallow canal containing Torpido grass, and adjacent fields of rice, maize and sugar cane.

2. Sampling program:

Graminaceous weeds:

Samples were taken at about 15 days intervals in case of common reed, while other weeds ,(tropido grass and mat sedge) were monthly sample during two successive years (2008 and 2009). Plants in each sample were randomly picked. Sample size was 50 plants/ host plant.

Graminaceous crops:

The study continued for one year on crops, 20 hills in rice, 20 plants in either maize and sugar cane were collected at 15 days intervals.

Plants in each sample in both weeds and crops were dissected to record the borers in their different live stages.

RESULTS AND DISCUSSION

Survey of the lepidopterous stem borers on weeds and crops:

During the course of the present study eight stem borers at Kafr El-Sheikh region were recorded on the investigated graminaceous weeds and crops namely; *Sesamia nonagrioides* Lef., *Mythimna crenulata* Hampson, *Chilo luteellus* Mosts., *Sesamia wiltshirei* Rungs *Chilo agamemnon* Bles., *Eldana saccharina* Walk., *Sesamia cretica* Led. and *Ostrinia nubilalis* Hub (Table,1).

As shown in Table (1), common reed harbored *S. nonagrioides M. crenulata*, and *C. luteellus*, Torpido grass harbored, *S. wiltshirei* and *C.*

agamemnon, while mat sedge harbored, *E. saccharina* but none of these weeds harbored *S. cretica*. This finding contradicts reports of various authors (Jepson, 1954; Selmi, 1964; El-Tantawy, 1973; Honsy *et al.*, 1976 and Hammad *et al.*, 1976). Who claimed that these weeds act as host for *S. cretica* and further suggested their removal as one of the control methods for *S. cretica*. It seems that there has been a misconception that borers on graminaceous weeds are *S. cretica*.

Table (1): List of stem borers and time of dormancy on the different tested plants at kafr El-Sheikh region.

Stem borer	Time of dormancy	The host plant					
		Weeds			Economic crops		
		Common reed	Torpido grass	Mat sedge	Rice	Maize	Sugar cane
Fam.: Noctuidae							
Sesamia cretica Led.	Winter	-	-	-	-	+	+
Sesamia nonagrioides Lef.	-	+	-	-	-	-	-
Sesamia wiltshirei Rungs	Summer	-	+	-	-	-	-
Mythimna crenulata Hampson	Summer	+	-	-	-	-	-
Fam.: Pyralidae							
Chilo agamemnon Bles.	Winter	-	+	-	+	+	+
Chilo luteellus Mot.	Winter	+	-	-	-	-	-
Eldana saccharina Walker	Winter	-	-	+	-	+	+
Ostrinia nubilalis Hub.	Winter	-	-	-	-	+	-

The close botanical relationship of maize and sugar cane with mat sedge suggests that *E. saccharina* is more likely an indigenous species on mat sedge that has been adapted maize and sugar cane as hosts. This species has already demonstrated its potentiality as a pest outside Egypt.

In South Africa, Atkinson (1980) and Conlong (2001) listed the indigenous host plants of *E. saccharina* and found them to be dominantly sedges (Cyperaceae). Also, *E. saccharina* was recorded from two indigenous grasses (*Phragmites australis* Trin. and *Panicum maximum* Jacqu.) and a sedge, *Cyperus articulates* L (Conlong *et al.* 2007). choice-test experiments conducted by Atachi *et al.* 2005 showed that the West African population of *E. saccharina* preferred indigenous grasses (natural hosts) in the region to crops. Conlong *et al.* 2007 added that *E. saccharina* preferred maize to sugar cane for oviposition.

So, torpido grass was found to be the only weed to serve as alternative host for *C. agamemnon* which is a main pest for rice, maize and sugar cane. It thus, contributes to propagation of the pest.

Population fluctuation of stem borers.

On weed plants:

Figures (1&2) show numbers of either *S. nonagrioides* and *M. crenulata* in different times of the year. *S. nonagrioides* was active all the year

round and its numbers showed five peaks (in mid February, beginning of April, mid May, early July and mid September in 2008). The same trend was given in 2009 but in less numbers, thus indicating five generations per year. However, *M. cernulate* aestivated (as full grown larvae) from May till September in 2008, in the second year 2009 its aestivation was extended until mid of October and therefore had only three generations per year (in mid-February, late April and mid-November in 2008 but extended in late November in the following year 2009. *C. luteellus* appeared in low numbers, entered hibernation as full grown larvae from November till June and was mainly active during August, September and October in the two years of study.

