

HOST PREFERENCES OF THE HAWAIIAN BEET WEBWORM, *HYMENIA RECURVALIS* (FAB.) (LEPIDOPTERA: PYRALIDAE)

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Abstract

The present work was carried out at Faculty of agriculture, Fayoum Univ. under laboratory conditions ($25 \pm 2^\circ\text{C}$ and $68 \pm 5\%$ R.H.). The obtained results are summarized as follow:

Third instar larvae of *Hymenia recurvalis* (Fab.) preferred 6 hosts namely, nettle leaf, wild beet, table beet, spinach, sugarbeet and pigweed. Percentages of attracted larvae on these hosts showed 24.3, 18.5, 17.7, 15.0, 13.7 and 10.5%, respectively. The respective attraction on hosts for egg laying were on table beet, spinach, sugarbeet, wild beet, nettle leaf and pigweed. Hawaiian beet webworm, *H. recurvalis* complete its life cycle on all hosts with significant differences in parameters especially pre-oviposition period and rate of egg deposition /♀. Lowest period and highest rate were recorded on nettle leaf.

Keywords: Hawaiian beet webworm - *Hymenia recurvalis* Fab - host preferences - biology.

INTRODUCTION

The Hawaiian beet webworm, *Hymenia recurvalis* (Fab.) was recorded as important pest of spinach, sugarbeet and other crops in central and southern Japan, cause heavy damage to autumn spinach. There are 5-7 generations in the year. Studies indicated that this pest preferred the two families of Amaranthaceae and Chenopodiaceae (Yamada and Koshihara, 1979).

Peter and Balasubramanian (1984) showed that larvae of *H. recurvalis* were collected from *Amaranthus* sp. from June to August in India. Miyahara (1991) stated that larvae of *H. recurvalis* were reared on *Amaranthus lividus* in the laboratory in Japan. In India, Puttaswamy *et al.* (1993) recorded the polyphagous pest, *H. recurvalis* feeding on the weed, *Achyranthes aspera* and the ornamental, *Gomphrena globosa*. More recently, Walsh and Hargreaves (2005) mentioned that the hosts of this insect include each of beetroot (*Beta vulgaris*), silverbeet (*B. vulgaris* var. *cicla*), black pigweed (*Trianthema portulacastrum*), cockscomb (*Celosia* sp.), *Chenopodium* spp., pigweed (*Portulaca* sp.) and *Amaranthus* sp.

In Egypt, this pest was recorded for the first time in 2001 at El-Fayoum Governorate on sugarbeet plants (Hussein, 2001). On the other hand, El-Gendi *et al.*

(2006) recorded that *H. recurvalis* was the most dangerous defoliators of sugarbeet plants at El-Fayoum.

Therefore the current study aimed to estimating the host range of *H. recurvalis*. Also biological aspects of this insect on sugarbeet, table beet, spinach and their weeds, wild beet, nettle leaf pigweed and determine the host preference were considered.

MATERIALS AND METHODS

To determine host preference for the larvae of *H. recurvalis* fifteen hosts were tested:

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|--|---|
| 1- Sugar beet, <i>Beta vulgaris</i> var. <i>altissima</i> L. | 9- Dock, <i>Rumex dentatus</i> L. |
| 2- Table beet, <i>Beta vulgaris</i> var. <i>vulgaris</i> L. | 10- Field bindweed, <i>Convolvulus arvensis</i> L. |
| 3- Spinach, <i>Spinacia oleracea</i> L. | 11- Chicory, <i>Cichorium pamilum</i> Jacqu. |
| 4- Annual sowthistle, <i>Sonchus oleraceus</i> L. | 12- Nettle leaf, <i>Chenopodium murale</i> L. |
| 5- Black nightshade, <i>Solanum nigrum</i> L. | 13- Wildbeet, <i>Beta vulgaris perennis</i> L. |
| 6- Broad leaf plantain, <i>Plantago major</i> L. | 14- Scarlet pimpernel, <i>Anagallis arvensis</i> L. |
| 7- Chesse weed, <i>Molva parviflora</i> L. | 15- Pigweed, <i>Amaranthus cruentus</i> L. |
| 8- Petty spurge, <i>Euphorbia peplus</i> L. | |

Stock culture of insect :

Infested sugarbeet leaves with *H. recurvalis* larvae were collected from the field El-Hadka village (El-Fayoum) and kept in glass jars (20 cm dia x 30 cm ht.). The introduced leaves for these larvae were washed and dried carefully. Such jars were covered with muslin and held in position by rubber bands. The jars were daily cleaned and fresh sugarbeet leaves were provided for larvae until pupation. The pupae were collected and placed in chimney glass cages until moths emergence. The emerged adults were separated into female and male.

