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A study on the richness of spider fauna in rice ecosystem

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Abstract

The study on the abundance and species richness of spiders in the paddy fields of Thiruvananthapuram district of Kerala state brought out the spider diversity within the rice ecosystem. A total of sixty five species of spiders representing two major groups, hunters and web builders, which belong to eleven families and seven foraging guilds was documented. The species composition of hunters was more than the web building spiders, although the latter was numerically dominant. The dominant guild was orb web weavers. Araneidae was the family with more species composition, followed by Tetragnathidae and Salticidae. The predominant genus being *Tetragnatha*, and species, *Tetragnatha mandibulata* Walckenaer. Seventeen species of spiders were reported for the first time from the rice fields of Kerala, and it included the three dominant spiders, viz., *Neoscona rumpfi* Tikader & Biswas, *Bianor carli* Reimoser and *Thomisus projectus* Tikader.

Keywords: Spiders, Diversity, Hunters, Web builders, Araneidae, Tetragnathidae

1. Introduction

The rice ecosystem is an indigenous system with a terrestrial and aquatic environment and these two dimensions of the rice crop account for the extremely high complexity and biodiversity. Our rice fields are robust and stable even in the absence of insecticides as a result of an extremely rich web of generalist natural enemies, mainly predatory spiders (Premila, 2003) [1]. Spiders are the most omnipresent and numerous predators in both agricultural and natural ecosystems and their potential as biological control agents can only be appreciated through a greater understanding of their abundance and species composition in different ecological systems (Kaur *et al.*, 2001; Sudhikumar *et al.*, 2005;) [2, 3]. Spiders in rice ecosystem are among the least studied arthropods (Singh and Singh, 2012) [4]. And the less explored natural enemy in Kerala, their study was mainly confined to the construction of species lists and identification of the species and the dominant ones, whereas the quantitative information of spiders and the knowledge about their distribution and abundance in Kerala is meager. In this context the present study was done to document and quantify the spiders in rice ecosystem and study their species diversity, seasonal occurrence and abundance during the entire crop cycle.

2. Materials and Methods

2.1 Survey and collection

A random survey was conducted in an extensive rice growing tract in Thiruvananthapuram district of Kerala state, to collect the spiders associated with the rice crop and to study the habitat and abundance of the spiders during the Kharif and Rabi of 2015. The collection of spiders was done by sweep net method and by direct count method, which are described below. Based on the frequency of occurrence of the spiders during the survey period the spiders are classified as regular, frequent, occasional and rare spiders. Also the appearance of spiders on different stages of crop growth is identified.

2.1.1. Sweep net method

A standard sweep net of 1.5 meter long was used to sweep the spiders from the crop canopy, Adopting the method suggested by Reissig *et al.* (1986) [5]. And Bayot *et al.*, 1990 [6]. The collections of the sweep net were transferred into long polythene bags and brought to the laboratory. The specimens of each polythene bag were killed by inserting a strip of cotton dipped in chloroform and transferred separately on a white sheet of paper and using a stereo microscope, the spiders were sorted out, separated, counted, identified on species and genus

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level and family level based on the available keys and literature described by Tikader (1987) [7] and Barrion and Litsinger (1995) [8]. And preserved.

2.1.2. By direct count

Twenty hills of rice plants were selected randomly from each sample plots for direct counting of spiders and the plants were searched thoroughly to collect the spiders. Spiders observed on the crop canopy, base and mid of the plants, from the webs in between the plants, from the webs in individual leaf folds, from water, border weeds and field bunds were carefully collected in specimen tubes and brought to the laboratory and sorted and grouped.

2.2 Preservation of Spiders

Spiders were killed using chloroform and the specimens were preserved separately in 70 per cent ethyl alcohol (70 parts of 100 per cent alcohol + 30 parts of distilled water) in ASGI 30 ml screw cap specimen tubes and sealed using cello tape and kept in dark coloured card board Boxes. The very small spider specimens and the juvenile spiders were preserved in Oudemans' fluid (85 parts of 70 per cent alcohol + 5 parts of glycerine + 8 parts of glacial acetic acid + 2 parts distilled water). The preservatives were changed once in fortnightly intervals to avoid the dilution of the preservative in the body fluids of the spider specimens and the resultant contamination and damage of the specimen.

