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Sustainable Control Tactics of the Cereal Leafminer Syringopais Temperatella Led. (Lep., Scythrididae) in Jordan: Resistant Cultivars and Combined Use of Tillage and Insecticides

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ABSTRACT

The cereal leafminer, Syringopais temperatella Led. (Lep., Scythrididae) is considered one of the most serious insect pests that infests wheat in the field, and causes economic damages to the crop in Jordan. However, little attention has been paid to the susceptibility of common wheat cultivars and no attention has been paid to the combined use of tillage regime and insecticides against S. temperatella. Concomitan tly, this study aimed at investigating the susceptibility of the most commonly grown wheat cultivars in Jordan to S. temperatella under field conditions, and the effect of the combined use of tillage regime and insecticide applications in controlling the pest on wheat. The 1st experiment was set up to determine the susceptibility of four common wheat cultivars to the pest in the 2016/2017 cropping season, while the 2nd one was set up to investigate the effect of the combined use of tillage regime and insecticides against the pest in 2017/2018 cropping season in Al-Qasr, Karak. Four common wheat cultivars (Deer Alla, Em-Qees, Sham, and Horani 27), were used in the 1st experiment, while in the 2nd experiment, 6 different treatments were done using the wheat cultivar, Horani 27, namely, T1: no-tillage, T2: deep plowing in summer, T3: deep plowing in summer and treating seeds with diazinon, T4: chisel plow at seed sowing time with treating seeds with diazinon, T5: no-tillage and treating seeds with diazinon, and T6: chisel plow at seed sowing time. In the two experiments, data on larvae number, infestation, grain and straw weights, and plant height were recorded. Results showed that infestation and larvae numbers were the lowest, and grain and straw weights were the highest in Horani 27 compared to other cultivars. Data showed that the lowest infestation and larvae number were obtained in the no-tillage, and grain and straw weights were the highest in deep plowing in summer and treating seeds with diazinon. While the tallest plant was recorded in deep plowing in summer and deep plowing in summer by treating seeds with diazinon. In conclusion, Horani 27 is the least susceptible cultivar

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to the pest, and no-tillage reduces larvae number and infestation while plowing in summer by treating seeds with diazinon increased yield and strawweight, and plant height.

Keywords: Syringopais temperatella, Cereal leafminer, Wheat, Cultivars, Tillage, Insecticides, Sustainable Management, Jordan.

INTRODUCTION

Wheat, Triticum durum L. is a principal food crop for millions of people in the predominantly mixed crop-livestock farming systems worldwide. Wheat production achieved by farmers in arid and semi-arid regions in West Asia and North Africa is low with large variability from year to year (FAO, 2018). The demand on world agriculture to rapidly increase cereal production should be effectively addressed through modifications in the current control measures, and the adaption of proven new protection measures. Besides drought, which is the main cause of the low productivity of wheat (ICARDA, 2007), agricultural pests cause serious yield losses to the crop (El-Bouhssini et al., 2009; Ennahli et al., 2009).

The cereal leafminer, Syringopais temperatella Led. (Lep., Scythrididae) is one of the most serious insect pests of wheat in the field, and causes economic damage to the crop in the countries of West Asia (Jemsi and Rajabi, 2003; Gozuacik et al., 2008). S. temperatella outbreaks have mostly occurred in Jordan since 2001, limiting the production of wheat (Mustafa, 2002; Al-Momany and Mustafa, 2008; Al-Zyoud et al., 2009; Al-Antary and Al Shalaan, 2016). The pest feeds on plant foliage, soon turning its leaves into yellow and leading to a sharp decline in production. S. temperatella infestation reduced grain yield by 72% and straw biomass by 59% (Ghabeish et al., 2014).

Human and environmental safety must be a part of every pest management decision. Successful pest managers should learn that incorporating several effective control tactics into a management strategy is the most effective method to manage pests over the long term. Pest control tactics must be economically viable, respectful of the environment, and compatible with integrated protection principles (Castanera, 2003). Integrated pest management (IPM) is used to manage pest damage by the most economical means and with the least hazards to humans and the environment (Ofuoku et al., 2009).

The development of resistant plant cultivars is an effective approach in IPM and is believed to help reduce pest infestation (Jallow et al., 2004). As an alternative approach to chemical control, host plant resistance has been increasingly recognized as being one of the most desirable economic control tactics in IPM. The use of plant resistant cultivars against pests is desirable to practice due to their effectiveness, safe to the environment (Saljoqi et al., 2012), durability and maintenance of natural balances within the ecosystem, and an ideal component of IPM strategy worldwide (Al-Zyoud, 2008; Smith and Clement, 2012). Plant resistance influences pest population dynamics by affecting their reproduction and improving the effectiveness of their natural enemies (Razmjou et al., 2014).

