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Studies on the Biology and Fecundity of the Wolf Spider *Lycosa pseudoannulata* Boes et.Str., A Potential Predator of Rice Hoppers

M.GANESH KUMAR and R.VELUSAMY

Dept. of Agrl. Entomology, TNAU
Coimbatore-641 003

ABSTRACT

The wolf spider *Lycosa pseudoannulata* Boes et.Str. one of the most prolific predators of rice hoppers in the field, was mass reared in the laboratory for three consecutive generations to enable investigation on its suitability as a biocontrol agent and also to find the effects of subculturing on the fecundity of the spider. Rearing the spider upto the third instar on nymphs of *Nilaparvata lugens* Stal and then with the grubs of *Tribolium castaneum* (Herbst) was the best for the spiders, taking minimum time to reach adult-hood with high fecundity and high percentage of individuals reaching the adult stage compared to the other preys used. *Aphis craccivora* Koch was found to be a poor prey for the multiplication of *L.pseudoannulata*.

KEY WORDS: *Lycosa pseudoannulata,* mass culturing, *Nilaparvata lugens, Nephotettix virescens, Sogatella furcifera, Aphis craccivora, Tribolium castaneum*

Arthropod predators and parasitoids are among the myriad life forms in rice fields of tropical and southeast Asia. The paradox in rice insect pest management is that when natural biological control works, these arthropod natural enemies are taken for granted which results in their mismanagement. In the pursuit of the identification of selective biocontrol agents, the spiders can be considered for the control of insect pests because they can kill a sizable number of pests per unit time. In the present study, the biology of the wolf spider *Lycosa pseudoannulata* Boes et.Str. was studied on certain prey species with a view to mass culture the predator in large numbers under controlled conditions.

MATERIALS AND METHODS

For studying the biology, individual spiderlings which were about to disperse from their mother were confined in specially constructed cages. The cages were made from louvers with compartments of 2.5 x 2.5 x 1 cm dimension. A sheet of sponge (1 cm thick) was pasted on the lower side and a sheet of mylar film on the upper side. Using a heated soldering iron, a single hole of diameter 0.5 cm was punched out in the mylar film. Into each of these compartments a single spiderling was introduced. The hole was plugged with a ball of cotton. The whole contraption was kept in a tray containing 1 cm level of water. The cage was slightly pressed down to enable the sponge to become fully soaked. Sufficient prey insects were introduced through the opening on alternate days after anesthetizing them with carbon dioxide for easy handling. The experiment was conducted in a factorial completely randomized design with five replications and 10 spiderlings per replication. There were five prey types used: *Nilaparvata lugens* Stal (BPH) nymphs and adults, *Nephotettix virescens* Distant (GLH) nymphs and adults, *N.lugens* nymphs upto third instar and then grubs of *Tribolium castaneum* Herbst, *Sogatella furcifera* Horwath (WBPH) nymphs and adults and *Aphis craccivora* Koch (Cowpea aphid).

The biology was studied on different preys for the second and third consecutive generations using the progeny obtained from the previous experiment. The same type of cages were used for holding the spiderlings individually.

RESULTS AND DISCUSSION

In the first generation, among the different preys used for rearing the wolf spider, sustaining upto the third instar on *N.lugens* nymphs and then with the grubs of *T.castaneum* was the best requiring only 129.85 days to reach adulthood and was superior to other prey used. Cowpea aphids proved to be the most adverse prey as the life cycle was extended to 180.57 days (Table 1)

It could also be seen that survival was greatest (80.80%) in the *N.lugens* and *T.cas-*

Table 1. Effect of different preys on the development of *L.pseudoannulata* (First generation)

Prey Used	Period (days)*										
	Instar										
	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
BPH	9.29b	12.56c	9.87b	12.90c	14.29c	16.17b	14.59c	25.90a	15.89c	18.25b	149.71d
WBPH	11.26a	11.48d	10.31b	14.43b	15.84a	14.38d	13.93c	25.38a	19.59a	14.53c	151.13c
BPH+ T.c**	8.92b	13.49b	8.25c	10.76d	14.82bc	15.34c	12.22d	19.20b	15.69c	11.16d	129.85e
GLH	7.04c	11.03d	13.56a	12.92c	13.00d	18.15a	16.49b	25.98a	19.11a	15.17c	152.45b
Aphid	11.25a	22.61a	12.87a	16.64a	15.15ab	16.11b	27.74a	18.22c	18.19b	21.79a	180.57a

In a column, means followed by the same letter (lower case) are not significantly different (P=0.05); by Duncan's (1951) multiple range test ** *T.castaneum*
* Mean of five replications.

Table 2. Survival of *L. pseudoannulata* when reared on different preys (First generation)*

Prey Used	Instar										
	I	II	III	IV	V	VI	VII	VIII	IX	X	Mean
BPH	98.00a	86.00a	78.00b	72.00c	72.00c	64.00c	62.00c	60.00c	60.00c	62.00c	71.40c
WBPH	94.00b	64.00b	66.00c	64.00d	62.00d	54.00d	54.00d	54.00d	54.00d	54.00d	62.00d
BPH+ T.c**	98.00a	84.00a	82.00a	82.00a	76.00b	78.00a	78.00a	78.00a	74.00a	78.00a	80.80a
GLH	98.00a	86.00a	78.00b	76.00b	80.00a	72.00b	72.00b	68.00b	66.00b	64.00b	76.00b
Aphid	82.00c	52.00c	42.00d	38.00e	42.00e	34.00e	34.00e	34.00e	34.00e	28.00e	42.00e

In a column, means followed by the same letter are not significantly different (P=0.05); by Duncan's (1951) multiple range test ** *T.castneum*
* Mean of five replications.