3. Results

Random survey conducted in the rice fields proved that rice fields harbour a multitude of spiders. Both hunters and web builders were prevalent in the field. Sixty five spiders belonging to seven guilds and eleven families were recorded (Table 1).

3.1. Web Builders

The web builders comprised of three guilds *viz.*, orb web weavers, scattered line weavers and sheet web builders. Different types of aerial webs were spun by these spiders for trapping their prey. Walking, jumping and flying insects constituted their main prey.

3.1.1 Orb Web Weavers

The orb web weavers consisting of 27 species of spiders were the major web builders in the rice ecosystem. The spiders built orb webs, a two dimensional snare, for prey capture. When an insect became entangled in the lines, it was seized, trussed with silk and carried to the hub in the web. The spiders recorded in the guild belonged to the families Tetragnathidae and Araneidae.

Tetragnathidae

Tetragnathidae was the predominant family in the rice ecosystem. Most of the tetragnathids recorded were small to medium sized, elongated spiders, colour of which ranged from fluorescent green to straw yellow and brown. These long jawed spiders built weak orb webs in between paddy plants or on border weeds or field bunds and always remained near their webs. They rested on individual leaves in an elongated posture. When disturbed, they dropped on to the surface of water, over which they strode like aquatic bugs. Two genera were recorded. *Tetragnatha* was characterized by elongate and tapering abdomen and *Dyschiriognatha* with rounded globose abdomen. *Tetragnatha* was the dominant genera. The species of spiders in the family included

Tetragnatha mandibulata Walckenaer, *Tetragnatha maxillosa* Thorell, *Tetragnatha javana* Thorell, *Tetragnatha viridorufa* Gravely, *Tetragnatha vermiformis* Emerton, *Tetragnatha andamanensis* Tikader, *Tetragnatha fletcheri* Gravely, *Tetragnatha cochinensis* Gravely, *Tetragnatha* spp., *Dyschiriognatha dentata* Zhu & Wen and *Dyschiriognatha* sp. *T. mandibulata* was the predominant species recorded followed by *T. maxillosa*. The females of *T. mandibulata* were dominant than the males. *T. mandibulata* was the largest and robust among the different species and possessed an extra tooth. *T. Maxillosa* occurred regularly in the field and its promarginal guide tooth and the first largest tooth were widely separated. *T. mandibulata*, *T. maxillosa*, *T. javana* and *T. viridorufa* were observed in the field during the nursery, vegetative, reproductive and maturity stages of the crop regularly. They were seen on border weeds, field bunds, and individual plants and within the crop canopy. *T. vermiformis* was found occurring regularly during the vegetative, reproductive and ripening stages of the crop. The spider was observed on border weeds, field bunds, individual plants and crop canopy. *T. andamanensis* was a frequently seen species during the vegetative, reproductive and maturity stages in the border weeds, field bunds, individual plants and crop canopy. *T. fletcheri* was occasionally seen during the vegetative, reproductive and maturity stages from the border weeds, individual plants and crop canopy. *T. cochinensis* was observed occasionally on the border weeds, field bunds, individual plants and crop canopy during the nursery, vegetative, reproductive and maturity stages of the crop. *Tetragnatha* spp. were occasionally collected during the vegetative, reproductive and maturity stages from the border weeds, field bunds, individual plants and crop canopy. *D. dentata* was occasionally recorded from the crop canopy and individual plants during the vegetative, reproductive and maturity stages of the crop. *Dyschiriognatha* sp. was found rarely during the vegetative, reproductive and maturity stages of the crop on the crop canopy and individual plants.

