

- Krishnamoorthy, A. and Singh, S. P. 1987. Observational studies on the occurrence of parasites on *Papilio* spp. in citrus. *Indian J. Plant Prot.* (in press).
- Miles, L. R. and King, B. G. 1975. Development of the tachinid parasite, *Lixophaga diatraeae* on various developmental stages of the sugarcane borer in the laboratory. *Environ. Entomol.*, **4**, 811-814.
- Nechols, J. R. and Tauber, M. J. 1977. Age specific interaction between the greenhouse whitefly and *Encarsia formosa*: influence of host on the parasite's oviposition and development. *Environ. Entomol.*, **6**, 143-149.
- Parker, F. D. and Pinnell, R. E. 1973. Effect on food consumption of the imported cabbage-worm when parasitized by two species of *Apanteles*. *Environ. Entomol.*, **2**, 216-219.
- Rahman, M. 1970. Effect of parasitism on food consumption of *Pieris rapae* larvae. *J. Econ. Entomol.*, **63**, 820-821.
- Sato, Y. 1976. Experimental studies on parasitization by *Apanteles glomeratus*. I. Parasitization of different species of genus *Pieris*. *Appl. Entomol. Zool.*, **11**, 165-175.
- Sato, Y. 1980. Experimental studies on parasitization by *Apanteles glomeratus*.
- V. Relationships between growth rate of parasitoid and host age at the time of oviposition. *Entomophaga*, **25**, 123-128.
- Sato, Y. and Tanaka, T. 1984. Effect of the number of parasitoid (*Apanteles kariyai*) (Hym.: Braconidae) eggs on the growth of host (*Leucania separata*) larvae (Lep.: Noctuidae). *Entomophaga*, **29**, 21-28.
- Sato, Y. Tagawa, J. and Hidaka, T. 1986. Effects of the gregarious parasitoids, *Apanteles ruficrus* and *A. kariyai* on host growth and development. *J. Insect Physiol.*, **32**, 281-286.
- Slansky, F. J. 1986. Nutritional ecology of endoparasitic insects and their hosts: An over view. *J. Insect Physiol.*, **32**, 255-261.
- Smilowitz, Z., and Iwantsch, F. G. 1973. Relationships between the parasitoid *Hyposoter exiguae* and the cabbage looper, *Trichoplusia ni*. Effects of host age on developmental rate of the parasitoid. *Environ. Entomol.*, **2**, 759-763.
- Smith, C. L. and Smilowitz, Z. 1976. Growth and development of *Pieris rapae* larvae parasitized by *Apanteles glomeratus*. *Entomol. Exp. et App.*, **19**, 189-195.
- Vinson, S. B., 1972. Effect of the parasitoid, *Campoletis sonorensis*, on the growth of its host, *Heliothis virescens*. *J. Insect Physiol.*, **18**, 1509-1514.

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Incidence of *Heliothis armigera* (Hubner) and Parasitism by *Campoletis chlorideae* (Uchida) in Chhattishgarh, Madhya Pradesh

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ABSTRACT

Gram pod borer, *Heliothis armigera* (Hubner) attacks gram crop severely at flowering and fruiting stages and the parasitism by *Campoletis chlorideae* is also higher at the same time. JG-64 and JG-62 were least susceptible and Kheri was the most susceptible gram variety for the pod borer at vegetative stage but at pod stage Gulabi, Ujjain-21 and Ujjain-24 varieties were more heavily attacked. Incidence of the pest and parasite were correlated.

Key words: *Heliothis armigera*, *Campoletis chlorideae*. Parasitisation, gram varieties.

