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Biology and seasonal incidence of *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) on Ashwagandha [*Withania somnifera* (L.) Dunal] in charotur region of Gujarat

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ABSTRACT : Spotted beetle, *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) is one of the major pest of ashwagandha in charotur region of Gujarat. Its seasonal incidence in cultivated ashwagandha during 2008-09 & 2009-10 along with biology was studied. Spotted beetle was active from last week of September to mid of December with a peak population of grubs (7.8 nos/plant) and adults (1.73 nos/plant) in 2nd week of October (41 SMW) during both the years of observation. Population of spotted beetle showed significant positive correlation with atmospheric temperature (Maximum, Minimum & Mean), however, relative humidity had no effect on development of various stages of the pest beetle. The pest completed its life cycle in 20.08±0.24 days on ashwagandha after passing through four larval instars. The longevity of male and female adults of the pest was 67.79±3.96 and 67.20±3.85 days, respectively. The gravid females laid 562.54±76.16 eggs in several batches during the ovipositional period of 45.67±5.19 days.

Keywords : Biology, *Henosepilachna vigintioctopunctata*, Seasonal incidence, *Withania somnifera*

INTRODUCTION

Spotted beetle, *Henosepilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae) is an important pest of solanaceous plants (Rajagopal and Trivedi, 1989). Besides, the pest is also recorded from Cucurbitaceous plants (Mandal, 1971; Mohansundram and Uthamaswamy, 1973; Azam *et al.*, 1974) and solanaceous plants of medicinal importance (Mathur and Srivastava, 1964, Mitra and Biswas, 2002; Venkatesh, 2006; Manjoo and Swaminathan, 2007). Ashwagandha [*Withania somnifera* (L.) Dunal], also known as Indian ginseng is an important medicinal plant used in Ayurvedic formulations to treat various aliments of mankind (Sangwan *et al.*, 2004). The plant is very hardy and drought resistant and now cultivated as rainfed crop in almost all the parts of country due to its high value and export potential (Chandranath and Katti, 2010). Domestication of wild plants is responsible for various maladies in these plants, of that depredation of crop by insect pest is foremost. The crop is reported to attack by many insect pests (Manjoo and Swaminathan, 2007; Ramanna *et al.*, 2010). *H. vigintioctopunctata* is one of the major pest of ashwagandha causing severe damage to crop (Manjoo and Swaminathan, 2007; Chandranath and Katti, 2010). The incidence of hadda beetle varies from place to place and year to year due to prevailing environment (Konar and Mohasin, 2002). Information on the incidence of *H. vigintioctopunctata* in the region is very meager. Thus to understand the pest status, seasonality and biology of the pest on ashwagandha in the region present investigation is attempted.

MATERIALS AND METHODS

Studies were conducted during 2008-09 and 2009-10 in Central research Farm of Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand (Gujarat).

Seasonal Incidence of H. *vigintioctopunctata*

Withania somnifera variety JA-134 was sown at the CR farm, DMAPR, Anand in the plot size of 3x4m^2 following standard agronomic practices in the second fortnight of August, 2008 and 2009 adopting line sowing method. In all 75 plants were screened during the entire crop growth period for eggs, grubs, pupae and adults by randomly selecting 5 plants from each plot at weekly interval. Data on weather parameters *viz.*, atmospheric temperatures (maximum, minimum & mean) & relative humidity (morning, evening & mean) were obtained from the Meteorological Department of the Anand Agricultural University, Anand located near to the experimental site. The data of seasonal incidence of the pest on ashwagandha for both the years (separately and pooled) were presented graphically with important weather

parameters namely temperature and relative humidity of same period. Correlation of co-efficient (r) was worked out between incidence of spotted beetle and important weather parameters during the period to find out the influence of weather on population fluctuation.

