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Assessment of suitability of different growth stages of *Chilo tumidicostalis* Hmpsn for development of parasitoid *Cotesia flavipes* Cam in Assam

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ABSTRACT

Host stage of *Chilo tumidicostalis* Hmpsn suitability for parasitization by *Cotesia flavipes* Cam and its development were studied under confinement. The adults of *C flavipes* preferred IV instar followed by V and III instar larvae of host *C tumidicostalis* by 80, 70 and 60 per cent respectively. On the other hand it was found that incubation and larval periods were longest in III instar (9.91 days) and shortest in VII instar (7.90 days) larvae. The pre-pupal and pupal periods of parasitoid larvae emerged from III instar host were longest (6.29 days) and in VI instar larvae it was shortest (6.01 days). This study revealed that although parasitoid preferred IV instar larvae for parasitizing but growth and development were found highest in VI instar larvae.

Keywords: *Chilo tumidicostalis*; *Cotesia flavipes*; larvae; host stage; suitability

INTRODUCTION

In Assam sugarcane (*Saccharum officinarum* L) is an important commercial crop grown extensively next to tea and jute. Productivity of sugarcane in the state is almost half of Indian productivity. This low yield of sugarcane in the state is attributed to various constraints and among them attack of pests is major one. Plassey borer, *Chilo tumidicostalis* Hmpsn a graminaceous stem borer is an important pest of sugarcane in Assam. *Cotesia flavipes* Cameron (Hymenoptera: Braconidae), an important gregarious endo-larval parasitoid of graminaceous stem borers is found in nature during Kharif season throughout the country and has proven as a dominant larval parasitoid of another graminaceous stem borer *Chilo partellus* by reducing the population up to 32-55 per cent (Divyal et al 2009). This important parasitoid has been introduced into more than 40 countries of the world to control native and exotic stem borers with variable success (Polaszek and

Walker 1991). In Assam so far this potential parasitoid has not been utilized for control of any stem borer except reports of *C flavipes* parasitizing plassey borer larvae in field (Borah and Arya 1995). For the parasitoid to establish there must be physiological compatibility between the parasitoid and its host because host unsuitability is one of the reasons for the lack of establishment (Overholt 1998). Host suitability test is a prerequisite so as to avoid wasting of resources. Various researchers have reported the effect of host age of larvae on parasitism but no systematic study has been conducted so far on *C flavipes* on host larvae of *C tumidicostalis*. Therefore it was planned to investigate the suitability of larval stage of *C tumidicostalis* on development of *C flavipes* and laboratory study was conducted at Entomology Division of Assam Agricultural University, Jorhat, Assam.

MATERIAL and METHODS

A mass culture of the *C tumidicostalis* was maintained in the laboratory by rearing adult moths in confinement providing 10 per cent sucrose solution as food and after mating allowed to lay eggs. On hatching the first instar larvae were transferred to excised sugarcane internodes and allowed to feed in the internodes. Mass culture of *C flavipes* also maintained in the laboratory by exposing around 50-60 freshly emerged male and female parasitoids (at the ratio 1: 2) were released for mating in glass jars covered with muslin cloth and with 10 per cent honey solution as food. Thereafter plassey borer larvae were introduced along with sugarcane bits and frass for oviposition by female parasitoids as mating process seemed to be over. The larvae after completion of oviposition were transferred to another apparatus where larvae were provided with sugarcane pieces as food material and reared till emergence of *C flavipes* larvae from host body. After emergence the larvae of *C flavipes* pupated and cocoons were collected and transferred to glass tubes for emergence of adults which were plugged with cotton. For the study of suitability of host stages 10 larvae of each of I, II, III, IV, V and VI instars *C tumidicostalis* larvae were kept for oviposition by *C flavipes* following the methods described by (Macedo et al 1984). The larvae were taken out of the chimney and reared on split sugarcane internodes in a glass jar covered with muslin cloth. The split internodes were inspected every day and new split internodes of sugarcane were provided on every alternate day to the *C tumidicostalis* larvae. Observations were recorded on emergence of *C flavipes* larvae and cocoon formation. The suitability of host stage was calculated from the records of pupation and development period within the host body.