Population density of either *S. wiltshieri* and *C. agamemnon* on Torpido grass during 2008 and 2009 seasons was illustrated in Figures 3 and 4 . *S. wiltshieri* aestivated as full grown larvae during June, July and August and its numbers manifested three peaks in mid-March, mid-May and late December, thus indicating three generations per year. *C. agamemnon* hibernated from November till May and was found in large numbers during the two years of study its activity period was especially in the beginning of July.

Moths of *C. agamemnon* emergence occur in late May and early June. By this time, few fields of rice and maize would have been planted. So, moth oviposit heavy on Tropido grass and the first generation develops, mostly on this weed. Therefore, number of *C. agamemnon* on this weed was highest in mid-July. Second generation moths emerging in late-July and early-August would then go to the economic crops (rice and maize). Such information could be utilized by directing the weed to serve as trap, this will be followed by its removal and destruction in mid-July. Just prior to emergence of second generation moths.

As shown in Figure(5) , *E. saccharina* population was recorded with relatively high numbers on mat sedge. The borer was active from June till October and inter hibernation from November till May.

All forenamed weed borers were formed to be host specific with the exception of *E. saccharina* it was recorded on maize and sugar cane. So, it seems to have the ability of becoming a serious pest of maize and sugar cane in Egypt.

On the main crops:

Table (2) shows relative numbers of the different borers larvae in sugar cane fields in 2009. The present results reveals that numbers of *C. agamemnon* represented 47.2 % of the total number of the borers. *E. saccharina* was found at 26.9 % of the total number of the borers but exceeds that of *S. cretica* 25.9%.

