

Studies on the Spider Fauna of Groundnut Fields in Gujarat, India

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ABSTRACT

A survey of spider fauna of groundnut fields from five different places in Gujarat was made from July to October during 1984-86. Altogether 2833 spiders belonging to 53 species, 34 genera and 14 families were collected from groundnut fields. They were classified into four guilds according to the predatory behaviour, hunting spiders, ambushing spiders, web building spiders and miscellaneous group of spiders, which were represented by 58.98%, 8.51%, 29.51% and 6.0%, respectively. Theridiidae and Lycosidae were the most dominant spiders and *Coleosoma blundum* Cambridge of Theridiidae and *Pardosa birmanica* Simon of Lycosidae were the most abundant spider species. The species diversity changed with the growth of the crop and reached the peak in October. The species composition at all the five sites is also discussed.

KEY WORDS : Spider fauna, groundnut, Gujarat

Spiders form one of the most ubiquitous groups of predaceous organisms in the animal kingdom (Riechert and Lockley, 1984). A number of entomologists have acknowledged the importance of spiders as one of the major predators in regulating the pests of different crops (Whitcomb *et al.*, 1963; Whitcomb and Bell, 1964; Bailey and Chada, 1968; Okuina, 1968; Kiritani *et al.*, 1972; Okuina and Wongsiri, 1973; Wheeler, 1973). The predatory efficiency of these arthropod predators have been evaluated by using radio active phosphorus labelled eggs and larvae of pests of cotton and soybeans (Buschman *et al.*, 1977; Mc Daniel and Sterling, 1979, 1981; Gravena and Sterling, 1983).

Comprehensive studies on the spiders of different habitats have been carried out from India (Tikader, 1982; Tikader and Malhotra, 1980) but to our knowledge, the extensive surveys in different agro-ecosystems are only a few. To form a basis for research into the role of spiders and to determine the economic importance as insect pest control agents in different agro-ecosystems, an account of the taxonomy, biology and species composition of the Araneae population is necessary. For this, a survey of Araneae population in groundnut fields was taken up in Gujarat in 1984. Information was collected not only on the principal species present in the groundnut fields, but also on where they were found and to some extent on their feeding habits. The species diversity at five different sites is also discussed.

MATERIALS AND METHODS

The spider collections and observations were made once a month from five sampling sites - viz., Akvada and Talaja (Bhavnagar Dist.), Gondal (Rajkot Dist.), and Rajula and Kodinar (Amreli Dist.) from Gujarat during the Kharif season - July to October, for three years during 1984-1986. Collections were made from five quadrates of 1 m² from four different corners, leaving sufficient core area and one from the middle of each field from all the sites. The plants and the area in the quadrate were searched thoroughly for possible webs and spiders. Spiders were collected in plastic tubes. All the specimens collected were preserved in 70% ethyl alcohol and identified upto the species level. These data were used to determine the species composition and their relative abundance in the fields. The species diversity was calculated using the Shannon Weiner index, $H = 3.321928/N(N \log 10^N - \sum n_i \log 10^{n_i})$ (Shannon, 1948), where 'N' is the number of specimens and 'n_i' the number of species.

RESULTS

A total of 2833 specimens belonging to 53 species under 34 genera distributed over 14 families of spiders were collected during the study period (Table 1). They can be grouped into four different guilds according to their predatory behaviour: (i) Hunting spiders, which were found chasing their preys, belonged to Lycosidae, Gnaphosidae, Oxyopidae, Clubionidae and Salticidae; (ii) Ambushing spiders which were seen in flowers and leaves waiting for their preys belonged to Thomisidae, (iii) Web building spiders i.e. those preparing their webs inbetween the branches and under the leaves to catch their prey belonged to

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Amaurobiidae, Theridiidae, Dictynidae and Araneidae, and (iv) Miscellaneous group of spiders which were neither hunters nor web builders and often found in secluded places belonged to the families Scytodidae, Heteropodidae, Zodariidae and Oonopidae. Of the 53 species collected in groundnut fields, 31 species (55.98%) were hunting spiders, 6 species (8.51%) ambushing, 11 species (29.51%) web-builders and 5 species (6%) belonged to miscellaneous group of spiders. Table 2 summarises the numerically dominant spider families and species in the fields.

HUNTING SPIDERS :

(i) Lycosidae :

The family Lycosidae is a large group, with twelve species commonly found in the groundnut fields, mostly on the ground. Members of this group were seldom seen on the plants in the day time. But immatures of *Pardosa birmanica*, *P. sumatrana* and *Lycosa poonaensis* were found swarming over the plants at night. Throughout the crop season, juveniles were collected in more numbers compared to the adults. Breeding season started by August in most of the lycosids and females were collected with cocoons attached to their spinnerets by the end of August. Males and females reached their peak in numbers during September - October.

