FLUCTUATION IN EGG NUMBERS OF THE SUGARCANE STEM BORER *SESAMIA NONAGRIOIDES* LEFEBVRE AND EGG PARASITISM BY *PLATYTELENOMUS HYLAS* NIXON RELATIVE TO DIFFERENT STAGES OF CANE GROWTH

By

A. SAYADMANSOUR[1], ASKARIANZADEH[2] and E. SOLEYMAN-NEJADEIAN[3]

[1]*Plant Protection Dept., Research Office, Karoun Agro- Industry Co. Khuzestan, Iran*
[2]*Plant Protection Dept., College of Agricultural Science, Shahed Univ., Tehran, Iran*
[3]*Plant Protection Dept., College of Agriculture, Shahid Chamran Univ., Ahvaz, Iran*
sayadm2004@yahoo.com

KEYWORDS: Sugarcane Stem Borer, *Sesamia nonagrioides*, Parasitoid, *Platytelenomus hylas*, Cane Age.

Abstract

SUGARCANE stem borers are the most important pests of sugarcane worldwide and also in Iran. We studied the fluctuation in egg numbers of the stem borer *Sesamia nonagrioides* Lefebvre and egg parasitism by *Platytelenomus hylas* Nixon in sugarcane fields of the Karoun Agro-Industry Company (Khuzestan, Iran) in 2005–2006. A ratoon field and plant cane field (both fields were cultivated with variety CP48-103) were selected for sampling. Egg numbers and percentage of parasitised eggs, numbers of sugarcane stalks/hectare and the stalk height were recorded weekly. Results showed that the peak of borer oviposition occurred in mid-August 2005 in the ratoon field, but was in mid-June 2006 in the plant cane field. The percentage of parasitism increased with increasing plant height in ratoon and plant cane fields. Peak percentage of parasitism was 67.8% when the mean of plant height was 96.2 cm in ratoon field in early July 2005 and 78.8% when stalk height was 78 cm in plant cane field (in mid-April 2006).

Introduction

Worldwide, sugarcane is an important tropical and semi-tropical crop (Azizi, 1990). Sugarcane is an important crop in Iran with nearly all 100 000 hectares of sugarcane planted in Khuzestan Province (Anon. 2006). Stem borers are important pests in most of the sugarcane producing areas of the world.

For example, the stem borer *Scirpophaga excerptalis* Walker infects 16 percent of sugarcane stems in India (Rajendran and Girdharn, 2003). *Sesamia nonagrioides* Lefebvre and *S. cretica* Lederer, are the most important pests of this plant in Iran (Ranjbar, 1999).

These pests are multivoltine and their population density varies with each generation (Sayadmansour *et al.,* 2004). They injure the apical meristem producing dead hearts (James, 2004) and eliminate tillers (Askarianzadeh, 2004) of plants. The larval feeding in stalks decreases yields 1.4 percent in refined sugar, 3.92 percent in juice purity and with total losses of 391 kg/ha of white sugar (Sayadmansour *et al.*, 2004).

Seraj (2002) showed that, for each percent internodes infested, there is a decrease of 110 kg white sugar per hectare at Amir Kabir Agro-Ind. Co. Iran (Anon., 2005).

Not surprisingly, varieties differ in their response to stem borer damage. Askarianzadeh *et al.* (2008a) showed that sugar losses for every 1% bored internodes were 0.17, 0.39 and 0.23%

(equal to 210, 482 and 241 kg sugar) in cultivars of CP70-1143, CP69-1062 and CP48-103, respectively. According to Sayadmansour *et al.* (2005), the cultivar CP48-103 (with 48.9% and 6.9% bored stalks and internodes, respectively) was the most susceptible, and the cultivar SP71-6163 (with 20.3% and 2.1% bored stalks and internodes, respectively) was the most resistant against stem borer.

The egg parasite, *Platytelenomus hylas* Nixon (Hymenoptera: Scelionidae), has shown promise for biological control of stem borers in Iran. This parasitoid completes its life cycle in 11–14 days and therefore can produce several generations each year. Studies on range of host acceptance showed that only *Sesamia* eggs were attacked by this parasitoid, and it prefers S. *nonagrioides* over *S. cretica* (Abbasipour, 2004).

