

## SHORT NOTE

# OCCURRENCE AND BIOLOGY OF SEMILOOPER, *Hypena sagitta* (Fabricius) (= *Dichromia orosia* Cramer) (LEPIDOPTERA: NOCTUIDAE) ON INDIAN IPECAC, *Tylophora indica* (Burm. f) Merr.

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Indian ipecac, *Tylophora indica* (Burm.f) Merr. is an important medicinal plant grown in India. It is a climber distributed in Assam, West Bengal, Orissa and Peninsular India. Leaves and roots are used as substitute for ipecacuanha; as emetic, diaphoretic and expectorant. The plant is also used for treating asthma, bronchitis, whooping cough, diarrhoea and dysentery (Singh *et al.*, 1983). A semilooper, *Dichromia orosia* Cramer (Lepidoptera: Noctuidae) was recorded as an important pest on this plant (Devaiah *et al.*, 1983). A thorough review of literature has revealed that the genus *Hypena* has about 20 junior synonyms and *D. orosia* is a synonym for *Hypena sagitta*. The larva feeds on all the parts of the host plant. The pest causes 50-70% defoliation when the incidence is severe. Occurrence of the pest was observed mainly during August-December, coinciding with the flowering of the plant. No information is available on the biology and feeding preference of *H. sagitta* on *T. indica*.

Keeping this in view, the studies on biology and feeding preference of the pest to various plant parts were conducted under laboratory conditions at Indian Institute of Horticultural Research, Bangalore during July-September 2006.

For the biology studies, larvae of *H. sagitta* were collected from the field and reared on host plant twigs in the laboratory till adult emergence. Freshly emerged adults were used for further study of various biological attributes. Five pairs of male and female adults were kept in plastic boxes (15 cm x 10 cm) provided with 10 % honey solution and plant twigs. Observations were recorded daily on egg laying and other life parameters. For studying the feeding preference of various plant parts, known weight of leaves, flowers and fruits were provided as food to the third instar larvae of the *H. sagitta* in Petri plates. The experiment was conducted in a Completely Randomized Design with seven replications. Two larvae were released per replication. Weight of the plant part fed by larvae was recorded after 24 hours. The data were subjected to statistical analysis through ANOVA and DMRT (Gomez and Gomez, 1984).

The observations on duration of various life stages of the pest are presented in the Table 1. Eggs were light yellow, spherical, netlike and were laid singly on leaves. On an average, each female laid 172 eggs which took 4.4 days for hatching. The percent hatching recorded was 85.71. There were five larval instars in the life cycle of

*H. sagitta* with total larval period of 25.5 days. The pupae were brown in colour and pupal period lasted for  $7.7 \pm 0.64$  days. The total developmental period was  $37.6 \pm 0.59$  days, with the adult longevity of 21.5 days. Observations on the related species of the semilooper, *H. laceratalis* on lantana showed 5 instars with total developmental period of  $24.92 \pm 3.5$  days (Visalakshy and Jayanth, 1990).

**Table 1 : Duration of various life stages of *H. sagitta* on *T. indica***

Biological attributes	Developmental Period (days)*	Range (days)
Egg	4.4±0.49	4-5
Larva:		
I instar	3.4±0.49	3-4
II instar	4.1±0.30	4-5
III instar	4.7±0.90	4-6
IV instar	5.6±0.80	5-7
V instar	7.7±0.78	6-9
Total larval period	25.5±0.65	22-31
Pupa	7.7±0.64	7-9
Egg to adult	37.6±0.59	36-40
Adult longevity	21.5±1.69	18-23
Fecundity	172.4**	140-205
Hatchability (%)	85.71	

\* (Mean ± S.D. of 10 observations)

\*\* (Mean ± S.D. of 5 observations)

Feeding preference of *H. sagitta* to the plant parts of *T. indica* is presented in Table 2. Based on per day consumption by larvae, it can be inferred that growing flowers (1.36 g) were most preferred, followed by leaves (0.42 g) and fruits (0.10 g) for feeding. Highest feeding preference to floral parts by the pest might be the reason for its peak incidence, coinciding with the flowering of the plant.

**Table 2. Feeding preference of *H. sagitta* to different plant parts of *T. indica***

Plant part	Consumption (g/2 larvae/day)*
Leaf	0.42 <sup>b</sup>
Flower	1.36 <sup>a</sup>
Fruit	0.10 <sup>c</sup>
SE m	0.04
CD (p=0.05)	0.11
CV (%)	14.96

\* Mean of 7 replications.