Gram pod borer, *Heliothis armigera* (Hubner) which has a wide distribution with many host plants is a major insect pest of gram (*Cicer arietinum* L.) in Chhattishgarh region, where gram is cultivated in about two million hectares with a production of about one million tonnes (Shrivastava, 1964; Baghel, 1977; Sharma, 1981). It attacks the crop from seedling to podding stage. During the vegetative stage of the crop, the pest incidence is usually low and the crop recovers itself. But during the pod formation stage the pest attack results in yield loss considerably. Kaushik *et al.* (1969) and Rawat and Kaushik (1983) have reported 15.0 to 20.4 per cent loss due to gram pod borer. Methods of integrated control

of *Heliothis* were suggested by Rathore *et al.* (1969) and Basu and Paramanik (1969) and its biology was studied by Patel *et al.* (1968) and Dubey *et al.* (1981) but no information in this region is available on the parasites of *Heliothis*. The present study is the first of its kind conducted in Chhattishgarh region of Madhya Pradesh.

MATERIALS AND METHODS

Seven popular varieties of gram (Table 1) were observed regularly at three stages; flowering, podding and maturity. The plants of each variety were observed in fields measuring about 0.5 hectare each. Percentage of plants attacked and pods damaged by pod borer and parasitism by *Camponotus chloridea* (Uchida) were calculated.

Table 1. Incidence of *Heliothis armigera* at various stages of growth in gram varieties.

Variety	Per cent incidence at			
	Flowering	Podding	Maturity	Mean
Ujjain-21	22.70 (28.45)	21.60 (27.69)	11.70 (20.00)	18.67 (25.38)
Ujjain-24	21.40 (27.56)	23.30 (28.86)	9.90 (18.34)	18.20 (24.92)
JG-62	18.60 (25.35)	16.20 (23.73)	11.20 (19.55)	15.33 (22.94)
JG-64	16.50 (23.97)	18.20 (25.25)	10.30 (18.72)	15.00 (22.65)
Kabuli	23.40 (28.93)	25.30 (30.20)	10.80 (19.19)	19.83 (26.11)
Gulabi	22.50 (28.32)	24.60 (29.73)	11.80 (20.09)	19.63 (26.05)
Kheri	28.60 (32.33)	30.40 (33.46)	12.60 (20.79)	23.87 (28.86)
Mean	21.96 (27.87)	22.80 (28.42)	11.19 (19.55)	
S. D.	12.63	19.09	0.75	

(Figures in parentheses are transformed values)

Table 2. Pod damage by *Heliothis armigera* in different gram varieties

Variety	Per cent pods infested at		
	Podding	Maturity	Mean
Ujjain-21	12.70 (20.88)	13.50 (21.56)	13.10 (21.22)
Ujjain-24	10.50 (18.91)	11.90 (20.18)	11.20 (19.55)
JG-62	11.70 (20.00)	13.20 (21.30)	12.45 (20.65)
JG-64	12.70 (20.88)	12.90 (21.05)	12.30 (20.97)
Kabuli	16.60 (24.04)	17.20 (24.50)	16.90 (24.27)
Gulabi	14.50 (22.30)	15.60 (23.26)	15.05 (22.78)
Kheri	19.50 (26.21)	19.80 (26.63)	19.65 (26.42)
Mean	14.03 (21.89)	14.87 (22.64)	
S. D.	8.31	6.80	

(Figures in parentheses are transformed values)

Correlation studies were made between pest incidence and pod damage as well as parasitism; and pod damage and parasitism to find out the relationship of parasitism to the activity of the pest.

RESULTS AND DISCUSSION

The incidence of *H. armigera* was maximum at flowering (21.96%) and podding stages (22.80%) as compared to the maturity stage (11.19%) (Table 1). Pod damage was 14.03% to 14.87% at podding and harvesting stages of the crop (Table 2). Among the varieties of gram, maximum pest incidence was observed in Kheri (23.87%) and minimum in JG-64 (15.0%) and JC 62

(18.2%) (Table 1). The incidence was higher at podding and flowering stages and lower at maturity stage. The pod infestation was more in Kheri followed by Kabuli and Gulabi varieties (Table 2). A similar level of incidence by *H. armigera* at harvesting stage was observed by Shrivastava (1963) and Rawat and Kaushik (1983) in Kheri and JG-64 varieties of gram.