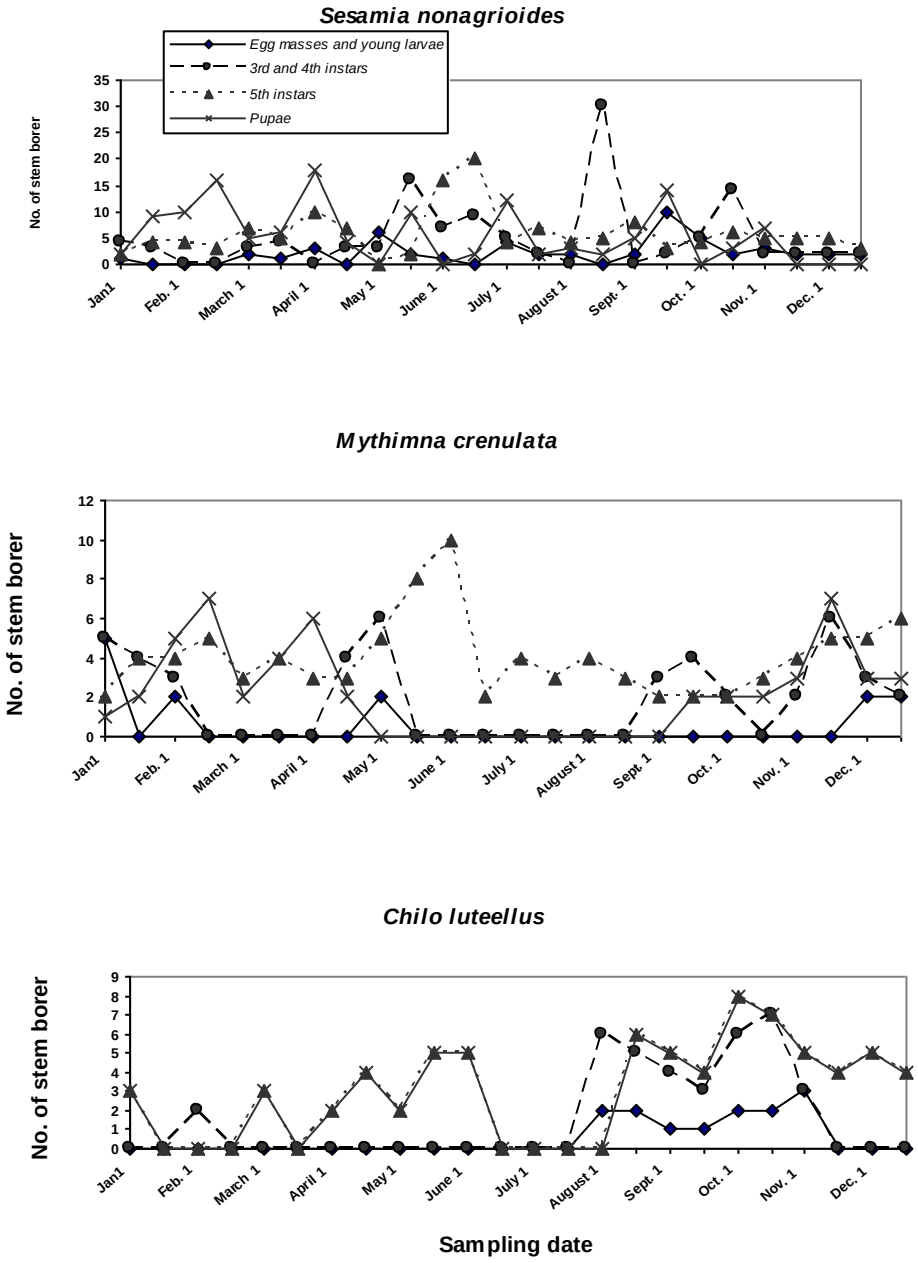

Fig. (1): Partial population curves of immature stages of certain stem borers (*Sesamia nonagrioides* Lef., *Mythimna crenulata* Hampson., and *Chilo luteellus* Mosts) on common reed during season 2008