Due to the uncountable number of adverse effects of pesticides (Kranthi et al., 2002, Al-Zyoud, 2014a), the interest in cultural methods for pest control is renewed, and now forms an important component of IPM. Cultural control methodologies have been in use for pest control for a long time, though the action of these practices was slow and not spectacular, it is a safe technique with less expenditure, which was the main reason to follow.). Cultural control influences directly the survival of soil-inhabiting pests (Al-Zyoud and Ghabeish, 2015) by creating a physical barrier to their movement, changing their habitat (Van Capelle et al., 2012), changing soil moisture and temperature dynamics, and increasing mechanical damage (Curry et al., 2002). Reduced tillage practices could influence different pest species in different ways due to different life strategies (Cherry and Sandhu, 2020). Deep tillage reduces pest infestation as compared to no- or reduced tillage, i.e. the cereal leafminer, Syringopais temperatella (Al-Zyoud and Ghabeish, 2015). Plowing treatment done up too late August with disking was effective in reducing S. temperatella infestation, provided that the depth of plowing must not be lower than 15 cm (Jemsi and Rajabi, 2003).

Pesticides have helped the world meets growing food demand by increasing agricultural productivity through controlling agricultural pests. Chemical control has been the mainly used method over the last many decades and ensured yields and benefits to the farmers (Naveed et al., 2011; Al-Zyoud, 2014a). Pesticide applications have been contributed to controlling many pests that would otherwise diminish the quantity and quality of agricultural production (Ommani, 2011). In contrast, it is unlikely that alternative methods of control alone will maintain pest populations at an acceptable level, but through careful integration, with pesticides, it could represent a significant source of sustainable control, or backup sprays may be appropriate during outbreaks of pests (Heinz, 1996).

However, to the best of our knowledge little attention has been paid to the susceptibility of common wheat cultivars and no attention has been paid to the combined use of tillage regime and insecticides against S. temperatella. Herein it is reported for the first time the efficacy of the combined effect of tillage regime and insecticide usage against the pest. Concomitantly, this study aimed at investigating the susceptibility of four most commonly grown wheat cultivars in Jordan to S. temperatella under field conditions, and the effect of combined use of tillage regime and insecticides in controlling the pest on wheat under semi-arid conditions of Jordan in order to improve wheat production in the country.

MATERIALS AND METHODS

The site, environmental conditions, and growing wheat plant

Two different experiments were conducted in this study. The first experiment aimed to assist the susceptibility of four common wheat cultivars to S. temperatella. The second experiment was set up to investigate the effect of combined use of tillage regime and insecticides against the pest. Both experiments were conducted in two different fields known to be heavily infested by S. temperatella for years in Al-Qasr, Karak (Latitude of 31°11", Longitude of 35°42", and altitude of 845 m). The experimental sites have semi-arid conditions with moderate rainfall; a long-term annual average of 300 mm. The first experiment was carried out during the 2016/2017 cropping season, and the second experiment was set up during the 2017/2018 cropping season. Generally, rainfall is irregular with intra- and inter-seasonal variability, where most of it falls from December to February. The wheat seeds were sown during the last week of November in both 2016 and 2017 years for the first and second experiments, respectively, and no fertilizers were applied to wheat plants. Routine cultural practices were conducted whenever necessary throughout both cropping seasons.

Experimental design and procedure

Seeds of four common wheat cultivars (Deer Alla, Em-Qees, Sham, and Horani 27) used in the first experiment were obtained from the Seed Bank of the National Agricultural Research Center (NARC), Baq'a, Jordan. Each cultivar was sown in plots of 4 m2 (2 m in width × 2 m in length) with 0.5 m spacing among plots, and 1 m among the different blocks. Each cultivar had four replicates distributed randomly in the field in a randomized complete block design (RCBD). In the second experiment, six different treatments were set up using the wheat cultivar, Horani 27, namely, T1: no-tillage, T2: deep plowing in summer, T3: deep plowing in summer and treating seeds with diazinon, T4: chisel plow at seed sowing time with treating seeds with diazinon, T5: no-tillage and treating seeds with diazinon, and T6: chisel plow at seed sowing time (farmer method). Also, the design in the second experiment was an RCBD. Each treatment was replicated three times (3 plots), in which each plot consisted of 25 m2 (2.5 m in width ×10 m in length), and a distance of 1 m among the different treatments. The seeds were sown using a seeder (Hububat Mibzeri, UNTAR, HBM, Turkey) at an average of 10 kg/dunum (the recommended rate). From each plot 1 m2 was randomly chosen for taking the data. Deep summer plowing was conducted in August 2017. For the no-tillage treatment, a leveling disk harrow was used to level the soil slightly at a shallow depth at the sowing time of seeds.