Host preference of *H. recurvalis* larvae:

The host preferences were carried out on the above mentioned hosts (15 hosts). Six replicates were used and each replicate consists of plastic container (40 cm dia. X 20 cm ht.) contained the examined host leaves and 100 larvae of the 3rd instar. After 24h, the tested hosts were examined to calculate the number of larvae on each host.

Host preference of *H. recurvalis* for depositing eggs:

To calculating the total deposited eggs on six hosts, newly 5 couples of *H. recurvalis* were used per replicate (10 replicates). Each replicate consists of wooden box (20x20x20 cm), contained sugar beet, table beet, spinach, wild beet, nettle leaf and pigweed, 5 couples and cotton soaked in 10 % sugar solution. Daily inspection was done for counting the eggs on each host until death of adults.

Biological aspects:

The life cycle of *H. recurvalis* was studied under laboratory conditions $25 \pm 2^\circ\text{C}$ and $68 \pm 5\%$ RH. Ten couples of newly emerged adults were used as replicates per each host (sugarbeet, table beet, spinach, wild beet, nettle leaf and pigweed). Each pair was kept in chimney glass, provided with pieces of cotton soaked in 10 % sugar solution and host as oviposition sites and changed daily. The date of deposited eggs and number of eggs / pair, pre- oviposition, oviposition, post-oviposition and date of death for adults were recorded to determine the duration of these parameters. Newly hatched larvae were transferred individually per host in sterilized Petri dishes (10 cm). Fifty larvae were used as replicates. Observations were daily done to estimate the duration of each larval instar and produced pupae.

Statistical analysis:

The data obtained were statistically analyzed by using F-test and L.S.D. value according to Senedecor and Cochran (1980).

RESULTS AND DISCUSSION

Host preference of *H. recurvalis* larvae:

As shown in fig. (1), the total attracted larvae to study hosts from 600 larvae showed 146, 111, 106, 90, 82 and 65 larvae on the respective hosts, nettle leaf, wild beet, table beet, spinach, sugarbeet and pigweed, with ratios 24.3, 18.5, 17.7, 15.0, 13.7 and 10.5%, respectively. After 24h no attracted larvae to other hosts were recorded. From the above data, nettle leaf, wild beet and table beet were the most preferred hosts for larvae compared with spinach, sugarbeet and pigweed. Statistical analysis showed significant differences between these hosts and the other plants.

Host preference of *H. recurvalis* for depositing eggs:

The total number of eggs on table beet, spinach , sugarbeet, wild beet, nettle leaf and pigweed were 975, 855, 701, 636, 476 and 305 eggs/ 50 females, with an average of 97.5, 85.5, 70.1, 63.6, 47.6 and 30.5 eggs/ 5 females (fig. 2), also, the ratios of deposited eggs showed 24.70, 21.66, 17.76, 16.11, 12.06 and 7.73%, respectively. Statistical analysis showed a highly significant differences in egg deposition between table beet, spinach, sugar beet and the other hosts.

Biological aspects:**Incubation period and hatchability:**

Table (1) showed that, the egg incubation period ranged between 3-4 days and recorded the values, 4.0, 3.7, 3.7, 3.5 and 3.5 days on the respective plants, wild beet, sugarbeet, spinach, nettle leaf, table beet and pigweed the differences between means were significant between wild beet and other host. The highest percentage of hatchability (96.5%) was recorded with nettle leaf, while the lowest one (68.0%) was obtained from spinach with a significantly differences between the last ratio and the others. (Table, 1)

Larval period:

Data in Table (1) indicated that, the larval stage of *H. recurvalis* has five instars. The duration of larval stage lasted, 11.5, 11.1, 11.4, 11.9, 11.3 and 10.3 days when reared on sugarbeet, table beet, spinach, wild beet, nettle leaf and pigweed, respectively. No differences between sugar beet, spinach and nettle leaf but the differences between these hosts and the other hosts were high significant.