Table 3. Effect of different preys on the development of *L. pseudoannulata* (Second generation)

Prey Used	Period (days)*										
	Instar										
	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
BPH	6.03d	17.43d	14.67b	12.64b	13.37b	15.39b	5.95d	15.72c	24.00a	41.00a	166.20c
WBPH	10.16b	20.47b	12.12d	8.27b	10.36d	27.31b	6.61d	12.77e	16.29c	39.67b	164.03d
BPH+ T.c**	6.98c	17.57d	12.98c	13.24d	18.49a	11.74e	10.66c	17.60b	11.00e	18.78c	139.04e
GLH	9.45b	19.05c	18.73a	11.50c	12.54c	18.29c	22.86a	20.12a	18.12b	18.37c	169.03b
Aphid	12.56a	25.55a	11.00e	20.16a	10.03d	30.17a	14.98b	14.59d	12.15d	38.96b	190.15a

In a column, means followed by the same letter are not significantly different (P=0.05); by Duncan's (1951) multiple range test ** *T.castaneum*
* Mean of five replications.

Table 4. Survival of *L. pseudoannulata* when reared on different preys (Second generation)*

Prey Used	Instar										
	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
BPH	96.67b	93.33b	93.33b	90.00a	83.33b	76.67b	70.00c	70.00b	63.33c	60.00c	79.67ab
WBPH	86.67c	86.67c	86.67c	83.33c	76.67b	76.67b	73.33b	66.67c	63.33c	56.67d	75.67c
BPH+ *T.c***	100.00a	96.67a	96.67a	93.33b	93.33a	83.33a	76.67a	76.67a	76.67a	76.67a	87.00a
GLH	86.67c	86.67c	83.33d	83.33c	80.00c	76.67b	76.67a	73.33b	66.67b	66.67b	78.00bc
Aphid	80.00d	80.00d	73.33e	66.67d	63.33c	50.00c	43.33d	40.00d	30.00d	26.67e	55.33d

In a column, means followed by the same letter are not significantly different (P=0.05); by Duncan's (1951) multiple range test ** *T.castaneum*
* Mean of five replications

taneum prey combination than with cowpea aphids in which 42 per cent of the spiderlings alone reached maturity (Table 2)

During the second generation too, the least time taken to reach adult-hood (139.04 days) with maximum survival on *N.lugens* and *T.castaneum* combination (87%) which was statistically on par to rearing on *N.lugens* alone but superior to the rest (Tables 3 and 4).

Among the different preys used for rearing the wolf spider, rearing upto the third instar on *N.lugens* nymphs and then with the grubs of *T.castaneum* was the best for the spiders, taking minimum time to reach adult-hood with high fecundity and high percentage of individuals reaching the adult stage compared to the other preys used. *A.craccivora* was found to be a poor prey for the multiplication of *L.pseudoannulata*. This may be attributed to the small size of the prey and further, the predator had to make several forays beyond the third instar to assuage its hunger. Rovner (1971) has utilized meal worms (*Tenebrio* sp.) for rearing the wolf spider *Lycosa rabida* and Ross *et al.* (1982) have reported that spiderlings of *Heteropoda venatoria* (Linnaeus) showed maximum weight gain on larvae of *Tenebrio molitor* L. Javier *et al* (1987) have used *T.castaneum* for mass culturing two species of earwigs. Gavarra and Raros (1975) reported that only the second instar emerged from the egg sac. The time taken to reach adult-hood is also in accordance with the findings of Thang *et al.* (1988).

The fecundity of the spiders was maximum (120.67) when reared on *N.lugens* nymphs upto the third instar and subsequently with grubs of *T.castaneum* till they reached the adult stage. This was, however, statistically on par with

Table 5. Effect of different preys on the fecundity of *L. pseudoannulata* over three consecutive generations*

Preys Used	Fecundity in generation			
	1	2	3	Mean
BPH	165.40a A	70.60a B	4.40a B	93.47ab
GLH	86.20b A	67.00a A	50.20a A	67.80b
WBPH	168.20a A	108.40a B	60.40a C	112.33a
BPH+ *T.castaneum*	180.00a A	104.80a A	77.20a B	120.67a
Mean	149.95A	87.70B	58.05C	

Mans followed by the same letter in columns (lower case) and in a row means followed by the same letter (upper case) are not significantly different (P=0.05); by Duncan's (1951) multiple range test
* Mean of five replications

spiders reared on *S. furcifera* and *N. lugens* but was significantly superior to rearing them on *N. virescens* alone. Continuous rearing of the spiders for three generations under controlled conditions with the same type of prey had a negative effect on their fecundity (Table 5). There was a sharp drop in the fecundity from the second generation (87.70) and declined further during the third generation (58.05) (Table 5).

That fecundity of spiders is a function of food abundance and ration has been proved in *Cyrtophora cicatrosa* (Palanichamy, 1984). However Turnbull (1962) has reported the absence of any such relationship in *Linyphia triangularis* Clerk. A high food intake could in turn increase the reproductive potential of spiders (Savory, 1928). However, Greenstone (1979) has reported that the insects most heavily represented in the diets of *Pardosa ramulosa* (McCook), belonged to the orders Homoptera, Hemiptera and Diptera. He suggested that these spiders have adapted to this particular form of polyphagy for nutritional reasons. Such behaviour has selective value, since in the laboratory at least, survival and fecundity are higher in *Pardosa* sp. raised on multiple species than on single species diets. Therefore, rearing the predator on the same prey might have attributed for the drop in the fecundity of the wolf spider in the present study.

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