Parameters tested

In the 1st and 2nd experiments, the percentage of infestation was independently determined by two experts by visually estimating the leaf area damage at the last week of March of 2017 and 2018 years, respectively, in all treatments, and the average infestation percentage was calculated. In addition, at the same time of estimating the infestation, the number of S. temperatella larvae was counted in the field from randomly selected 20 wheat plants per treatment in both experiments and the average number of larvae per plant was calculated. Hereafter, at the harvesting stage in the last week of May of 2017 and 2018 for the first and second experiments, respectively, all the plants in 1 m2/plot from all treatments of both experiments were collected from the field, and the plants were separately kept in a paper bag and brought back to the laboratory. In the laboratory, data were recorded on grain weight and dry straw biomass from all treatments in both experiments. The plant height of randomly selected 20 wheat plants/1 m2/plot was recorded only for the second experiment.

Statistical analysis

In order to affirm the basic assumptions of the data to be analyzed, they were firstly tested for the normal distribution and the homogeneity of variance using the Barlett-test (Kohler et al., 2002). After fulfilling the fore-mentioned assumptions, analysis of variance (ANOVA) was conducted (Zar, 1999) through the Proc GLM of the Statistical Package SigmaStat version 22.0 (SPSS, 1997) to detect differences among means. In case of differences among means were detected, the second step was to determine the significant differences among the means using least significant differences (LSD) at a probability level of 0.05 (Abacus Concepts, 1991). In addition, correlation analysis among the different parameters tested was calculated by Spearman’s correlation test at a probability level of 0.05 (Zar, 1999).

RESULTS

Susceptibility of wheat cultivar to Syringopais temperatella infestation

Mean S. temperatella infestation percentage, a number of larvae, grain, and straw weights of different wheat cultivars are presented in Fig. 1A-D. Mean S. temperatella infestation percentage was significantly ($F_{3,32}=3.31$; $P \leq 0.05$) different among the four cultivars tested (Fig. 1A). The infestation percentages were in the following ascending: Horani 27 (61.9±23.79%), Em-Qees (65.5±23.47%), Deer Alla (66.59±25.17%), and the highest infestation was recorded for Sham (71.65±21.01%) (Fig. 1A). Results demonstrated no significant differences ($F_{3,32}=0.31$; $P>0.05$) in the number of larvae/plants among the different tested wheat cultivars (Fig. 1B). The numbers of larvae were the lowest in Horani 27 (2.46±1.58 larvae/plant) and the highest in Sham (3.03±1.46 larvae/plant). They were 2.91±1.79 and 2.49±0.97 larvae/plant in Deer Alla and Em-Qees cultivars, respectively. Results indicated significant differences ($F_{3,32}=3.98$; $P \leq 0.05$) in grain yield among the different tested wheat cultivars (Fig. 1C). Mean grain yield was in the following descending: Horani 27 (123.75±26.15 g/1 m2), Deer Alla (108.75±37.96 g/1 m2), Em-Qees (86.25±20.66 g/1 m2), and then Sham (81.25±24.75 g/1 m2). Results showed no significant differences ($F_{3,32}=0.98$; $P>0.05$) in straw biomass among the different tested wheat cultivars (Fig. 1D). Mean straw biomass was the highest in Horani 27 (273.75±66.96 g/1 m2), followed by Em-Qees (272.50±34.95 g/1 m2), Sham (262.50±39.19 g/1 m2), and then the lowest in Deer Alla (235.00±57.82 g/1 m2).

Combined use of tillage regime and insecticides

Mean S. temperatella infestation percentage, a number of larvae, grain and straw weights, and plant height under different tillage regimes and insecticide applications are shown in Fig. 2A-E. Data showed significant differences ($F_{5,18}=45.545$; $P \leq 0.05$) in S. temperatella infestation among the different treatments (Fig. 2A). Significantly the highest infestation was recorded in the chisel plow at seed sowing time with 39.33±2.31%. The infestation then decreased significantly in the following order; deep plowing in summer and treating seeds with diazinon (37.33±1.155%), chisel plow at seed sowing time with treating seeds with diazinon (35.33±1.154%), deep plowing in summer (34.67±1.155%), and no-tillage and treating seeds with diazinon (33.33±1.154%). However, the lowest infestation was significantly recorded in the no-tillage with only 22.00±2.00%.

