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Functional Response of Hunting Spiders, *Pardosa sumatrana* Thorell and *Pardosa birmanica* Simon (Lycosidae : Araneae) with Rice Brown Planthopper, *Nilaparvata lugens* (Stal.)

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Abstract

The laboratory experiments were conducted to study the functional response of the two spider species, *Pardosa sumatrana* Thorell and *Pardosa birmanica* Simon with different forms of the rice brown planthopper. Female P. sumatrana showed higher satiation levels on macropterous (29.25/day) and fifth instar (27.25/day) BPH compared to brachypterous (14.00/day) BPH. The feeding response curves were fitted to Holling's type II curve indicating that once the satiation level reached further feeding was not possible at any increase in prey density.
Key words : Functional response, *Pardosa sumatrana* and *Pardosa birmainca,* Brown planthopper.

Spiders, as representatives of sit and wait predators constitute 35% of the predatory arthropod fauna of rice agroecosystems. They play an important role in limiting the pest population from reaching harmful level. Hunting spiders belonging to Lycosidae have been reported to be efficient predators on green leafhopper, *Nephotettix* sp. and brown planthopper, *Nilaparvata lugens* (Stal). Survey conducted across the geographical regions has indicated *Lycosa* spp. and *Pardosa* spp. as most predominant in rice ecosystem. They have shown high capture rate for highly motile prey. Wolf spider, Lycosa pseudoannulata Bosenberg and Strand, showed a Hollings type-II curve towards hoppers in general (Heong and Rubia 1989), brown planthopper in particular (Heong and Rubia 1990). Yet little attention has been paid to the possible use of locally dominant spiders in rice insect pest management.

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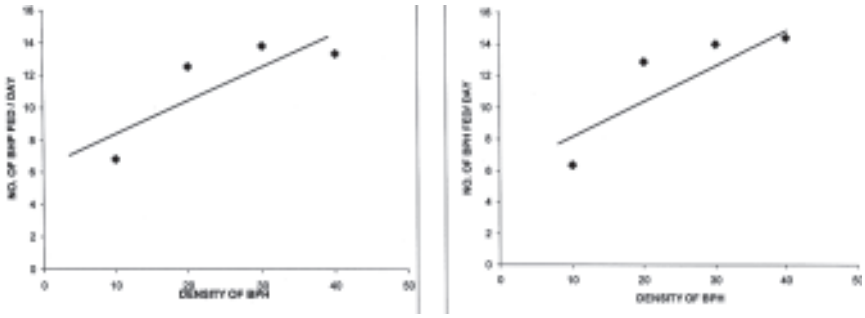
Methods

The functional response of the two major spider species of southern Karnataka, *Pardosa sumatrana* Thorell (maleand female) and Pardosa birmanica Simon were studied in the laboratory. Adult spiders were collected from the same field to have same level of satiation and selected based on the uniform size of abdomen in order to maintain uniformity in the adult stage.

The experimental set-up consisted of a rectangular glass jars (12 × 5 × 30 cm, L × W × H, respectively) containing two glass vials (2 cm length × 0.5 cm dia) at the bottom of the jars. The glass vials were filled with water and placed three 25 day old rice seedlings in it and plugged with cotton. The glass jars were filled with soil upto the rim of glass vial to facilitate easy movement for the spider. A known number

Table 1. Functional response of *Pardosa sumatrana* and *Pardosa birmaica* with brachypterous *Nilaparvata lugens.* BPH : Brown planthopper, SD : Standard deviation.

Density of BPH	Mean no. of BPH consumed/day ± SD P. sumatrana		P. birmanica
	Male	Female	
10	6.80 ± 12.42	6.33 ± 2.34	7.50 ± 1.50
20	12.50 ± 3.24	12.88 ± 4.07	11.40 ± 3.24
30	13.80 ± 2.76	14.00 ± 4.30	19.40 ± 3.67
40	13.30 ± 2.33	14.38 ± 4.69	24.50 ± 4.72



a. Male spider b. Female spider

Figure1. Functional response of *Pardosa sumatrana* with brachyperous BPH.

of prey were allowed to settle for 3 hours and then a adult spider starved for 24 hours was released and mouth of the jar was covered with muslin cloth. Mortality of prey was recorded after 24 hours of release of the spider.

Number of prey consumed by adult female of P. sumatrana on fifth instar and macropterous forms of the BPH were worked out at the prey densities of 10, 20, 30, 40 and 50, while the predatory capacity on brachypterous BPH was worked out at the prey densities of 10, 20, 30 and 40. The number of prey consumed by the adult males of *P. sumatrana* and females of *P. birmanica* was also studied at the prey densities of 10, 20, 30 and 40 brachypterous BPH. The treatments were replicated eight times. The number of prey consumed was determined as follows

Number of prey consumed = No. of prey provided –No. of prey alive

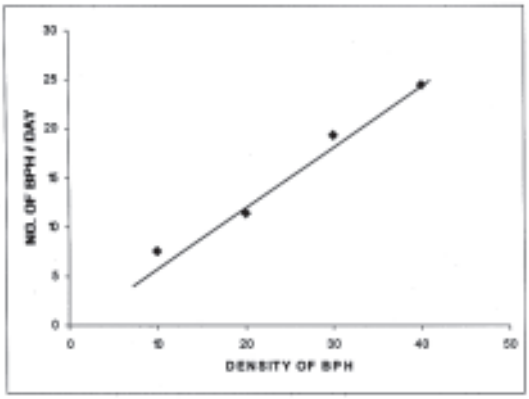


Figure 2. Functional response of *Pardosa birmaica* with brachypterous BPH.