Biology of *H. vigintioctopunctata*

Grubs of *H. vigintioctopunctata* were collected from the field of Ashwagandha variety JA-134 grown in Farm, Directorate of Medicinal and Aromatic Plants, Anand, Gujarat. These grubs were reared on the leaves of same host in transparent plastic containers of 10x8 cm^2 lined with moistened blotting paper until they reached the pupal stage. The pupae then separated and kept in a single layer in small transparent plastic containers having perforated lid and lined with moistened blotting paper. The emerged adults were collected, sexed and cultured on the leaves of same host in transparent plastic containers of 10x8 cm^2 lined with moistened blotting paper to prevent desiccation of leaves and life stages. Fresh leaf twigs were offered to the adults daily. Adults copulated and laid eggs in batches on the leaves. The egg masses were carefully removed from the leaves along with a small bit of leaf on which they were attached and placed in transparent plastic petri dish (90 mm) lined with moistened blotting paper to avoid desiccation of eggs. The newly hatched grubs were released on leaves kept in transparent petri dish (90mm) lined with moistened blotting paper. The fresh leaves were provided regularly. The observation on pre-oviposition, oviposition, post oviposition periods, fecundity, percentage hatchability of eggs, incubation period and adult longevity was recorded. The total fecundity was recorded by counting and marking the number of eggs laid on each day. Similarly, number and duration of larval instars, survival percentage of grubs and pupa were also determined.

RESULT AND DISCUSSION

Seasonal Incidence of *H. vigintioctopunctata*

The activity of adults and grubs was first noticed in 4th week of September (39 SMW) during 2008-09 and 2009-10, when average population level of grubs and adults were 5.0 & 1.0 and 0.5 & 01 individual per plant, respectively. The average egg population during the period was 04 & 03 nos. per plant, respectively. The pest attained its peak during 2nd week of Oct. (41st SMW) in both the years, when mean population of eggs, grubs and adults were 16, 09 and 1.95 (2008-09) and 7.1, 6.6 and 1.5 (2009-10) respectively. During this period the average maximum, minimum & mean temperature, respectively were, 36.4, 22.9 & 29.60 ^{0}C for 2008-09 and 34.4, 23.3 & 28.9 ^{0}C for 2009-10, whereas, average morning, evening and mean relative humidity (RH) were, 87.0, 39.0 & 63.0 for 2008-09 and 83.6, 39.3 & 61.4 for 2009-10, respectively. The activity of pest then gradually decreased and grub population reached to zero level in 1st week of December (49 SMW) in 2008-09 and 2nd week of December (50 SMW) in 2009-10, however, adult population reached to zero level in 3rd week of December (51 SMW) in both the years of observation. The egg population recorded during December (2009-10) was not fertile. The nil activity of pest was seen on up to harvest of the crop (Fig. 1& 2). The reason attributed to this may be the maturity of the leaves. The present findings corroborates with the finding of Manjoo and Swaminathan (2007), who under Udaipur condition found maximum population of pest on ashwagandha during October, which gradually decreased and reached to zero level in December. However, they recorded reappearance of population in last week of February continuing upto April, but in present finding no reappearance of population till harvest was observed. Venkatesha (2006) in Bangalore condition reported peak population of *E. vigintioctopunctata* in mid August and from last week of August and onwards the population started declining and reached to zero in October. Mathur and Srivastava (1964) reported damage to wild solonaceous plants including ashwagandha by both adult and grubs from April-October with maximum activity period was July-September, when (80%) of leaves of these plants were found damaged. They further reported ashwagandha as preferred crop for hada beetle compared to other solanaceous plants and this was observed by others also (Parihar *et al.*, 1997 and Saeed *et al.*, 1997). Similarly, high level of infestation of *E. vigintioctopunctata* on different crops was reported during June-October in various parts of India (Hameed and Adlakha. 1973; Ramzan *et al.*, 1990; Ghosh and Senapati, 2001).

Analysis of pooled mean data (Fig. 3) for two years on the incidence of spotted beetle revealed high activity of beetle in cultivated ashwagandha from 4th week of September (39 SMW), which further increased and reached to peak in 1st fortnight of October and then decreased gradually and reached to zero level in 3rd week of December (51 SMW). Highest average population (eggs 11.55, grubs 7.8 and adults 1.73 individuals per plant) was reached in 2nd week of Oct (41 SMW), when the average temperature and relative humidity was 29.24 ^{0}C and 62.21 percent, respectively. The high incidence of pest has been reported during the temperature range of 26.4-30.05 (^{0}C) and relative humidity 49.14-69.4

