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Peripheral and Central Distribution of Spider Species of the Cursorial Spider Along with Percent Trap Success in Wheat Field

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Abstract: The total number of genera and species, as well as number of specimens varied in the monthly samples. There was a gradual increase in the first three months and in the next two months samples the number of specimens captured increased manifold and drastically reduced in the month of May. This can be judged from the trap success data for the seven trapping session which is as followed; 0.8, 1.6, 8.0, 76.0, 50.4, 43.81 and 28.8% respectively. Peripheral and Central distribution of spiders were also studied. The peripheral traps were set within 10 meters distance from the periphery whereas the central traps were located at least 20 meter from the periphery.

Key words: Cursorial spider, peripheral and central distribution, percent trap success, wheat

Introduction

Bhathal *et al*. (1990) surveyed the predatory fauna of rice ecosystem in Ludhiana, Punjab, India. Thirteen species of araneae were recorded preying on insect pests of rice. Spiders are less sensitive to insecticides than other insect predators. Thus, there is a scope for selective use of pesticides conserving spiders as biological control agents against insect pests in combination with appropriate pesticides. This strategy will help as in minimizing the use of undesirable and costly insecticides. Cocquempot *et al*. (1991) studied the effect of incidence of insecticide treatment on the Araneae of wheat field at flowering stage. It was calculated that insecticides did not cause the substantial mortality of the Araneae and had only a brief effect on the population but had a relatively large effect on their predatory activity over a viral period. Spiders are also studied for their precious silk which may prove to be important both in medical and fiber industry. Genetic engineers nay utilize the spider's genetic material for producing the silk on commercial scale.

Materials and Methods

A non-experimental field of wheat was selected for the collection and study of ground dwelling spiders in agricultural research area of University of Agriculture Campus Faisalabad for the two seasons from Winter December through Summer May.

The method used for the collection of wandering spiders for a period of 6 months was pitfall trapping. It was recommended an absolute sampling method for the collection and nocturnally and diurnally active spiders.

The field was 0.75 hector in size. Inside the field two transacts comprising 25 squares were established. Each trap was placed at 10 meter distance from each other as well as from all sides of the field. These squares were continuously sampled for a period of 6 months and for five consecutive days each month. Each trap comprised of a glass jar of 13 cm high and 6 cm in diameter, with a removable lid. Inside each trap nearly 150 to 200 ml of 70% Ethyl alcohol (Ethylene glycerol, C ommercial) and a small quantity of (5-10 ml) of Kerosine oil was used as killing and preservative agent. The traps were buried in the soil with the open end flushed with the soil surface with minimum habitat disturbance. The collected specimens were brought to the Laboratory. All the specimens including spiders, insects and other animals were washed with xylene, separated, carated, sorted and individually numbered and preserved separately into recommended glass vial already having a mixture of 1:1 ethyl alcohol and glycerine with a permanent label. All the spiders were identified upto the species level. Krause (1987) studied the spider fauna of summer wheat and winter rey and spider density varied from 3 to 61 individuals. Alderweireld (1987) recorded 70 species from edge and centre of the field and recorded 45 spiders/m in the centre and 150 spiders/m at edge. The data obtained for the pitfall trapping were analysed for the species relative abundance and other diversity indices. For the estimation of species richness Margalef's Index was used which is represented by:

$$E = \frac{\left(\frac{1}{\lambda}\right) - 1}{\sum H - 1}$$

(E = Evenness)

where 'λ', is Simpson's index and 'H' is Shanon's index,

$$S = \frac{ni(ni-1)}{i = 1n(ni-1)}$$

Where 'ni' is the number of individuals of the ith species and 'n' is the total number of individuals trapped.

For the calculation of Diversity Exponential Shanon's Index was used,

D = Hi

where, 'Hi' is the Simpson's index.

$$Hi = \sum_{i=1}^{S} \frac{(ni)}{n} - \frac{(ni)}{n}$$

whereas 'ni, is the number of individuals belonging to the 'ith' of 's' species in the sample and 'n' is the total number of individuals in the sample.