Prepupal duration:

As shown in Table (1), the duration of prepupal stage ranged between 1.8 - 2.1 days.

Pupal duration:

The pupal stages lasted 7.7, 11.3, 8.4, 7.9 and 8.3 days when feeding on the respective hosts (Table,1). The pupal durations were statistically significant.

Total duration of immature stages:

Total durations of immature stages ranged between 21- 32 days. The longest period recorded on table beet while the shortest one was achieved on sugarbeet and pigweed. No significant differences were recorded between table beet and wild beet, but the difference between these hosts and other hosts were statistically significant.

Adult longevity:**Female longevity:****Pre- oviposition period:**

Data in Table (2) showed that the pre-oviposition period ranged between 2 and 9 days. The mean shortest period (2 days) recorded on pigweed, while the longest one (9 days) were proved on wild beet. Statistical analysis showed a highly significant difference between the obtained means.

Oviposition period:

When this insect was reared on leaves of sugarbeet, table beet, spinach, wild beet, nettle leaf and pigweed, the oviposition period recorded 13.5, 12.7, 12.8, 10.3, 13.9 and 12.7 days (Table 2). Generally, the differences between the studied hosts were statistically insignificant.

Post oviposition period:

Post oviposition period was significantly differed with sugarbeet (5.3 days) compared with the fifth other hosts. As a general trend, the statistical analysis proved insignificant in the total of female longevity with six hosts. The longest period was 22.8 days on sugarbeet, while the shortest 19.1 days on spinach.

Fecundity:

As shown in Table (2), the tested hosts produced significant influence on fecundity when feeding on pigweed and nettle leaf, number of egg /female were 244.8 and 167.1 associated with 17.4 and 11.8 eggs/female/day. Feeding on sugarbeet, table beet, spinach and wild beet had no significant effect on the fecundity showing the values, 4.4, 6.4, 4.2 and 7.2 egg /♀/day.

Sex ratio:

The sex ratio (♀: ♂) not varied with rearing on sugarbeet and table beet (1.5:1). But on other hosts these values varied to recording 1:1.2, 1.9:1, 1.9:1 and 2.3:1 on spinach, wild beet, nettle leaf and pigweed, respectively.

As conclusion of the above mentioned results, *H. recurvalis* attacking sugarbeet, table beet, spinach, wild beet, nettle leaf and pigweed under laboratory conditions (25 ± 2 °C and $68 \pm 5\%$ R. H.) and the weeds, *Chenopodium murale*, *Beta vulgaris perennis* and *Amaranthus cruentus* were host preferable than the other experimented hosts. So this pest appear all over the year on Chenopidaceae plants.

The obtained results are in full agreement with those obtained by El- Gendi *et al.* (2006) in Egypt, who reared this pest on leaves of sugar beet Peter and Balasubramanian (1984) who collected the larvae from *Amaranthus* spp in Japan, Yamada and Koshihara (1979) who recorded this pest as serious on spinach, sugar beet and other crops. Recently, Walsh and Hargeaves (2005) recorded that *H. recurvalis* feeding on beetroot (*Beta vulgaris*), silverbeet (*B. vulgaris* var. *cicla*), black pigweed (*Trianthema portulacastrum*), cockscomb (*Celosia* sp.), *Chenopodium* spp., pigweed (*Portulaca* sp.) and *Amaranthus* sp. from June to August.