(ii) Gnaphosidae :

Seven species belonging to five genera represented the family Gnaphosidae in groundnut fields. These moderate to small sized spiders were found in the fallen leaves and under stones in the ground.

(iii) Clubionidae :

Most of the clubionids, except *Castianeira* were most often found during the day time in silken tubes prepared by rolling the leaves. They were found hunting in the night and hiding themselves during the day time. These spiders were collected in more numbers during late August through October. The juveniles were found to be present in the silken tubes almost on every leaf of the plants during late October. The ground dwelling forms of this family, *Castianeira indica* and *C. tinae* were found throughout the crop season on the ground level.

(iv) Salticidae :

This family of jumping spiders was one of the dominant groups in the groundnut fields, both in number and activity. These spiders were found on all parts of

the plant from the terminals to the base. In groundnut field, this family was represented by five species belonging to four genera. Three species, *Plexippus paykullii*, *Marpissa tigrina* and *M. decorata*, were found frequently in the fields. Immatures appeared in large numbers in the fields since the beginning of the crop and males and females appeared by August.

(v) Oxyopidae :

Although only two species of Oxyopidae were found in the fields, it is an extremely important group. These lynx spiders were found hunting actively during the day time. They were found on the upper portion of the plants moving over the foliage. Few females appeared in the fields in July along with immature ones and the number of immatures increased considerably by October.

AMBUSHING SPIDERS :

(iv) Thomisidae :

These crab-like spiders were found particularly numerous in the terminal buds and flowers. However, they were found on all parts of the plants and on the ground also. Six species of four genera were present in the fields. *Thomisus pugilis* appeared in the fields as immatures in early July and increased in number considerably by August - September. Males and females were observed during August through October. The other five species were collected sporadically in the fields. *Oxyptila maratha* and *Xysticus sujatai* were found only on the ground, hidden under the stones and dead leaves.

WEB - BUILDING SPIDERS

(vii) Theridiidae :

The family Theridiidae was the most abundantly represented group of spiders comprising of five species under four genera. The tangled webs of *Coleosoma blundum*, *Steatoda* sp. nov. and *Theridion tikaderi* were commonly found on the upper two-thirds of the plant. *C. blundum* was found to be the most abundant spider species. Large numbers of juveniles and adults were found in the field since the beginning of the crop in July and maximum numbers during October.

(viii) Amaurobiidae :

Two species of this family were represented in the groundnut fields. They were found in the lower stratum of the plants in flat, dense webs built among the

branches and leaves and sometimes on the ground. Immatures were observed in the fields by late August and adult males and females were found in October.

(ix) **Dictynidae :**

This family was represented by a single species spinning small snares on the terminals and were seen from August through October in the fields.

(x) **Araneidae :**

These true orb weavers prepared their webs among the plants and could best be seen early in the morning and evening. Only immatures were found in the fields throughout the crop season.

MISCELLANEOUS GROUP OF SPIDERS

(xi) **Scytodidae :**

Two species *Scytodes kinsukus* and *S. thoracica* were found in the fields under dead leaves.

(xii) **Heteropodidae :**

These giant crab-spiders were observed in the field running over the plants and hiding under the dead leaves during day time. Immatures of a single species, *Heteropoda bhaikakii* represented the family in the fields.

(xiii) **Oonopidae :**

Members of this family were also found to be very rare both in number and species, where only nine specimens of *Triaeris poonaensis* were collected from the ground under the leaves.

(xiv) **Zodariidae :**

Only two females and two males of *Storena indica* of this family were collected from the fields. They were seen under secluded places, like beneath the stones and dead leaves.

SPECIES COMPOSITION AND SPECIES DIVERSITY OF SPIDERS AT DIFFERENT SITES

A total of 795 spiders of 47 species from Akvada, 614 specimens of 46 species from Rajula, 460 specimens of 34 species from Gondal, 484 specimens of 32 species from Talaja and 480 specimens of 31

species from Kodinar were collected during the three year study period. There was considerable increase both in the number of specimens and species during August through October at all the five sites. The species composition changed with the growth of the crop. At all the five sites, the species diversity index (H') was seen increasing from July through October (Table 3) attaining the peak in October. This supports the hypothesis of Pianka (1966) that as the crop grows increase in the prey availability supports more species to co-exist.

