The influence of different host plants on some biological aspects of *Heliothis armigera* (Hub.)

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Summary. The suitability of 6 different plants as natural food for *Heliothis armigera* was tested. The different biological aspects of *H. armigera* were taken in consideration. Kidney bean pods and cotton plant leaves were the most successful host plants tested as they increased the pupal weight and the reproductive potential of the resulting moths, followed by lettuce, which decreased the larval duration remarkably.

Heliothis armigera attacks several crops and vegetables in Egypt and has become a major pest in recent years. Because of its economic importance, many previous workers[1-3] have attempted to tackle the problem on the basis of biological studies. However, little is known about the behavioural response of this pest towards its different hosts[4,5].

The present investigation was conducted to investigate which are the most acceptable hosts which support growth well, and also to evaluate the influence of the different host plants on the biological activity and fecundity of the pest.

Materials and methods. Newly hatched larvae of *H. armigera* were obtained from laboratory cultures reared on castor oil plant leaves at 27 °C and 60% relative humidity. The larvae were reared individually on 6 different host plants, namely green kidney bean pods (*Phaseolus vulgaris* L.), lettuce leaves (*Lactuca sativa* L.), dwarf mallow (*Malva parviflora* L.), cotton leaves (*Gossypium barbadense*), musk mallow (*Hibiscus abelmoschus*) and castor oil plant leaves (*Ricinus communis* L.).

For each plant tested, 1 newly hatched larva was placed in a clean plastic pot (6.5 × 7.0 cm) and offered daily the host being examined. The pot was covered with a perforated lid. 50 replicates of the pots were used for each plant. The experimental pots were incubated in an incubator at 27 °C and 60% relative humidity. Care was taken to avoid insect diseases by transferring the experimental larvae daily to clean sterilized pots previously rinsed with 2% formaldehyde solution. The general behaviour, feeding activity, growth rate and mortality of the larvae were observed daily. The resulting pupae were weighed within 24 h of pupation.

To evaluate the role of larval diet on adult activity, newly emerged adults previously reared on each the of the tested host plants as larvae were confined in mating jars of 1 kg capacity. 1 pair was put in each jar. Daily observations were conducted and the number of eggs was counted during the ovipositional period of the adult females. At least 10 replicates of the mating jars were studied for each plant. The data obtained were analysed statistically, and are summarized in tables 1 and 2.

Results and discussion. 1. Effect of the different hosts on the developmental stages of H. armigera. The results shown in table 1 show that the larval duration of *H. armigera* was remarkably affected by the diet offered to the larva during its whole life. Lettuce, cotton and kidney bean pods ranked the first among the tested host plants. They decreased significantly the larval duration of the larvae tested. Abul-Nasr et. al[3] and Dhandapani and Balasubramian showed that maize also decreased the larval duration of the same species.

Table 1. Effect of different hosts on larval development and pupal stage

Host	Whole larval duration in days	Mortality (%)	Pupal duration (mean ± SE)	Pupal weight (mg, mean ± SE)	Pupal mortality (%)
Lettuce	12.78 ± 0.68⁻	10	11.83 ± 0.60⁻	329 ± 0.08*	18
Kidney bean pods	14.19 ± 0.93	10	13.33 ± 0.55	378 ± 0.01	10
Cotton leaves	16.08 ± 1.32⁻	4	16.43 ± 0.41**	337 ± 0.07⁻	4
Dwarf mallow	19.20 ± 0.89**	22	16.83 ± 0.54**	273 ± 0.08**	26
Musk mallow	23.32 ± 1.20**	16	17.45 ± 0.59**	317 ± 0.02*	16
Castor oil plant leaves	21.68 ± 0.96**	32	23.57 ± 0.62**	312 ± 0.01*	34
F-value	8.87		77.32	4.62	
L.S.D. at 0.05	2.80		1.93	46.00	
L.S.D. at 0.01	4.04		2.77	67.00	

* Significant difference; ** highly significant difference; ⁻ not significant difference.

Table 2. Effect of different host plants on moth longevity and egg laying activity of *Heliothis armigera*

Host plant	Pre-oviposition period (days)	Oviposition period (days)	Post-oviposition period (days)	Longevity of adult females (days)	Fecundity (No. of eggs/female)
Lettuce	3.5 ± 0.17⁻	15.5 ± 0.90**	1.6 ± 0.31*	20.6 ± 1.00**	485.32 ± 31.68*
Kidney bean pods	3.2 ± 0.13	20.6 ± 0.50	2.1 ± 0.29	25.9 ± 0.59	698.34 ± 12.90
Cotton leaves	3.1 ± 0.31⁻	17.0 ± 0.86**	1.7 ± 0.26⁻	21.8 ± 0.87**	506.50 ± 19.12⁻
Dwarf mallow	3.8 ± 0.26*	14.8 ± 0.74**	2.7 ± 0.21*	21.3 ± 0.58**	210.30 ± 19.13**
Musk mallow	3.4 ± 0.16⁻	13.9 ± 0.35**	1.7 ± 0.37⁻	19.0 ± 0.46**	329.32 ± 13.28*
Castor oil plant leaves	3.1 ± 0.10⁻	13.6 ± 0.70**	1.7 ± 0.21⁻	18.4 ± 0.49**	194.10 ± 21.75**
F-value	0.04	13.39	4.2	18.6	20.97
L.S.D. at 0.05		1.69	0.49	1.66	209.24
L.S.D. at 0.01		4.42	0.69	2.37	299.69

* Significant; ** highly significant; ⁻ not significant.

