Journal of Plant Protection and Pathology

Journal homepage & Available online at: www.jppp.journals.ekb.eg

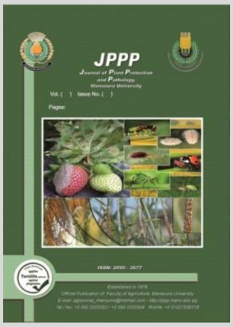
Development, longevity, Fecundity, and Life Table Parameters of Fall Armyworm *Spodoptera frugiperda* (Smith) in Relation to Crops

Walaa A. Tawfik[1]; Hala E. Moafy [1]; Amira A. A. Abdel-Hady[2] and Marwa M. Ramadan[2*]

[1]Research Institute, Agricultural Research Center, Dokki, Giza-12618, Egypt

[2]Economic Entomology Department, Faculty of Agriculture, Mansoura University

Cross Mark



Article Information
Received 28/ 9 /2025
Accepted 8 /10/2025

ABSTRACT

The fall armyworm (FAW), *Spodoptera frugiperda* (Smith), is recognized as one of the most destructive invasive pests worldwide, with serious implications for global food production and security. *Spodoptera frugiperda* rearing at three host plants maize, sweet potato and eggplant under three temperature 25ºC, 30ºC and fluctuating temperatures to determine its biological characters, the obtained results showed that there were significant effects of temperature, host plant and their interaction ($F4$=5.86; P<0.001) on total development time (egg-adult) of FAW. The results showed that there were significant differences between temperatures, host plants and their interaction, where are effect on weight of pupa ($F2$= 52.88; P<0.001, $F2$= 21.61; P<0.001, and $F4$=12.76; P<0.001, respectively). The shortest developmental time of FAW was recorded on maize under fluctuating temperatures (18.8 days), confirming maize as the most favorable host for rapid development. Conversely, the lowest recorded longevity was observed on eggplant at 25 °C (7.6 days). Sweet potato may better sustain female longevity, whereas eggplant appears to be the least favorable host overall. Results indicated clear variation with temperature development and reproduction depends strongly on temperature. At 25 °C, the insects have the longest generation time and highest reproductive potential (R_0 and GRR), but slower population growth (lower r_m and λ). At 30 °C, development is much faster, and the intrinsic growth rate is highest, though reproductive output decreases. Field conditions produced intermediate values, closer to 30 °C. Overall, higher temperatures accelerate development and increase growth rate, but reduce fecundity.

Keywords: *Spodoptera frugiperda*, biological characters, maize, sweet potato, Eggplan

INTRODUCTION

The fall armyworm (FAW), *Spodoptera frugiperda* (Smith), is recognized as one of the most destructive invasive pests worldwide, with serious implications for global food production and security (Baudron *et al*., 2019). This highly polyphagous insect feeds on more than 353 plant species, inflicting heavy damage on staple and cash crops such as maize, rice, cotton, soybean, beans, and various vegetables like and grasses (Bueno *et al*., 2010; Nabity *et al*., 2011; FAO, 2017; Bateman *et al*., 2018; Montezano *et al*., 2018; Kansiime *et al*., 2019; Rwomushana, 2019; Awadalla *et al*., 2025). On a global scale, the insect is capable of causing yield reductions ranging from 20% to nearly 100%, depending on crop type and infestation level (Hardke *et al.,* 2015; Mallapur *et al.,* 2018). Considering its rapid dispersal, broad host range, and devastating impact on crop yields, the development of effective management approaches has become essential. Numerous studies have examined the life history traits of the fall armyworm (FAW) on a range of host plants, including cotton, millet, maize, soybean, peanut, tomato, pepper, coriander, and eggplant (Santiz *et al.*, 2021; He *et al.,*2020; Wu *et al.,*2021 and Shoman *et al*., 2025). The pest's invasion into regions dependent on potato and eggplant production further amplifies its economic impact, highlighting the urgency of research into its population dynamics and management on vegetable crops. Despite extensive studies on cereal crops, limited information exists on the development and life table parameters of *S. frugiperda* when reared on vegetable crops such as potato and eggplant under different thermal regimes. Understanding host–temperature interactions is fundamental for predicting population dynamics, assessing risk levels, and designing integrated pest management (IPM) strategies. Therefore, this study aims to investigate the biology and demographic parameters of *S. frugiperda* reared on sweet potato, eggplant, and maize under three constant temperature regimes (25, 30 °C and a fluctuating-temperature treatment).

