EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
ENTOMOLOGY

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ISSN
1687-8809

WWW.EAJBS.EG.NET

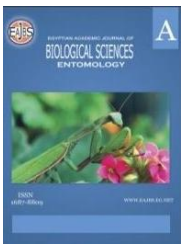
Vol. 18 No. 1 (2025)

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 18(1) pp.69-75 (2025)*
DOI: **10.21608/EAJBSA.2025.410665**

Egypt. Acad. J. Biolog. Sci., 18(1):69-75(2025)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
http://eajbsa.journals.ekb.eg/



Morpho-Description and Certain Biological Aspects of *Herpetogramma* (*Pachyzancla) licarsisalis* (Walker) (Lepidoptera: Crambidae) on Two new Host Plants in Egypt

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ARTICLE INFO
Article History
Received:30/11/2024
Accepted:7/2/2025
Available:11/2/2025

Keywords:
Herpetogramma licarsisalis; Turfgrass; *Pasplum vagenatum*; *Cynodon dactylon*; Smart-Village.

ABSTRACT

The grass webworm, *Herpetogramma* (*Pachyzancla*) *licarsisalis* (Walker) (Lepidoptera: Crambidae) severely infest turf and lawn grasses (green spaces) in Egypt. It easily domesticated in the laboratory, especially in an externally supported breeding cage and the protected outdoor cage. Adults require a sugar solution or floral nectar to achieve maximum longevity and increase the production of fertilized eggs, which female moths lay on the upper surfaces of the host turf grass. The present study aimed to rear larvae on *Paspalum vagenatum* and *Cynodon dactylon* in plastic trays. Pupae were maintained in cubic screens and transparent boxes to emergence. The generation period lasted at least 28 days at a temperature of about 25 °C. By observation and experimentation, it is recommended not to plant flowering plants such as *Lantana camara* near the Lawns (Turf grass), because its flowers attract adult moths and provide them with food. Feeding on the nectar of its flowers affects the density and number of eggs from other insect hosts and a distinctive place to hide.

INTRODUCTION

Turf grass or lawn grass as green spaces; found worldwide in private yards, public areas, play grounds and parks; serve various purposes. They are designed for visual appeal, recreational activities and sports. The use of turf grass as a playing surface not only helps to reduce erosion and dust caused by heavy foot traffic, but also offers a comfortable cushion for sport players and children (Hammad *et al*., 1968). The demand for turf grass is rapidly increasing to diversify the consumption of turf grass and obtain a high profit. (Youn *et al*., 2006). The seashore paspalum, *Paspalum vaginatum* (Sw.). and Bermudagrass, Cynodon *dactylon* (L.) Pers.), all over the world, as green spaces in landscape design, sport fields and a beautification of all type of residential units. (Choo *et al*., 2000). The different herbs used as green spaces are often attacked by larvae of several insects belonging to lepidopterans which feed on leaves, stems and plant crowns causing negatively significant damage and leading to large patches of dead lawn in case of severe infestation. (Meyer and Whitlow, 1992 and Mitchell *et al*., 2016). The Sod webworm, Grass webworm or Tropical grass webworm moth, *Herpetogramma* (*Pachyzancla*) *licarsisalis* (Walker) (Lepidoptera: Crambidae) is a widespread insect in Middle East regions as well tropical and subtropical countries infesting many types of grasses (Champ, 1955). Also, the insect pest is considering a major turf grass pest in Hawaii, Florida, and North-Eastern of Australia (Ward, 1997). The tropical sod webworm, *H. licarsisalis* destroys a large part of the warm season grasses in

Egypt as *Paspalum vagenatum*, Bermuda grass (*Cynodon dactylon*) and Lolium perenne turf grass. In recent time *Herpetogramma licarsisalis* was investigated to infest *Paspalum vagenatum* and *Cynodon dactylon* grasses in Smart-Village, Giza governorate during 2023. Thus, the insect was collected from Smart-Village for identification and rearing in laboratory on *Paspalum vagenatum* and *Cynodon dactylon* to study certain biological aspects.

MATERIALS AND METHODS

Location of Experiments:

Damaged parts of *Paspalum vaginatum* and *Cynodon dactylon* heavily infested by grass webworm *Herpetogramma licarsisalis* (GWW) were investigated in Smart Village in 6 October City, Giza governorate, Egypt from April to August 2023. To identify the species of insect responsible for infestation, samples of the damaged parts were collected where the larval instars were separated using a soft-bristled brush. Also, Adult specimens were also manually collected by immersing the turf grass with water to catch butterflies and using a light trap. Immersion was carried out between 9 and 11 am. But, the light trap of 250 watts lamp was situated about 2-3 m above the ground. Samples of the collected individuals were sorted and transferred for identification in Survey and Taxonomy Research Department, Plant Protection Research Institute, Agricultural Research Center, Giza, Egypt.