Parasitism by *C. chlorideae* was observed to be from 7.5% to 10.1% (Table 3) which is higher than that reported by Subba Rao (1954) and Kaushik *et al.* (1969) and lower than that observed by Sharma (1985). Average parasitism was more at flowering stage (11.89%) followed by 11.26% at

Table 3. Parasitism of *Heliothis armigera* by *Campoletis chloridae* at various stages of growth in gram varieties

Variety	Per cent parasitism at			
	Flowering	Podding	Maturity	Mean
Ujjain-21	11.60 (19.91)	13.50 (21.56)	3.20 (10.31)	9.43 (17.26)
Ujjain-24	15.30 (23.03)	12.40 (20.62)	2.50 (9.10)	10.07 (17.58)
JG-62	10.20 (18.63)	10.30 (18.72)	2.40 (8.91)	7.63 (15.42)
JG 64	11.60 (19.91)	9.50 (17.95)	1.60 (7.27)	7.57 (15.04)
Kabuli	11.50 (19.82)	10.80 (19.19)	2.30 (8.72)	8.20 (15.91)
Gulabi	14.40 (22.30)	11.50 (19.82)	7.4 (15.79)	10.10 (19.30)
Kheri	8.60 (17.05)	10.80 (19.19)	4.30 (11.97)	7.23 (16.07)
Mean	11.89 (20.09)	11.26 (19.58)	3.39 (10.30)	
S. D.	4.56	1.55	3.30	

(Figures in parentheses are transformed values)

podding stage and less at harvesting stage (3.39%) (Table 3). At flowering stage, pest incidence was negatively correlated with parasitism ($r = -0.829$). At podding stage, pest incidence and damage to pods showed positive correlation ($r = 0.698$).

REFERENCES

- Baghel, K. S. 1977. Estimation of losses by pod borers of arhar *Cajanus cajan* L. M.Sc. (Ag.) Thesis, J. N. K. V. V., Raipur, pp. 75.
- Basu, A. C. and Paramanik, L. N. 1969. Effect of planting dates on the infestation of *Heliothis armigera* (Hub.) and the grain yield. *Indian J. Entomol.*, **31**, 24-27.
- Dubey, A. K., Dixit, S. A. and Katiyar, O. P. 1981. The influence of host plants on body length and body weight of gram pod borer *Heliothis armigera* (Hubner). *J. N. K. V. V. Res. J.*, **15**, 148.
- Kaushik, U. K., Rathore, V.S. and Sood, N. K. 1969. Incidence of bollworms and losses caused to cotton in M. P. *Indian J. Entomol.*, **31**, 75-77.
- Patel, R. C., Patel, J. K., Patel, P. B. and Singh R. 1968. Mass breeding of *Heliothis armigera* (Hub). *Indian J. Entomol.*, **30**, 272-280.
- Rathore, V. S., Sood, N. K. and Kaushik, U. K. 1969. Scope of integrated pest control in M. P. *International Seminar on Integrated Pest Control*. J. A. R. J., Abst. 4.
- Rawat, R. R. and Kaushik, U. K. 1983. Crop losses due to insect pests in North East M. P. *National Symposium on Crop Loss by pests*, Entomol. Soc. India, Hyderabad, Jan 8-11, 1982, pp. 1-24.
- Sharma, D. K. 1981. New trends in agricultural Research (25 Years) of Madhya Pradesh. *Commerce*, **142**, 27-31.
- Sharma, O. P. 1985. Varietal incidence of gram caterpillar *Heliothis armigera* (Hubner) on G. C. V. T., I. C. C. T. and I. C. S. N. cultures of gram. M. Sc. (Ag.) Thesis. J. N. K. V. V., Raipur, pp. 65.
- Shrivastava, A. S. 1964. *Heliothis armigera* is a serious pest of gram. Res. Memoir No. III. Entomological Research during last ten years in the Section of Entomology, Govt. of U. P., Kanpur, pp. 51-55.
- Subba Rao, B. R. 1954. *Chelonus narayani* on *Heliothis armigera* in India. *Indian J. Entomol.*, **16**, 426.