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## SHORT NOTE

# EFFECT OF NITROGEN STRESS ON BIOCHEMICAL PROFILES AND ENZYME ACTIVITIES IN *Vigna unguiculata* (L.) WALP INFECTED BY *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood (1949)

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There is an intimate relation between host susceptibility, nutrition and parasitism. It is imminent to deal with the host parasitic relations from the point of nutritional physiology of the host for successful control of plant parasitic nematodes. A study of the mineral nutrition of the host plant at various levels of different inorganic elements is a prelude to understand the host pathogen relation (Bird 1960). Alterations in the presence of major and minor elements would affect the host-plant metabolism which in turn affect the pathological characteristic features of the host plant. There are conflicting evidences on the role of N, P and K fertilizers on nematode population and plant growth. A nutrient medium low in the minor elements generally resulted in poor absorption of the same by root knot nematode, *Meloidogyne incognita*. Bird (1960) observed rapid growth of *M. incognita* in nitrogen deficient medium. Kannan (1958) observed more number of eggs and larvae when the susceptible host had been fed with a nutrient solution enriched with potassium in the form of KCL Literature akin. The effect of nitrogen nutrient stress on few biochemical profiles and enzyme activities in root knot infected host plants have received sparse attention. In the present investigations, an attempt was made to elucidate the role of nitrogen stress on the same aspects in an infected host plant.

Seeds of *Vigna unguiculata* were surface sterilized with 0.1% HgCl<sub>2</sub>, washed with sterile water and raised in 10cm diameter pots containing autoclaved sand-soil mixture. Fifty pots were filled with sterilized sand. The pot culture experiment was carried out in the garden of PG and Research department of zoology of the college.

The normal nutrition used for sand soil culture experiment was that of Arnon and Hoagand (1940) at full strength. A single seedling was maintained in each pot. Each seedling was inoculated with 2000 J<sub>2</sub> of *M.incognita*. The nutrient solution was applied twice in a week with intermittent sterile water wash.

The following treatments were used with four replicates :

- CUI : Control-uninfected and untreated.
- IT<sub>0</sub> : Infected (with nematode), untreated.
- IT<sub>1</sub> : Infected-Normal 'N' treatment.
- IT<sub>2</sub> : Infected- Excess 'N' treatment (adding double the amount of KNO<sub>3</sub> in the normal nutrient solution).
- IT<sub>3</sub> : Infected-Deficient 'N' treatment omitting KNO<sub>3</sub> salt in the normal nutrient solution).

After 35 days, the plants were uprooted for biochemical studies. The dried samples of root and shoot were ground to 60 mesh powder. The total sugar (Seifter *et al.*, 1950), proteins (Lowry *et al.*, 1951), lipids (Bragdon, 1951) and phenols (Bray and Thoop, 1954) were estimated.

The use of triphenyl tetrazolium chloride (TTC) as an artificial electron acceptor had been introduced by Kun and Abood (1949). In the present studies, TTC was used to determine the activities of various enzymes. The method of Kannan (1968) was employed for estimating the activities of catalytic and synthetic (total endogenous reductases) enzymes. The results were statistically analyzed. Analysis of variance was carried out and the critical difference was also calculated (Gupta and Kapoor, 1976).

The impact of pathogenesis is reflected at tissue level with low sugar, and elevated protein, lipid and phenol levels (Table 1). The low level of sugar might be due to the possible consumption by the nematode for its sustenance or mobilization in the metabolic pool for synthesis of other metabolites viz protein, phenol and lipid etc through shikimic acid pathway (Cowling and Horsfall, 1980) as suggested by Kannan (1977). Similar results were also obtained by many workers (Das Gupta *et al.*, 1981, Owens and Rubinstein, 1966; Vaitheeswaran, 1990; Vaitheeswaran *et al.*, 2006). The increased levels of protein in the infected-untreated plant also presumed to be due to the action of proteolytic enzymes from plant sources and nematode source too. Ganguly and Das Gupta (1979) related the changes in the protein levels after infection to be one indicating the defence action of host plant against the infection. A significant increase in phenolic contents in root and shoot tissues of infected untreated plant than that of control plant appeared to be due to host response to nematode attack. The increased accumulation of phenol in infected tissue may be explained by glycosidase activity by the parasite as well as plant too. The increased level of lipid in the present study is suggestive of the synthetic process taking place

during the course of break down of tissues by the parasite.

When the infected plant was treated with excess nitrogen stress, the sugar content was found to be reduced (Table 1). It was observed by Hoggie and Watson (1944) that nitrogen in excess might stimulate protein synthesis, for which large amount of sugar might be utilized. This might be a reason for reduction in sugar content.

The reduction in sugar content observed during nitrogen deficiency may be due to reduced parasitic effect of the root knot nematode. It was discernible that during nitrogen deficiency number of root galls reduced due to reduced activities of the nematode (Kannan, 1958).

Nitrogen in excess resulted in accumulation of protein in the infected plant. This is also indicated in the observations of Kannan (1958) who recorded that nitrogen in excess counters the parasitic effect by promoting protein synthesis as evidenced by an increased value in both the systems.

