Incidence of Wheat Stem Sawflies and Their Natural Enemies on Wheat and Barley in Northern Syria

R.H. Miller[1], Samia El Masri[2], K. Al Jundi[2].

(1) Cereal improvement Program, International Center for Agricultural Research in the Dry Areas, P.O. Box 5466, Aleppo, Syria

(2) Faculty of Agriculture, Tichrin University, Lattakia, Syria

Abstract

Miller, R.H.; S. El Masri and K. Aljundi. 1992. Incidence of Wheat Stem Sawflies and their Natural Enemies on Wheat and Barley in Syria. Arab J. Pl. Prot. 10 (1): 30- 25

Durum wheat *(Triticum turgidum* L. var. *durum)*, bread wheat *(Triticum aestivum* L.) and barley *(Hordeum vulgare* L.) fields were sampled for stem sawflies in northern Syria in 1987/88 and 1988/89. Collections from yellow water traps contained *Cephus pygmaeus* L.,*Trachelus judaicus* konow, and *Trachelus libanensis* Andre (Hymenoptera: Cephidae) as well as the parasites *Collyria coxator* Villers and *Collyria orientator* Aubert (Hymenoptera: Ichneumonidae), and *Bracon terebrella* Wesmael (Hymenoptera: Braconidae). Sawflies were collected from late March until early May. Parasitoids appeared several days after sawflies and generally reached their maximum numbers coincidentally with *T. judaicus* in wheat. *C. pygmeaus* was the most frequently trapped sawfly with *T. judaicus* second. Dry, cold weather conditions in 1988/89 contributed to lower sawfly catches than in 1987/88. Peak sawfly emergence both years corresponded to a level of wheat development optimal for sawfly attack.

Key words: Barley, natural enemies, sawflies, wheat.

Introduction

Wheat in Syria is commonly infested by a number of insect pests that frequently cause either relatively minor damage over large regions or severe damage over small areas. The European wheat stem sawfly, *Cephus pygmaeus* L. (Hymenoptera: Cephidae), is one of the more serious pests infesting wheat and barley in the rainfed areas of northwestern Syria, although it is not the only stem sawfly that attacks cereals in the region (Benson, 1968; Gentry, 1965; Hariri, 1971; Miller, 1991). Wheat stem sawfly infestations as high as 38 % in barley and 28 % in wheat were recorded near the village of Suran, about 40 km south of Aleppo (Rashwani, 1983). From 1986 to 1990 wheat stem sawfly infestations averaged about 20 % in wheat and barly in farmers' fields near Aleppo and at ICARDA's main research farm at Tel Hadya, in the moderate rainfall zones (250 mm to 350 mm) of northern Syria (R.H. Miller, unpublished data). Infestations at ICARDA occasionally reached as high as 40 % (ICARDA, 1987). In addition, sawfly infestations up to 22 % have been observed in farmers' fields in wild grasses bordering wheat and barley fields (ICARDA, 1988).

The purpose of this study was to describe the incidence and phenology of wheat stem sawfly and some of its natural enemies in wheat and barley fields at ICARDA's primary research farm in northern Syria.

Materials and Methods

Field surveys were conducted in breat wheat, durum wheat and barley fields at ICARDA's 1000 ha main research station located near the village of Tel Hadya (36° 01'N, 36° 56'E, elevation 284 m) approximately 26 km south of Aleppo, Syria during the cropping seasons of 1987/88 and 1988/89. The ICARDA farm is characterized by phosphorus-deficient calcareous soils, medium to heavy in texture (Cooper et al., 1987). The long-term rainfall average for the Tel Hadya farm is about 350 mm, occurring mainly between October and April. The area experiences a Mediterranean-continental climate, with summer temperatures approaching 40° C during July and August and winter temperatures occasionally descending below - 5° C. Wheat and barley in northern Syria are normally sown from late October through early December following the first autumn rains. Barley is harvested in late May and is followed by wheat harvest in early June.