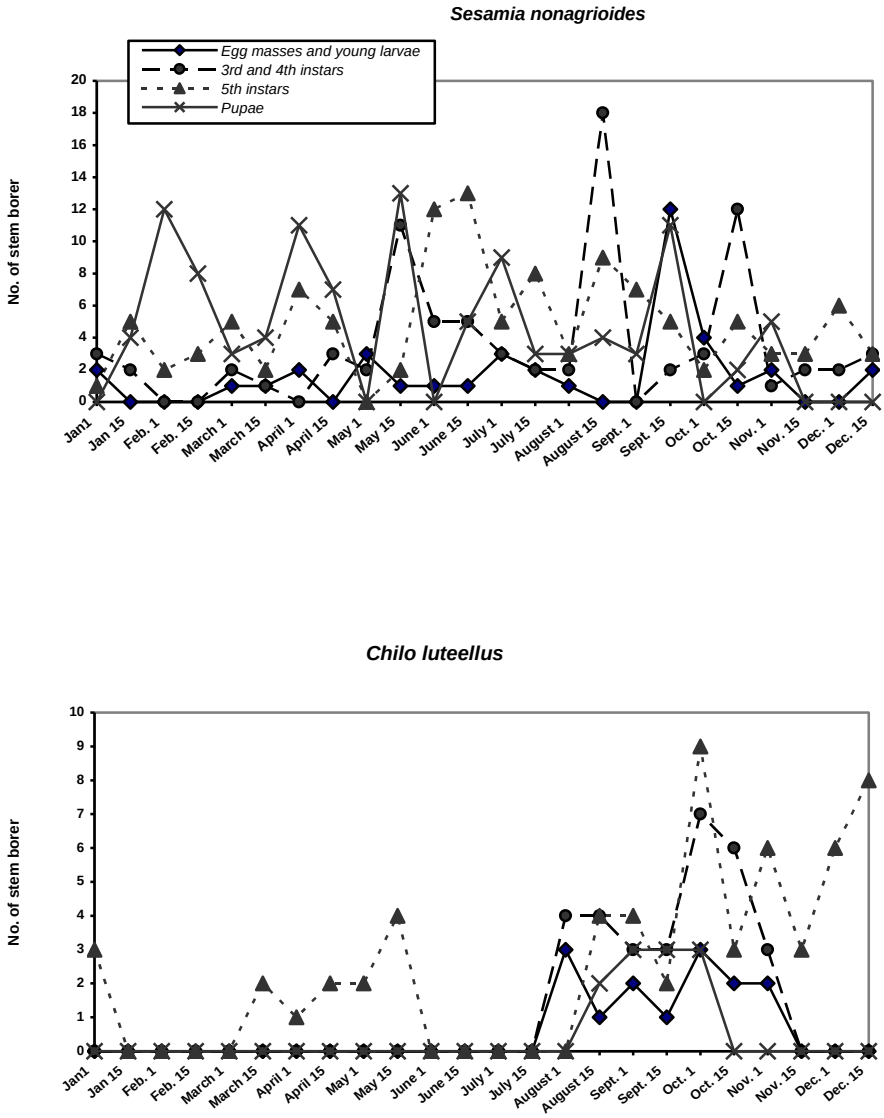

Fig. (2): Partial population curves of immature stages of certain stem borers (*Sesamia nonagrioides* Lef., *Mythimna crenulata* Hampson, and *Chilo luteellus* Mosts) on common reed during season 2009.

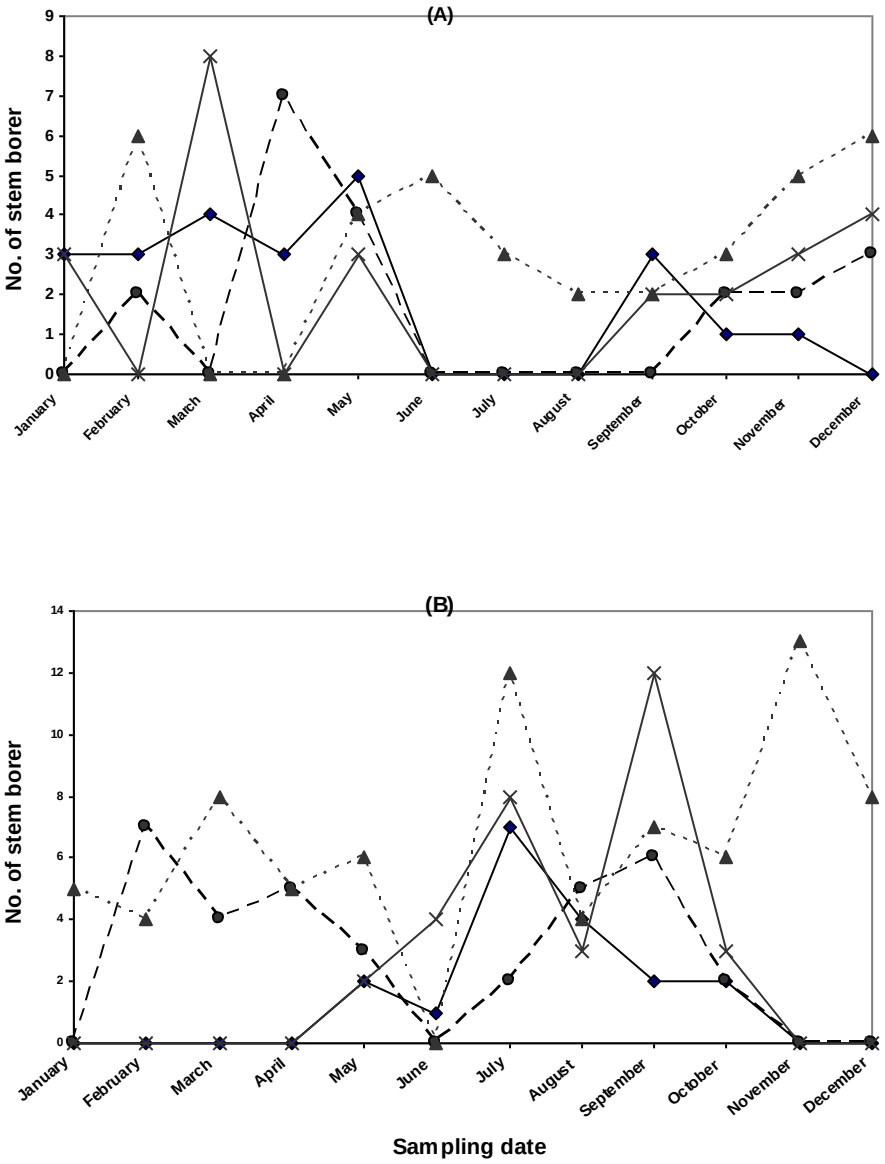

Fig. (3): Partial population curves of immature stages of certain stem borers [*Sesamia wiltshirei* Rungs (A) and *Chilo agamemnon* Bles. (B)] on Torpido grass during season 2008.

