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Developmental potential of Henosepilachna vigintioctopunctata (F.) (Col., Coccinellidae) on some wild solanaceous plants[1]

By G. C. SACHAN and Y. S. RATHORE

Abstract

Studies on growth and development of *Henosepilachna vigintioctopunctata* on solanaceous wild plants revealed that varied number of larvae were able to survive on these plants except on *Solanum pubescens.* Maximum number of larvae survived on *S. xanthocarpum* and *S. indicum* followed by *Datura fastuosa, S. melongena* and *S. khasianum.* On all the test plants the number of larvae pupated all reached to the adult stage. The adults were found heavier on *S. indicum* and lighter on *S. melongena.* Large number of males emerged on *S. khasianum* while on *S. melongena* females outnumbered males. On other plants male and female emerged in equal number. Average adult longevity was greater on *S. xanthocarpum* and lowest on *S. khasianum.* Adults on *S. khasianum* died within few days without egg laying. On all the plant species males lived for a longer period than females. Pre-oviposition, oviposition and post-oviposition periods also varied and indicated higher on *S. xanthocarpum* and lowest on *S. indicum.* Fecundity was also higher on *S. xanthocarpum* but least on *D. fastuosa.* Overall comparison of these plant species clearly established the superiority of *S. xanthocarpum* and *S. indicum* over other host plants for growth and development of *H. vigintioctopunctata.*

1 Introduction

Henosepilachna vigintioctopunctata (Fabr.) is a very destructive pest and causes serious damage to brinjal and potato crops all over India and South East Asia (PRUTHI 1969). The detailed biology of this insect on cultivated crops has been reported by several workers (PANDEY and UMA SHANKER 1975; MUKHERJEA 1977), but very little information is available on wild plants (THOMAS et al. 1969). This investigation was, therefore, undertaken to work out the developmental pattern of *H. vigintioctopunctata* on wild solanaceous plants.

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2 Materials and methods

Eggs of *H. vigintioctopunctata* were obtained from brinjal leaves. These eggs were incubated at 27 ± 1 °C and 85 ± 5 % r.h. Six plant species viz., *Solanum melongena* Linnaeus, *S. xanthocarpum* Schrad. and Wendl., *S. indicum* Linnaeus, *S. khasianum* Clarke emend. Sen Gupta, *S. pubescens* Willd. and *Datura fastuosa* Linnaeus were used as test plants. First instar larvae (0–12 h old) were released individually on leaves of each plant species which were kept in semi-transparent plastic petridish (10 cm dia). A wet piece of cotton was used to cover the base of the petiole to avoid dessication of food. Each treatment was replicated five times and each replication comprised of 10 larvae. The experiment was conducted in an incubator maintained at 27 ± 1 °C, 85 ± 5 % r.h. and 12 h dark: 12 h light photoperiod. Freshly emerged adults were sexed and kept for oviposition in battery jars (12 × 10 cm). A small twig of respective hosts having 4–5 leaves were fixed in a small vial (5 × 2.5 cm) containing water, with the help of cotton, which in turn was placed in battery jars. The mouth of battery jar was covered by a piece of muslin cloth. Fresh twigs were replaced at 24 h interval. Observations were recorded on duration of various larval instars, per cent larval survival, prepupal and pupal period, per cent adult emergence, adult weight, sex ratio, adult longevity, fecundity, preoviposition, oviposition and post-oviposition periods. For over all comparison various indices as suggested by PANT and DANG (1969), HOWE (1971), SEHGAL (1971), PRASAD and BHATTACHARYA (1975), MUKHERJEA (1977) and DESHMUKH et al. (1977) were computed. Data was subjected to analysis of variance on TDC – 12 computer.

3 Results and discussion

Perusal of table 1 reveals that significantly higher larval survival (100 %) was obtained when *S. xanthocarpum* and *S. indicum* were fed to the larvae followed by *D. fastuosa* (83.08) and *S. melongena* (78.89). The poor larval survival was observed on *S. khasianum* (33.64 %). On *S. pubescens* no larva reached up to pupal stage. The reason for such a high mortality could be attributed due to glabrous nature of leaves which might have prevented the sufficient feeding of required tissues. When hairs were scrapped the few larvae survived for about two weeks. This further indicates that besides physical barrier, perhaps, toxic compounds present in leaves were also responsible for total mortality of larvae. In the present investigation per cent larval survival on *S. melongena* was quite low (76.89 %) as compared to that reported by PANDEY and UMA SHANKER (1975) and MUKHERJEA (1977) which was 87.5 and 93.3 % respectively.