MATERIALS AND METHODS

Collection and rearing of *S. frugiperda*

Egg masses were obtained from the Agricultural Research Center (ARC), Giza, Cairo, Egypt, and were reared for one generation in the Economic Entomology Laboratory, Faculty of Agriculture, prior to the start of the experiment. Development from egg to adult of *S. frugiperda* was assessed under two experimental factors: temperature and host plant. Larvae were reared under three thermal regimes (25, 30°C and a fluctuating-temperature treatment) on three host plants (maize, sweet potato and eggplant). At each temperature, larvae were provided a single host plant. Fresh egg masses were obtained from a laboratory colony. Newly hatched *S. frugiperda* larvae were separated on the day of exclusion and reared individually in transparent plastic containers (12 × 10.5 × 3.5 cm^3) supplied with leaves from a single test host plant. Rearing conditions were 60 to 70% relative humidity and a 10:14 h L:D photoperiod until pupation. Each container held a 2 cm saw dust as the medium for pupation till adult's emergence. Ten replicates were prepared for each host plant at each temperature treatment. As larvae grew older, the daily

* Corresponding author.
E-mail address: marwa010@mans.edu.eg

DOI: 10.21608/jppp.2025.427747.1387

amount was increased to prevent starvation. Fresh host-plant leaves were provided daily. Newly emerged adults were paired and confined to an plastic jars (30 × 20 × 15 cm³) and were provided with a 10% honey solution (diluted with water) for feeding then.covered with muslin cloth. Fragments of 20 cm long oleander (Nerium oleander L., Family: Apocynaceae) branches with leaves that are used to collect egg masses that adults deposit. Every day, the deposited egg masses on the oleander leaves were carefully gathered. For every tested temperature, five replicates of a single male-female pair were made. Every day, the amount of egg masses in the cages was counted.

Biological aspects:

Biological aspects of *S. frugiperda* were evaluated, including stage-specific developmental time and total life-cycle duration; egg incubation, larval, and pupal durations were recorded for all host–temperature combinations, and total development time from egg to adult was used for statistical analyses; adult traits measured were female pre-oviposition, oviposition, and post-oviposition periods, female longevity, fecundity (eggs per female), and female fertility; in addition to hatching success was calculated following Zidan and Abdel-Megeed (1987).

Analysis of Plant Components:

Leaflet samples of sweet potato, were picked and kept in paper bags. The leaflet specimens were sent to laboratory belonging to Soil, Water and Environment Research Institute, Agricultural Research Center, Mansoura Branch. Leave's chlorophyll (a and b) was measured using methanol (100%) as described by Aminot and Rey (2000) Carotenoids were determined according to Lichtenthaler and Buschmann (2001). To digest the plant samples (either leaves or seeds) for determining the content of N.P.K. mixed of $HClO_4$+H_2So_4 was used as described by Peterburgski (1968). Nitrogen levels were determined using the Kjeldahl method, phosphorus levels were analyzed through the spectrophotometric method, and potassium levels were ascertained using the flame photometer method (Ashworth *et al.,* 1997).

Data analysis:

Data on developmental times, female pre-oviposition, inter-oviposition, and oviposition periods, in addition to total female longevity of *S. frugiperda* were analyzed using Costat Software (2004) with a two-way ANOVA to test the main effects of temperature and host plant and their interaction on developmental traits; when the interaction was significant, variables were reanalyzed separately by one-way ANOVA, and means were separated using the Student-Newman-Keuls test.

Life table parameters:

Life table parameters of female of *S. frugiperda* females which reared on three host plants, were calculated using LIFE 48 BASIC computer program of Abou-Setta *et al.* (1986).