Results indicated significant differences ($F_{5,18}=6.882$; $P \leq 0.05$) in the number of larvae/plants among the six different treatments (Fig. 2B). Significantly the highest number of larvae was recorded in the chisel plow at seed sowing time (1.57±0.50 larvae/plant), followed by deep plowing in summer and treating seeds with diazinon (1.30±0.26 larvae/plant), while the lowest number of larvae was obtained in no-tillage (0.37±10.15 larvae/plant). However, deep plowing in summer (0.93±0.21 larvae/plant), chisel plow at seed sowing time with treating seeds with diazinon (1.033±0.153 larvae/plant), and no-tillage and treating seeds with diazinon (0.87±0.15 larvae/plant) were significantly at the bar with each other.

Results indicated no significant differences ($F_{5,18}=0.305$; $P>0.05$) in the grain yield of wheat plants among the different treatments (Fig. 2C). Numerically, the grain yield was the highest in deep plowing in summer and treating seeds with diazinon (23.33±15.28 g/1 m2), followed by chisel plow at seed sowing time with treating seeds with diazinon (22.00±13.75 g/1 m2), chisel plow at seed sowing time (19.67±8.74 g/1 m2), no-tillage and treating seeds with diazinon (19.00±7.00 g/1 m2), deep plowing in summer (15.67±9.81 g/1 m2), and no-tillage (14.67±6.51 g/1 m2). There were no significant differences ($F_{5,18}=014$; $P>0.05$) in straw biomass of wheat plants among the different treatments (fig. 2D). Numerically, the straw biomass was the highest in deep plowing in summer and treating seeds with diazinon (370.00±96.44 g/1 m2), chisel plow at seed sowing time with treating seeds with diazinon (359.67±111.72 g/1 m2), deep plowing in summer (352.67±109.21 g/1 m2), no-tillage (352.00±34.05 g/1 m2), chisel plow at seed sowing time (347.00±70.38 g/1 m2), and then no-tillage and treating seeds with diazinon (312.67±691.09 g/1 m2).

Data indicated significant differences ($F_{5,18}=2.037$; $P \leq 0.05$) in wheat plant height among the different treatments (Fig. 2E). Significantly, the highest plant height was recorded in deep plowing in summer (60.00±1.73 cm). This was followed by deep plowing in summer and treating seeds with diazinon (56.00±2.65 cm), chisel plow at seed sowing time with treating seeds with diazinon (54.33±2.52 cm), and chisel plow at seed sowing time (52.33±19.07 cm) which were signed at the bar with each other. The least plant height was recorded in no-tillage (51.00±1.00 cm) and no-tillage and treating seeds with diazinon (51.33±2.08 cm).

Correlation analyses

Correlation analysis among the different variables investigated in the first experiment on the susceptibility of wheat cultivars to S. temperatella indicated that the larval number was correlated significantly and positively with the infestation percentage ($r = 0.83$, $P < 0.05$) and significantly and negatively with the grain yield ($r = -0.383$, $P < 0.05$). In the second experiment on the combined use of tillage regime and insecticides, the larval number was correlated significantly and negatively with straw biomass ($r = -0.44$, $P < 0.05$).

DISCUSSION

Nowadays, increasing the productivity of agricultural crops in a sustainable manner is one of the major global challenges (Al-Dosary et al., 2016). Sustainable agriculture is a key element of sustainable development and essential to the future of human beings (Shojaei et al., 2013). Sustainability aims to achieve adequate safe and healthy food production, and improve the livelihoods of food producers (Uwagboe et al., 2012). Human and environmental safety must be a part of every pest management decision. Successful pest managers should learn that incorporating several effective control tactics into a management strategy is the most effective method to manage pests over the long term. A new economic evaluation of alternative methods of pest management must be performed (Enkerlin and Mumford, 1997) in order to identify the most effective techniques.