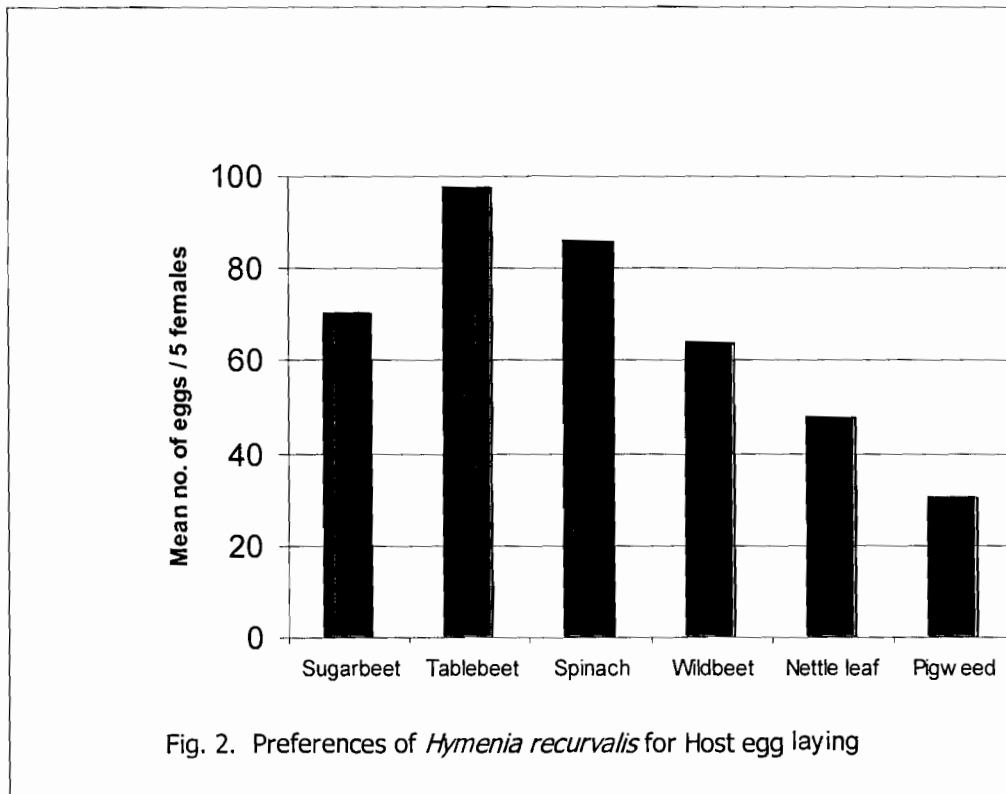
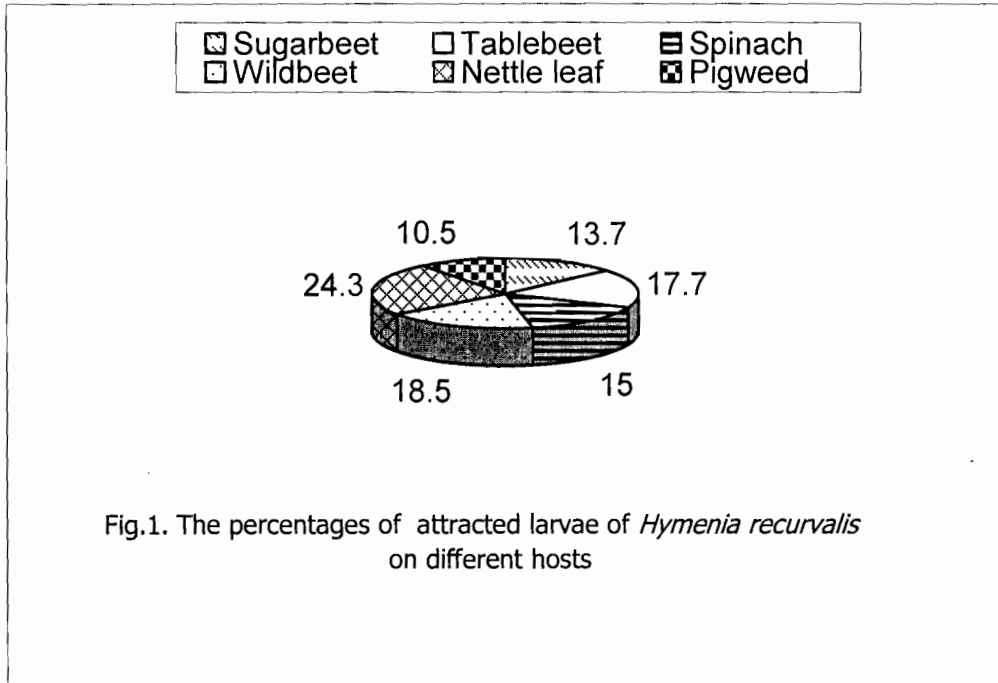


Table 1. Hatchability and durations (in days) of the immature stages of *Hymenia recurvalis* when reared on different hosts under lab. conditions (25 ± 2 °C and 68 ± 5 % RH.).