RESULTS AND DISCUSSION

Results

A -Effect of host plants and temperatures on biological characters of *S. frugiperda*

Dats presented in Table (1) showed that there were significant effects of temperature (*F*2= 76.81; *P*<0.001), host plant (*F*2= 29.91; *P*<0.001), and their interaction (*F*4=5.86; *P*<0.001) on total development time (egg-adult) of FAW. There were significant variations for the effect of temperature and host plants in the total longevity for females (*F*2= 3.67; *P*<0.001 and *F*2= 12.92; *P*<0.001): while, the effect of the interaction temperatures- host plants, was insignificant (F4= 2.47, P=0.0580 ns). The result showed that there are significant effects of temperatures, host plants and their interaction, on weight of pupal weight (*F*2= 52.88; *P*<0.001, *F*2= 21.61; *P*<0.001, and *F*4=12.76; *P*<0.001, respectively). Two-way ANOVA revealed that there were significant effects of temperature (F = 3.73; P = 0.0317*) on the fecundity of *S. frugiperda* females. However, host plant and the interaction between temperature and host plant (F_2 = 0.2949; P = 0.7460 ns and dF_4 = 0.3055; P = 0.8728 ns) showed no significant effects on the fecundity of *S. frugiperda* females.

Table 1. Main effects of temperature, host plant, and their interaction on total development time (egg-adult), female longevity, pupal weight and female fecundity of fall armyworm (FAW) *Spodoptera frugiperda*.

Source of Variation	Degrees of freedom	F	P
Days from egg to emergence			
Temperatures	2	76.81	0.0000 ***
Host Plant	2	29.91	0.0000 ***
Host Plant XTemperatures	4	5.86	0.0007 ***
Female longevity			
Temperatures	2	3.67	0.0334 *
Host Plant	2	12.92	0.0000 ***
Host Plant XTemperatures	4	2.47	0.0580 ns
Weight of pupa			
Temperatures	2	52.88	0.0000 ***
Host Plant	2	21.61	0.0000 ***
Host Plant Temperatures	4	12.76	0.0000 ***
Fecundity			
Temperatures	2	3.73	0.0317 *
Host Plant	2	0.2949312	0.7460 ns
Host Plant XTemperatures	4	0.3055089	0.8728 ns

B-Effect of host plants and temperatures on development time and longevity of *S. frugiperda*

The statistical analysis revealed that there were no significant variations in the developmental time (egg- adult) of FAW at 25 °C across different host plants. However, significant variations were observed in female longevity at the same temperature Table (2). At 30 °C, both developmental time and longevity of FAW showed significant differences depending on the host plant, indicating that host plant quality plays a stronger role under warmer conditions. The results presented in Table (2) further indicate substantial variations in developmental time and longevity across temperatures within the same host plant, reflecting the importance of thermal environment in shaping insect biology. In contrast, fluctuating temperatures did not cause significant variations in developmental time or longevity, which suggests that FAW may be more tolerant to natural fluctuating conditions compared to constant laboratory temperatures.

The shortest developmental time of FAW was recorded on maize under fluctuating temperatures (18.8 days), confirming maize as the most favorable host for rapid development. Conversely, the lowest recorded longevity was observed on eggplant at 25 °C (7.6 days), highlighting eggplant as a comparatively less suitable host. These findings suggest that while maize promotes faster development and higher intrinsic growth potential, sweet potato may better sustain female longevity, whereas eggplant appears to be the least favorable host overall

Table 2. Mean (±SE) of total development period (egg-adult) and female longevity (in days) of fall armyworm (FAW), *Spodoptera frugiperda* that reared on three host plants under different constant temperature regimes.