Nitrogen deficiency resulted in reduced protein value in the infected plant might be due to depressed turn over of aminoacides. Our observations do reconcile with the findings of Shear and Wingard (1944) who stated that during nitrogen deficiency protein synthesis was interrupted. Though proteolysis was evidenced in the infected plant during nitrogen deficiency, yet it did not seem to be so severe.

The total lipid and phenol contents were found to be increased in nitrogen excess treated infected plant. The derouting of sugar carbon for the synthesis of phenol (Neish, 1964) is envisaged. Increased phenol content might give resistance to the infected plant to with stand the infection stress.

When the infected plant was treated with normal and excess nitrogen, the phenol content was found to be decreased. The

**Table 1. Influence of nitrogen stress on biochemical profiles in the root and shoot systems of *Vigna unguiculata* infected by *Meloidogyne incognita***

Treatment	Sugar (mg/g)		Protein (mg/g)		Lipid (mg/g)		Phenols (mg/g)	
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
IUT	8.23 ± 0.11 *(-57.59)	16.22 ± 0.43 *(-16.64)	33.44 ± 0.27 *(+78.99)	38.49 ± 0.29 *(+68.05)	41.72 ± 0.29 *(+307.57)	58.03 ± 0.47 *(+49.06)	318.12 ± 31.9 *(+171.56)	267.46 ± 17.8 *(+69.00)
IT <sub>1</sub>	12.36 ± 0.18 **(+50.30)	26.67 ± 0.04 **(+64.42)	8.09 ± 0.04 **(-75.78)	7.81 ± 0.04 **(-79.70)	54.46 ± 0.41 **(+30.55)	63.21 ± 0.56 **(+8.93)	80.01 ± 1.01 **(-74.85)	61.43 ± 0.51 **(-77.03)
IT <sub>2</sub>	7.68 ± 0.21 **(-6.67)	11.65 ± 0.16 **(-28.16)	37.09 ± 0.33 **(+10.91)	52.50 ± 0.54 **(+36.39)	59.00 ± 0.49 **(+41.44)	70.80 ± 0.70 **(+22.00)	56.34 ± 0.68 **(-82.28)	143.83 ± 6.54 **(-46.22)
IT <sub>3</sub>	4.20 ± 0.04 **(-48.93)	4.04 ± 0.04 **(-75.04)	5.99 ± 0.03 **(-82.06)	8.09 ± 0.04 **(-78.96)	9.77 ± 0.05 **(-76.56)	4.00 ± 0.02 **(-93.10)	199.81 ± 8.79 **(-37.19)	354.03 ± 30.6 **(+32.36)
CD 5%	0.854	0.596	0.324	0.441	0.510	0.686	22.325	16.476
CD 1%	1.303	0.910	0.494	0.672	0.778	1.046	34.055	25.132
CUI	19.41 ± 1.25	19.46 ± 0.48	18.68 ± 0.12	22.90 ± 0.18	10.24 ± 0.06	38.93 ± 0.26	117.14 ± 4.34	158.26 ± 7.92

\*. Per cent increase/decrease over CUI

CUI : Control – Uninfected

IT<sub>1</sub> : Infected + normal N treatment

\*\* - Per cent increase/decrease over IUT

IUT : Infected – Untreated

IT<sub>2</sub> : Infected + Excess N treatment

IT<sub>3</sub> : Infected + Deficient N treatment

Each value (mean ± SD) represents an average performance of three observations.

**Table 2. Influence of nitrogen stress on enzyme activity in the shoot system of *Vigna unguiculata* infected by *Meloidogyne incognita*.**

Treatment	GD	AD	FD	SD	GLD	AO	TDH	TED
<b>CUI</b>	4.712 ± 0.181	6.31 ± 0.307	1.044 ± 0.008	2.550 ± 0.053	10.247 ± 0.856	1.29 ± 0.02	25.97	1.799 ± 0.022
<b>IUT</b>	2.448 ± 0.048 *(-48.04)	3.827 ± 0.119 *(-37.56)	6.13 ± 0.307 *(+487.16)	6.13 ± 0.307 *(140.39)	4.374 ± 0.156 *(-57.31)	10.29 ± 1.02 *(697.6)	33.19 *(+27.8)	2.110 ± 0.036 *(+17.28)
<b>IT<sub>1</sub></b>	2.018 ± 0.068 *(-17.56)	1.755 ± 0.021 *(-54.14)	1.047 ± 0.007 *(+82.92)	1.454 ± 0.014 *(-76.27)	2.550 ± 0.053 *(-41.70)	1.5 ± 0.031 *(+16.27)	10.324 *(-57.33)	1.599 ± 0.017 *(24.21)
<b>IT<sub>2</sub></b>	1.493 ± 0.079 *(-39.01)	1.179 ± 0.01 *(-69.19)	1.088 ± 0.013 *(-82.25)	1.499 ± 0.015 *(-75.53)	1.499 ± 0.015 *(-65.72)	1.800 ± 0.045 *(+39.53)	8.558 *(-64.63)	1.439 ± 0.017 *(-31.80)
<b>IT<sub>3</sub></b>	1.799 ± 0.022 *(-26.51)	1.103 ± 0.009 *(-71.17)	1.469 ± 0.015 *(-76.03)	1.599 ± 0.017 *(-73.91)	1.085 ± 0.008 *(-75.19)	0.789 ± 0.010 *(38.83)	7.844 *(-67.58)	2.448 ± 0.048 *(+16.0)
<b>CD 5%</b>	0.140	0.216	0.202	0.205	0.3717	1.163	5.645	1.036
<b>CD 1%</b>	0.214	0.330	0.308	0.314	0.5671	1.774	8.611	1.580