Results and Discussion

Percent trap success of spiders of wheat field: During first trapping session only a simple specimen of spiders belonging to one genus and one family Lycosidae was recorded. the over all tap success was 0.80.

In 2nd trapping session, a total of two specimens belong to family Lycosidae was recorded. During this session the over all trap success was 1.60 which was higher than the previous month, which indicated that at this time of the year spider

Table 1: Comparison of percent trap success of spiders of wheat field during seven trapping sessions

Tax Indices	First trapping season	Second trapping season	Third trapping season	Fourth trapping season	Fifth trapping season	Sixth trapping season	Seventh trapping season
No. of specimens	1	2	10	95	63	33	36
Trap success	0.8%	1.60%	8.0%	76.0%	50.4%	43.91%	28.8%

Table 2: A comparison of the spider fauna collected from the peripheral and central areas of the wheat field 'X' during different growth stages of the crop. In the table are given trap success and number of specimens (in parenthesis) for each of the seven trapping sessions

Species *Lycosidae*	No. of species	Early stage (Dec-Feb)		Maturing stage (March-April)		After harvesting (Apr-May)		Combined (Dec-May)	
		P	C	P	C	P	C	P	C
		Tn = 240	Tn = 135	Tn =160	Tn = 90	Tn = 140	Tn = 60	Tn = 540	Tn =285
L. bistriata	3	0.83(2)	- -	- -	- -	0.71(1)	- -	0.55(3)	- -
L. moulmeinensis	3	0.41(1)	- -	0.62(1)	1.11(1)	- -	- -	0.37(2)	0.35(1)
L. carmichaeli	2	0.41(1)	- -	0.62(1)	- -	- -	- -	0.37(2)	- -
L. negrotibialis	2	0.41(1)	0.74(1)	- -	- -	- -	- -	0.18(1)	0.35(1)
L. madani	8	- -	0.74(1)	3.12(6)	- -	- -	1.67(1)	1.11(6)	0.70(2)
L. mackenziei	7	- -	- -	3.74(5)	1.11(1)	0.71(1)	- -	1.11(6)	0.35(1)
L. guadrifer	7	- -	- -	2.50(4)	2.22(2)	- -	1.67(1)	0.74(4)	1.05(3)
L. mahabaleshwarensis	2	- -	- -	1.25(2)	- -	- -	- -	0.37(2)	- -
L. poonaensis	3	- -	- -	0.62(1)	1.11(1)	0.71(1)	- -	0.37(2)	0.35(1)
L. chaperi	3	- -	- -	0.62(1)	2.22(2)	- -	- -	0.81(1)	0.70(2)
L. pictula	2	- -	- -	0.62(1)	1.11(1)	- -	- -	0.18(1)	0.35(1)
L. indagatrix	3	- -	- -	1.25(2)	- -	- -	1.67(1)	0.37(2)	0.35(1)
L. mysorensis	1	- -	- -	- -	1.11(1)	- -	- -	- -	0.35(1)
L. masteri	3	- -	- -	- -	- -	2.14(3)	- -	0.55(3)	- -
L. prolifica	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
Lycosid immature	10	- -	- -	1.25(2)	2.22(2)	3.57(5)	1.67(1)	1.29(7)	1.05(3)
E. shivajii	4	- -	0.74(1)	- -	1.11(1)	- -	3.33(2)	- -	1.40(4)
E. banarensis	7	- -	- -	2.50(4)	1.11(1)	0.71(1)	1.67(1)	0.92(5)	0.70(2)
E. rubiginose	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
E. solanensis	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
E. sohani	2	- -	- -	- -	- -	0.71(1)	1.67(1)	0.18(1)	0.35(1)