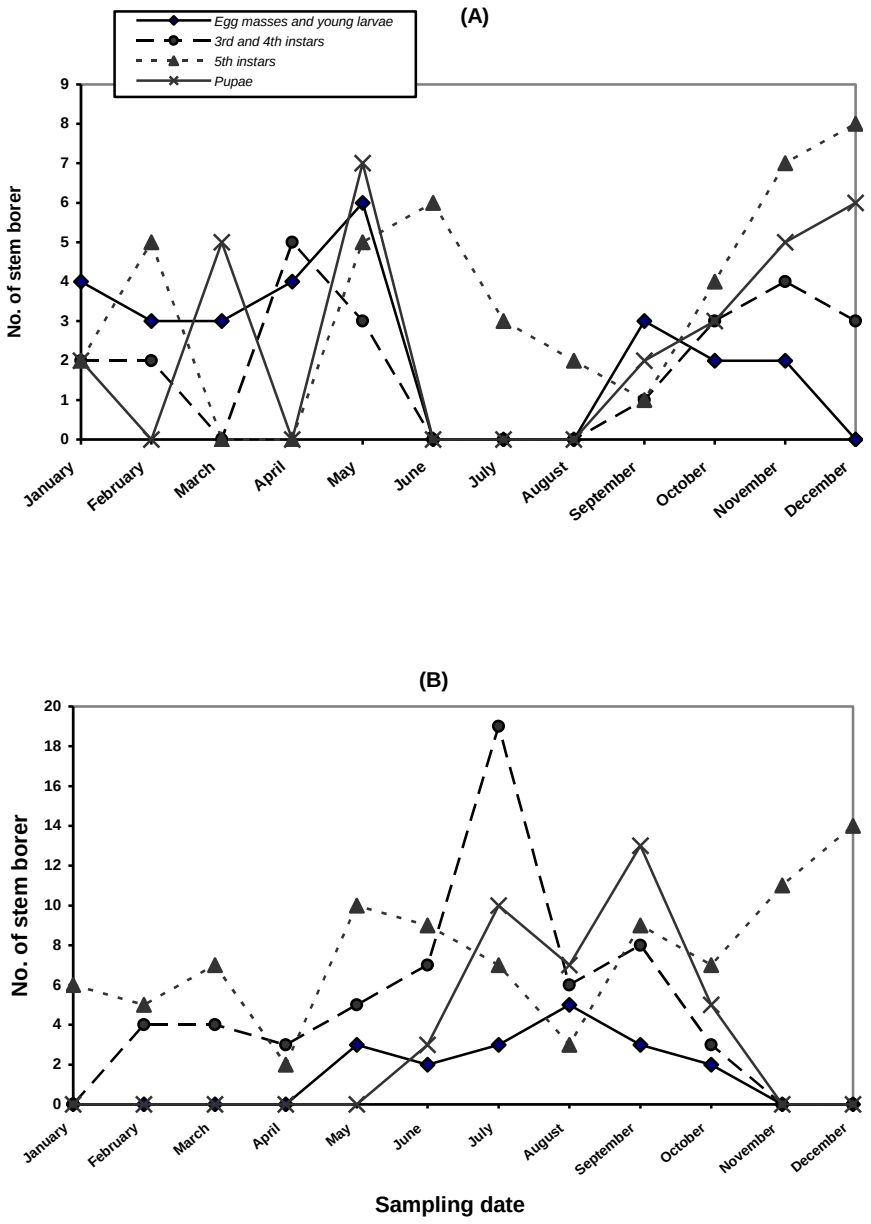

Fig. (4): Partial population curves of immature stages of certain stem borers [*Sesamia wiltshirei* Rungs (B) and *Chilo agamemnon* Bles. (B)] on Torpido grass during season 2009.