Laboratory Rearing on Host Plants:

Pre-prepared grass cutting of Paspalum and Bermuda grasses heavily infested with the grass weed worm were separately put in two wooden cages for rearing under laboratory conditions (24±5 °C and 70± 5% RH). Each cage (50 x 30 x 60 cm) was covered by wire mesh. Adults in the cages were supplied with cotton wicks saturated with 15% sucrose solution. Turf grass plastic pots (20 cm in diameter) containing Paspalum and Bermuda grasses were used. Five pots of each grass type were separately rowed. Fifty newly laid eggs on leaves were scattered on pots (10 eggs / pot). The pots daily inspected until pupation where incubation period and larval instars durations as well as pupal periods were determined. Also, head capsule of each larval instar was measured. On other side, females were fed on water, sugar solution (10%) and *Lantana camara* flowers to determine their effect on fecundity. All studied parameters were statistically analyzed using SAS software (2003) and t-test at 5% level of probability.

RESULTS AND DISCUSSION

1-Measurements of Larval Instars Head Capsule:

Data in Table (1), indicate length and width of head capsule of the five larval instars of grass webworm which increased with the increase of larval instar.

Table 1: Length and width of the cephalic capsule of the five instar larvae of the webworm *H. licarsisalis*

Larval instar	Grass webworm head capsule	
	Length (mm)	width (mm)
First	0.23	0.25
Second	0.32	0.37
Third	0.45	0.49
Fourth	0.67	0.59
Fifth	0.92	0.80

The caterpillars emerge (4 – 6) days after hatching and go through 5 instars over the following 14 days. A blackhead capsule characterizes first instar larvae, while later instar larvae have brawn head capsule. Fully developed larvae appear a range in color from green to brown, occasionally displaying a pinkish. The larvae, which are about 20 mm in length, undergo pupation within a loose tissue hibernaculum, a process that takes roughly 7.3 days. adult moths have a lifespan of approximately 13 days. The moth has a wingspan of approximately 24 mm. The species is active exclusively at night, with all important developmental stages (mating, egg laying and larval hatching, larval feeding, molting, pupation and hatching) occurring at night. The data obtained provide an in-depth understanding of both endemic species, *H. licarsisalis* and its host plants, Paspalum and Bermuda,

2-Biological Aspects of *H. licarsisalis* Immatures on Turf Grass, Paspalum and Bermuda Grasses:

The influence of two turf grasses on the biological characteristics of *H. licarsisalis* were studied under laboratory conditions. As shown in Table (2), the developmental durations of all immature stages were nearly identical across both tested plants. The egg incubation period was insignificantly shorter on Paspalum grass than that of Bermuda (3.54±0.07 and 3.81±0.08 days, respectively). Also, the duration of the live instars of larvae were insignificantly shorter on paspalum grass showing larval duration of 15.24 ± 0.27 compared to 16.7 ± 0.24 on Bermuda grass. Overall, the pupal stage insignificantly exhibited longer durations (7.92±0.76 and 7.54±0.43, respectively) on Bermuda grass than in Paspalum. Life cycle of *H. licarsisalis* (egg to adult) was slightly and insignificantly longer in Bermuda grass than in Paspalum (Table 3). Adult longevity was slightly and not significantly longer on Paspalum for both females and males of *H. licarsisalis* (Table 3). Additionally, a higher survival rate (86%) was observed on Paspalum compared to Bermuda grass (82%). The current findings also showed a marginally higher % emerged females in Bermuda grass (54%) compared to Paspalum (53%) (Table 3), though this difference was not statistically significant. Without a doubt, Paspalum was a suitable host for the rearing *H. licarsisalis* under laboratory conditions.

Table 2: Average duration of developmental stages ± SE of *H. licarsisalis* reared on Paspalum and Bermuda grasses under laboratory conditions.

