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Research Note

Is *Apanteles paludicole* Cameron, a limiting biotic factor for minor pest status of *Sphenarches caffer* (Zeller)?

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ABSTRACT: The seasonal incidence and biology of plume moth, *Sphenarches caffer* infesting bottle gourd was studied in Varanasi, Uttar Pradesh. The incidence of plume moth started from May and reached its peak during the first week of August. A solitary, larval endoparasitoid, *Apanteles paludicole* Cameron (Braconidae) was found to co-exist with this pest almost from beginning with peak parasitization of 40.91%. Among the biotic factors, higher parasitization by this endoparasitoid and relatively lower temperature amongst the abiotic parameters from November onwards might be responsible for the minor pest status of *S. caffer* on bottle gourd in this region.

KEY WORDS: *Sphenarches caffer,* bottle gourd, minor pest, *Apanteles paludicole,* parasitization

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Sphenarches caffer (Zeller), white plume moth, is known as a pest of bottle gourd and several leguminous vegetables including lablab, beans etc. (Nair, 1995; Butani and Jotwani, 1984; David, 2001). This moth belongs to family Pterophoridae, a unique, conspicuous group of slender moth called plume moths with long legs and fissured wings. The fore wings are longitudinally cleft into 2 or 3 or rarely 5 divisions and the hind wings into 3. Approximately 600 species have been reported worldwide (Stanek and Turner, 1977). During summer seasons of 2011 to 2013, incidence of this plume moth was observed in and around the experimental farm of Indian Institute of Vegetable Research (25°12' N, 82°52' E), Varanasi, Uttar Pradesh, India, on bottle gourd (*Lagenaria siceraria* (Molina) Standl.). Larvae of plume moth, *S. caffer* damaged the leaves and buds of bottle gourd by scraping the chlorophyllous portion thereby reducing the photosynthetic activity of the plants. However, damage was more severe when they fed on the emerging buds resulting in restricted growth of the buds with characteristic black excreta inside it. Literature on biology of the *S. caffer* on bottle gourd and its potential parasitoid(s) is scanty; hence, detailed investigation on bionomics of the plume moth along with its important parasitoid(s) was undertaken at Biocontrol Laboratory, Indian Institute Vegetable Research, Varanasi, Uttar Pradesh-221305, India.

Occurrence of *S. caffer* was recorded at weekly intervals in the field throughout the year during 2011-13 on bottle gourd. In addition, the biology of *S. caffer* was also studied under laboratory conditions of 28±2°C and 75-80 % R.H. Initial culture of plume moth, *S. caffer* was maintained by collecting the infested leaves and buds of bottle gourd containing different developmental stages of the moth. Infested shoots and buds were placed in the plastic jars (15 cm diameter and 19.2 cm height) and reared on their natural host for further multiplication of the pest. The observations on oviposition were made by keeping pairs of moths in wire screen cages (36 cm x 30 cm x 40 cm) with healthy twigs of bottle gourd placed in conical flasks with water to maintain their freshness. The larvae were reared in Petri dishes with tender leaves. Pupae were segregated and placed in cages for adult emergence. All the biological parameters were recorded and statistically analyzed.

Field incidence of the larvae was observed from the nineteenth standard week (second week of May) along with its larval endoparasitoid, *Apanteles paludicole*. Whitish solitary oval-shaped cocoon adhering to the upper and sometimes on the lower side of the leaves indicated the presence of this braconid parasitoid. Peak population of this moth was recorded during the 31st standard week (first week of August) (12.2 larvae/plant) after which the population gradually declined. Interestingly, during the peak summer months of May – June when atmospheric temperature was around 45°C in Varanasi, *S. caffer* and its larval parasitoid, *A. paludicole* were among the few insects that were visible

in the research farm on bottle gourd. However, parasitoid population and per cent parasitization did not follow the same trend. Number of parasitoids recovered during the 32nd standard week (second week of August) was 4.3 cocoons / plant. However, parasitization rate progressed 33rd standard week onwards and peaked during the last week of August (40.91%) when 8.8 larvae per plant were recorded. Relatively lower number of plume moth larvae at this time might be due to the natural control exerted by the parasitoid whose population was quite high during this period. Both *S. caffer* and its parasitoid, *A. paludicole* co-existed almost from the beginning of the crop season when the plants were at early vegetative stage. However, from mid October onwards when rabi season bottle gourd was in its vegetative stage and field beans were in early reproductive stage interestingly, there was no incidence of this plume moth on these preferred hosts. The probable reason could be prevalence of relatively lower temperatures from November onwards till February.

The neonate larvae of *S. caffer* were light yellowish green in colour with minute black spots all over the body. Four larval instars were observed and larval period ranged from 15 to 17.75 days. The mean duration of the first, second, third and fourth instars larvae were 2.75, 3.05, 4.75 and 5.97 days, respectively. The third instar larvae were greenish brown in colour with prominent black hairs on its body whereas fourth instar larvae were densely clothed with white hairs and black spines. Pupation took place mostly on the upper surface of leaves. The obtect pupae were light whitish green in colour and gradually turned brown before adult emergence. The pupal period ranged from 7 to 8.5 days, with an average period of 7.75 days. Adult was medium sized moth whose fissured fore and hind wings were divided into two and three lobes, respectively. Adult longevity varied from 3.5 to 5.25 days. The adult female survived longer (average 4.65 days) than the male (3.95 days). Mating took place mostly during night hours and gravid females laid eggs singly on the tender leaves and buds. Freshly laid eggs were oval in shape, light yellowish green colour which turned to yellowish brown before hatching. The oviposition period ranged from 2 to 3.25 days (Table 1).