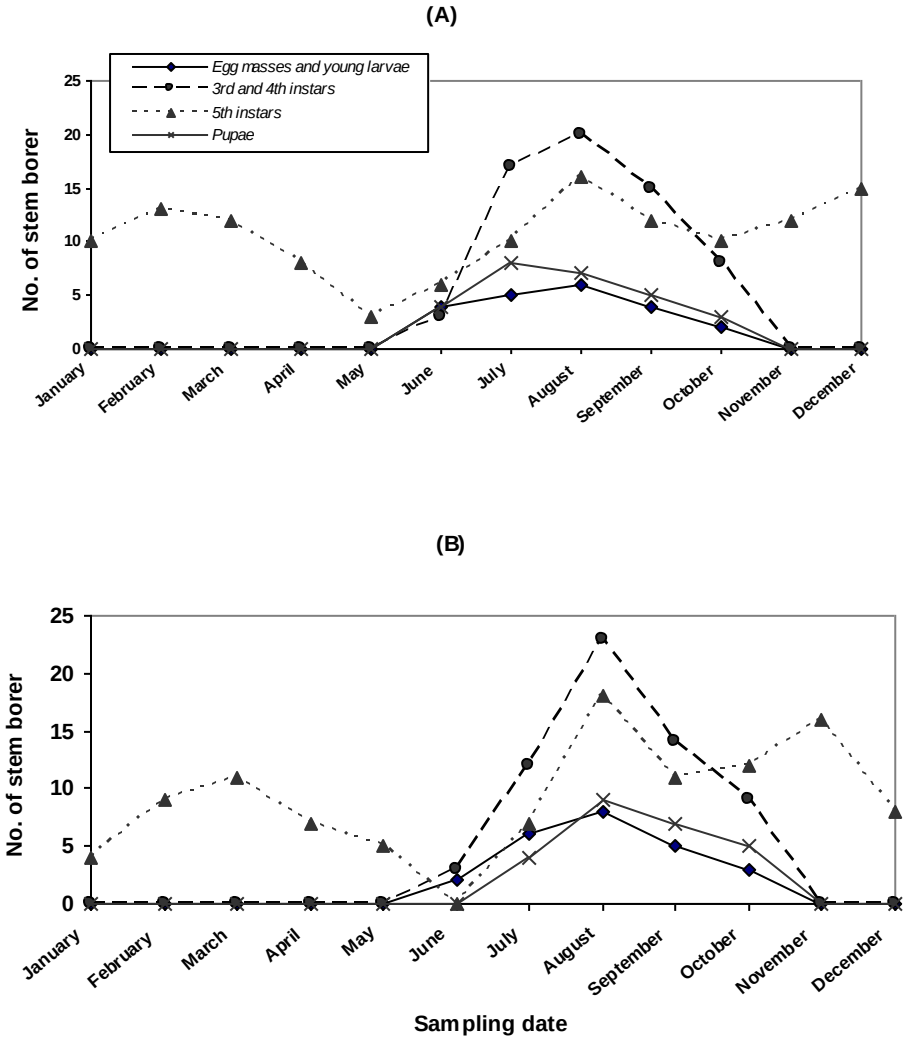

Fig. (5): Partial population curves of immature stages of certain stem borer, on mat sedge during 2008 (A) and 2009 (B) seasons.

With respect to maize crop: the obtained data (Table, 3) reveals that maize harbored *O. nubilalis* which represented 90.1 % of the total borers especially in Nily plantation in addition to *S. cretica* which represented by 7.1 % and *C. agamemnon* which came in the last arrange 2.8 %.

Maize and sugar cane were the only host for *S. cretica* while only maize harbored *O. nubilalis*. Both borers hibernated from November to April and were active during other months of the year.

Table (2): Numbers of larvae of the different borers/ sample in sugar cane field during 2009 season.

Examination date		No. of larvae of the different borers/ 20 plants		
		Chilo agamemnon	*Eldana saccharina*	*Sesamia cretica*
July	15	10	14	6
	30	12	7	8
Aug.	15	19	9	14
	30	22	11	19
Sept.	15	27	17	9
	30	20	8	7
Oct.	15	17	12	11
	30	22	14	13
Nov.	15	30	10	12
Total		**179**	**102**	**98**
%		**47.2**	**26.9**	**25.9**

Table (3): Numbers of larvae of the different borers/ sample in maize field during 2009 season.

