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DEVELOPMENTAL STUDIES OF *BLAPTOSTETHUS PALLESCENS* (POPPIUS) (ANTHOCORIDAE : HETEROPTERA) ON DIFFERENT PREYS

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ABSTRACT : The key for understanding the behavior and vitality of an insect is to study the effect of food, temperature and changing factors responsible for insect development. The effect on prey intake on the development of predator varies distinctly with the prey consumed. The study was conducted to understand the impact of different hosts on development of anthocorid predator, *Blaptostethus pallescens* under laboratory conditions. The studywas carried out on the sucking pests like thrips, red spider mites, nymphs of papaya mealybug and eggs of rice moth. The results showed that incubation period lasted for 5.57±0.37 days in thrips followed by papaya mealy bug crawlers (5.14±0.26 days) which was the longest duration among the hosts evaluated. Papaya mealybug nymphs had longest average nymphal period (23 days) whereas shortest was observed in rice moth eggs(17 days). Adult longevity was highest in rice moth eggs (47 days)compared over other prey. The total number of instars remained constant among all the host *i.e.*, 5 nymphal instars during the complete development of the predator.The experimental results indicated that alternate hosts containing thrips and mites can be incorporated in field for maintaining predator population in absence of primary hosts.

Key words : *B. pallescens*, *T. urticae*, *P. marginatus*, *C. cephalonica*, *Thrips* spp.

INTRODUCTION

With changes in the cropping pattern, injudicious use of pesticides, climate change and introduction of input intensive high yielding varieties/hybrids and cultivars results in imminent shift in pest status (Rathee and Dalal, 2018). With the introduction of *Bt* crops, there was a shift in pest scenario where sucking pests dominated lepidopteran pests in causing maximum devastation to the crop. The trading of commodities across the continents has facilitated the introduction of several invasive species which had created havocamong the Indian farmers. Among them, papaya mealy bugcaused a huge impact on mulberry cultivation affecting the silk industry in South India. It was introduced in 2005, yet it remained unidentified until it caused huge losses in mulberry. Parasitoids were imported to manage the mealybug, which presented better management results. Pest control utilising natural enemies has been popularised because ofthe problems faced by excessive insecticide usage impacting environmental, economic, social and ecological problems (Tiwari *et al*, 2017). However, availability of parasitoids throughout the year was a major downside due to which there has beena constant lookout for native predators in the provided ecosystem. Predators offered an ecological benefit as they were generalists in food intake, which permits their stay for longer period in the ecosystem.

Anthocorid bug, *Blaptostethus pallescens* (Poppius) belonging to Anthocoridae, Heteroptera is one of the efficient predator of sucking pests like mites, thrips, aphids, psocids, small lepidopteran larvae, grubs and few storage pests. *Blaptostethus* was found to be the potential anthocorid predator of pests in the maize ecosystem in Egypt (Ballal *et al*, 2003). In India, documentation and identification of anthocorid predators is confined. Indigenous anthocorid predators were reported from Mysore (Rajasekhara, 1973), Tamil Nadu and Maharashtra (Muraleedharan, 1977) and Kerala (Jalali and Singh, 2002). Experimental investigations on anthocorid revealed that it could be a potential predator for maize aphid, *Rhopalosiphum maidis* (Fitch) and also few primary and secondary storage grain pests. In India, *B. pallescens* Poppius was found preying on mites on castor, aphids on maize, and moth pests in storage (Ballal *et al*, 2003). Knowledge of the effects of fluctuating temperatures prey consumed and other changing factors encountered during the development of predatory insects, are essential in understanding the vitality of an insect. The developmental studies help in understanding the life cycle of the predator among the hosts. This information helps in selecting the alternate prey resources required for incorporation into ecosystem in the absence of the primary host.

MATERIALS AND METHODS

The study was conducted during 2016-17 at Centre for Biological Control (CBC) laboratory, National Institute of Plant Health Management, Hyderabad. The anthocorid bugnucleus culture wasobtained from NBAIR, Bengaluru which was further mass multiplied in the laboratory on the rice moth eggs employing the technique developed by Ballal *et al* (2003). A wide mouthed jar was taken and moistened tissue was placed at the bottom of jar upon which a layer of cotton was placed. *Corcyra* eggs were sprinkled and fresh beans were providedeveryday for oviposition by the adults. The jar is covered with muslin cloth for aeration. The oviposited beans were collected and placed separately. The newly hatched 24 hr old nymphs were gathered and used for the study. The experiments were carried out at 25±2°C and 80% RH.