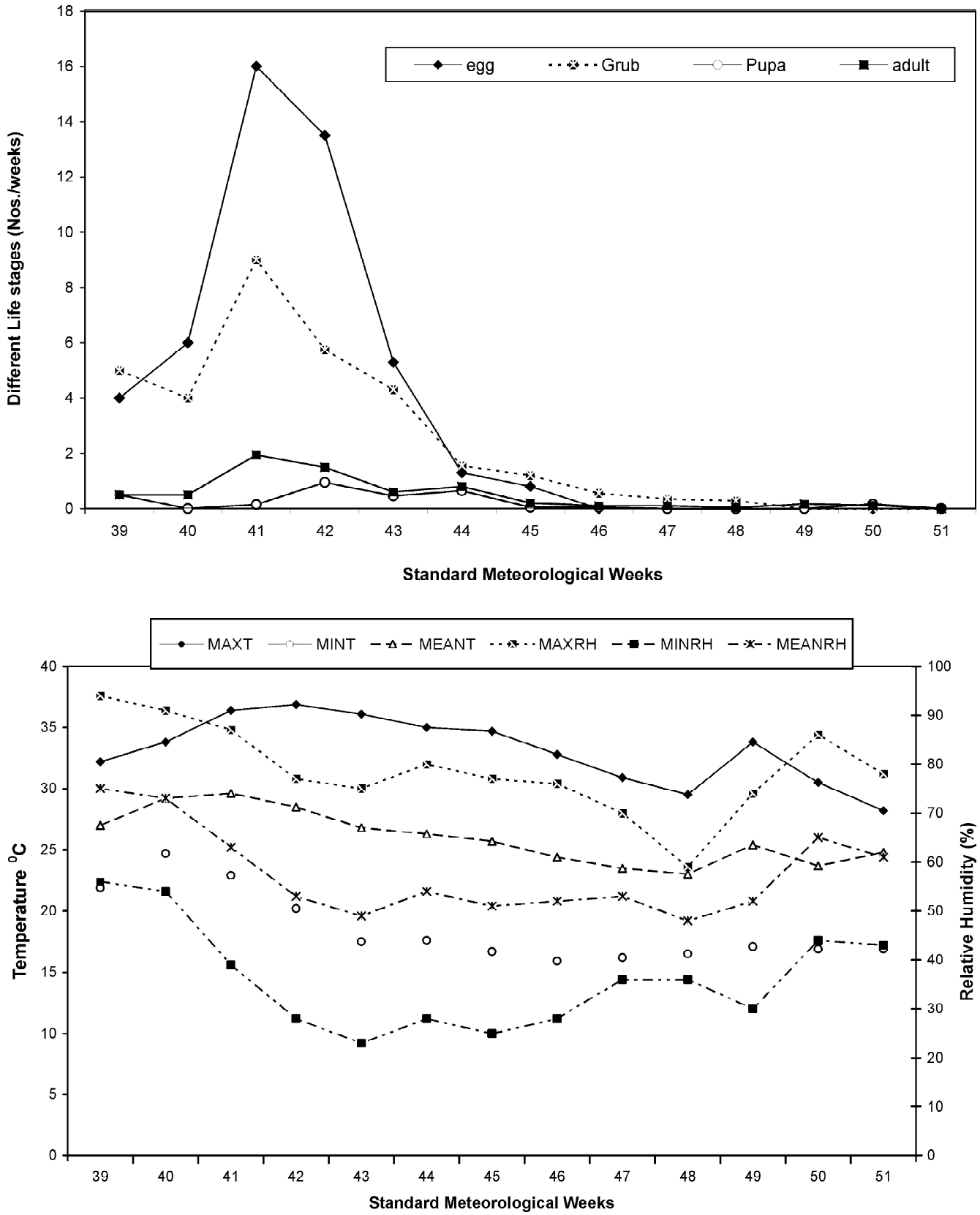

Fig. 1. (A) Weekly incidence of *H. vigintioctopunctata* in ashwagandha (*Withania somnifera*) during 2008-09; (B) Environmental variables during the pest incidence