Examination date		No. of larvae of the different borers/ 20 plants		
		Sesamia cretica	*Ostrinia nubilalis*	*Chilo agamemnon*
July	30	2	6	2
	15	7	135	4
Aug.	30	9	128	3
	15	12	100	2
Sept.	30	8	95	2
	15	6	90	3
Oct.	30	7	86	3
Total		**51**	**640**	**19**
%		**7.1**	**90.1**	**2.8**

Data in Table (4) showed the percentage of dead hearts and white heads /500 tillers. The most important symptoms of rice stem borer infestation to rice plants. So, it could be concluded that *C. agamemnon* is the main stem borer in rice field during investigation period.

Table (4): Mean percentage of dead hearts and white heads caused by *Chilo agamemnon* larvae in rice field during 2009 season..

Examination date		Dead hearts/500 tillers (%)	White heads/500 tillers (%)
August	15	61.27	26.33
	30	66.66	22.00
September	15	58.67	24.20
	30	53.23	25.33
October	15	49.72	23.07
	30	45.32	21.22

In conclusion, lepidopterous stem borers of graminaceous plants can be divided into three categories according to time of dormancy, *e.g.* 1. *S. nonagrioides* active all the year round, 2. borers which aestivate (as full grown larvae) in summer, *e.g. M. crenulata* and *S. wiltshirei* and 3. borers which hibernate as full grown larvae in winter, *e.g., C. agamemnon, C. lutellus, S. cretica, E. saccharina* and *O. nubilalis*.

REFERENCES

Abd El-Rahman, I.; Z. Shenishen and A. S. El-Nawawy (1983). Survey of lepidopterous stem borers on the main weeds at Kafr El-Sheikh Governorate, Egypt. Proc. 5th Arab Pesticide Conf., Tanta Univ., Vol. 111, 118-127.

Atachi, P. Adeloka Et and F. Schulthess (2005). Study on some biological aspects of *Eldana saccharina* Walker (Lepidoptera: Pyralidae) on *Zea mays* L. and alternative host plants. J. Appl. Enomol., 129 (8): 447-455.

Atkinson, P. R. (1980). On the biology, distribuation and natural host-plants of *Eldana saccharina* Walker (Lepidoptera: Pyralidae). J. Entomol. Soc. Southern Africa., 43: 171-194.

Awadallah, W. H. (1972). Biological studies on corn borers in Egypt. Ph.D. Thesis, Fac. Agric., Ain Shams Univ.

Conlong, G. E. (2001). Biological control of indigenous African stem borers. Insect Sci. Aplic., 21: 267-274.

Conlong, D. E.; B. Kasl and M. Byrne (2007). Independent kids-or motherly moms? Implications for integrated pest management of *Eldana saccharina* Walker (Lepidoptera: Pyralidae). Proc. Int. Soc. Sugarcane Technical., 26: 787-796.

El-Tantawy, A. M. (1973). Studies on the lepidopterous stem borers, *Chilo agamemnon* Bles. and *Sesamia cretica* Led., and the tabanid, *Atylotus agrestis* Wied. in the rice fields in Egypt. Ph. D. Thesis, Fac. Agric., Cairo Univ.

Getu, E.; W. A. Overholt and E. Kairn (2001). Distribution and species composition of stem borers and their natural enemies in maize and sorghum in Ethiopia. Insect Sci. Aplic., 21 (4): 353-359.

Hammed, S. M.; F. El-Gayar and A. M. El-Minshawy (1976). Economic entomology (in Arabic), Alexandria. New Publication House. 304 pp.

Hill, J. K.; C. D. Thomas; R. Fax; M. G. Telfer; S. G. Willis; J. Asher and B. Huntley (2002). Responses of butterflies to twentieth century climate warming implications for future ranges. Proc. Biol. Sci., (1505): 2163-2171.

Hosny, M. M.; M. A. Asem and E. A. Nasr (1976). Agricultural pests (in Arabic). Cairo: Dar El-Maarif. 1076 pp.

Jepson, W. F. (1954). A critical review of the world literature on the lepidopterous stalk borers of tropical graminaceous crops. London: commonwealth Inst., Entomol., 127 pp.

Khan, Z. R.; P. A. Chilisma; K. Nyarko; L. G. Smart; A. Polasgck; J. Wandera and M. A. Mulaa (1997). Utilization on wild gramineous plants for management of cereal stem borers and sorghum in Africa. Insect Sci., Applic. 17: 143-150.

Selmi, K. S. (1964). Studies on the pink borer of sugarcane, *Sesamia cretica* Led. and its control by chemicals. M. Sc. Thesis, Fac. Agric., Cairo Univ.