Araneidae

Araneidae was the second abundant family collected from the rice fields. These conspicuous creatures were brightly coloured and made large webs. The araneids built orb webs either in between the plants or just above the crop canopy. Eight genera and sixteen species were recorded in the family. The major genera were *Argiope* and *Neoscona*. *Argiope* species were large sized, brightly coloured and built a three dimensional snare whereas *Neoscona* species were small sized, mostly brown coloured with dull markings and built a weak orb web. The species recorded were *Argiope anasuja* Thorell, *Argiope aemula* Walckenaer, *Argiope catenulata* Doleschall, *Argiope pulchella* Thorell, *Neoscona rumpfi* Tikader & Biswas, *Neoscona bengalensis* Tikader & Bal, *Neoscona mukerjei* Tikader, *Neoscona* spp., *Araneus ellipticus* Tikader & Bal, *Araneus* spp., *Eriovixia laglaizei* Simon, *Eriovixia* sp., *Larinia* sp., *Cyrtarachne keralensis* Sunil & Sebastian, *Cyrtophora citricola* Forskål and *Gasteracantha geminata* Fabricius. *A. anasuja* and *N. rumpfi* were the two dominant species. Both the spiders were found during vegetative, reproductive and maturity stages regularly and occupied almost all habitats in the rice fields, like field bunds, border weeds, individual plants and from within the crop canopy. *N. rumpfi* was also recorded during the nursery stage of the crop. *A. anasuja* was bright red and grey coloured with yellow stripes in the abdomen with a flat cephalothorax clothed with thick layer of short white hairs,

long legs and variably shaped abdomen. *N. rumpfi* was yellowish brown coloured, clothed with long white hairs in the cephalic area, and abdomen is sub-ovate to sub-triangular, longer than wide, dorsum with an inverted christmas tree like folium of brown and chalk white bands. *A. ellipticus* occurred frequently during the vegetative, reproductive and maturity stages of the crop and was obtained from border weeds, field bunds, and individual plants and within the crop canopy. *Araneus* spp. and *A. aemula* were present occasionally during vegetative and maturity stage of the crop and was collected from within the crop canopy and individual plants except *A. aemula*, also found in the border weeds. *A. catenulata*, *A. pulchella*, *N. bengalensis*, *N. mukerjei*, *Neoscona* spp. and *E. laglaizei* were obtained during the vegetative, reproductive and maturity stages of the crop occasionally from field bunds, border weeds, and individual plants and within the crop canopy. *Eriovixia* sp. was rare in the field and collected from the crop canopy. *Larinia* sp. was observed during vegetative and maturity stages occasionally from within the crop canopy and individual plant and *C. keralaensis* was occasionally collected during vegetative, reproductive and maturity stages from within the crop canopy and individual plant. *C. citricola* and *G. geminata* were rare in the field during the vegetative and maturity stages and collected from the crop canopy.

3.1.2 Scattered Line Weavers

The scattered line weavers spun loose, irregular webs in dark places. The only family recorded in the guild was Theridiidae.

Theridiidae

The spiders were small sized thick set spiders, creamy white coloured with globose abdomen and long thin legs also called as comb footed or cob web spiders. They hung upside down from the dry threads of irregular maze webs. Only a single species was recorded in the family, viz., *Theridion* spp., which was found in large numbers throughout the crop period from nursery to the maturity stages. It was seen in diverse habitats like field bunds, border weeds, and individual plants and in the crop canopy.

3.1.3 Sheet Web Builders

The sheet web building spiders spun closely woven sheet of irregularly tangled loose and thin spaced webs. The spiders were observed clinging upside down beneath the blanket, upon which flying and jumping insects were trapped. Linyphiidae and Agelenidae were the two families recorded in the guild.

Linyphiidae

The linyphiids were small spiders which preferred shady and hidden places. The family contributed only a single genus with a single species, *Linyphia* spp. which occurred rarely during the vegetative and maturity stages of the crop. It was observed from the crop canopy and on individual plants.

Agelenidae

Agelenidae was one of the least represented families with a single species viz., *Agelena* sp. Occurrence of these flesh coloured, large sized spiders were rare and found only during the vegetative stage of the crop. It was collected from the crop canopy and from loose webs spun on individual plants.