Literature revealed that *S. caffer* as a major pest in the southern India both on bottle gourd as well as on field bean. Sujithra *et al*.,(2010) from Tirupati, Andhra Pradesh, India reported that *S. caffer* as a major pest of field bean (*Lablab purpureus* (L.)) as 33% pods were damaged by this borer alone. Krishnamurthi and Appanna (1951) also considered *S. caffer* as a major pest and reported its occurrence from October to January in Mysore, Karnataka. Earlier Nair (1995) reported *S. caffer* as a common pest of bottle gourd in south India. In contrast, in the eastern part of the country especially Pusa, Bihar as mentioned by Pruthi, 1937 and Varanasi, eastern part of Uttar Pradesh from our present findings, *S. caffer* can be considered as a minor pest of bottle gourd. Fertile alluvial soil of the Indo-Gangetic

Table. 1 Biological events in life-cycle of *Spenarches caffer* on bottle gourd under laboratory conditions

Biological parameters	Maximum	Minimum	Mean* ± SD
Fecundity (Nos.)	45.0	77.0	64.2 ± 12.70
Egg viability (%)	76.0	93.0	86.6 ± 6.58
Oviposition period (days)	2.0	3.2	2.55 ± 0.57
Incubation period (days)	3.5	5.0	4.2 ± 0.57
Larval duration (days)			
First instar	2.5	3.0	2.75 ± 0.25
Second instar	2.5	3.5	3.05 ± 0.37
Third instar	4.0	5.5	4.75 ± 0.56
Fourth instar	5.5	6.6	5.97 ± 0.46
Total larval period	15.0	15.7	16.52 ± 1.02
Pupal duration (days)	7.0	8.5	7.75 ± 0.56
Adult longevity (days)			
Male	3.5	4.5	3.95 ± 0.37
Female	4.0	5.25	4.65 ± 0.49

SD = Standard Deviation

*Means are based on five replications

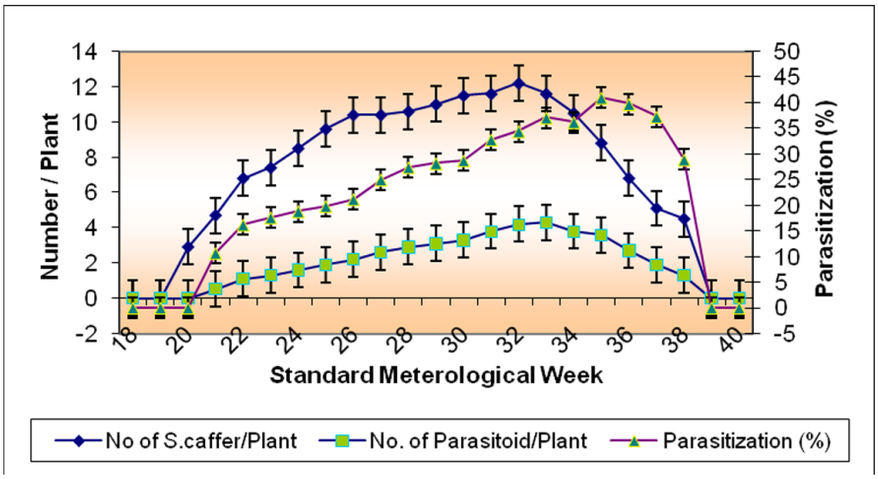

Fig. 1. Seasonal incidence of *Spenarches caffer* and its parasitoid *Apanteles paludicole*

plains and river beds of this region are considered highly suitable for cucurbit cultivation including bottle gourd but incidence of this plume moth is still considered as minor. Even though field bean, an alternate host of this moth, is known as a popular winter vegetable in this region, during our study, its infestation was not observed on field bean. Sujithra *et al*. (2010) in their study further reported high level of parasitization (82%) of *S. caffer* infesting field bean by a chalcid pupal parasitoid, *Tropimeris monodon* from end of January, 2006 during physiological maturity of the crop. Interestingly, their study also revealed that highest pod damage (33%) was noted when per cent parasitization level was also high (72%). Anonymous (2001) implicated an unidentified species of *Tropimeris* sp. to be an efficient natural enemy controlling other plume moths on pulses to the extent of 90%. In spite of presence of this chalcid pupal parasitoid, major pest status of *S. caffer* in field bean indicated the absence of any suitable larval parasitoid in the region. The pupal parasitoid might be exerting control on the pupae as well as adult population thereby affecting the subsequent generations but they do not seem to have any direct control on the existing larval population inflicting pod damage. However, larval parasitoid is capable of controlling the existing larval population before they reached the third or fourth instar stage. During our course of study, the only parasitoid observed was *A. paludicole*, a solitary larval endoparasitoid with highest per cent parasitization of 40.91 during the last week of August. Earlier high percent parasitisation of the caterpillars of *S. caffer* by *A. paludicolae* was observed by Pruthi (1937) from Pusa, Bihar.

From our present study, it is evident that *A. paludicole* is the only larval parasitoid of plume moth in this region and co-existed from beginning of its incidence. Therefore it can be surmised that among the biotic factors, coexistence and higher parasitization (41.91%) by this braconid endoparasitoid and relatively lower temperature among the abiotic parameters from November onwards might be responsible for minor pest status of *S. caffer* in this region.

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