Temperature	Stages duration	Host plant: Maize	Sweet	Eggplant
25 C	Incubation period	5.17 ±0.3aA	5.17 ±0.3aA	5.17 ±0.3aA
	Larval period	20.83 ± 0.94bA	21.0 ± 1.39bA	25.8± 0.95aA
	Pupal period	12.67 ±1.02aA	7.5 ± 0.92bA	7.6 ± 1.84 bB
	Egg - Adult	38.4±1.43aA	34.2±1.49aA	38.8±2.73aA
	Female longevity	13.0 ± 0.45 aA	14.5 ±1.42 aA	7.6 ±2.04 bA
	Pre-oviposition	5.17 ± 0.31aA	5.67 ±0.71aA	2.67 ±0.88bA
	oviposition	5.0 ± 0.37aA	5.67 ±0.71aA	2 ±0.68bA
	Post- oviposition	2.83 ± 0.31abA	3.16 ± 0.31aB	1.67 ±0.55bB
30 C	Incubation period	3.2 ±0.34aB	3.2 ±0.34aB	3.2 ±0.34aB
	Larval period	12.17 ± 0.61bB	13.83 ± 0.83bB	18.2±0.96aB
	Pupal period	4.67±0.84bB	6.5±0.84bA	11.5±0.95aA
	Egg - Adult	20 ± 0.78cB	23.5 ±1.23bB	32.75±1.06aB
	Female longevity	8.9 ±0.22bB	11.3±0.76aA	8.6 ±0.61bA
	Pre-oviposition	3.8 ±0.67 aA	3.3 ± 0.42 aB	3±0.28 aA
	oviposition	3.4 ±0.22aB	3.3±0.21aB	3.4±0.22aA
	Post- oviposition	1.7 ±0.36bB	4.7±0.42aA	2.2±0.34bAB
fluctuated	Incubation period	3 ±0.28 aB	3 ±0.28aB	3.2±0.24aB
	Larval period	12.8 ± 0.34bB	14±0.5bB	18±1.2aB
	Pupal period	3 ±0.29 aB	3 ±0.28 aB	3.2±0.2 aC
	Egg - Adult	18.8±0.92bB	20±1.07bB	24.5±1.61aC
	Female longevity	13±1.47aA	13±1.47aA	9.5± 0.78aA
	Pre-oviposition	4 ±0.57aA	4 ±0.57aAB	3 ±0.33aA
	oviposition	6 ±0.57aA	6 ±0.57 aA	3.5±0.53bA
	Post- oviposition	3 +0.41aA	3 ±0.41aB	3±0.33aA

Small letter between host plants under the same temperatures, while capital letters between the temperatures under the same host plant. Where, means have the same letter are not differed significantly at probability of 5%.

C- Effect of host plant species and temperature regimes on *S. frugiperda* life table parameters:

The data illustrated in (Table 3) showed that temperature strongly influences development and reproduction. On maize mean generation time (T) and doubling time (DT) were longest at 25 °C (40.96 and 4.61 days), but shortened considerably at 30 °C (21.53 and 2.66 days) and under field conditions (20.28 and 2.76 days). This indicates faster development and quicker population turnover at higher temperatures. Meanwhile net reproductive rate (R_o) and gross reproductive rate (GRR) were highest at 25 °C (475.2 and 709.5, respectively), but decreased sharply at 30 °C (272.16 and 379.2) and further under fluctuated conditions (162 and 251.25). Thus, fecundity declines as temperature rises. In contrast, intrinsic rate of increase (r_m) and finite rate of increase (λ) increased with temperature increases, from 0.15 and 1.16 at 25 °C to 0.26 and 1.29 at 30 °C, with slightly lower but still high values under fluctuated conditions (0.25 and 1.29). This shows that population growth potential is maximized at warmer conditions.

Also the results in Table (3) indicated that temperature-dependent variations in the population growth parameters of *S. frugiperda* reared on sweet potato plant. Mean generation time (T) decreased substantially as temperature increased, where at 25 °C, the generation time was the longest (36.96 days), whereas it was shortest at 30 °C (25.34 days). This indicates that higher temperatures accelerated development, Doubling time (DT) followed a similar trend, being highest at 25 °C (4.14 days) and shortest at 30 °C (3.06 days), while with the fluctuated conditions showing an intermediate value (3.2 days). Shorter doubling times were at higher temperatures suggest faster population multiplication. Meanwhile, net reproductive rate (R_o) was highest at 25 °C (486.54), but declined markedly at 30 °C (310.5) and under fluctuated conditions (308.88). This suggests that while warmer conditions accelerate development, they may reduce survival or fecundity, leading to a lower overall reproductive output. Intrinsic rate of increase (r_m) and finite rate of increase (λ) showed the opposite pattern: both were lowest at 25 °C (0.17 and 1.18, respectively) and highest at 30 °C (0.23 and 1.25). Field growth potential is maximized at 30 °C, even though the net reproductive rate is lower than at 25 °C. Finally, gross reproductive rate (GRR) was highest at 25 °C (775.13), but decreased substantially at 30 °C (480) and under fluctuated conditions (538.2). This again highlights that higher temperatures, while promoting faster development, negatively impact the total reproductive output.

Table 3. Life table parameters of *Spodoptera frugiperda* reared on three host plant at three temperature regimes.