Talali, R. G.; A. K. Ansarc and J. Vanden Berg (2002). Lepidopterous stem borers of maize and sorghum in Lesotho. Pp. 17-20.

Tefera, T. (2004). Lepidopterous stem borers of sorghum and their natural enemies in eastern Ethiopia. Tropic Sci., 44: 44-46.

Webster, T. M.; G. W. Maher and D. E. Conlong (2005). An integrated pest management system for *Eldana saccharina* in the Middle North Region of Kwa Zulu_Natal. Proc. Afer Sug Technal Ass., 79: 347-358.

Zaki, M. A. (1991). Identification of the important weeds of Egypt. Agricultural Production & Credit Project (APCP) in Arabic and English. Cairo, Ministry of Agriculture, 225 pp.

دراسات بيئية على الثاقبات من رتبة حرشفية الأجنحة على بعض الحشائش والمحاصيل الرئيسية النجيلية في منطقة كفر الشيخ

ممدوح محمد متولى

قسم بحوث المكافحة الحيوية-مركز البحوث الزراعية-معهد بحوث وقاية النباتات الدقى-مصر

أجريت هذه الدراسة عامى 2008 و 2009 بهدف معرفة:

أ. ثاقبات المحاصيل من رتبة حرشفية الأجنحة وعوائلها البديلة من الحشائش المختبرة.

ب. الثاقبات التى تتواجد على الحشائش ولا تتواجد على المحاصيل مع دراسة نشاط وغدد أجيال هذه الثاقبات على هذه الحشائش.

وذلك فى فى بركة مياه عذبة ينمو بها الحجنة والسمار وترعة مياه رى مجاورة لها ينمو بها النسيلة وحقول الأرز والذرة والقصب المحيطة بكل من البركة والترعة- شرحت النباتات وسجلت أعداد الثاقبات فى أطوارها المختلفة وتم التوصل إلى النتائج التالية:

أولاً: بوجد 8 ثاقبات على المحاصيل والحشائش النجيلية المختبرة وهى:

1- *Sesamia cretica* Led. على الذرة والقصب ولها بيات شتوى (نوفمبر-إبريل).

2- *Sesamia nonagrioides* Lef. على حشيشة الحجنة ونشطة طوال العام.

3- *Sesamia wiltshirei* Rungs على حشيشة النسيلة ولها بيات صيفى (يونيو-أغسطس).

4- *Mythimna crenulata* Hampson على حشيشة الحجنة ولها بيات صيفى (مايو-سبتمبر).

5- *Chilo agamemnon* Bles. على الأرز والذرة والقصب وحشيشة النسيلة ولها بيات شتوى (نوفمبر-مايو).

6- *Chilo luteellus* Mot. على حشيشة الحجنة ولها بيات شتوى (نوفمبر-يونيو).

7- *Eldana saccharina* Walker على الذرة والقصب وحشيشة السمار ولها بيات شتوى (نوفمبر-مايو).

8- *Ostrinia nubilalis* Hub. على الذرة ولها بيات شتوى (نوفمبر-إبريل).

ثانياً: تعتبر حشيشة السمار عائلاً بديلاً لحشرة *E. saccharina* وتواجدت على محصولى الذرة والقصب.

ثالثاً: وجد أن النسيلة عائلاً بديلاً لدودة القصب الصغيرة وهى أهم آفات الأرز وأحد آفات الذرة والقصب وتضع الفراشات بيضها وتقضى جيلها الأول عليها وتخرج فراشات هذا الجيل فى أواخر يوليو لتضع بيضها على الأرز والذرة المتأخرة.

رابعاً: وجدت دودة القصب الكبيرة على الذرة والقصب، بينما وجدت دودة الذرة الأوربية على الذرة فقط ولم يظهر لهما عوائل بديلة من الحشائش المختبرة.

خامساً: وجدت الثاقبات *S. nonagrioides* و *M. crenulata* و *C. luteellus* على الحجنة فقط، بينما وجدت *S. wiltsherei* على النسيلة فقط.

قام بتحكيم البحث

أ.د / عبد الستار ابراهيم عبد الكريم — **كلية الزراعة – جامعة المنصورة**

أ.د / فهمى الدكرورى عبد الله — **مركز البحوث الزراعية**