RESULTS and DISCUSSION

The data observed on per cent parasitization on exposure of six larval

instars (I, II, III, IV, V and VI) of *C tumidicostalis* to *C flavipes* revealed that there was more acceptability of instars from III to VI by the parasitoid. I instar larvae of *C tumidicostalis* were not accepted at all by parasitoid *C flavipes* followed by only 20 per cent parasitization in case of II instar larvae. However it was found that *C flavipes* showed more preference for parasitizing IV instar larvae with 80 per cent followed by V instar with 70, III instar with 60 and VI instar with 50 per cent (Fig 1). Under laboratory condition the instar IV larvae appeared to be more preferred for oviposition which is evident from the per cent parasitism as this instar was less active in comparision to instars III, V and VI. Jalali and Singh (2002) also found similar results and reported that 2nd to 6th instars of *C partellus* were most preferred for parasitism by *C flavipes*. Shekharappa and Kulkarni (2003) also reported that among all the instars III instar larvae of *C partellus* were most suitable for parasitization by *C flavipes*. It was observed from the study that instar I was very smaller in size and instars II and III were migratory in nature while instar V and VI seemed more defensive against the parasitoid. Host defensive behavior plays a role in reducing successful parasitization. Takasu and Overholt (1997) also reported parasitoid mortality due to the reason that aggressive defensive behaviour was significantly higher when older larvae were attacked. In the study of development of *C flavipes* within host body from I to VI instar larvae it was found that although II instar larvae were parasitized, no development of parasitoid was observed in II instar larvae. It was found that parasitoid incubation and larval period were longest in instar III larvae (9.91 days) and shortest (7.90 days) in VII instar larvae. The pre-pupal and pupal period of parasitoid larvae emerged from III instar host was longest (6.29 days) and in VI instar larvae it was shortest (6.01 days). However pre-pupal and pupal period of parasitoid emerged from III instar host did not differ significantly from those that emerged from IV instar host larvae but differed significantly from the larvae that emerged from V and VI instar larvae. Adult longevity of the parasitoid was longest when the larvae developed in IV and V instar larvae and shortest in case of VI instar host larvae. There was no significant variation of adult longevity of parasitoids developed in different instars. However the egg plus larval period of parasitoid decreased significantly from 9.91 to 7.90 days from instar III to instar VI. This might be due to the availability of more food in the later instar host which hastened the larval development of the parsitoid. The pre-pupal and pupal period of the parasitoid that emerged from instar III to instar VI host larvae also decreased from 6.29 to 6.01 days. But the adult longevity of the parasitoid did not vary depending on host stage. Based on the shortest incubation and larval period and pre-pupal and pupal period it was apparent that instar VI host larvae were comparatively more suitable for development of the parasitoid. However under laboratory conditions the instar IV

Table 1. Development of *Cotesia flavipes* on different growth stages of *Chilo tumidicostalis*

Host stage (instar)	*Incubation + larval period (days)	**Pre-pupal + pupal period (days)	Adult longevity (days)	Temperature (ºC)		Average RH (%)
				Maximum	Minimum	
III	9.91 (9.58-10.25)	6.29 (6.15-6.41)	3.60 (3.45- 3.75)			
IV	9.32 (9.15-9.50)	6.24 (6.15-6.33)	3.63 (3.50-3.75)			
V	8.59 (8.36- 8.75)	6.11 (5.93-6.25)	3.63 (3.45-3.80)	32.53	25.40	83.27
VI	7.90 (7.66-8.95)	6.01 (5.88-6.15)	3.52 (3.33-3.75)			
SEd±	0.18	0.11	NS			
$CD_{0.05}$	0.42	0.25	-			

*Observations based on 10 host larvae exposed for oviposition, **F-test based on 3 observations, Figures in parentheses indicate range, NS= Non-significant

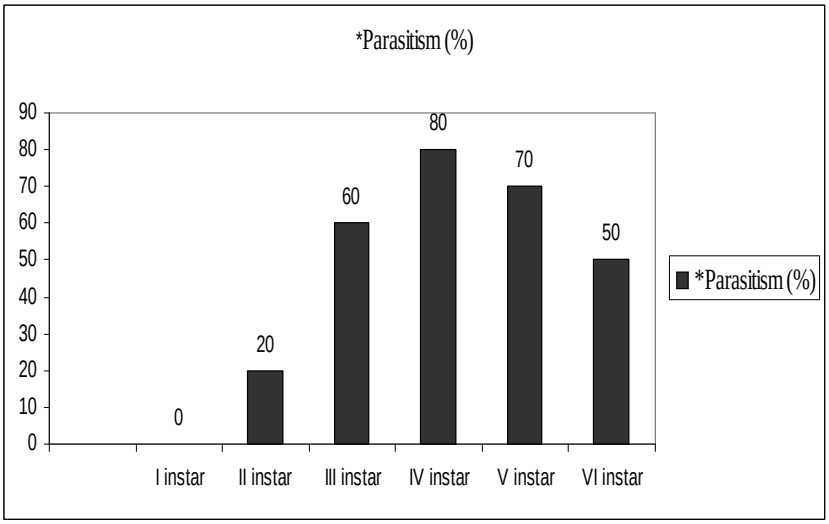

Fig 1. Host stage preference by *C flavipes* for parasitism

larvae appeared to be more preferred for oviposition even though the development in this instar was comparatively slower.

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