Life table parameters	Temperatures: 25°C	30°C	Fluctuated
Maize			
Mean generation time (T) (in days)	40.96	21.53	20.28
Doubling time(DT) (in days)	4.61	2.66	2.76
Net reproductive rate(R_o)	475.2	272.16	162
Intrinsic rate of increase (r_m)	0.15	0.26	0.25
Finite rate of increase(λ - erm))	1.16	1.29	1.29
Gross reproductive rate (GRR)	709.5	379.2	251.25
Sweet potato			
Mean generation time (T) (in days)	36.96	25.34	26.46
Doubling time(DT) (in days)	4.14	3.06	3.2
Net reproductive rate(R_o)	486.54	310.5	308.88
Intrinsic rate of increase (r_m)	0.17	0.23	0.22
Finite rate of increase(λ - erm))	1.18	1.25	1.24
Gross reproductive rate (GRR)	775.13	480	538.2
Eggplant plant			
Mean generation time (T) (in days)	40.83	34.19	26.31
Doubling time(DT) (in days)	4.75	4.23	3.44
Net reproductive rate(R_o)	386.1	270	201.83
Intrinsic rate of increase (r_m)	0.15	0.16	0.20
Finite rate of increase(λ - erm))	1.16	1.18	1.22
Gross reproductive rate (GRR)	546	518.75	327.75

The results of rearing *S. frugiperda* on eggplant indicated that the mean generation time (T) and doubling time (DT) were longest at 25 °C (40.83 days and 4.75 days, respectively), but both decreased progressively at higher temperatures, reaching the shortest values under fluctuated conditions (26.31 days and 3.44 days). This cleared that warmer environments accelerate development and population turnover. The net reproductive rate (R_0) and gross reproductive rate (GRR) were highest at 25 °C (386.1 and 546.0), but decreased notably at 30 °C (270 and 518.75) and further under fluctuated conditions (201.83 and 327.75). Thus, fecundity and survival decline with increasing temperature. By contrast, the intrinsic rate of increase (r_m) and the finite rate of increase (λ) were lowest at 25 °C (0.15 and 1.16), and increased with temperature increases, reaching a peak under fluctuated conditions (0.20 and 1.22). This suggests that while reproduction is reduced at higher temperatures, overall population growth rate is faster because of shorter development times (Table 3).

By comparing the results of rearing *S. frugiperda* on the three different host plants, it become clear that the mean generation time and doubling time were moderate in sweet potato plant (it was 26.46–36.96 days for T and 3.2–4.14 days for DT), while on eggplant these parameters at 25°C (T=40.83 days and DT=4.75), but shorter under fluctuated conditions (26.31 days; DT = 3.44). Much shorter were recorded under higher temperature and fluctuated (T was 21.53–20.28 days; DT was 2.66–2.76), meaning faster turnover on maize provides the fastest development compared to the other plants. Meanwhile, reproduction (R_0 and GRR) were highest values overall (R_0 = 486.54; GRR = 775.13 at 25°C in on sweet potato. Mean generation time and doubling time longer at 25°C (40.83 days and 4.75 days on eggplant), but shorter under fluctuated conditions (T=26.31 days; DT = 3.44), while much shorter under higher temperature and fluctuated (21.53–20.28 days; DT = 2.66–2.76) in maize leaves meaning faster turnover compared to the other plants. In addition, reproduction (R_0 and GRR) were highest values overall (R_0 = 486.54; GRR = 775.13 at 25 °C) in on sweet potato but, slightly lower than sweet potato in on eggplant it were (r_m = 0.20; λ = 1.22 under fluctuated temperatures) and highest growth rates (r_m = 0.25–0.26; λ = 1.29) on maize, showing very rapid multiplication despite lower fecundity as it mean maize promotes the fastest growth rate.

Estimated of the life table parameters of *S. frugiperda*, were given in Table (3), indicated clear variation with temperature development and reproduction depends strongly on temperature. At 25 °C, the insects have the longest generation time and highest reproductive potential (R_0 and GRR), but slower population growth (lower r_m and λ). At 30 °C, development is much faster, and the intrinsic growth rate is highest, though reproductive output decreases. Field conditions produced intermediate values, closer to 30 °C. Overall, higher temperatures accelerate development and increase growth rate, but reduce fecundity.