On the other hand, musk mallow and castor oil plant leaves extended the larval period greatly, to nearly twice that of larvae fed on lettuce (table 1).

With respect to larval mortality, it was observed that the short larval duration was associated with low larval mortality (table 1); when the mortality rate increased, the larval duration was extended.

As regards the pupal stage, it was observed that under a constant temperature of 27 °C and 60% relative humidity the duration of this stage, for pupae developing from larvae fed on different diets, varied considerably according to the host plant used. The shortest pupal duration was 11.83 ± 0.6 days in the case of pupae developing from larvae reared on lettuce, while the longest one was 23.57 ± 0.62 days in case of pupae resulting from larvae fed on castor oil plant leaves (table 1).

On the other hand, the pupal weight was significantly affected by the nutritional value of the larval diet. Pupae developing from larvae fed on kidney bean pods and cotton plant leaves gave rise to heavier pupae (378 ± 0.01 and 337 ± 0.07 mg/pupa, for both diets respectively). The present finding is in agreement with the data obtained by Dhandapani and Balasubramanian[4], who found the heaviest pupae of *H. armigera* on cotton. The minimum pupal weight was obtained from larvae reared on dwarf mallow leaves, it was 273 ± 0.08 mg/pupa.

Castor oil plant leaves which had a retardation effect on the developmental duration gave pupae of normal wight; 312 ± 0.01 mg/pupa (table 1).

2. Effect of larval diet on the activity of the emerging adults. The data obtained in table 2 clarify that the duration of the ovipositional period, as well as the life span of the adults, was remarkably influenced by the different larval food. Maximum longevity was shown by larvae reared on kidney bean pods and minimum longevity by those reared on castor oil plant leaves.

The larval food also has a significant effect on the reproductive potentiality of the emerging moths (table 2). Females which emerged from larvae fed on kidney bean pods laid the highest number of eggs (698.34 ± 12.9 egg/female), followed by moths from larvae fed on cotton plant leaves. The lowest average number of eggs was recorded from moths which emerged from larvae reared on castor oil plant leaves.

Statistical analysis of the data revealed that kidney bean pods and cotton plant leaves significantly affected the reproductive potentiality of the emerging females. This may be due to the nutritional constituents, especially protein, in these plants[4,6]. The presence of high quantities of water and sugar in cotton plant leaves[7] may induce the larvae to consume more food. Thus heavy pupae were obtained and the reporductive potential of the females increased.

Therefore, the order of preference of the different hosts can be arranged as follows with regard to the different biological aspects: kidney bean pods = > cotton plant leaves > lettuce ≫ musk mallow ≫ castor oil plant leaves = dwarf mallow.

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Mechanism of intercellular synchronization in the rabbit sinus node[1]

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Summary. A strip of tissue cut from the sinus node, 0.5 mm wide, was studied in a sucrose gap chamber. With the gap width of 0.6–1.5 mm the 2 ends of the preparation showed nonsynchronous activity. Synchronization could be re-established by a shunt resistor, 15–100 kΩ, connected a cross the gap, suggesting that synchronous firing of the sinus node requires local circuit currents.

Despite the fact that sinus node cells are coupled electrically[3-6], the mechanism of the synchronization remains unclear[7,8]. Thus we attempted to find out whether or not local circuit currents could bring about synchronization between 2 parts of a sinus node strip separated by a sucrose gap.

Methods. Spontaneously active strips, 4–6 mm long and 0.5 mm wide, were cut from the rabbit sinus nodes parallel to the crista terminalis. The distance between crista terminalis and cut line was 2–2.5 mm. Such preparations comprised the pacemaker cells almost exclusively[6], and were verified electrophysiologically (fig. 1). Each strip was mounted in a 3-compartment chamber, tyrode – sucrose – tyrode. The gap width could be changed between 0 and 2 mm. Perspex plates of 0.09 mm in thickness separated the compartments. The preparation was pulled through 0.5-mm holes drilled in these plates, and the holes made watertight with silicone grease. Both ends of the strip protruded freely into the outer compartments perfused with Tyrode solution (NaCl 147 mM, KCl 2.7 mM, $CaCl_2$ 1.8

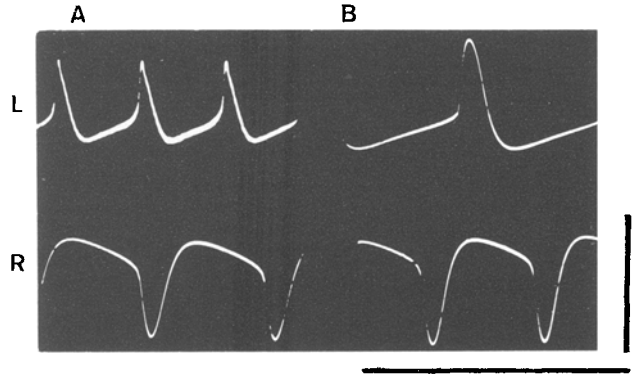

Fig. 1. Control transgap action potentials recorded from 2 different strips (A and B). L, activity of the left-hand side of the strip, the right-hand side being depolarized by KCl. R, activity of the right-hand side of the same strip, the left-hand side being now depolarized by KCl. Time: 1 sec, voltage: 50 mV.