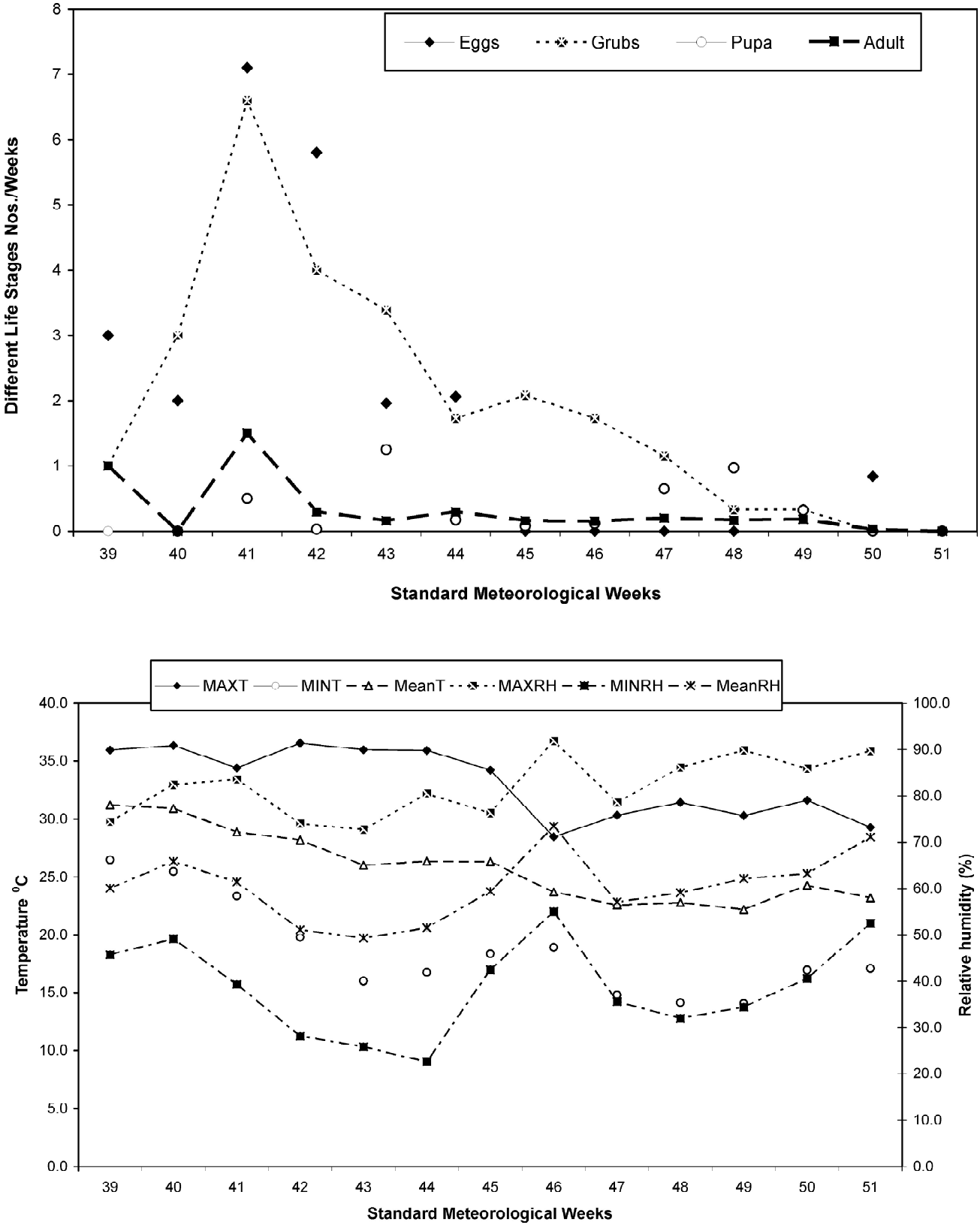

Fig. 2. (A) Weekly incidence of E. *vigintioctopunctata* in ashwagandha (*Withania somnifera*) during 2009-10; (B) Environmental variables during the pest incidence