Four distinct larval instars were observed on all the plant species. RATHORE and VERMA (1977) also found four instars when larvae reared on potato. However, duration of different instars varied greatly (table 1). Larvae took significantly longer time to complete first instar when fed on *D. fastuosa*. There was no significant difference in the duration of first instar between other plant species. The duration of second instar ranged from 2.5 to 2.9 d but did not show significant difference. The third and fourth instar larvae again took longer time to complete these instars on *D. fastuosa* and *S. melongena* while on other plant species it did not differ significantly. When mean larval duration was computed it was 11.0, 11.6, 11.6, 11.9 and 14.4 d on *S. indicum*, *S. khasianum*, *S. xanthocarpum*, *S. melongena* and *D. fastuosa* respectively. The larval period on *S. melongena* reported by PANDEY and UMA SHANKER (1975) is in agreement with the present investigation.

Prepupal period was significantly shorter on *S. khasianum* than other plant species. Similarly pupal period was also shorter on *S. khasianum* and it did not differ on other host plants. All the larvae those pupated emerged as adult. A

Table 1. Average larval period of different instars, larval period, larval survival, prepupal and pupal period, per cent adult emergence, adult weight and sex ratio of *H. vigintioctopunctata* on different host plants

Host	Duration of larval instars (d) I	II	III	IV	Mean larval duration (AV)	Per cent larval survival (N)	Prepupal period (d)	Pupal period (d)	Per cent adult emergence	Adult weight (mg)	Sex ratio ♀ : ♂
S. melongena	2.3	2.5	3.1	3.9	11.9	76.89 (62.36)	1.6	3.9	76.89 (62.36)	22.106	1 : 0.61
S. xanthocarpum	2.3	2.9	2.6	3.7	11.6	100.00 (90.00)	1.6	4.0	100.00 (90.00)	22.944	1 : 1.04
S. indicum	2.2	2.6	2.7	3.4	11.0	100.00 (90.00)	1.5	4.0	100.00 (90.00)	25.648	1 : 1.08
S. khasianum	2.2	2.7	2.9	2.7	11.6	33.64 (35.22)	1.2	3.4	33.64 (35.22)	25.556	1 : 2.00
D. fastuosa	3.8	2.9	3.3	4.2	14.4	83.08 (66.06)	1.5	4.0	83.08 (66.06)	22.698	1 : 1.20
C. D. at 5 %	0.29	NS	0.35	0.36	0.69	(8.78)	0.24	0.34	(8.78)	2.377	

Values in parenthesis indicate angular transformed value.

Table 2. Pre-oviposition, oviposition and post oviposition period, adult longevity, fecundity, incubation period, per cent egg hatch of *H. vigintioctopunctata* on different test plants

Host	Pre-oviposition period (d)	Oviposition period (d)	Post oviposition period (d)	Adult longevity (d) Female Range	Female Mean	Male Range	Male Mean	Average	Fecundity	Per cent egg hatch	Incubation period (d)
S. melongena	10.5	33.2	20.5	50–84	66.2	58–139	89.7	77.00	258.75	74.61	4.058
S. xanthocarpum	12.4	73.5	22.8	56–145	108.7	101–155	127.6	111.33	667.25	65.56	4.015
S. indicum	7.8	35.0	10.8	47–63	53.6	49–83	66.0	58.25	646.80	49.37	4.111
S. khasianum	–	–	–	4–13	7.7	1–12	6.0	6.87	–	–	–
D. fastuosa	12.6	53.2	11.8	32–111	77.6	63–127	91.2	86.12	249.75	65.49	3.984

Table 3. Growth index values of *H. vigintioctopunctata* on different test plants