Hosts	Eggs		Larvae						Pre-pupae	Pupae	Total
	Incubation period	Hatchability %	1 st	2 nd	3 rd	4 th	5 th	Total			
Sugarbeet	3.7 ± 0.11b (3-4)	91.5 ± 1.33a (60-100)	1.6 ± 0.13 (1-3)	2.8 ± 0.12 (2-4)	2.4 ± 0.11 (2-3)	2.4 ± 0.20 (1-3)	2.3 ± 0.01 (1-3)	11.5 ± 0.27ab (9-12)	2.0 ± 0.00 (2-2)	7.7 ± 0.33d (5-10)	24.8 ± 0.34bc (21-27)
Table beet	3.5 ± 0.12b (3-4)	90.5 ± 0.27a (70-100)	1.3 ± 0.10 (1-2)	2.6 ± 0.15 (2-4)	2.3 ± 0.11 (2-3)	2.6 ± 0.18 (1-3)	2.3 ± 0.18 (1-3)	11.1 ± 0.30b (9-14)	1.9 ± 0.19 (1-2)	11.3 ± 0.25a (9-13)	27.8 ± 0.54a (24-32)
Spinach	3.7 ± 0.10b (3-4)	68.0 ± 0.37b (40-100)	3.0 ± 0.00 (3-3)	2.7 ± 0.10 (2-3)	1.6 ± 0.11 (1-2)	2.1 ± 0.04 (2-3)	2.2 ± 0.11 (2-4)	11.4 ± 0.17ab (10-13)	2.1 ± 0.09 (1-3)	8.4 ± 0.18c (7-9)	25.5 ± 0.31b (23-27)
Wild beet	4.0 ± 0.05a (3-4)	92.5 ± 0.32a (50-100)	2.0 ± 0.05 (2-3)	2.8 ± 0.10 (2-3)	2.8 ± 0.12 (2-4)	2.0 ± 0.00 (2-2)	2.3 ± 0.10 (2-3)	11.9 ± 0.10a (11-14)	1.9 ± 0.05 (1-2)	9.7 ± 0.27b (7-12)	27.6 ± 0.30a (26-30)
Nettle leaf	3.7 ± 0.10b (3-4)	96.5 ± 0.19a (70-100)	3.1 ± 0.12 (2-4)	2.1 ± 0.07 (2-3)	1.8 ± 0.09 (1-2)	2.3 ± 0.10 (2-3)	2.0 ± 0.10 (1-3)	11.3 ± 0.25ab (9-13)	1.9 ± 0.07 (1-2)	7.9 ± 0.21d (7-10)	24.8 ± 0.40bc (23-27)
Pigweed	3.5 ± 0.11b (3-4)	95.0 ± 0.13a (80-100)	2.6 ± 0.18 (1-3)	2.1 ± 0.14 (1-3)	1.3 ± 0.10 (1-2)	2.2 ± 0.08 (2-3)	2.3 ± 0.15 (1-3)	10.3 ± 0.22c (8-12)	1.8 ± 0.08 (1-2)	8.3 ± 0.25c (7-10)	23.9 ± 0.41c (21-27)
L.S.D. (5%)	0.29	0.74						0.73	-	0.26	1.06

N.B. :The data indicated that (means ± S.E.) but between parenthesis indicated that the range.

Table 2 . Longevity , fecundity and sex ratio for adults of *Hymenia recurvalis* when reared on different hosts under lab. conditions :
(25 ± 2 °C and 68 ± 5 % RH.).