Different cultivated host and different varieties of cultivated host can influence behavioural characteristics and efficiency of this parasitoid. Research showed that levels of egg parasitism by *P. hylas* on three sugarcane cultivars (CP48-103, CP57-614 and CP69-1062) differed significantly (Askarianzadeh *et al.*, 2008b). Sayadmansour *et al.* (2008) in olfactometer studies showed that this parasitoid has different responses to corn (cultivar 704) and three sugarcane cultivars (CP48-103, CP69-1062 and CP57-614).

Since parasitism is affected by several factors and much of the variation in parasitism levels is due to direct and indirect influence by the host plant (Faria *et al.*, 2007) and, considering the potential importance of this parasitoid in Iran, fluctuations in oviposition by *S. nonagrioides* and parasitism by the egg parasitoid, *P. hylas*, were studied relative to different stages of cane growth.

Materials and methods

An eight hectare ratoon field of the cultivar CP48-103 comprising 264 furrows (200×1.5 m) was selected for our test site. Samplings were conducted from early July until late September 2005. At each sampling time, 30 furrows were selected at random and then 4 stations per each furrow were identified as sample stations. At each station, 0.3 m of row was examined. There were 120 sample stations.

All shoots in each station were removed and examined. The number of egg clutches per station was recorded. Additional information from each station (i.e. number of sugarcane shoots and weekly height measurements) was also recorded.

All egg clutches collected from behind the leaf sheath (the typical oviposition site) were transported to the laboratory. The eggs were then placed in a small Petri dish for 1–2 days. Then, the eggs were inspected for parasitism under a stereo microscope. Also, the height of stalks in each station was measured as described by Sund and Clements (1974).

In September 2005, a plant cane field (21 hectares with 690 furrows) was also selected for survey. The sampling method was the same as for the ratoon field. The sampling program in the plant cane field was continued until late September 2006.

Results

Variation in the number of stem borer eggs in relation to sugarcane weekly growth

Variations in number of sugarcane stalks per hectare, number of borer eggs and the height of stalks are shown in Figure 1.

Peak number of borer eggs occurred in early September 2005 in ratoon field (333 716 eggs per hectare) when there were about 333 000 stalks per hectare and the height of sugarcane was 208 cm. Therefore, on average, there was nearly one egg per stalk. In the plant field, number of eggs varied more than those in ratoon field (Figure 2).

The peak of the borer eggs occurred early July 2006 (737 865 eggs on 341 112 stalks per hectare). So, there was more than one egg per stalk during September, November and July in plant field.