Adult sawflies were collected throughout the spring flight season in round yellow plastic basins (27 cm wide by 8 cm deep) filled with soapy water. Two traps were placed along each of 3 field edges 1 m from the crop of each barley, bread wheat, and durum wheat field sampled during 1987/88 and 1988/89 in early March before the flight season began. An additional three traps were placed along a transect within each field at 50 m intervals, making a total of nine traps per field. Sawflies were removed from the traps twice a week and

preserved in 70 % ethanol. Counts and preliminary identifications were made in the laboratory at ICARDA, with confirmation of identification provided by staff of the British Museum of Natural History, London. Plant height and crop developmental stage (Zadoks scale; Zadoks et al., 1974) were recorded at each sampling interval.

Weather data were collected from a centrally located weather station on the ICARDA farm approximately 500 m from the wheat and barley fiels sampled for sawflies in this study.

Results and Discussion

C. pygmaeus L., *Trachelus judaicus* Konow, and *Trachelus libanensis* Andre (Hymenoptera: Cephidae) were identified from water trap catches in 1987/88 and 1988/89 (Table 1). *Calamenta idolon* Rossi (Hymenoptera: Cephidae) and an unidentified *Trachelus* sp. near *libanensis* were also collected on the Tel Hadya farm in sweep nets but were never found in water traps. More sawflies were trapped in bread wheat than in either durum wheat or barley in 1987/88. During the 1988/89 season more sawflies were trapped in durum wheat than in bread wheat. In both years the fewest sawflies were trapped in barley.

Table 1. Total wheat stem sawflies and parasitoids[a] captured per nine water traps in durum wheat, bread wheat, and barley in the 1987/88 and 1988/89 seasons.

		1987	1988	Total	X^2
C. pygmaeus	Durum Wheat	453	486	939	1.160^{ns}
	Bread Wheat	989	375	1364	276.390**
	Barley	133	192	325	10.711**
	X^2	712.6549**	125.617**	622.961**	
T. Judaicus	Durum Wheat	79	277	306	71.582**
	Bread Wheat	143	209	352	12.375**
	Barley	10	91	101	64.960**
	X^2	114.422**	62.132**	141.162**	
T. libanensis	Durum Wheat	24	0	24	24.000**
	Bread Wheat	57	0	57	57.000**
	Barley	0	0	0	0.000^{ns}
	X^2	60.666**	0.000^{ns}	60.666**	

[a] *Collyria* sp. and *B. terebrella*

^{ns} $P \geq 0.05$; * $P \leq 0.05$; ** $P \leq 0.01$

The number of parasitoids trapped in the three crops was proportional to the total number of sawflies captured in that field ($r=0.97$, $df=4$, $P<0.01$; Table 1). Parasite collections consisted primarily of *Collyria coxator* Villers, and *Collyria orientator* Aubert (Hymenoptera: Ichneumonidae), with fewer numbers of *Bracon terebrella* Wesmael (Hymenoptera: Braconidae) (ICARDA, 1988).

Overall sex ratios of *C. pygmaeus* were skewed in favor of females both years. The sex ratio of *C. pygmaeus* in durum wheat in 1987/88 was 10♀:1♂ while it decreased to 7♀ 1♂ in 1988/89. Similarly, females outnumbered males 9♀:1♂ in bread wheat in 1987/88 decreasing to 7♀:1 ♂ in 1988/89. Female sawflies greatly outnumbered males in trap catches in barley both seasons, averaging 43♀:1♂ in 1987/88 and decreasing to 5♀:1♂ in 1988/89.

Fig. 1. shows the species composition of trap catches for both seasons in the three crops. In durum wheat (Fig.1A), *C. pymaeus* began flying 14 days earlier than *T. judaicus*, and 18 days earlier than *T. libanensis* in 1987/88 and numbers were consistently higher. No *T. libanensis* were captured after May 8, while other sawfly species were captured until May 12. Catches of *T. judaicus* were higher than *T. libanensis* on most dates. Similar observations were recorded on durum in 1988/89 (Fig. 1B), except that no *T. libanensis* were trapped. In 1988/89, *C. pygmaeus* appeared in the traps earlier and were generally more numerous than those of *T. judaicus* until about April 10, when *T. judaicus* populations began to consistently exceed those of *C. pygmaeus*.