\* - Per cent increase/decrease over CUI

\*\* - Per cent increase/decrease over IUT

GD : Glucose dehydrogenase  
 SD : Succinate dehydrogenase  
 TDH : Total dehydrogenase  
 AO : Ascorbate oxidase  
 AD : Alcohol dehydrogenase  
 FD : Formate dehydrogenase  
 GLD : Glyceraldehyde dehydrogenase  
 TED : Total Endogenous reductase

Each value (mean ± SD) represents an average performance of three observations. Readings are expressed in mg TTC reduced/gm dry weight.

**Table 3. Influence of nitrogen stress on enzyme activity in the root system of *Vigna unguiculata* infected by *Meloidogyne incognita*.**

Treatment	GD	AD	FD	SD	GLD	AO	TDH	TED
<b>CUI</b>	5.96 ± 0.57	1.19 ± 0.01	0.79 ± 0.00	1.19 ± 0.01	2.35 ± 0.04	1.39 ± 0.01	12.62	0.58 ± 0.003
<b>IUT</b>	3.22 ± 0.08 *(-45.94)	0.79 ± 0.00 *(-32.96)	1.27 ± 0.01 *(+59.69)	4.08 ± 0.13 *(+240.45)	1.71 ± 0.02 *(-27.18)	1.53 ± 0.03 *(+9.66)	12.90 ± 2.22 *(-2.14)	1.243 ± 0.011 *(+114.31)
<b>IT<sub>1</sub></b>	3.06 ± 0.07 *(-4.99)	0.76 ± 0.00 *(-3.75)	1.13 ± 0.00 *(-10.73)	0.65 ± 0.01 *(-84.07)	1.49 ± 0.01 *(-84.07)	1.71 ± 0.04 *(+11.87)	8.832	1.052 ± 0.008 *(-15.36)
<b>IT<sub>2</sub></b>	1.74 ± 0.02 *(-45.74)	0.60 ± 0.00 *(-24.15)	0.60 ± 0.0 *(-52.50)	1.05 ± 0.01 *(-74.26)	1.43 ± 0.01 *(-16.04)	1.97 ± 0.06 *(+28.91)	7.431	1.29 ± 0.012 *(+3.78)
<b>IT<sub>3</sub></b>	1.67 ± 0.01 *(-48.04)	0.59 ± 0.00 *(-25.28)	0.65 ± 0.01 *(-49.05)	1.56 ± 0.02 *(-61.50)	1.17 ± 0.01 *(-31.21)	1.07 ± 0.01 *(-29.96)	6.743	1.799 ± 0.022 *(+44.73)
<b>CD 5 %</b>	0.388	0.029	0.020	1.539	0.032	0.057	2.068	0.019
<b>CD 1 %</b>	0.593	0.045	0.031	2.341	0.049	0.087	3.148	0.029

\*- Per cent increase/decrease over CUI

\*\*- Per cent increase/decrease over IUT

Each value (mean ± SD) represents an average performance of three observations. Readings are expressed in mg TTC reduced/gm dry weight.

derouting of phenol for synthesis of other plant metabolites might be a reason for decreased phenol content.

A perusal of data on redox enzyme showed a specific increase in the activities of the most dehydrogenase enzymes in the infected host plant when compared to uninfected plant (Table 2 and 3). This indicated greater energy yield through catalysis due to expected increase in tissue damage by the nematode. However, this seem to be offset by the increased velocities of endogenous reductases involved in synthesis. The resultant of these two enzymes activities is quite evidenced in the increments of sugar, lipid, protein and phenol. This synthetic activity is for repair and maintenance in spite of severe infection. In normal, excess and deficient nitrogen treated infected plant reduced the dehydrogenase enzyme activities were discernible when compared to infected untreated plant. This indicated reduced catalysis due to reduced pathogenic impact. Correspondingly the synthetic rates as expressed by endogenous reductase are also depressed in normal, and excess nitrogen treated infected plant suiting the need of the demands. Further studies are imminent in this direction.

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