The spider fauna of groundnut fields in the study area had several species in common with the fauna of other crop fields in Gujarat (Patel *et al.*, 1987). All the major families of spiders reported from Gujarat (Patel 1971; Patel 1985) were represented in the groundnut fields. Members of the families Theridiidae, Lycosidae, Salticidae, Clubionidae and Thomisidae were particularly rich in numbers. Population of spiders was found to be quite homogeneous with a clear cut seasonal succession. Of course, there was some variation from field to field, but the most common spiders were distributed evenly in all the sites. Far fewer spiders were found in fields treated with insecticides such as monocrotophos, phosphamidon and fenvalerate at a concentration of 0.02% and even eliminated them completely from the fields due to continuous application of insecticides at higher concentrations (0.03% & 0.04%). Results on feeding experiments conducted in the laboratory by encaging the pests and spiders on groundnut plants in glass chimneys were encouraging and require large scale field trials to confirm the biological control potential of these naturally occurring predator population.

ACKNOWLEDGEMENTS

The authors are thankful to Prof. K.B. Tipnis, Principal, Sir P.P. Institute of Science, Bhavnagar, for providing laboratory facilities and encouragement. The financial assistance from the Indian Council of Agricultural Research, New Delhi, Project No. 13/81-PP, is gratefully acknowledged.

TABLE 1: Spiders collected from groundnut fields during July - October, 1984 to 1986 at five sites

Sl. No.	Spider species	No. of specimens					Total	Percentage of total collections
		Akvada	Rajula	Gondal	Talaja	Kodinar		
HUNTING SPIDERS		494	346	246	255	245	1586	55.98
I	Family Lycosidae	155	115	72	86	80	508	17.90
1	<i>Evippa pralongipes</i> (Cambridge)	1	1	--	--	--	2	0.07
2	<i>E. rajasthanensis</i> Tikader & Malhotra	3	1	--	--	--	4	0.14
3	<i>E. sohani</i> Tikader & Malhotra	1	--	--	--	--	1	0.04
4	<i>Hippasa pisaurina</i> Pocock	7	4	--	--	--	11	0.39
5	<i>Lycosa poonaensis</i> Tikader & Malhotra	32	30	9	32	27	130	4.59
6	<i>L. tista</i> Tikader	22	19	6	15	14	86	3.04
7	<i>Lycosa</i> sp.	1	--	--	--	--	1	0.04
8	<i>Pardosa birmanica</i> Simon	64	51	34	28	37	214	7.52
9	<i>P. fletcheri</i> (Gravely)	1	--	--	--	--	1	0.04
10	<i>P. mukundi</i> Tikader & Malhotra	1	1	--	--	--	2	0.07
11	<i>P. sumatrana</i> (Thorell)	21	8	13	11	2	55	1.94
12	<i>Pardosa</i> sp.	1	--	--	--	--	1	0.04
II	Family Gnaphosidae	94	45	30	30	34	233	8.23
13	<i>Drassodes intraprashta</i> Tikader & Gajbe	2	1	1	--	--	4	0.14
14	<i>Gnaphosa jodhpurensis</i> Tikader & Gijbe	14	4	6	2	6	32	1.13
15	<i>G. poonaensis</i> Tikader	50	17	11	22	26	126	4.45
16	<i>Scotophaeus poonaensis</i> Tikader	3	3	6	2	1	15	0.53
17	<i>S. rajasthanensis</i> Tikader	4	6	--	1	--	11	0.39
18	<i>Scotophilus maindroni</i> Simon	19	13	6	3	--	41	1.45
19	<i>Zelotes shantae</i> Tikader	2	1	--	--	1	4	0.14
III	Family Clubionidae	92	60	38	56	39	285	10.06
20	<i>Castianeira indica</i> Tikader	13	5	1	2	3	24	0.85
21	<i>C. tinae</i> Patel & Patel	6	15	2	5	4	32	1.13
22	<i>Cheiracanthium melanostoma</i> (Thorell)	29	12	3	9	15	68	2.40
23	<i>C. nalsaroverensis</i> Patel & Patel	3	1	13	27	2	46	1.62
24	<i>Clubiona pashabhaili</i> Patel & Patel	41	27	19	13	15	115	4.06
IV	Family Salticidae	98	87	69	51	44	349	12.32
25	<i>Marpissa decorata</i> Tikader	--	18	26	14	4	62	2.19
26	<i>M. tigrina</i> Tikader	32	21	9	5	11	78	2.75
27	<i>Phidippus pateli</i> Tikader	26	9	2	--	--	37	1.31
28	<i>Plexippus paykullii</i> (Audouin)	39	39	32	32	29	171	6.04
29	<i>Salticus andamanicus</i> Tikader	1	--	--	--	--	1	0.04
V	Family Oxyopidae	55	39	37	32	48	211	7.45
30	<i>Oxyopes shweta</i> Tikader	26	27	29	21	31	134	4.73
31	<i>Peucatia latikae</i> Tikader	29	12	8	11	17	77	2.72
AMBUSHING SPIDERS		72	62	28	54	25	241	8.51
VI	Family Thomisidae	72	62	28	54	25	241	8.51
32	<i>Oxyptila maratha</i> (Tikader)	5	7	2	6	1	21	0.74
33	<i>Thomisus cherapunjeus</i> Tikader	7	5	--	--	--	12	0.42
34	<i>T. elongatus</i> Stoliczka	1	1	--	--	--	2	0.07
35	<i>T. pugilis</i> Stoliczka	43	41	25	44	23	176	6.21
36	<i>Tibellus chatursinhgi</i> Tikader	1	3	--	--	--	4	0.14
37	<i>Xysticus sujatai</i> Tikader	15	5	1	4	1	26	0.92