D. Chemical compositions of the leaves of tested host plants .

Data presented in Table (4) showed that the chemical analysis of leaves of the tested host plants. Total protein, N%, P%, K%, chlorophyI a, chlorophyI b and carotene were higher in maize (24.52, 3.92%, 0.39 %, 2.92 % 46.47 and 131.4, respectively) while, it was moderate in sweet potato and shorter in eggplants which explains why growth rate to *S. frugiperda* was fastest on maize and moderate on sweet potato but shorter on eggplant.

Table 4. Chemical composition of the leaves of the tested host plants.

Host plant	Leaflet chemical composition						
	N%	P%	K%	Total protein	ChlorophyI a, mg/g F.W	ChlorophyI b, mg/g F.W	Carotene (Mg/100g)
Maize	3.92	0.39	2.92	24.52	Total chlorophyll 46.47		131.4
Eggplant	2.91	0.55	1.76	18.18	0.53	0.19	1.41
Sweet potato	3.42	2.98	3.98	21.37	0.726	0.445	27.22

The results revealed that *S. frugiperda* development and reproduction depend strongly on temperature. At 25 °C, the insects have the longest generation time and highest reproductive potential (R_0 and GRR), but slower population growth (lower r_m and λ). At 30 °C, development is much faster, and the intrinsic growth rate is highest, though reproductive output decreases. Field conditions produced intermediate values, closer to 30 °C. Overall, higher temperatures accelerate development and increase growth rate, but reduce fecundity, these results are in agreement with Sabra *et a*l., 2022 indicated that temperature fluctuations influence the rate of development, the length of the life cycle, and ultimately the survival of the organism. Amira *et al.,* 2024 indicated that larvae fed on leaves of maize, rice and artificial diets had the fastest larval and pupal development cycle, while those fed on pea and tomato had the longest one. In case of moth emerging from larvae fed on maize showed longest life span. But moths producing from larvae fed on leaves of tomato had the shortest life span. The present results are in agreement with the results of Shoman *et al.* (2025); they reported that *S. frugiperda* reared on maize leaves showed shortest developmental periods and adult longevity in comparison with those reared on tomato leaves. Also, the same authors added that mean generation time (T) was higher on tomato leaves than on maize leaves; while, net reproductive rate (R_o) and intrinsic rate of increase (r_m) were higher on maize in comparison with tomato leaves. Meanwhile the elevated crude protein and carotene contents in maize and sweet potato likely contributed to the strong preference of *S. frugiperda* larvae towards these host plants. Indices denoting the larval performance, such as relative consumption rate, relative growth rate and consumption index also positively correlated with the nutritional contents of the host plants suggesting the suitability of maize and sweet potato as a host for FAW (Ajmal *et* al., 2024)

REFERENCES

Abou-Setta MM Sorrel RW Childers CC (1986). Life 48: A basic computer program to calculate life table parameters for an insect or mite species. Florida Entomol. 69 (4): 690-697.

Ajmal MS, Ali S, Jamal A, Saeed MF, Radicetti E, Civolani S. (2024). Feeding and growth response of fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) towards different host plants. Insects.;15(10):789. https://doi.org/10.3390/insects15100789.

Aminot, A. and F. Rey, (2000). Standard procedure for the determination of chlorophyll a by spectroscopic methods. International Council for the Exploration of the Sea, 112,25.

Amira, M. El-shewy., Esmat , S. A. Zaghlol and Sara E. El-Deeb (2024). Life table, host selection behavior and biochemical aspects of fall armyworm *Spodoptera frugiperda* (J.E.Smith) reared on various host plants on laboratory. J. of Plant Protection and Pathology, Mansoura Univ., Vol. 15 (5):149 – 154. www.jppp.journals.ekb.eg.

Ashworth, D. J., B. J. Alloway and B. p. shaw, (1997). Soil-plant analysis: a laboratory manual. Routledge.

Awadalla, S. s., Olyme,M.f., Bayoumy, M.H.(2025). Laboratory estimation of lower temperature threshold and thermal constant (DDs) for development of *Spodoptera frugiperda* and *Spodoptera littoralis* (Noctusiae: Lepidoptera) regimes and host plants. Journal of plant protection ans pathology, Mansoura University, 16(6),319-325.