Host	Growth index (N/AV)	Howe's growth index (Log S/T)	Larval pupal index	Adult weight index	Adult longevity index Female	Male	Average	Oviposition index	Survival index	Success index
S. melongena	6.439	0.364	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
S. xanthocarpum	8.554	0.394	1.011	1.035	1.693	1.422	1.446	2.579	1.301	1.940
S. indicum	9.091	0.419	1.060	1.160	0.834	0.735	0.756	2.500	1.301	1.901
S. khasianum	2.900	0.303	1.061	1.156	0.121	0.066	0.089	–	0.438	–
D. fastuosa	5.761	0.306	0.863	1.027	1.200	1.016	1.120	0.965	1.081	1.023

common trend was, therefore, observed for per cent larval survival, per cent pupation and per cent adult emergence.

The adult weight taken on the day of emergence indicated that adult gained higher weight when fed as larvae on *S. indicum* and *S. khasianum* as compared to those fed on *S. melongena*, *S. xanthocarpum* and *D. fastuosa*. There was no significant difference in the weight of adults obtained from last three plant species. On all the plant species females gained higher weight than males. Sex ratio computed for insects on all the plant species indicated that females outnumbered males on *S. melongena* whereas those reared on *S. khasianum* males outnumbered the females. On other hosts males and females emerged more or less in equal numbers. Similar sex ratio on *S. melongena* was also observed by Pandey and Uma Shanker (1975) and Mukherjea (1977).

The data obtained on pre-oviposition, oviposition and post-oviposition period differed from host to host and are presented in table 2. Pre-oviposition period was longer when *S. xanthocarpum* was provided as food (12.4 d) followed by *D. fastuosa; S. melongena* occupied an intermediate position. This period was shortest on *S. indicum* (7.4 d). Interestingly, when *S. khasianum* was fed to *H. vigintioctopunctata* the adults survived for a shorter duration and laid no eggs. Ovipositional periods could not be worked out on this plant species. Oviposition period followed the similar trend that is being longest on *S. xanthocarpum* (73.5d) followed by *D. fastuosa* (53.3 d). This period was found about the same when insect was fed on *S. melongena* and *S. indicum*. On the other hand the post oviposition period was longer on *S. xanthocarpum* followed by *S. melongena* while it was shorter on *D. fastuosa* and *S. indicum*.

Adults lived longer on *S. xanthocarpum* followed by *D. fastuosa*, *S. melongena*, *S. indicum* and *S. khasianum*. The longevity was 111.3, 86.1, 77.0, 58.3 and 6.9 d respectively. Females lived for a shorter period than males on all the plant species except on *S. khasianum* where no significant difference appears between longevity of the two sexes.

Adults fed on *S. xanthocarpum* and *S. indicum* laid maximum number of eggs (646.8, 646.0). On *S. melongena* and *D. fastuosa* comparatively very poor fecundity was observed which was in tune of less than fifty per cent of the other two plant species. The per cent egg hatch was maximum on *S. melongena* and least on *S. indicum*. *S. xanthocarpum* and *D. fastuosa* were in intermediate range. No difference was observed in the incubation period of the eggs laid on different host plants.

In order to find out the suitability of host plants in supporting the growth and development of *H. vigintioctopunctata* various growth indices were calculated (table 3). Higher growth index values were obtained on *S. indicum* and *S. xanthocarpum* and lowest on *S. khasianum*. This clearly indicates the superiority of these two hosts over the others. Values obtained by computing growth index of Howe (1971) also followed the same trend except that the values on *S. khasianum* and *D. fastuosa* were same. Other indices such as larval-pupal index, adult weight index, adult longevity index, oviposition index and survival index were also computed. To calculate these indices a value of 1 was given to *S. melongena*. If the value exceeded one the test plant was considered superior over the standard host and if less than 1 the test plant was inferior than the standard. The values for larval-pupal index and adult weight index were higher on *S. indicum* and *S. khasianum* followed by *S. xanthocarpum* and *D. fastuosa*. The adult longevity index was higher on *S. xanthocarpum* (1.446) and lowest on *S. khasianum* (0.089). For other plant species the values were 1.120 and 0.756 on *D. fastuosa* and *S. indicum* respectively. Oviposition index and survival index showed the superiority of *S. xanthocarpum* and *S. indicum* for this insect. Success index which accounts for the oviposition and survival of the individual was also computed. The value computed for this insect is ultimately correlated with the population increase in the next generation. In the present investigation values of success index were higher on *S. xanthocarpum* and *S. indicum.* Variation in the trend of these indices on different food plants clearly reveals that some plants were suitable for larval and pupal development and others for adult longevity and fecundity. However, *S. xanthocarpum* and *S. indicum* proved better than the standard host, *S. melongena* in all respects and *S. khasianum* the poorest one.