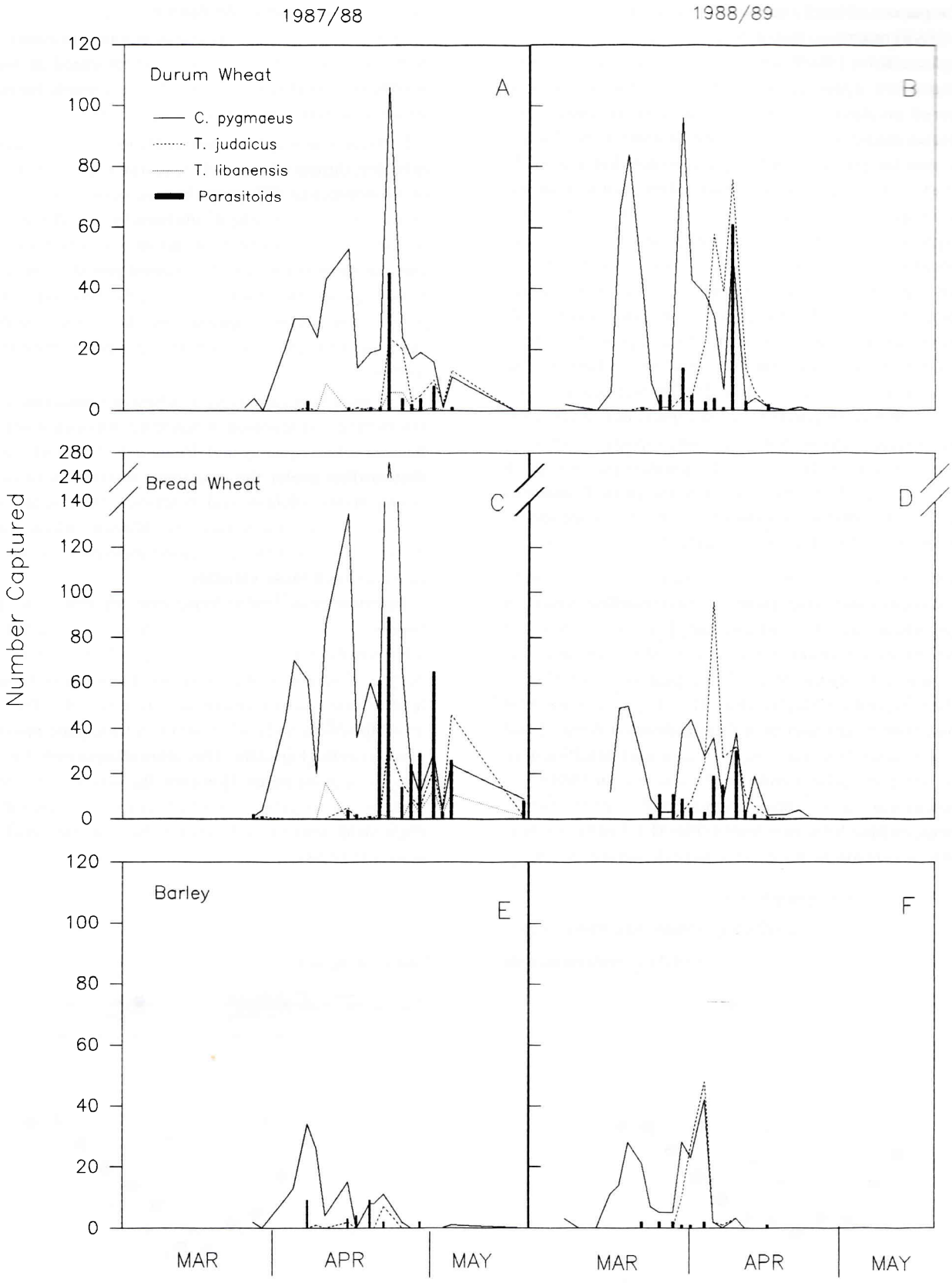

Fig. 1. Breakdown of water trap catches in durum wheat at Tel Hadya, Syria in 1987/88 (A) and 1988/89 (B); in bread wheat in 1987/88 (C) and 1988/89 (D); and in barley in 1987/88 (E) and 1988/89 (F).