3.2. Hunters

The hunters recorded from the rice ecosystem included the stalkers, ambushers, ground runners and foliage runners. These spiders are generally strong bold creatures, with elongate and cylindrical bodies propelled by stout legs of moderate length. Most of them were big eyed. They caught prey by pursuing and overpowering them with strength, speed and alertness.

3.2.1 Stalkers

The stalkers were generally observed running over vegetation with great agility. They were mostly active during day time. Two families were recorded in the guild.

Salticidae

The family salticidae was another dominant family in the rice field. These jumping spiders were big eyed, diurnal, with hairy bodies. The family recorded nine genera with fourteen species. The different species recorded were *Telamonia dimidiata* Simon, *Bianor carli* Reimoser, *Bianor* sp., *Plexippus paykulli* Savingny & Audouin, *Plexippus* sp., *Bavia kairali* Samson & Sebastian, *Thiania bhamoensis* Thorell, *Epeus indicus* Proszynski, *Carhottus viduus* C.L. Koch, *Carhottus* sp., *Hyllus semicupreus* Simon, *Hyllus* sp., *Myrmarachne plataleoides* O.P. Cambridge and *Myrmarachne* sp. *T. dimidiata* and *B. carli* were the dominant species among the salticidae. *T. dimidiata* was moderately large, beautifully coloured, males with reddish brown and snowy white stripes and females with yellow and white long stripes. *T. dimidiata* was observed in the field during vegetative, reproductive and maturity stages regularly and were mostly collected from individual thick, white, viscid silk retreats in rice plants and from the crop canopy. *B. carli* occurred frequently during vegetative and maturity stages and were collected from the crop canopy and field bunds. *Bianor* sp. was recorded occasionally during vegetative stage from the crop canopy. *P. paykulli* was present in the field during vegetative, reproductive and maturity stages occasionally and obtained from the field bunds, border weeds, individual plants and the crop canopy. *Plexippus* sp. was found occasionally during vegetative and maturity stages and *T. bhamoensis* and *C. viduus* were observed occasionally during the vegetative stage only and were obtained from the crop canopy alone. *B. kairali* was observed during the vegetative and maturity stages of the crop occasionally from the field bunds, border weeds and within the crop canopy. *E. indicus* was recorded during the vegetative, reproductive and maturity stages occasionally from field bunds, border weeds and within the crop canopy. *Carhottus* sp. was found occasionally during vegetative and maturity stages in field bunds and crop canopy. *H. semicupreus*, *Hyllus* sp. and *M. plataleoides* were occasionally seen during the vegetative and maturity stages of the crop from field bunds, border weeds and within the crop canopy except *H. semicupreus* which was also found in nursery stage of the crop. *Myrmarachne* sp. was found rarely and only during the vegetative stage from the crop canopy.

Oxyopidae

The lynx spiders were strongly built, with a high, oval cephalothorax and rounded abdomen tapering to a point behind. Their legs were thin, long and armed with long black spines. All the legs were of the same length. The family comprised two genera, viz., *Oxyopes* and *Peucetia*. Four species of spider's viz., *Oxyopes javanus* Thorell, *Peucetia*

viridans Stoliczka, *Oxyopes shweta* Tikader and *Oxyopes sunandae* Tikader were recorded. *O. Javanus* and *P. viridans* were the dominant species among them. *O. javanus* was straw coloured with brown cephalothorax and eight eyes arranged in four rows. *P. viridans* was beautifully coloured with bright transparent green variegated with rows of small red and yellow spots. *O. javanus* occurred regularly in the field during the nursery, vegetative, reproductive and maturity stages on the field bunds, border weeds, and individual plants and within the crop canopy. *P. viridans* and *O. shweta* too were present in the field regularly during the vegetative, reproductive and maturity stages and obtained from the border weeds, individual plant and within the crop canopy. *O. sunandae* was found during vegetative and maturity stages frequently and found in individual plants and within the crop canopy.