Using fewer preference cultivars reduce the reliance of cereal farmers on insecticides, and provides farmers with a viable alternative to chemical control (Al-Zyoud et al., 2011; Smith and Clement, 2012). The current findings indicated that larvae number and infestation percentage were the lowest, and grain and straw weights were the highest in Horani 27 compared to the other three cultivars. There were significant differences in the susceptibility of 6 cultivars of wheat offered separately to S. temperatella (Al-Zyoud et al., 2009) or together (Al-Zyoud, 2012), in which the wheat cultivars, Assad 65 and Horani 27 were the least preferred ones by the pest, which is an agreement with the present findings. It was found that the wheat cultivar, Sham 6 is less susceptible to S. temperatella larvae (ICARDA, 2007). In a field trial, Ali et al. (2007) found in Iraq that the wheat cultivar, IPA99 is the least preferred by S. temperatella. Although no cultivar/accession tested in the different studies was immune to S. temperatella, it appears promising a type of resistance to S. temperatella that could be useful as a source of genetic material for future studies in breeding programs to produce S. temperatella-resistant cultivars. The preference of the cereal leafminer for a wheat cultivar over another might be due to physical factors such as hairiness, hardiness, and thickness of the plant leaves (Cotter and Edwards, 2006), as well as to differences in the chemical composition of the leaves (Al-Zyoud et al., 2009). Also, this might be due to morphological and physiological features of the cultivars (Ali et al., 2007).

The present data indicated that the lowest larvae number and infestation percentage were recorded in no-tillage followed by no-tillage and treating seeds with diazinon. The grain yield, straw biomass, and plant height were the highest in deep plowing in summer and treating seeds with diazinon treatment, and chisel plow at seed sowing time with treating seeds with diazinon. In many agricultural-based systems, cultural control is used to reduce pest populations (Al-Zyoud, 2014b, c), it influences directly the survival of soil-inhabiting pests (Rodriguez et al., 2006) by creating a physical barrier to their movement (Strnad and Bergman, 1987), changing their habitat (Van Capelle et al., 2012), changing soil moisture and temperature dynamics and increasing mechanical damage (Curry et al., 2002). Reduced tillage practices could influence different pest species in different ways due to different life strategies (Andersen, 1999). However, deep tillage has controlled several pests as compared to no- or reduced tillage, i.e. S. temperatella (Al-Zyoud and Ghabeish, 2015) and earthworms (Briones and Schmidt, 2017). Tillage could change the soil moisture, which has a great effect on crop yield (Vita et al., 2007) by changing the water distribution within the soil profile after precipitation (Schwartz et al., 2010). The right tillage system could increase soil moisture as a result of increasing infiltration (Zhao et al., 2018), reducing evaporation (Wang et al., 2007), eliminating weed competition, and allowing a better development of root systems (Mosaddeghi et al., 2009), improving crop yield (Guan et al., 2015), and controlling pests (Al-Zyoud and Ghabeish, 2015). Concerning the plowing depth, in Jordan, it was found that the number of diapaused larvae increased with increasing soil depth. These assumptions confirmed by the infestation percentage and larval number are higher for both wheat and barley plants are grown in soil taken from the deeper field soil depth (21-40 cm) than shallower one (0-20 cm) (Al-Zyoud and Ghabeish, 2015). Furthermore, in Iran plowing treatment done up too late August with disking was effective in reducing the pest infestation, provided that the depth of plowing must not be lower than 15 cm (Jemsi and Rajabi, 2003). In Cyprus, it was found that a single deep plowing in summer was not effective against larvae, but gave a slight reduction in the pest population (Serghiou, 1975). The present results are in agreement with the findings of several workers (Li et al., 2007; Meena et al., 2013; Guan et al., 2015), who reported that tillage significantly increased the grain yield of wheat compared to no-tillage treatment. Based on our results, plowing soil in summer will be of great benefit to wheat production. However, the lower number of larvae obtained in the no-tillage treatment could be explained by the that non-tilled soils tend to have high bulk density and compacted soil layers (USDA, 2008), and since most S. temperatella daiposed at a deeper soil depth (21-40 cm) (Al-Zyoud and Ghabeish, 2015), thus these two soul features might limit the coming up or penetration of the pest larvae from deeper soil upward to the soil surface to infest the plants.

It is unlikely that resistant plant cultivars or cultural control alone will maintain pest populations at acceptable levels, but through careful integration, with insecticides, it could represent a significant source of sustainable control, or backup sprays may be appropriate during outbreaks of pests (Heinz, 1996). In the current results, chisel plow at seed sowing time with treating seeds with diazinon resulted in lower larvae number and infestation percentage as well as higher grain yield, straw biomass, and plant height. This is agreed with several other studies in which diazinon is the most effective insecticide against the pest. In Jordan, under laboratory conditions, Al-Zyoud (2008) reported that diazinon, chlorpyrifos, and fenitrothion caused pest mortality to reach 100%. In Jordan, also under filed conditions, diazinon caused the highest mortality to S. temperatella with 99.8% (Al-Zyoud, 2013). In Cyprus, Melifronides (1977) reported that diazinon, fenitrothion, and phosphamidon caused mortalities of more than 90% of the pest larvae. In Turkey, Kaya (1976) mentioned that diazinon proved to be effective against the larvae, giving 96% mortality. In Iran, diazinon was effective against the pest (Jemsi and Rajabi, 2003). Insecticides can be also applied onto the soil or mixed with the seeds before sowing and not only applying them directly to the plants. In this regard, in Iraq granular diazinon was mixed with seeds of three wheat cultivars, and the results showed a low percentage of infested leaves and larval population size (ICARDA, 2007), which is agreed completely with the current data.