Bateman, M. L., Day, R. K., Luke, B., Edgington, S., Kuhlmann, U., Cock, M.J. (2018). Assessment of potential biopesticide options for managing fall armyworm (*Spodoptera frugiperda*) in Africa. J. of Applied Entomol., 142(9): 805-819.

Baudron, F., Zaman-Allah, M.A., Chaipa, I., Chari, N., Chinwada, P. (2019). Understanding the factors influencing fall armyworm (*Spodoptera frugiperda* JE Smith) damage in African smallholder maize fields and quantifying its impact on yield. A case study in Eastern Zimbabwe. Crop Protection 120, 141-150.

Bueno, R.C.O.F., Carneiro, T.R., Bueno, A.F., Pratissoli, D., Fernandes, O.A and Vieira, S.S. (2010). Parasitism capacity of *Telenomus remus* Nixon (Hymenoptera: Scelionidae) on *Spodoptera frugiperda* (Smith) (Lepidoptera:Noctuidae) eggs. Brazilian Archives of Biology and Technology 53, 133-139.

CoStat Software. (2004). CoStat Software, Version 6.204. Cohort Software, Monterey, California, USA. www.cohort.com.

FAO. (2017). FAO Advisory Note on Fall Armyworm (FAW) in Africa. Food and Agriculture Organization of the United Nations, Rome, Italy, 7 pp.

He, L.M.; Wang, T.L.; Chen, Y.C.; Ge, S.S.; Wyckhuys, K.A.G.; Wu, K.M.(2021). Larval diet affects development and reproduction of East Asian strain of the fall armyworm, Spodoptera frugiperda. J. Integr. Agric. 20, 736–744.

He, L.M.; Wu, Q.L.; Gao, X.W.; Wu, K.M.(2020). Population life tables for the invasive fall armyworm, *Spodoptera frugiperda* fed on major oil crops planted in China. J. Integr. Agric. 20, 745–754.

Kansiime, M.K., Mugambi, I., Rwomushana, I., Nunda, W., Lamontagne-Godwin, J., Rware, H., Day, R. (2019). Farmer perception of fall armyworm (*Spodoptera frugiderda* JE Smith) and farm-level management practices in Zambia. Pest Management Science 75(10): 2840-2850.

Lichtenthaler, H. K., and C. Buschmann, (2001). Chlorophylls and carotenoids :Measurement and characterization by UV-VIS spectroscopy. Current protocols in food analytical chemistry.1(1), F4-3.

Mallapur, C.P.; Naik, A.K.; Hagari, S.; Prabhu, S.T. and Patil, R.K. (2018). Status of alien pest fall armyworm, *Spodoptera frugiperda* (J E Smith) on maize in Northern Karnataka. Journal of Entomological and Zoological Studies 6(6): 432-436.

Montezano, D.G., Specht, A., Sosa-Gómez, D.R., Roque-Specht, V.F., Sousa-Silva, J.C., Paula-Moraes, S.V., Peterson, J.A., Hunt, T.E. (2018). Host plants of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in the Americas. African Entomol. 26(2): 286–300.

Nabity, P.D., Zangerl, A.R., Berenbaum, M.R., Delucia, E.H. (2011). Bioenergy crops *Miscanthus giganteus* and *Panicum virgatum* reduce growth and survivorship of *Spodoptera frugiperda* (Lepidoptera: Noctuidae). J. of Econ. Entomol. 104, 459-464

Peterburgski, A.V. 1968. ‘‘Hand Book of Agronomic chemistry’’. Kolas publishing House Moscow, (in Russian).

Rwomushana, I. (2019). *Spodoptera frugiperda* (fall armyworm). CABI Compendium.

Sabra, I.M.; Kandil, M.A.A.; El-Shennawy, R.M.; Ahmed, A.F. (2022). Effect of Temperature on Development and Life Table Parameters of Fall Armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae). J. Plant Prot. Pathol., Mansoura Univ., 13 (11):267-271.

Santiz, E.E.; Barrera, E.D.A.; Larsen, J.; Del-Val, E. (2021). Climate change can trigger fall armyworm outbreaks: A developmental response experiment with two Mexican maize landraces. *Int. J. Pest Manag.* 1–9.