The pattern of sawfly captures in bread wheat in 1987/88 and 1988/89 resembled that of durum wheat for the same year, though catches in 1988/89 were generally lower. In 1987/88 *C. pygmaeus* first appeared on March 31 while *T. judaicus* appeared on April 15. There was an obvious peak in *C. pygmaeus* catches observed on April 28 which coincided exactly with the greatest catch of parasitoides that season. In contrast, numbers of *T. judaicus* showed no obvious peak and were insignificantly different from those of *T. libanensis* throughout the season. In 1988/89, no prominent peaks were observed in catches of *C. pygmaeus*. Rather, the number of insects captured gradually decreased from the initial levels at the beginning of the flight season. In constrast, catches of *T. judaicus* were first observed on April 3 and peaked on April 10. Parasite numbers were similar in 1987/88 and 1988/89. The greatest number of parasitoids in 1987/88 were captured on April 28 which corresponded to peak capture of *C. pygmaeus*, though a second smaller peak of parasite capture occurred on May 8 that season. In 1988/89 the greatest parasite catch occurred on April 15, five days after the peak *T. judaicus* catch. In both 1987/88 and 1988/89 parasitoids did not appear in the traps until well after the sawfly flight had begun.

Trap catches of sawflies and parasitoids in barley were substantially lower than those in corresponding years on durum wheat and bread wheat, and *T. libanensis* was not found on barley in either season. In 1987/88 *C. pygmaeus* was first trapped on March 29, reached a peak on April 10, and was last trapped on May 12 (Fig. 1E). *T. judaicus* was first captured two weeks later than *C. pygmaeus* on April 12 and was last captured on April 28. Trap data were insufficient to detect any population trends for *T. judaicus*. In 1988/89 *C. pygmaeus* was again captured substantially earlier than *T. judaicus*, on March 8 versus April 4 (Fig. 1F). Sawfly numbers in 1988/89 were low as in 1987/88 with peak captures occurring for both sawfly species on April 9.

Only one parasite was found in any trap in barley on any sampling date and parasitoids first appeared in the traps several days later than sawflies. No distinguishable peaks of parasite capture were observed in either season.

Difference in numbers observed between sawflies collected in barley, durum wheat, and bread wheat fields are likely due to developmental differences between sawfly species and between barley, durum wheat, and bread wheat. Barley normally matures more rapidly than durum wheat or bread wheat, and may therefore escape the heaviest period of sawlfy flight. If the peak adult sawfly density in the field corresponds to the period when barley is ripening and desiccating, sawflies are more likely to select succulent younger plants of other cereal species.

The peak trap capture of *T. libanensis* occurred relatively late in the growing season, when barley was an unsuitable host because it was ripening and drying out. Past work has shown that sawflies prefer the elongating internodes of relatively young plants. Holmes and Peterson (1960) suggested that different development rates in different wheat varieties, grown in North America, caused differences in infestation rates between those varieties.

Peterson et al. (1968) found that adequate soil moisture produced lush plant growth, which in turn resulted in high adult sawfly populations and a high (78.5 %) rate of stem cutting. Conversely, they also found that dry soil conditions lead to lower sawfly emergence from stubble. The 1987/88 growing season had good rainfall and adequate moisture for plant growth (Fig. 2A). This allowed relatively high larval survival in moist stems. However, the very dry 1988/89 growing season resulted in rapid plant maturation, generally lower grain yield, lower larval survival and a shorter sawfly flight season (Fig.2B).