TABLE 1 : Spiders collected from groundnut fields during July - October, 1984 to 1986 at five sites (Contd.)

Sl. No.	Spider species	No. of specimens					Total	Percentage of total collections
		Akvada	Rajula	Gondal	Talaja	Kodinar		
WEB BUILDING SPIDERS		189	152	156	163	176	836	29.51
VII Family Theridiidae		95	88	102	124	128	537	18.96
38	<i>Argyroides projiciens</i> Patel	4	--	--	--	--	4	0.14
39	<i>Coleosoma blundum</i> Cambridge	36	45	43	49	54	227	8.02
40	<i>Steatoda</i> sp. nov.	34	10	36	46	50	176	6.21
41	<i>Theridion manjithar</i> Tikader	10	3	--	--	--	13	0.46
42	<i>T. tikaderi</i> Patel	11	30	23	29	24	117	4.13
VIII Family Amaurobiidae		31	16	31	17	16	111	3.92
43	<i>Amaurodubius nathabhahi</i> Patel & Patel	--	16	21	17	16	70	2.47
44	<i>Amaurodubius</i> sp. nov.	31	--	10	--	--	41	1.45
IX Family Dictynidae		23	18	6	12	21	80	2.82
45	<i>Dictyna shiprai</i> Tikader	23	18	6	12	21	80	2.82
X Family Araneidae		40	30	17	10	11	108	3.81
46	<i>Araneus mitifica</i> Simon	--	2	--	--	--	2	0.07
47	<i>Neoscona mukerjei</i> Tikader	28	18	16	10	11	83	2.93
48	<i>N. theis</i> (Walckenaer)	12	10	1	--	--	23	0.81
MISCELLANEOUS GROUP OF SPIDERS		40	54	30	12	34	170	6.00
XI Family Scytodidae		6	14	9	2	14	45	1.59
49	<i>Scytodes kinsukus</i> Patel	--	9	2	--	2	13	0.46
50	<i>S. thoracica</i> (Latreille)	6	5	7	2	12	32	1.13
XII Family Heteropodidae		34	33	21	6	18	112	3.95
51	<i>Heteropoda bhaikakai</i> Patel & Patel	34	33	21	6	18	112	3.95
XIII Family Oonopidae		--	4	--	3	2	9	0.32
52	<i>Triaeris poonaensis</i> Tikader & Malhotra	--	4	--	3	2	9	0.32
XIV Family Zodariidae		--	3	--	1	--	4	0.14
53	<i>Storen indica</i> Tikader	--	3	--	1	--	4	0.14
Total number of specimens		795	614	460	484	480	2833	
Total number of species		47	46	34	32	31	53	

TABLE 2 : Numerically dominant spider families and species in groundnut fields

Family Rank	Family	Species	Species Rank
1	Theridiidae	<i>Coleosoma blundum</i>	1
		<i>Steatoda dhruvai</i>	3
		<i>Theridion tikaderi</i>	8
2	Lycosidae	<i>Pardosa birmanica</i>	2
		<i>Lycosa poonaensis</i>	6
3	Salticidae	<i>Plexippus paykullii</i>	4
4	Clubionidae	<i>Clubiona pashabhahi</i>	9
5	Thomisidae	<i>Thomisus pugilis</i>	3
6	Gnaphosidae	<i>Gnaphosa poonaensis</i>	7
7	Oxyopidae	<i>Oxyopes shweta</i>	5

TABLE 3: Spider species diversity (H') at 5 sites in groundnut fields Calculated using Shannon Weiner Index
 $H' = 3.321928/N (N \log_{10} N - \sum n_i \log_{10} n_i)$.

Site	July	August	September	October
Akvada	2.069	3.426	4.828	5.645
Talaja	3.262	4.029	4.972	5.692
Rajula	2.218	3.730	4.289	4.823
Kodinar	1.583	3.268	4.345	4.883
Gondal	0.895	3.026	4.071	4.868

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