Functional response curves were drawn and data obtained were subjected to regression analysis.

Results and Discussion

Male *P. sumatrana* consumed an average of 6.8, 12.5, 13.30 and 13.25 brachypterous form BPH at the prey densities of 10, 20, 30 and 40, respectively. The female *P. sumatrana* consumed an average of 6.33, 12.88, 14.0 and 14.38 brachypterous form BPH at the prey densities of 10, 20, 30 and 40, respectively (Table 1 and Fig. 1a and b). Female *P. birmaica consumed* an average of 7.5, 11.37, 19.37 and 24.48 brachypeterous at the prey densities of 10, 20, 30 and 40, respectively (Fig. 2).

Female *P. sumatrana* consumed an average of 6.38, 11.13, 20.38, 25.63 and 29.25, macropterous BPH at the prey densities of 10, 20, 30, 40 and 50, respectively. When female *P. sumatrana* was tested on fifth instar BPH, they consumed an average of 7.13, 11.75, 20.00, 25.75and 27.25BPH, at the prey densities of 10, 20, 30, 40 and 50, respectively (Table 2 and Fig. 3 a and b).

Table 2. Functional response of female *Pardosa sumatrana* with macropterous and 5th instar BPH. BPH : Brown planthopper, SD : Standard deviation.

Density of BPH	Mean no. of BPH consumed/day ± SD	
	Macropterous BPH	5th instar BPH
10	6.38 ± 2.50	7.13 ± 2.20
20	11.13 ± 4.62	11.75 ± 3.96
30	20.38 ± 5.59	20.00 ± 3.16
40	25.63 ± 6.32	25.75 ± 4.58
50	29.25 ± 13.70	27.25 ± 5.38

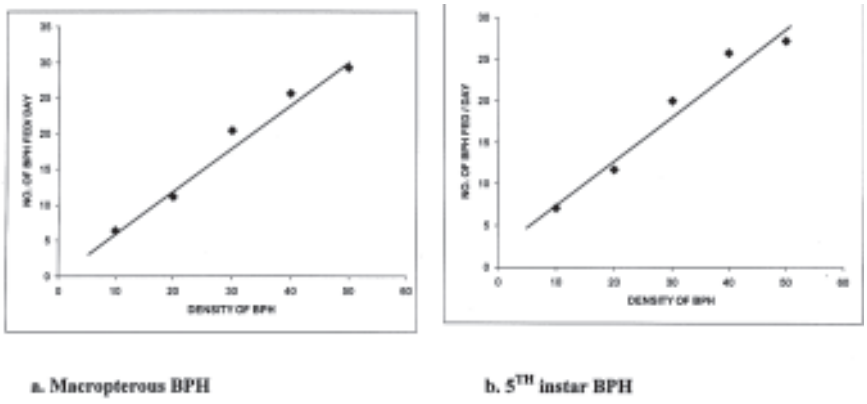


Figure 3. Functional response of female *Pardosa sumatrana* with different stages of BPH.

Number of brachypterous brown planthopper fed by male and female P. sumatrana increased with increasing density of prey but the plateau was reached at a density of 30 and further increase in the prey population did not increase prey consumption . The plateau was slightly higher for the female (14.0) compared to the male (13.5). The feeding response curves were fitted to Holling's type II curve (Holling 1959) as once the satiation level was reached further feeding was not possible at any increase in prey density. This phenomenon was also reported for L. pseudoannulata on BPH (Anon 1984, Heong and Rubia 1990), for *Theridion octomaculatum* on *N. lugens* (Ge and Chen 1989) and for L. pseudoannulata on BPH and GLH (Heong and Rubia 1989).

Functional response curves of female *Pardosa birmanica* with brachypterous BPH and female of *P. sumatrana* to macroterous BPH and fifth instar nymphs showed nearly linear curve indicating the type (II) functional response. That means the number of BPH fed increased at increasing rate with increasing density of prey. This was true in this case also. This might be because the macropterous and fifth instar BPH being highly motile and small prey stimulated and extended the satiation level. *Lycosa pseudoannulata* reached satiation level at fairly higher densities of nymphs of WBPH (Anon 1984). Nakamura (1977) demonstrated that spiders showed high capture rate for highly motile prey. Mansour et al. (1980) demonstrated that the number of *Spodoptera littoralis* (Boisdual) larvae consumed appeared to level off (188.9) at the highest densities of 250 and 300 per spider in the case of *Chiracanthium mildei* (Thorell).

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