Stage	Incubation period (day)	Larval duration (days)					Pupal duration (day)	Larval duration (days)
		1st	2nd	3rd	4th	5th		
Paspalum Mean ± SE	3.54 ± 0.07	2.2 ± 0.2	2.9 ± 0.2	3.2 ± 0.16	3.14 ± 0.21	3.8 ± 0.6	7.54 ± 0.43	15.24 ± 0.27
Bermuda Mean ± SE	3.81 ± 0.08	2.5 ± 0.3	3 ± 0.29	3.6 ± 0.21	3.7 ± 0.25	3.9 ± 0.16	7.92 ± 0.76	16.7 ± 0.24
Std. Deviation	0.191	0.212	0.071	0.283	0.396	0.071	0.269	1.032

Table 3: Biological characteristics of *H. licarsisalis* reared on two types of turf grasses laboratory conditions.

Biological parameters		Host plants		Significant level	
		Paspalum	Bermuda	t-value	Pr > T
Life cycle ± SE (days)		20.64 ± 1.11	21.7± 1.26	- 0.90	0.42
Longevity ± SE (days)	Female	11.87±0.49	10.93±0.37	1.28	0.27
	Male	8.60 ± 0.95	7.60 ± 0.73	2.04	0.11
Survival rate%		86%	82%	-	-
Sex ratio (Females %)		53%	54%	-	-

Data in Table (4), compare the survival of webworm larvae *H. licarsisalis*, on two grass species, Paspalum and Bermuda grass, over several days. For Paspalum grass, larvae started out with a survival rate of 83% on the 2nd day of feeding, then gradually declined to 0% by day 10. For Bermuda grass, larvae started out with a slightly lower survival rate of 71% on the 2nd day, then also declined to reach 0% after 10 days. The decline in survival occurred at a relatively similar rate for both grass species, but Paspalum initially showed a slightly higher survival rate. The pupation rate (% pupation) was 71% on Paspalum, while only 62% on Bermuda grass. It is be concluded that Paspalum grass appears to have provided a more favourable diet for larval development than Bermuda grass, both in terms of survival and pupation. Type of grass can greatly affect the insect's ability to survive and develop. The differences were slight or the difference between the two grasses is not radical, Paspalum grass appears to be more "hospitable" to the larvae than Bermuda grass.

Table 4: Survival percentage of webworm larvae in Paspalum and Bermuda grasses

Turf grass	Days after starting feeding (survival percentage)					% Pupating
	2	4	6	8	10	
Paspalum	83	81	74	47	0	71%
Bermuda	71	65	62	49	0	62%

The data indicated that relatively higher populations of certain turf pests are necessary to inflict significant feeding damage on turf grasses. According to California guidelines (Jefferson *et al.,* 1959), insecticide treatment is recommended when there are more than 18 webworm larvae per square meter of turf. A straight forward and reliable method for estimating the number of grass caterpillars in a given area was previously published (Tashiro *et al.,* 1983). For optimal control of grass caterpillars, insecticides should only be applied when population counts confirm sufficient numbers to cause visible damage to the grass.

3. Investigation on Infestation Rate and Adult Diet:

Densities of 2 and 4 larvae per pot caused minimal impact, while serious damage occurred with 8 to 10 larvae per pot after 4 days, leading to near-total destruction of the turf at 10 larvae per pot. The grass webworm greater than 4 per pot completely consumed Paspalum grass in one week. Bermuda grass was not destroyed at lower densities, though noticeable damage appeared within 5 to 6 days per pot and within 3 days with 2 larvae per pot. All tested GWW densities caused significant feeding damage, with near-total turf consumption observed at 4 larvae per pot. Even a single GWW larva per pot caused only minor feeding damage after 4 to 5 days. Complete turf consumption was observed at a density of 10 larvae per pot within 5 days. While, 4 or 7 larvae per pot did not completely consume the turf, these densities caused severe damage within 3 days. A single GWW larva caused only slight damage to the turf over the entire 10-day testing period.

Field Observations:

Adults of Sod webworms Fig. (1), are usually observed flying in the vicinity of the host plant, The Pasplum and Bermuda grasses which can be found in many gardens in commercial, recreational, private residential areas, and various sport fields. They are viewed as a pest by gardeners as their presence usually leaves the plant rhizomes without new growth. The adults visit flowers for nectar and have the habit of sunbathing with open wings in sunny conditions. It is not preferable to plant flowering plants such as *Lantana camara* (common Lantana) near turf grass, because its flowers attract adult moths, provide them with food, (the nectar of its flowers) that enhanced female fecundity and highly increasing the

mean number of eggs (Table 5).