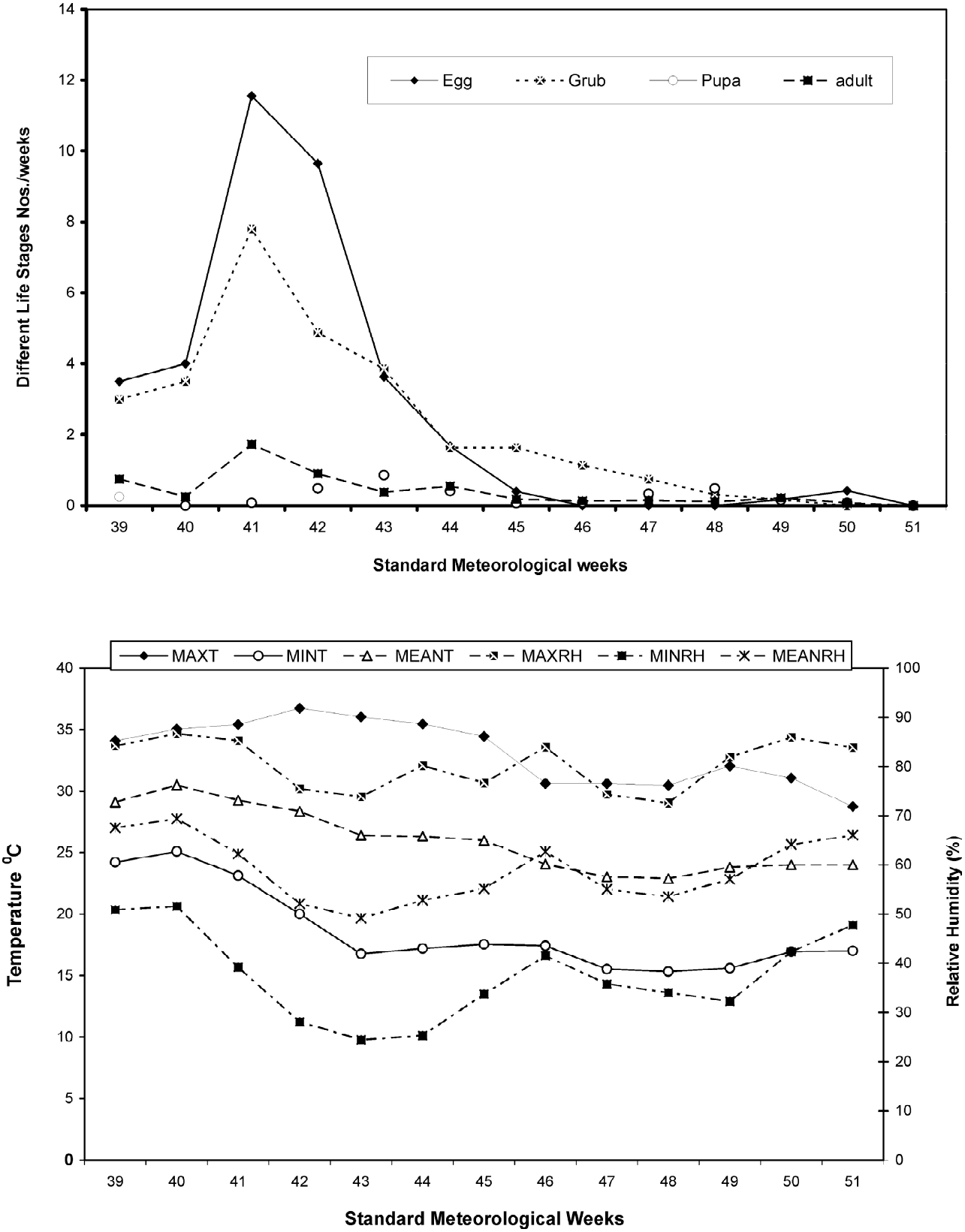

Fig. 3. (A) Weekly incidence of *E. vigintioctopunctata* in ashwagandha (*Withania somnifera*) during 2008-09 &09-10 (Polled); (B) Environmental variables during the pest incidence (polled).

Table 1. Correlation co-efficient between important weather parameter and incidence of *H. vigintioctopunctata*

Life stages	Temperature (^{0}C)			Relative Humidity (%)		
of pest	Maximum	Minimum	Mean	Maximum	Minimum	Mean
Egg	0.708557	0.644918	0.755338	0.108001	-0.08351	-0.01298
Grub	0.76656	0.691899	0.809842	0.097538	-0.06778	-0.00879
Pupa	0.377067	-0.30056	-0.05587	-0.75868	-0.71897	-0.78441
Adult	0.63452	0.590508	0.666273	0.162867	-0.09583	-0.00541

Table 2. Developmental durations of different life stages of *H. vigintioctopunctata* on *W. somnifera* under laboratory condition

Stages	Duration of development in days (Mean±SE)	Range (Days)
Egg	4.75 ± 0.24	3-7
Larvae :		
I	3.08±0.06	3-4
II	2.00±0.06	1-2
III	2.38±0.10	2-3
IV	3.42±0.10	3-4
Total Larval Period	10.88±0.13	10-12
Pre-pupa	1.04±0.04	1-2
Pupa	3.41±0.10	3-4
Egg to Adult	20.08±0.24	18-22

N=25

Table 3. Reproductive phases and fecundity of *H. vigintioctopunctata* on *W. somnifera* under laboratory condition