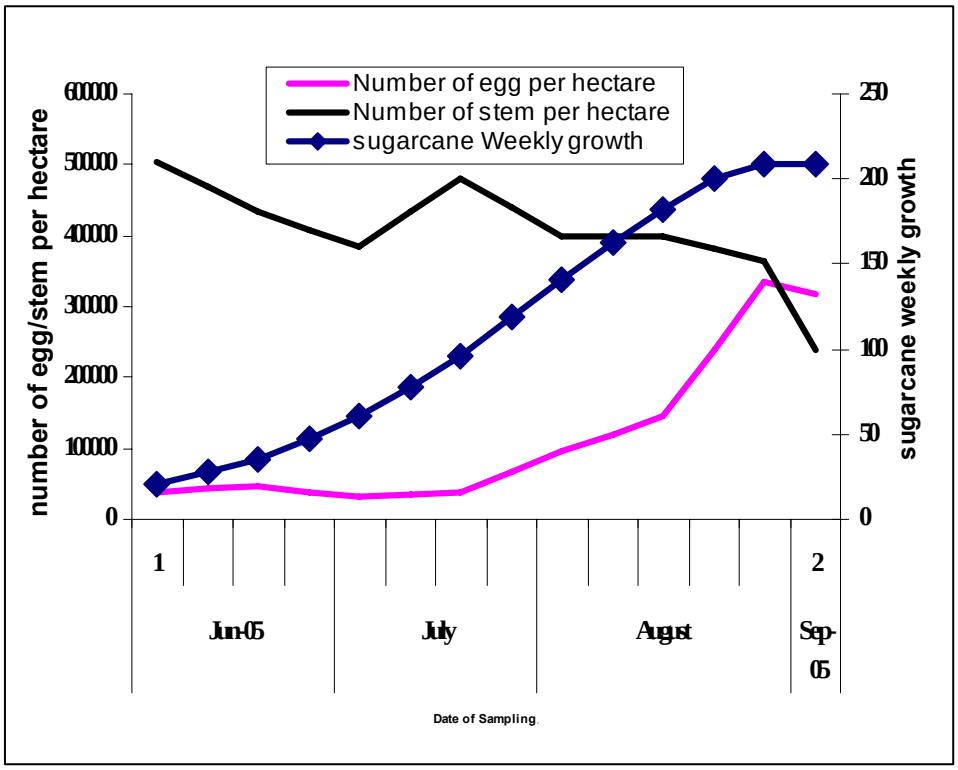

Fig. 1—Variation in number of sugarcane stalks, stem borer eggs and weekly growth of cane in ratoon field from July until September 2005.

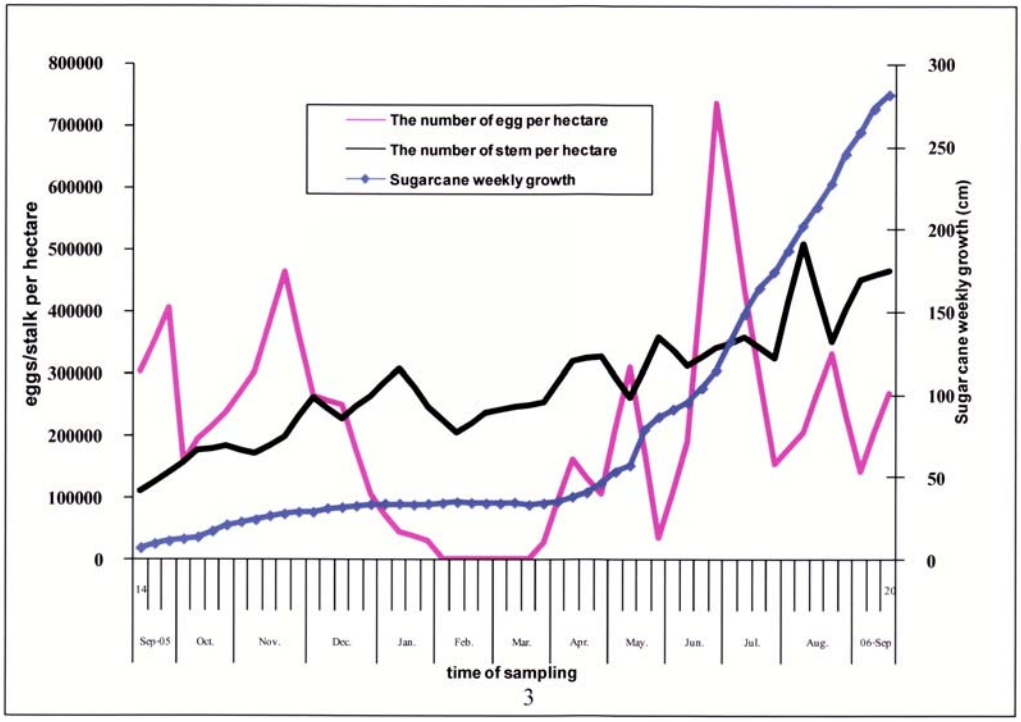

Fig. 2—Variation in the number of sugarcane stalks, stem borer eggs and weekly growth of sugarcane in plant field from Sep. 2005 until Sep. 2006

Variation in percentage of parasitism and sugarcane weekly growth

Variation in percentage of parasitism and weekly growth of sugarcane in the ratoon field is shown in Figure 3. When sugarcane was short (about 21 cm), the level of parasitism was low (near

zero); increasing to 68% parasitism when the height of stalks was 96 cm. In Figure 4, in plant field, the percentage of parasitism was also low when the height of sugarcane was low in September. After that, the parasitism percentage increased gradually until early November when it increased sharply. With regard to the duration of oviposition by the borer in this region, the sharp increase in percentage of parasitism in November could be due to the limited number of borer eggs present in fields, since nearly all eggs are parasitised. After the regrowth of sugarcane in early April 2006, the percentage of parasitism also increased. The peak of parasitism (78.8%) occurred in early May 2006 when the growth rate of sugarcane (plant and ratoon) is increasing.