E. rajasthaneus	4	0.83(2)	1.49(2)	- -	- -	- -	- -	0.37(2)	0.70(2)
H. pisaurina	5	- -	- -	1.25(2)	1.11(1)	1.42(2)	- -	0.74(4)	0.35(1)
H. madhuae	3	- -	- -	1.25(2)	- -	0.71(1)	- -	0.55(3)	- -
H. madraspatanta	1	- -	- -	- -	- -	- -	1.67(1)	- -	0.35(1)
H. himalayensis	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
H. oliyacea	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
O. atalanta	1	- -	- -	0.62(1)	- -	- -	- -	0.18(1)	- -
P. annandalei	2	- -	- -	0.62(1)	1.11(1)	- -	- -	0.18(1)	0.35(1)
P. tatensis	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
P. sumatrana	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
P. altitudus	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
P. songosa	2	- -	- -	- -	- -	1.42(2)	- -	0.37(2)	- -
P. shyamae	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
P. oakelyi	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
Sub-Total	100	2.9(7)	3.7(5)	22.5(36)	16.7(15)	19.9(28)	15.02(9)	13.2(71)	10.2(29)
Gnaphosidae									
G. poonaensis	1	- -	- -	2.50(4)	- -	2.85(4)	5.0(3)	1.48(8)	1.05(3)
T. tibialis	2	- -	- -	0.62(1)	1.11(1)	- -	- -	0.18(1)	0.35(1)
M. ashae	1	- -	- -	- -	1.11(1)	- -	- -	- -	0.35(1)
P. sedula	1	- -	- -	- -	1.11(1)	- -	- -	- -	0.35(1)
H. sataraensis	1	- -	- -	- -	1.11(1)	- -	- -	- -	0.35(1)
C. lambai	1	- -	- -	- -	1.11(1)	- -	- -	- -	0.35(1)
N. solanensis	3	- -	- -	- -	1.11(1)	0.71(1)	1.67(1)	0.18(1)	0.70(2)
Z. sataraensis	3	- -	- -	- -	1.11(1)	0.71(1)	1.67(1)	0.18(1)	0.70(2)
Z. mandae	4	- -	- -	- -	- -	2.14(3)	1.67(1)	0.55(3)	0.35(1)
O. adamensis	2	- -	- -	0.62(1)	- -	0.71(1)	- -	0.37(2)	- -
S. maindrani	8	- -	- -	- -	- -	3.57(5)	5.0(3)	0.92(5)	1.05(3)
Sub-Total	37	0.42(1)	- -	3.74(6)	7.77(7)	10.7(15)	15.01(9)	3.89(21)	5.61(16)
Salticidae M. tigrina	3	- -	- -	0.62(1)	1.11(1)	- -	1.67(1)	0.18(1)	0.70(2)
P. dhalchuriensis	6	- -	- -	2.50(4)	2.22(2)	- -	- -	0.74(4)	0.70(2)
H. brachiotus	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
Unidentified sp. III	4	- -	- -	- -	- -	2.14(3)	1.67(1)	0.55(3)	0.35(1)
Immature	1	- -	- -	- -	- -	0.71(1)	- -	0.18(1)	- -
Sub-Total	15	- -	- -	3.12(5)	3.33(3)	3.56(5)	3.34(2)	1.85(10)	1.75(5)
Araneidae N. mukerjei	4	- -	- -	0.62(1)	1.11(1)	1.42(2)	- -	0.55(3)	0.35(1)
Sub-Total	4	- -	- -	0.62(1)	1.11(1)	1.42(2)	- -	0.55(3)	0.35(1)
Linyphiidae									
Dubiaranea sp.	84	0.41(1)	- -	32.5(52)	34.4(31)	- -	- -	9.81(53)	10.9(31)
Sub-Total	84	0.41(1)	- -	32.5(52)	34.4(31)	- -	- -	9.81(53)	10.9(31)
Thomisidae Thanatus sp.	1	- -	- -	- -	- -	- -	1.67(1)	- -	0.35(1)
Sub-Total	1	- -	- -	- -	- -	- -	1.67(1)	- -	0.35(1)
Grand-Total	241	3.3(8)	3.7(5)	62.4(100)	63.3(57)	35.6(50)	35.04(21)	29.3(158)	29.12(83)