The present findings showed that larvae number was correlated significantly and positively with the infestation percentage and negatively with the grain yield and straw biomass. These results are in line with the findings of Ghabeish et al. (2014) who reported a negative correlation between the percentage of infestation and the grain yield and straw biomass in wheat and barley, and Al-Zyoud and Ghabeish (2015) who stated that larval population size is negatively correlated with grain yield and dry biomass and positively correlated with plant infestation percentage. In addition, Serghiou (1975) stated a negative correlation between the larval population size and grain yield.

In conclusion, this work is the first to tackle the effect of the combined use of tillage regime and insecticides to control S. temperatella. In addition, the wheat cultivar, Horani 27 is the least preferred by the pest represented by lower larvae number and moderate infestation percentage, and higher grain and straw weights. It is hoped that the outcomes of this study could give an appropriate low-cost and environmentally sound control tactic to S. temperatella in Jordan.

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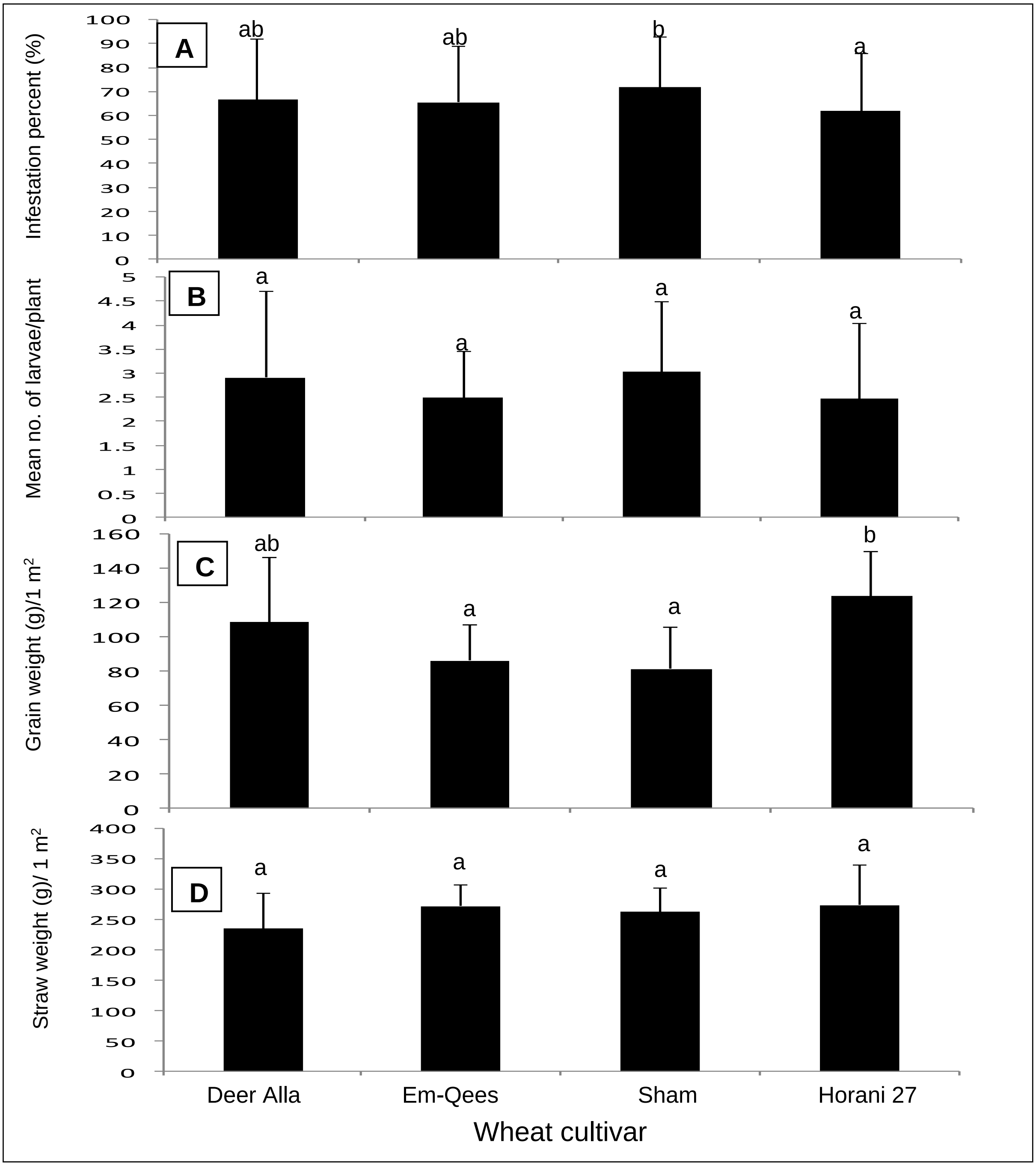