The development of anthocorid bug was studied on different preys *viz*., red spider mites, thrips, papaya mealybug nymphs and adults and rice moth eggs under laboratory conditions. The preys were collected from in and around agricultural fields and laboratory (*Corcyra* eggs). The collected preys along with their hosts were placed in a petridish containing one day old hatched nymph or adult at the beginning of the experiment. Subsequently, the preys along with their hosts were changed daily so as to provide enough food for development of anthocorid bug.

Data was recorded on incubation period- once the adults emerged in each experiment were collected and placed in an oviposition box containing a layer of cotton on the bottom and fresh beans for oviposition. And the time taken for hatching is recorded for each prey species; nymphal duration- single nymph was released into each replicated petriplate containing respective hosts with date and time of release recorded. Moulting was identified by the presence ofexuviae in the petriplate. After each moult, the cast skin was removed from petriplate and the time lapse between two moults was recorded. Summation of the individual instar durations gave the total nymphal period. The total number of instars were also observed and recorded for each prey species. Adult longevity-number of days the adult survived *i.e*., the duration from the last nymphal moult up to death of the adult was recorded on all the preys under experiment. A total of 7 replications were maintained for each experiment. Data was collected onnumber of days and all the observations were subjected to One-way analysis of variance (ANOVA) using statistical analysis software *i.e*., SPSS 21 version.

RESULTS AND DISCUSSION

The observations on the development of *B. pallescens* on different preys obtained are presented in Table 1. Being a paurametabolus insect, anthocorid bug has 3 life stages *viz*., egg, nymph and adult. Adult females laid cylindrical eggs in the epidermal layers of fresh bean pods. The highest incubation period was5.57±0.37 days on thrips followed by 5.14±0.26 days in papaya mealybug nymph, red spider mites (4.86±0.26 days), rice moth UV-sterilised eggs (4.43±0.30 days) and the least development was observed in the case ofrice moth UV- sterilised eggs (4.29±0.36 days). Similar results were observed in an experiment conducted by Srikumar *et al* (2017), who found that incubation period of *B. pallescens* in red spider mites was 4.4±0.34 days.

Nymphs remained translucent during the first instar and later, in second instar developed reddish brown pigmentation. The nymphal period was highly significant amongst the preys provided. However, during the first 2 days of nymphal period, prey consumption was nil. Similar observations were found in experiments of Ballal *et al* (2003), who reported that freshly hatched nymphs preferred to feed on plant sap for the first few days. Papaya mealybug nymph recorded the highest total nymphal period duration (23 days) followed by red spider mite (20.29 days), thrips (20 days), rice moth unsterilized eggs (16.86 days) and lowest total nymphal period was recorded in rice moth UV- sterilized eggs (16.57 days). A study conducted by Srikumar *et al* (2017) reported that total nymphal period in case of red spider mites was 17.1±0.35 days. The present findings were in confirmation with findings of Ballal *et al* (2009), where an extended nymphal period of 21 days was observed in *B. pallescens* when fed on *T. urticae*. First instar period ranged between 4.57±0.20 and 2.29±0.18 days in red spider mites and thrips, respectively. Second instar period was found to be highest in papaya mealybug nymphs (5.00±0.44 days) followed by red spider mites (4.14±0.26 days) and least was found in rice moth UV- sterilised eggs (2.86±0.14 days).

Third instar period followed the similar trend as 2nd instar where highest period was found in papaya mealybug nymphs (4.57±0.20 days) and least in rice moth UV-sterilised eggs (2.71±0.29 days). Fourth instar period

Table 1 : Development of *Blaptostethus pallescens* on different preys.