C = Central, P = Peripheral, Tn = Trap nights

population density was very low. Due to low temperature, early crop phenology and unavailability of prey. In February 10 specimen were recorded with 8.0% trap success and triple fold increase in populations density was recorded in this month. In the month of March 95 specimens were captured with 76.0% trap success. However, the total number spiders trapped in April not increased in number but it was 63 with a trap success 50.4%. In April 2nd trapping was done just after the harvesting with a total catch of 33 specimens and 43.91% trap success. In May total catch was 36 specimens with 28.8% trap success was recorded small but numerically it was nearly equal to the 2nd trapping of April (Table 1).

In all seven samples the number of individuals recorded ranged from 1-95 specimens per month. 25 pitfall traps were used randomly, trapping days were kept constant for adequate sampling size. Total number of specimens caught were used as index of abundance of spiders in habiting in the ground surface of sampled field. Lotz *et al*. (1991), also used 25 pitfall traps for the diversity, phenology and.trap site preference at equal distance while Topping and Sunderland (1992) also carried on the ecological study of spiders of winter wheat was carried on for a period of six month.

Peripheral and central distribution of spiders in experimental field: Table 2 Compares the distribution of spiders in the peripheral and central parts of the experimental wheat field. The peripheral traps were set within 10 m distance from the periphery, whereas the central traps were located at least 20 meter from the periphery. In this table the data have been lumped into three time periods, viz. December to February during which the wheat crop was in early stage of growth, March to April during which the crop was in maturing and ripening stage and April to May during which the crop had been harvested.

During the early stage December to February faunistic diversity was generally low. Species belonging to Lycosidae out numbered, the taxa of other families. Trap success for Lycosidae in the peripheral area of the field was 2.9% as compared to 3.7% of the central area. Families Gnaphosidae and Linyphiidae were represented by single specimen of one species captured from the peripheral zone. The over all trap success during this growing stage was 3.3% for the peripheral area and 3.7% for central area. During the maturation and ripening stage the spider diversity was greatly improved as for the number of species was contemned. Linyphiidae was the richest family followed by Gnaphosidae, Linyphiidae, Salticidae and Aranedae. Although Linyphiidae was represented by two species get it out numbered all the other families as for as the number of specimens in the samples were concerned. The trap success for Lycosidae was 22.5% in the peripheral area as compared to 16.7% from the central area. In Gnaphosidae the trap success for the peripheral area was 3.74 and 7.77% for the central area. In Linyphiidae the trap success for the peripheral area was 32.5% and for the central area it was 34.4%. As the samples of Salticidae and Aranedae were not captured. The trap success for all the species was 62.4% for the peripheral area and 63.3% for the central area. During April and May when the crop had been harvested. Lycosidae was the most dominant family followed by Linyphiidae, Gnaphosidae, Thomisidae, Salticidae and Aranedae. It is of interest to point out that a specimen of Thomisidae appeared for the 1st. time after the crop had been harvested. In Lycosidae trap success was 19.9% in the peripheral area and 15.02% in the central area. Gnaphosidae spiders from the peripheral area was 10.7 and 15.01% from central area. the trap success for salticidae from peripheral area was 3.12% and in central area 3.34%. The Linphiidae was not captured during this stage. In Thomisidae the peripheral area had a trap success the central area of 1.67%. The overall trap success was 35.6% in peripheral area and 35.04 in the central area.

When the data of all the three growth stages were compiled together it was found that there was very little different between the trap success of peripheral and central area. The trap success for all the families was 29.3% for the peripheral area and 29.12% for the central area. Bishop (1981) studied the special distribution of spiders in cotton. He recorded three equally distributed species in the outer, middle and inner portions of the field. Krause (1987) studies the spider fauna of summer wheat and winter ray and spider density varied from 3 to 61 individual. Alderweireld (1987) recorded 70 species from edge and centre of the field and recorded 45 spiders lin in the centre and 150 spiders/m edge.

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