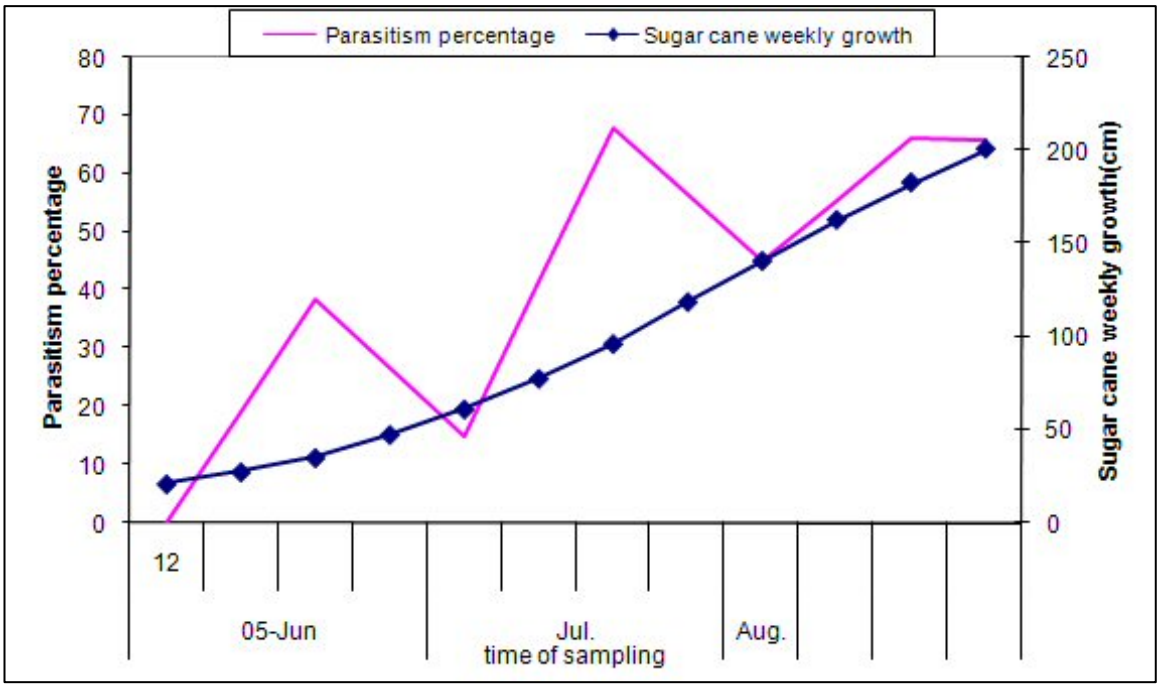

Fig. 3—Comparison between weekly growth of cane and percentage of parasitism by *P. hylas* in ratoon field.