On the basis of these observations it appears that wild plants like *S. xanthocarpum, S. indicum* and *D. fastuosa* could act as an important co-lateral and alternate host plants of this insect in nature. This fact was further substantiated by our periodic survey of wild vegetation in the nearby forest area where heavy population of this insect causing severe damage to *S. xanthocarpum* and *S. indicum* was observed. On *D. fastuosa* population build up was found at much later stage. No infestation or presence of insect was observed on *S. khasianum* and *S. pubescens* in nature indicating the presence of physio-chemical barrier.

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Zusammenfassung

Zur Entwicklung und Vermehrung von Henosepilachna vigintioctopunctata (F.) (Col. Coccinellidae) an einigen wild wachsenden Solanaceen

Der in Süd- und Südostasien als Schädling an Kartoffel und Brinjal lebende Marienkäfer *H. vigintioctopunctata* war an 5 von 6 getesteten wilden Solanaceen lebens- und entwicklungsfähig; nur an *S. pubescens* starben die angesetzten Junglarven ab. Die größte Zahl überlebender Larven wurden an *S. xanthocarpum* und *S. indicum* beobachtet; es folgten *Datura fastuosa, S. melongena* und *S. khasianum.* Aus allen Larven gingen Adulte hervor. Diese hatten an *S. indicum* ein größeres, an *S. melongena* ein geringeres Gewicht. Von *S. khasianum* schlüpften mehr ♂♂, von *S. melongena* mehr ♀♀. An den anderen Pflanzen war das Geschlechterverhältnis ausgeglichen. Die mittlere Lebensdauer der Käfer war am längsten bei *S. xanthocarpum,* am kürzesten bei *S. khasianum.* Die Adulten an *S. khasianum* starben innerhalb weniger Tage, ohne Eier zu legen. An allen Pflanzen lebten die ♂♂ länger als die ♀♀. Die Präovipositions-, Ovipositions- und Postovipositionsperiode waren am längsten an *S. xanthocarpum,* am kürzesten an *S. indicum.* An *S. xanthocarpum* war auch die Fekundität am höchsten. Die Untersuchungen zeigten, daß sich der Schädling vor allem an *S. xanthocarpum* und *S. indicum* entwickeln kann, die für ihn somit ein Reservoir bilden.

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Temporal flight pattern of the large pine weevil, Hylobius abietis L. (Coleoptera, Curculionidae), with special reference to the influence of weather

By C. SOLBRECK and B. GYLDBERG

Abstract

The seasonal and diurnal periodicity of dispersal flights of *H. abietis* L. is described based upon suction trap catches in 1978 at a sawmill in Central Sweden. Most flights occurred within two weeks in late May and early June. During the first few days 3–5 times as many males as females were engaged in flight, but this ratio soon changed to 1 : 1. Flights occurred from 7.00 h to 22.00 h. Flight periodicity can be explained largely as a response to immediate weather conditions. The conditions favourable for sustained flight were found to be temperatures above 18–19 °C and wind speeds less than 3–4 m/s.

1 Introduction

The large pine weevil (*Hylobius abietis* L.) is an insect of considerable economic importance. Adult weevils feed on the bark of young conifer plants, thus often causing heavy plant mortality. Dispersal by flight is an important process in the dynamics of pine weevil populations. In May and June the weevils migrate by flight to colonize areas where suitable breeding material, such as roots of newly cut coniferous trees, is available. In this period flying beetles often accumulate in places where odours from freshly cut pine or spruce wood emanate, such as clear cuttings or sawdust heaps (EIDMANN 1974).

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