Fig. 1. Mean (±SD) *Syringopais temperatella* infestation percentage (%) (A), number of larvae (B), grain weight (C) and straw weight (D) in four wheat cultivars. [Different small letters above bars indicated significant differences within the same tested parameter among the different wheat cultivars at P≤0.05, one-factor analysis of variance].

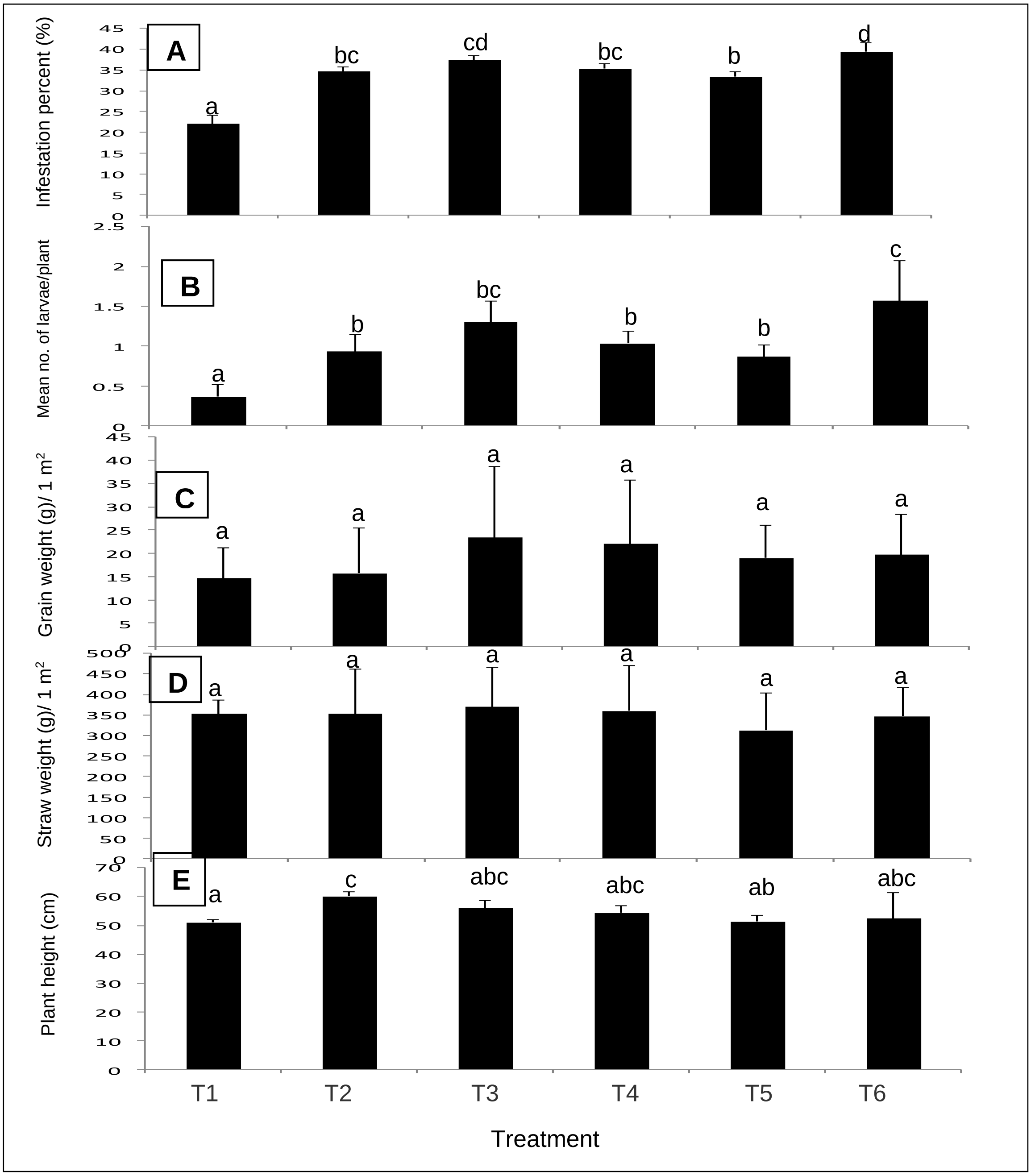

Fig. 2: Mean (±SD) ***Syringopais temperatella*** **infestation percentage (%) (A), number of larvae (B), grain weight (C), straw weight (D) and plant height (E) under different tillage regimes and insecticide applications. T1: no-tillage, T2: deep plowing in summer, T3: deep plowing in summer and treating seeds with diazinon, T4: chisel plow at seed sowing time with treating seeds with diazinon, T5: no-tillage and treating seeds with diazinon, and T6: chisel plow at seed sowing time (farmer method). [Different small letters above bars indicated significant differences within the same tested parameter among the different six treatments at P≤0.05, one-factor analysis of variance].**

تكتيكات المكافحة المستدامة لمنشرة لأوراق الحبوب Syringopais Temperatella Led. Scythrididae (Lep.)، في الأردن: الأصناف المقاومة والاستخدام المشترك للحراثة والمبيدات الحشرية

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ملخص

تعتبرمنشرة أوراق الحبوب، Syringopais Temperatella Led. (Lep. ،Scythrididae) من أخطر الآفات الحشرية التي تصيب القمح في الحقل وتتسبب في أضرار اقتصادية للمحصول في الأردن. ومع ذلك، فقد تم إيلاء القليل من الاهتمام لقابلية أصناف القمح الشائعة للتأثر ولم يتم إيلاء اهتمام للاستخدام المشترك لنظام الحراثة والمبيدات الحشرية ضدS. temperatella. بالتزامن مع ذلك، هدفت هذه الدراسة إلى