	Incubation period (days)	Nymphal instar period (Days)						Adult longevity (days)
		1st	2nd	3rd	4th	5th	Total	
RSM	4.86±0.26 (2.31)^{abc}	4.57±0.20 (2.25)^{a}	4.14±0.26 (2.15)^{ab}	2.71±0.36 (1.78)^{b}	4.86±0.26 (2.31)^{a}	4.00±0.54 (2.10)^{c}	20.29	18.43±0.43 (4.35)^{b}
PMB (N)	5.14±0.26 (2.37)^{ab}	3.29±0.29 (1.94)^{b}	5.00±0.44 (2.33)^{a}	4.57±0.20 (2.25)^{a}	4.57±0.20 (2.25)^{a}	5.57±0.48 (2.45)^{b}	23.00	16.71±0.18 (4.15)^{c}
PMB (A)	0.00 (0.71)^{d}	0.00 (0.71)^{d}	0.00 (0.71)^{d}	0.00 (0.71)^{c}	0.00 (0.71)^{d}	0.00 (0.71)^{d}	0.00	0.00 (0.71)^{e}
CCE (S)	4.29±0.36 (2.18)^{c}	4.14±0.34 (2.15)^{a}	2.86±0.14 (1.83)^{c}	2.71±0.29 (1.78)^{b}	2.71±0.42 (1.77)^{c}	4.14±0.34 (2.15)^{c}	16.57	47.00±0.58 (6.89)^{a}
CCE (US)	4.43±0.30 (2.21)^{bc}	4.14±0.34 (2.15)^{a}	3.00±0.44 (1.85)^{c}	2.71±0.29 (1.78)^{b}	3.00±0.22 (1.87)^{bc}	4.00±0.22 (2.12)^{c}	16.86	47.00±0.44 (6.89)^{a}
THRIPS	5.57±0.37 (2.46)^{a}	2.29±0.18 (1.66)^{c}	3.27±0.36 (1.93)^{bc}	3.14±0.26 (1.90)^{b}	3.71±0.18 (2.05)^{b}	7.57±0.20 (2.84)^{a}	20.00	14.14±0.34 (3.83)^{d}
SEm	0.286	0.254	0.316	0.259	0.247	0.347	-	0.378
CD(p=0.05)	0.823	0.732	0.910	0.745	0.713	0.998	-	1.088

One-way ANOVA, $p \leq 0.05$, Tukey's HSD.

*The data provided in parenthesis are square root transformed average of 7 replications. Different letters after mean values indicate significant difference among treatments.

was observed to be 4.86±0.26 days in red spider mites followed by papaya mealybug nymph (4.57±0.20 days) and the lowest was noted in rice moth UV-sterilised eggs (2.71±0.42 days). Fifth instar period lasted for 7.57±0.20 daysin thrips which was the highest nymphal period followed by papaya mealybug nymph (5.57±0.48 days) and lowest nymphal period in the 5th instar was noted in red spider mites (4.00±0.54 days) and rice moth unsterilized eggs (4.00±0.22 days). Tawfik and El-Husseini (1971) reared *B. pallescens* on few lepidopteran larvae, aphids and mites and noticed that the nymphs were unable to moult when they fed on aphids or plant sap.As the experiment was conducted in laboratory conditions, least mortality of nymphs was observed. However, Temperatures higher than 30°C would cause huge mortality of eggs and nymphs in the development of *B. pallescens* (Kaur and Kaur, 2018).

Adults were reddish blackish in colour. There was a prominent dent on the scutellum of the adults. Male were slightly smaller than female and had asymmetrical posterior segments in abdomen. Adult longevity was observed to be highest in case of rice moth UV-sterilised and unsterilized eggs (47.00±0.44 days), which were statistically on par amongst each other followed by red spider mites (18.43±0.43 days) and the lowest adult period was observed in thrips (14.14±0.34 days). When fed on mites and aphids in laboratory conditions, the longevity of adult *B. pallescens* was only 21 days, while it could live for even up to 2 months on *C. cephalonica* eggs (Ballal *et al*, 2003). However, during the investigation it was noticed that development on papaya mealybug adults was restricted or reduced. Apart from prey, the development in case of *B. pallescens* would also depend on temperature (Kaur and Kaur, 2018). Their study showed that development of eggs, nymphs and reproduction rate of *B. pallescens* is optimal at 25 and 30°C and could be used in developing release technology in suitable climatic conditions. The longest adult longevity and nymphal duration helps in higher consumption of prey per day. Even though, anthocorid bugs had higher nymphal period in case of papaya mealybug, its availability is restricted only to few hosts and moreover in field conditions, *Corcyra* eggs availability will be a constraint. But *Corcyra* eggs can be ideal for mass culturing as they have shorter nymphal period and higher adult longevity, which is a primary requisite for mass multiplication. Therefore, red spider mites and thrips can be provided as prey on alternate hosts, when primary hosts are not available. Further studies can be carried out on preference of prey in the presence of other predators or parasitoids and the effects of abiotic factors on the development of the anthocorid bug.

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