Stages	Duration of development in days (Mean±SE)	Range (Days)
Pre-oviposition period	9.21 ± 1.64	4-37
Oviposition period	45.67± 5.19	3-97
Post-oviposition period	12.42 ± 1.64	0-27
Adult Longevity:		
Male	67.79 ± 3.96	27-108
Female	67.20 ± 3.85	37-108
Fecundity (Nos.)	562.54 ± 76.16	61-1560 (Nos.)
Hatchability (%)	95.55 ± 1.26	75.61-100 (%)

N=25

percent. In field condition high incidence of the pest has been reported between the temperature range 24-31 ^{0}C and Relative humidity 58-75% (Ramzan *et al*., 1990; Ghosh and Senapiti, 2001) corroborates with the present findings.

Correlation studies (Table 1) between weekly mean population of different life stages of hada beetle and important weather parameters revealed a positive significant correlation with atmospheric temperature (maximum, minimum & mean). However, relative humidity recorded during the period has no effect on development of various stages of the pest beetle. Similar observation was recorded by Manjoo and Swaminathan (2007) under Udaipur condition, they recorded positive correlation of atmospheric temperature with the grub and adult population of the pest. A significant positive correlation between peak pest population and atmospheric temperature and relative humidity was recorded by Venkatesha (2006) under Bangalore conditions. Similarly, Raghuraman and Veeravel (1999) recorded a significant positive correlation between the peak population of *E. vigintioctopunctata* and maximum atmospheric temperature and average relative humidity on brinjal during February and March. A significant positive correlation existed between beetle population and maximum atmospheric temperature infesting aubergine (Muthukumar and Kalyansundram, 2003).

Biology of *H. vigintioctopunctata*

The observation on duration of various life stages (egg, larvae, pre-pupa and pupa) of beetle are presented in Table-2. Eggs were yellow, elongated-oval and laid in clusters on the under surface of leaves. There were four larval instars as reported earlier (Venkatesha, 2006, Kaur and Mavi, 2005) in the life cycle of *H. vigintioctopunctata* with a total larval period of 10.88±0.13. First instar larvae fed gregariously and they became non-gregarious from second instar onwards. The larvae scraped epidermal layer of leaves and sometimes skeletonised the entire leaf. Venkatesha (2006) recorded similar observation for incubation period, duration of various larval instars, pre-pupa and pupa under Bangalore conditions. However, Kaur and Mavi (2005) recorded incubation period of 5.20±0.87, total larval period of 13.60±1.11 and pupal duration of 4.10±0.54 under Ludhiana condition, which is not in conformity with the present findings, the reason for the same might be due regional variation as influenced by weather conditions.

The adult beetle started feeding after hardening of elytra. The nature of damage by adults is same as that of larvae, they also fed on epidermal layer of leaves, but sometimes made tattered holes on the leaves. The mating started 2-3 days after adult emergence. Individual pair copulated several times and single copulation lasted for 2-3 minutes. The pre-oviposition period ranged from 4-37 days. The gravid females laid 562.54±76.16 eggs in several batches during the ovipositional period of 45.67±5.19 days. Egg hatch ranged between 75.61-100 per cent. One female laid exceptionally high nos. of egg upto 1560 nos. The longevity of male was 27 to 108 days (Av. 67.79±3.96 days) and that of females was 37 to 108 days (Av. 67.20±3.85 days) (Table 3). Venkatesha (2006) under Bangalore conditions recorded the preoviposition period of 6.0±1.56 days, fecundity of 287.64±33.38 nos. with oviposition period of 10.40±2.80 days. However, Kaur and Mavi (2005) under Ludhiana condition recorded mean pre-oviposition, oviposition and post oviposition period of 8.60±0.80, 11.80±1.54 and 6.90±0.83 days, respectively with a fecundity of 114.80±52.85 nos. These findings are not in conformity with the present findings, might be due to variations in climatic conditions. The beetle completed its life cycle in 20.08±0.24 days. Similar observation in respect developmental period of beetle (20.15±1.50) has been recorded by Venkatesh (2006). *H. vigintioctopunctata* has been known to complete its life cycle in 22-30 days depending upon the host plant which it feeds and prevailing climatic conditions such as temperature and relative humidity (Chowdhuri, 1965, Ramzan *et al*., 1990 and Ghosh and Senapati, 2001).

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