Shoman, S.A., N.M. Ghanim, N.H. Harraz and W.Z. Aziz (2025). Effect of four host plants on biological characteristics of *Spodoptera frugiperda* and *Spodoptera littoralis* (both Lepidoptera: Noctuidae). Inter. J. of Tropical Insect Sci.. https://doi.org/10.1007/s42690-025-01572-x.

Wu, L.H.; Zhou, C.; Long, G.Y.; Yang, X.B.; Wei, Z.Y.; Liao, Y.J.; Yang, H.; Hu, C.X. (2021). Fitness of fall armyworm, *Spodoptera frugiperda,* to three solanaceous vegetables. J. Integr. Agric 20, 755–763.

Zidan, H., and Abdel-Megeed, M.I. (1987). New Trends in Pesticides and Pest Control – Part II. Al-Dar Al-Arabia for Publishing and Distribution, Cairo, Egypt.

النمو والقدرة التكاثرية ومعايير جدول الحياة لدودة الحشد الخريفية *Spodoptera frugiperda* (J.E. Smith) على بعض المحاصيل

ولاء عبد المعطى توفيق[١]، هالة السيد أحمد الموافى[١]، أميرة على على عبد الهادى[٢]ومروه محمود رمضان[٢]

[١]معهد بحوث وقاية النباتات، مركز البحوث الزراعية، الدقي، الجيزة ١٢٦١٨، مصر
[٢]قسم الحشرات الاقتصادية، كلية الزراعة، جامعة المنصورة، مصر

الملخص

تُعد دودة الحشد الخريفية (*Spodoptera frugiperda* J.E. Smith) من أكثر الآفات الغازية تدميراً على مستوى العالم، لما لها من تأثير بالغ على إنتاج الغذاء والأمن الغذائي العالمي. هدف هذا البحث إلى دراسة بعض الخصائص البيولوجية لهذه الحشرة عند تربيتها على ثلاثة نباتات عائلة هي: الذرة الشامية(*Zea mays*) ، البطاطا الحلوة، والباذنجان، وذلك تحت ثلاث ظروف حرارية مختلفة: درجة حرارة ثابتة (٢٥°م)، ودرجة حرارة مرتفعة (٣٠°م)، ودرجات حرارة متذبذبة تحاكي الظروف الحقلية. أظهرت النتائج وجود تأثيرات معنوية لدرجة الحرارة، والنبات العائل، والتفاعل بينهما على مدة التطور الكلي (من البيضة إلى الحشرة الكاملة)، حيث كانت القيم الإحصائية ($F4$=5.86; P<0.001) كما لوحظت فروق معنوية في وزن العذراء تعزى لدرجة الحرارة ($F2$= 52.88; P<0.001, $F2$= 21.61; P<0.001, and $F4$=12.76; P<0.001), على التوالى. سُجلت أقصر فترة تطور للحشرة على نبات الذرة الشامية تحت درجات حرارة متذبذبة، حيث بلغت ١٨,٨ يوماً، مما يشير إلى أن الذرة الشامية تُعد العائل الأكثر ملاءمة للتطور السريع. في المقابل، لوحظت أقصر فترة حياة على نبات الباذنجان عند درجة حرارة ٢٥°م، والتي بلغت ٧,٦ أيام. أظهرت النتائج أن البطاطا الحلوة قد تكون أكثر قدرة على دعم طول عمر الإناث، في حين يُعد الباذنجان الأقل ملاءمة بشكل عام. كما بيّنت الدراسة وجود تباين واضح في صفات التطور والتكاثر باختلاف درجات الحرارة؛ ففي درجة الحرارة ٢٥°م، امتلكت الحشرة أطول زمن جيل وأعلى معدل للتكاثر (R_0 and GRR)، إلا أن معدل النمو الذاتي (r_m) ومعدل الزيادة المحدد (λ) كانا منخفضين. بينما في درجة الحرارة ٣٠°م، كان التطور أسرع ومعدل النمو الذاتي أعلى، رغم انخفاض القدرة الإنجابية. أما الظروف الحقلية فأسفرت عن نتائج متوسطة تميل إلى ظروف ٣٠°م. تشير هذه النتائج إلى أن ارتفاع درجات الحرارة يسرّع من نمو الحشرة ويزيد من معدل نموها السكاني، لكنه في المقابل يؤدي إلى انخفاض الخصوبة.