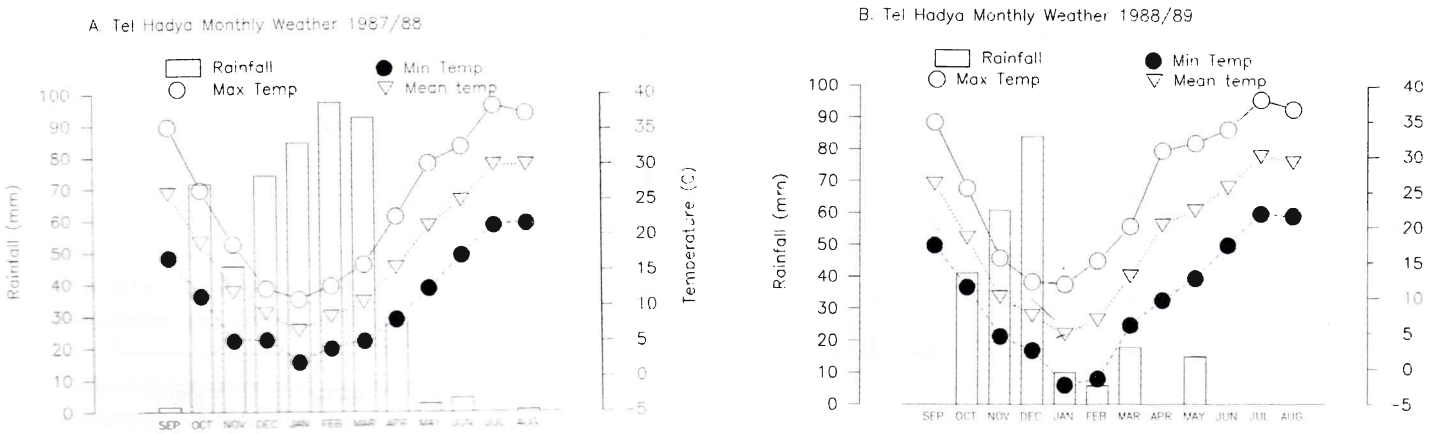

Fig. 2. Average monthly rainfall, maximum temperature, minimum temperature, and mean temperature at Tel Hadya, Syria during 1987/88 (A) and 1988/89 (B).

Ambient temperature, along with rainfall, also affects larval survival and adult emergence. Villacorta et al. (1971) suggested that rainfall prior to sawfly flight promotes adult emergence from stubble when the temperature reaches or exceeds 12 ° C, while a temperature of 10° C or less suppresses postdiapause development. They also suggested that the developmental threshold for most sawfly populations was about 15° C, and that post-diapause development occurred within a temperature range of 15° C - 28° C. Daily maximum temperatures were higher in the 1988/89 season and probably accounted for adult emergence occurring 19 days earlier and the adult flight period being 27 days shorter than in 1987/88. *T. judaicus* appeared later in the season than *C. pygmaeus* both seasons and was not affected by 1988/89's drought conditions or greater daily temperature fluctuations.

Our data suggest that the peak sawfly flight period was associated with the wheat plant growth stage optimal for sawfly selection and oviposition. Females began ovipositing in young plants in the uppermost portion of the lower two internodes, and then selected progressively higher internodes as the season progressed. The highest sawfly collections coincided with the booting-flowering stage in wheat (Zadoks 40 to 65), approximately March 30 to May 9 in 1987/88 and April 2 to April 18 in 1988/89. Should agronomic or environmental factors alter adult sawfly flight during this period, or significantly alter plant development, plants may then escape significant sawfly attack through nonselection for oviposition, as apparently occurred in barley in 1988/89.

Parasitism did not seem to significantly affect sawfly populations. Gol'berg (1986) reported from 5 % to 12 % parasitism in sawfly-infested wheat due to *Tetrastichus* sp. (Hymenoptera: Eulophidae) and *Collyria* sp. in the Negev Desert, and Miller (cited in ICARDA, 1988) reported slightly higher parasitism rates of 17 % and 5 % for *Collyria* spp. and *B. terebrella* in wheat, respectively in northern Syria. Parasite populations observed in this study were likely strongly influenced by both the number of sawflies available at parasite emergence and by the weather and plant conditions during their emergence and development.