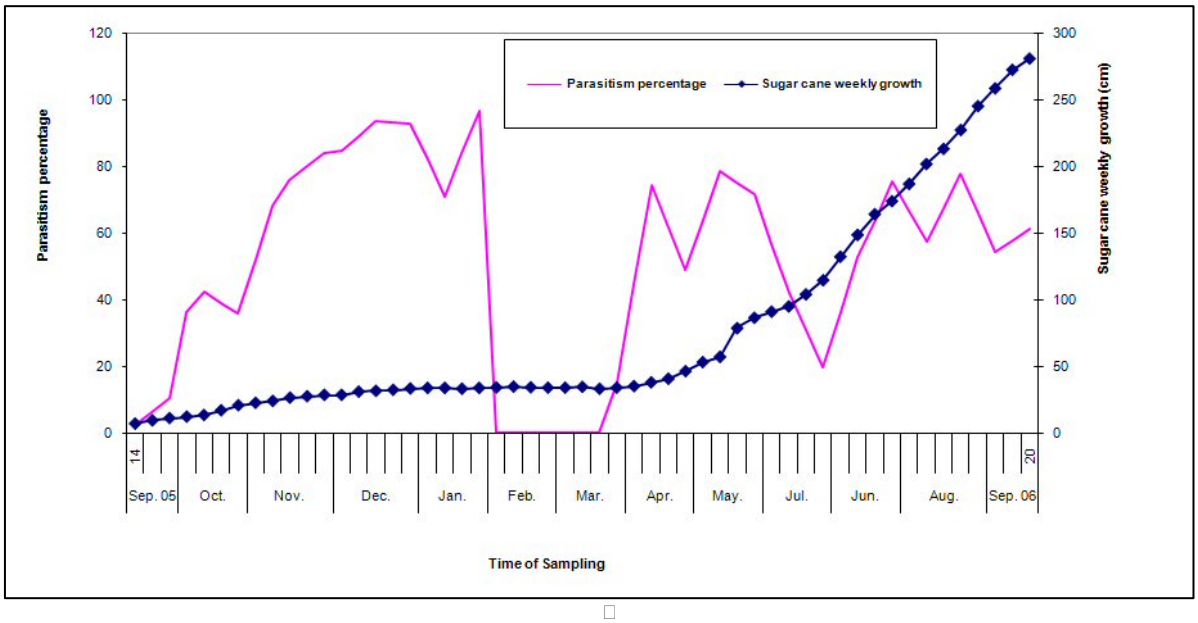

Fig. 4—Comparison between weekly growth of cane and percentage of parasitism by *P. hylas* in plant field.

Discussion

Our data show a difference in the number of borer eggs oviposited between ratoon and plant cane fields. In ratoon fields, plants re-generate from stubble and consequently the number of tillers increases rapidly (Kord, 2000). Therefore, 502 000 stalks in ratoon and 302 000 stalks in plant cane field were encountered. According to Figures 1 and 2, when the number of stalks is very high, the oviposition of the pest was low.

Furthermore, when the plants in the ratoon field were starting to re-generate in May, the number of adults of *S. nonagroides* was low whereas, in plant cane field, the beginning of new plant growth in September corresponded with high numbers of adult moths that were ready for laying eggs on the new plants.

With our knowledge of the biology of sugarcane stem borer (Daniali, 1984) we can estimate the population of adult moths on the first of June from their egg population on the first of May. We can also estimate the size of the adult population in September by monitoring egg numbers on the first of August.

This study showed a positive relationship between sugarcane growth and percentage of parasitism of the stem borer eggs. That is, in ratoon fields, the percentage of parasitism increased with sugarcane growth from early June until the middle of July and then the percentage of parasitism was maintained at a high level. In plant cane fields, since oviposition of the borer was low in November and December, percentage of parasitism was high. This caused difficulty for the parasitoid, as there were limited pest eggs.

In spring, the percentage of parasitism increased with sugarcane growth and peaked in mid-May. Then, with some changes, due to overlap of parasitoid generations, reached a constant level. These results are similar to studies of Oztemis and Kornosor (2007) who reported on the percentage of parasitism by wasp parasitoid *Trichogramma evanescens* on *Ostrinia nubilalis* in corn.

These results are also similar to Abbasipor (2004) who reported on percentage parasitism by *P. hylas* on *S. nonagrioides* in corn fields of Khuzestan Province, Iran. Therefore, because of the high numbers of pest eggs and the low level of parasitism in early September, we plan to release the parasitoid at this time.

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FLUCTUATION DU NOMBRE DES OEUFS DU FOREUR DE TIGE DE LA CANNE À SUCRE *SESAMIA NONAGRIOIDES* LEFÉBVRE ET PARASITISME DES OEUFS PAR *PLATYTELENOMUS HYLAS* NIXON EN RELATION AVEC LES STADES DE CROISSANCE DE LA CANNE

Par

A. SAYADMANSOUR[1], ASKARIANZADEH[2] ET E. SOLEYMAN-NEJADEIAN[3]

[1]*Plant Protection Dept., Research Office, Karoun Agro- Industry Co. Khuzestan, Iran*
[2] *Plant Protection Dept., College of Agricultural Science, Shahed Univ., Theran, Iran*
[3]*Plant Protection Dept., College of Agriculture, Shahid Chamran Univ., Ahvaz, Iran*
sayadm2004@yahoo.com

MOTS CLÉS: Foreur de la Tige de Canne à Sucre, *Sesamia nonagrioides*, Parasitoïde, *Platytelenomus hylas*, Age de la Canne à Sucre.