Fig. 1: Grass webworm, *H. licarsisalis* moth

Table 5: Impact of adult diet on the fecundity of female grass webworm moths

feeding diet	Avg. no. eggs deposited/female						
	3-4 days	5-6 days	7-8 days	9-10 days	11-12 days	13-18 days	Total eggs/female
Water	45	0	0	0	0	0	45
Sugar solution 10 %	79	64	49	23	0	0	215
Lantana Camara flowers	105	81	65	54	7	0	312

The grass webworm, *H. licarsisalis* larval rearing was carried out on *Paspalum vagenatum* and *Cynodon dactylon* in pots in plastic trays (Fig. 2). Field observations revealed that there were numbers of meadow webworms in some of the monitored lawns, causing damage to the grass and stems close to the ground. The larvae hide in the grass leaves and in cracks, and are lined with a silky web (hence the name), penetrating the dry layer below the grass to the soil. These larvae feed on most types of lawns, especially Pasplum and Bermuda grass. Signs of insect infestation of the lawn include brown spots on the surface of the grass and erosion of the edges of the grass leaves. As the meadow webworms, GWW continue to grow and feed, the affected spots become larger and overlap. Under the stress of meadow webworms, large areas of lawn can be defoliated. And even diminshed during periods of summer heat and drought, with the most severe turf damage typically occurring in mid to late summer**.** Tropical sod webworms exhibit a preference for Augustine grass (*Stenotaphrum secundatum*) and Bermuda grass (*Cynodon* spp.). Additionally, other significant warm-season turf grasses that frequently face annual infestations by *H. phaeopteralis* include centipede grass (*Eremochloa ophiuroides*), seashore paspalum (*Paspalum vaginatum*), carpetgrass (*Axonopus spp*.), zoysia grass (*Zoysia japonica*), and Bahia grass (*Paspalum notatum*) (Kerr, 1955).

It is not preferable to plant flowering plants such as *Lantana camara* (common Lantana) near turf grass. Because its flowers attract adult butterflies, provide them with food, and feeding on the nectar of its flowers increase the number of eggs**.** Adults live for 10-14 days when provided 5% honey water in greenhouse cages and likely nectar-feed on flowering plants. (Sourakov *et al*., 2008). noted this species feeding on extra floral nectarines (EFN) of passion vines, Passiflora incarnate (L.). The presence of both flowers and EFN on plants will support the flight ability, longevity and fecundity of the adult moth as well as some of its natural enemies (Wäckers *et al*., 2007). Adults have a high preference to reside in tall grass and shrubs during the day and are most active at dusk (Cherry and Wilson 2005). Climate change and anthropogenic disturbance in agricultural production systems can facilitate shifts within the distribution of arthropod pest species and within the range of plant

hosts on which they feed (Leandro *et al*., 2024).

Fig. 2: *H. licarsisalis* reared on two turf grass types

Declarations:
Ethical Approval: Not applicable.
Authors Contributions: All authors contributed equally, and have read and agreed to the published version of the manuscript.
Conflicts Interests: The authors declare no conflict of interest.
Availability of Data and Materials: All datasets analyzed and described during the present study are available from the corresponding author upon reasonable request.
Source of Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.
Acknowledgements: Not applicable**.**

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ARABIC SUMMARY

الوصف الظاهرى وبعض المظاهر البيولوجية لحشرة دودة فراشة الجازون على عائلين جديدين في مصر

محمد اسماعيل حسن ، هيام مصطفى سعد و منيرعبد السلام عبد المجيد
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي – الجيزة – 12618 مصر

تم تربية دودة فراشة الجازون *Herpetogramma licarsisalis* (Walker) على مسطحات الباسبيلم والبرمودا كعوائل جديدة تصاب بحشرة دودة فراشة الجازون في مصر في المعمل وفى صناديق التربية حيث تم تغذية الفراشات على محلول سكرى لزيادة فترة حياة الفراشات وكمية البيض المخصب الناتج من الاناث. تم تربية اليرقات على اجزاء من اوراق عشب الباسبيلم و عشب البرمودا في اطباق بلاستيكية. تم الاحتفاظ بالعذارى في قماش من الشاش وداخل صناديق زجاجية حيث ظهرت الفراشات الجديدة ثم تم التزاوج بين الذكر والانثى ووضع بيض من جديد. كان الحد الأدنى لمدة الجيل 28 يومًا عند درجة حرارة 25 درجة مئوية. ومن خلال الملاحظة والتجريب يوصى بعدم زراعة نباتات مزهرة مثل نبات اللانتانا كامارا بالقرب من العشب. لأن أزهارها تجذب الفراشات البالغة وتوفر لها الغذاء. والتغذية على رحيق أزهارها مما تؤثر بصورة ايجابية على كثافة واعداد البيض كما انها تشكل مكانا مميز للاختباء.