الملخص

ميللر روس وسامية المصري وخالد الجندي. 1992. الإصابة بدبابير الحنطة المنشارية على القمح والشعير وأعداءها الطبيعية في سورية. مجلة وقاية النبات العربية 10 (1): 25 - 30

تم في الموسمين الزراعيين 88/1987 و 89/88 رصد حقول القمح الصلب والقمح الطري والشعير المزروعة في شمالي سورية بحثاً عن اصابات بدبابير الحنطة المنشارية. وقد احتوت المصائد المائية الصفراء اللون التي وزعت في الحقول المرصودة على الأنواع التالية: *Cephus pygmaeus* L.، *Trachelus libanensis* Andre *Trache-glus judaicus* konow (من غشائيات الأجنحة وفصيلة Cephidae) وعلى المتطفلات التالية: *Collyria coxator* Villers و *C. orientator* Aubert (من غشائيات الأجنحة وفصيلة Ichneumonidae) و *Bracon terebrella* Wesmael (من غشائيات الأجنحة وفصيلة Braconidae). وقد تم جمع حشرات الدبور من أواخر آذار/مارس وحتى اوائل أيار/مايو. وظهرت المتطفلات بعد عدة أيام من ظهور حشرات الدبور، ووصل تعدادها ذروته مع ظهور *T. judaicus* في القمح. وكان النوع *C. pygmacus* أكثر الأنواع الممسوكة تلاه النوع *T. judaicus*. وقد أسهمت الظروف الباردة والجافة في موسم 89/1988 في انخفاض اعداد حشرات الدبور الممسوكة مقارنة بموسم 88/1987. وقد ارتبطت ذروة خروج حشرات الدبور في كلا الموسمين بالمستوى الأمثل لتطور القمح المناسب للإصابة.

كلمات مفتاحية: Sawflies، اعداء حيوية، شعير، قمح.

References

المراجع

1. Cooper, P.J.M., P.J. Gregory, D. Tully, & H.C. Harris (1987) Improving water use efficiency of annual crops in the rainfed farming systems of West Asia and North Africa. Exp. Agric. 23: 113-158.
2. Benson, R.B. 1968. Hymenoptera from Turkey, Symphyta. Bull. British Mus. Nat. Hist. Ent. 22:109-207.
3. Gentry, J.W. 1965. Crop insects of northeast Africa-southwest Asia. USDA/ARS Agric. Hndbk. No. 273.
4. Gol'berg, A.M. (1986) Biology of the stem sawflies *Trachelus tabidus* and *Cephus pygmaeus* in the Negev. Ent. exp. appl. 40: 117-121.
5. Hariri, G. 1971. A list of recorded insect fauna of Syria, part 2. Fac. Agric., University of Aleppo.
6. Holmes, N.D. & L.K. Peterson (1960) The influence of the host on oviposition by the wheat stem sawfly (Hymenoptera: Cephidae). Can. J. Plant Sci. 40: 29-46.
7. ICARDA (1987) Cereal Improvement Program annual report, 1987. 206 pp. Aleppo, Syria: International Center for Agricultural Research in the Dry Areas.
8. ICARDA (1988) Cereal Improvement Program annual report, 1988. 187 pp. Aleppo, Syria: International Center for Agricultural Research in the Dry Areas.
9. Miller, R.H. (1991) Insect pests of wheat and barley in West Asia and North Africa. ICARDA Technical Manu-

al 9 (Rev. 1) 209 pp. Aleppo, Syria: International Center for Agricultural Development in the Dry Areas.

10. Peterson, L.K., H. Mckenzie, & N.D. Holmes, (1968) Establishment of a nursery for evaluation of resistance of strains of wheat to the wheat stem sawfly. J. Econ. Ent. 61: 836-839.
11. Rashwani, A. 1983. Resistance to wheat stem sawfly *(Cephus pygmaeus* L.) and related species in cereals. Rachis 2: 15-16.
12. Villacorta, A., R.A. Bell, & J.A. Callenbach, (1971) Influence of high temperature and light on postdiapause development of the wheat stem sawfly. J. Econ. Ent. 64: 749-751.
13. Zadoks, J.C., T.T. Chang, & C.F. Konzak, (1974) A decimal code for the growth stages of cereals. Weed Res. 14: 415-421.