Résumé

LES FOREURS de tige sont les ravageurs les plus importants de la canne à sucre dans le monde et en Iran. Nous avons étudié la fluctuation du nombre des œufs du foreur de tige *Sesamia nonagrioides* Lefebvre ainsi que le parasitisme des œufs par *Platytelenomus hylas* Nixon dans les champs de canne à sucre de la Karoun Agro-Industry Company (Khuzestan, Iran) en 2005–2006. Un champ en repousse et un en vierge (tous deux cultivés par la variété CP48-103), ont été sélectionnés pour l'échantillonnage. Le nombre des œufs et le pourcentage des œufs parasités, le nombre de tiges/hectare et la longueur de la tige ont été répertoriés chaque semaine. Les résultats ont démontré que le pic d'oviposition se situait mi-août 2005 dans le champ en repousse et mi-juin 2006 dans le champ en canne vierge. Le pourcentage de parasitisme augmentait avec la hauteur de la canne que ce soit en canne vierge ou en repousse. Le pic du parasitisme se situait à 67.8% quand la hauteur moyenne de la canne était de 96.2 cm dans le champ en repousse début juillet 2005 et à 78.8% quand la hauteur des cannes vierges était de 78 cm (mi-avril 2006).

FLUCTUACIÓN EN EL NÚMERO DE HUEVOS DEL BARRENADOR DE LA CAÑA *SESAMIA NONAGRIOIDES* LEFEBVRE Y EL PARASITISMO DE HUEVOS POR *PLATYTELENOMUS HYLAS* NIXON EN RELACIÓN CON LOS DIFERENTES ESTADOS DE CRECIMIENTO DE LA CAÑA

SAYADMANSOUR[1], A., ASKARIANZADEH[2] AND E. SOLEYMAN-NEJADEIAN[3]

[1]*Plant Protection Dept., Research Office, Karoun Agro- Industry Co. Khuzestan, Iran*
[2]Plant Protection Dept., College of Agricultural Science, Shahed Univ., Tehran, Iran
[3]Plant Protection Dept., College of Agriculture, Shahid Chamran Univ., Ahvaz, Iran.
sayadm2004@yahoo.com

PALABRAS CLAVE: Barrenador de la Caña, *Sesamia nonagrioides*, Parasitoide, *Platytelenomus hylas*, Edad de la Caña.

Resumen

LOS BARRENADORES del tallo de caña son las plagas más importantes para el mundo de caña de azúcar así como también para Irán. En el presente trabajo se estudió la fluctuación en el número de huevos del barrenador del tallo *Sesamia nonagrioides* Lefebvre y el parasitismo de huevos por *Platytelenomus hylas* Nixon en los campos de caña de azúcar de la Agro-Industria Karoun Company (Khuzestán, Irán) en 2005–2006. Se estudió un campo en soca y uno en plantilla (ambos sembrados con variedad CP 48-103), seleccionados ambos para el muestreo. Semanalmente se registró el número de huevos y el porcentaje de huevos parasitados, así como el número de tallos de caña por hectárea y la altura de los tallos. Los resultados mostraron que el pico de oviposición del barrenador ocurrió en el campo en soca, a mediados de agosto de 2005, en cambio ese pico ocurrió para la plantilla, a mediados de junio de 2006. El porcentaje de parasitismo aumentó con la altura de los tallos tanto en plantilla como en soca. El porcentaje máximo de parasitismo en la soca fue de 67.8%, cuando la altura media de los tallos fue de 96,2 cm a principios de julio de 2005 y de 78.8% en la plantilla, cuando la altura media de los tallos fue de 78 cm (a mediados de abril de 2006).