التحقق من قابلية أصناف القمح الأكثر شيوعًا المزروعة في الأردن للإصابة بـ S. temperatella في ظل الظروف الحقلية، وتأثير الاستخدام المشترك لنظام الحراثة وتطبيقات المبيدات الحشرية في مكافحة الآفة على القمح. أجريت التجربة الأولى لتحديد مدى حساسية أربعة أصناف من القمح الشائع للآفة في الموسم الزراعي 2017/2016، بينما أجريت التجربة الثانية لدراسة تأثير الاستخدام المشترك لنظام الحراثة والمبيدات الحشرية ضد الآفة في عام 2017 / 2018 في الموسم الزراعى بالقصر بالكرك. تم استخدام أربعة أصناف من القمح الشائع (دير علا، أم قيس، شام، حوراني 27) في التجربة الأولى، بينما أجريت في التجربة الثانية 6 معاملات مختلفة باستخدام صنف حوراني 27، وهي T1: بدون حرث. ، T2: الحرث العميق في الصيف ، T3: الحرث العميق في الصيف ومعالجة البذور بالديازينون ، T4: المحراث الإزميل في وقت بذر البذور بمعالجة البذور بالديازينون ، T5: عدم الحرث ومعالجة البذور بالديازينون ، و T6: المحراث الإزميل في وقت بذر البذور. في التجربتين تم تسجيل بيانات عن عدد اليرقات، والإصابة، ووزن الحبوب والقش، وارتفاع النبات. اظهرت النتائج ان الاصابة وعدد اليرقات كان الاقل واوزان الحبوب والقش كان الاعلى في حوراني 27 مقارنة مع الاصناف الاخرى. أظهرت البيانات أن أقل عدد للإصابة واليرقات كان في حالة عدم الحرث. كانت الحبوب ووزن القش هي الأعلى في الحرث العميق في الصيف ومعالجة البذور بالديازينون. بينما سجل أطول نبتة في الحرث العميق صيفا والحرث العميق صيفا بمعالجة البذور بالديازينون. في الختام، حوراني 27 هو الصنف الأقل تأثراً بالآفة، وعدم الحرث يقلل من عدد اليرقات والإصابة بينما ادى الحرث في الصيف عن طريق معالجة البذور بالديازينون الى زيادة المحصول ووزن القش، وارتفاع النبات.

الكلمات الدالة: سيرينجوبايس تيمبيراتيلا، منشرة أوراق الحبوب، قمح، أصناف، حراثة، مبيدات حشرية، إدارة مستدامة، الأردن

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