Hosts	Female longevity (in days)				Male longevity	Fecundity		Sex ratio ♀:♂
	Pre-oviposition	Oviposition	Post-oviposition	Total		No. eggs / ♀	No. eggs / ♀ / day	
Sugarbeet	3.9 ± 0.30 cd (2-5)	13.5 ± 0.40 (11-13)	5.3 ± 1.10 a (2-12)	22.8 ± 1.10 (17-29)	18.1 ± 1.40 ab (9-26)	58.5 ± 4.00 c (43-84)	4.4 ± 0.41 c (3.3-7.6)	1.5 : 1
Table beet	4.3 ± 0.20 c (3-5)	12.7 ± 0.50 (11-15)	2.9 ± 0.30 b (2-4)	19.9 ± 0.7 (18-23)	13.2 ± 1.30 bc (7-20)	79.7 ± 5.81 c (50-104)	6.4 ± 0.50 c (4.2-9.5)	1.5 : 1
Spinach	5.4 ± 0.40 b (3-7)	12.8 ± 1.30 (7-19)	1.3 ± 0.30 b (1-2)	19.1 ± 1.30 (15-27)	19.4 ± 2.30 a (6-25)	54.2 ± 7.22 c (24-101)	4.2 ± 0.20 c (3.3-5.6)	1 : 1.2
Wild beet	8.3 ± 0.30 a (6-9)	10.3 ± 1.00 (3-14)	2.2 ± 0.40 b (1-4)	20.8 ± 1.40 (11-26)	12.0 ± 2.10 c (3-23)	44.1 ± 4.71 c (9-58)	4.2 ± 0.22 c (3.0-4.9)	1.9 : 1
Nettle leaf	4.1 ± 0.20 d (3-5)	13.9 ± 1.70 (9-24)	2.4 ± 0.30 b (1-4)	19.3 ± 1.51 (16-29)	19.5 ± 1.10 a (13-23)	244.8 ± 39.30 a (53-472)	17.4 ± 1.80 a (4.4-27.2)	1.9 : 1
Pigweed	3.0 ± 0.10 d (2-4)	12.7 ± 1.70 (7-21)	3.0 ± 0.50 b (1-6)	19.8 ± 1.90 (12-29)	15.9 ± 2.10 abc (3-26)	167.1 ± 42.70 b (25-354)	11.8 ± 2.30b (2.8-26.7)	2.3 : 1
L.S.D. (5%)	0.87	-	1.7	-	5.3	67.3	3.7	

N.B. :The data indicated that (means ± S.E.) but between parenthesis indicated that the range.

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التفضيل العوائلى لدودة هاوايى الناسجة لأوراق البنجر *Hymenia recurvalis*سيد حسين أحمد حسين^١ ، عاطف أحمد عبدالجيد^٢

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٢ قسم وقاية النباتات - كلية الزراعة بالفيوم - جامعة الفيوم.

- أجريت هذه التجربة بكلية الزراعة جامعة الفيوم تحت الظروف المعملية (٢٥ ± ٢ م ، ٦٨ ± ٥ % رطوبة نسبية) ، وأوضحت النتائج ما يلي:
- ١- وجد أن يرقات العمر الثالث لهذه الحشرة تفضل ستة عوائل وهى الزربيح، السلق، بنجر المائدة، السبانخ، بنجر السكر و عرف الديك.
 - ٢- نسبة انجذاب اليرقات لهذه العوائل معمليا بالترتيب على التوالى هي ١٨,٥، ٢٤,٣ ، ١٧,٧ ، ١٥,٠٠ ، ١٣,٧ ، ١٠,٥ % .
 - ٣- كان ترتيب العوائل حسب الأفضلية في وضع البيض بنجر المائدة، السبانخ، بنجر السكر، السلق، الزربيح ثم عرف الديك.
 - ٤- من الدراسات البيولوجية لهذه الآفة ونتائج التحليل الأحصائى تبين أنها أتمت دورة حياتها على كل العوائل الستة بفروق معنوية في كل القياسات وخاصة فترة ما قبل وضع البيض والمعدل اليومي لوضع البيض لكل أنثى وقد سجلت اقصر فترة واعلى معدل لوضع البيض على الزربيح.