3.2.2 Ground Runners

These spiders were two clawed and were seen moving on soil and vegetation. The front legs were directed forwards. The spider was observed to pounce upon its prey and holding the body in its strong front legs, crushed it with its stout chelicera.

Lycosidae

The members of this family usually known as wolf spiders were good hunters, and chased their prey. The cuticle was clothed with simple or squamose hairs, which helped them to swim through water in the paddy fields and thus moved from one plant to another. The females enclosed the eggs in a carefully moulded subspherical bag and attached the sac to their spinnerets and dragged it around with her wherever she went. The family Lycosidae recorded six species of spiders. *Pardosa* and *Lycosa* were the two genera obtained, of which *Pardosa* was predominant. The different species observed were *Pardosa pseudoannulata* Böesenberg & Strand, *Pardosa sumatrana* Throell, *Pardosa amkhaensis* Tikader & Malhotra, *Pardosa* sp., *Lycosa tista* Tikader and *Lycosa* sp. Among these, *P. pseudoannulata* was dominant. The spider was medium large sized, greyish brown coloured, with a fork shaped median band on cephalothorax, two median yellow spots and three or four transverse yellow bands posteriorly in the abdominal dorsum. It was abundant in the field throughout the crop period, during vegetative, reproductive and maturity stages and were observed from field bund, border weeds, individual plant, within the crop canopy. *P. sumatrana* was encountered frequently during vegetative, reproductive and maturity stages from field bunds, individual plant and within the crop canopy. *P. pseudoannulata* and *P. sumatrana* were found resting at the base of the paddy plants. *P. amkhaensis* was recorded during vegetative and maturity stages occasionally from within the crop canopy. *Pardosa* sp. recorded its presence occasionally during vegetative stage from the crop canopy alone. *L. tista* and *Lycosa* sp. were encountered frequently during vegetative and maturity stages from the crop canopy, except the latter which was found during reproductive stage and collected from border weeds also.

3.2.3 Ambushers

The ambushers or crab spiders were mostly found in and among the inflorescence. They ran swiftly and pursued the prey.

Thomisidae

The thomisidae spiders had a flattened body and were formidable creatures which attacked insects and other spiders much larger than themselves and exhibited camouflaged prey capture. Four genera and six species of ambushers were observed during the study period, they were *Thomisus projectus* Tikader, *Misumena* sp, *Thomisus pugilis* Stoliczka, *Thomisus* sp, *Runcinia* sp. and *Xysticus* sp. *T. projectus* was the dominant spider, pearly white with eyes small and laterally projected large horn like protuberances on the head and exhibited vigour and good prey capturing abilities, and longevity. *T. projectus* was encountered regularly during vegetative, reproductive and maturity stages from field bunds, border weeds, and individual plant and within the crop canopy. *Misumena* sp. and *T. pugilis* appeared occasionally collected during vegetative, reproductive and maturity stages on the field bunds, border weeds and within the crop canopy except *T. pugilis* which was also found in creamy white silken retreats in individual leaves on plants. *Thomisus* sp. was rarely observed during flowering and maturity stages from within crop canopy and individually in webs made on twisted leaves. *Runcinia* sp. and *Xysticus* sp. were present occasionally during the flowering and maturity stages of paddy. They were seen both on border weeds and within crop canopy.

3.2.4 Foliage Runners

These vagrants had long legs with well-developed claw tufts and were good climbers, mostly whitish or brownish coloured. They lived in flat tubular nests, open at both ends, rolled in leaves or under bark. The plant hunters observed belonged to the families Miturgidae and Clubionidae.

Miturgidae

Cheiracanthium was the only genus recorded under this family, with three species viz., *Cheiracanthium danieli* Tikader, *Cheiracanthium melanostomum* Thorell, and *Cheiracanthium* sp. *C. danieli* was the dominant among the three and was seen occasionally during the vegetative, reproductive and maturity stages of the crop from within the crop canopy. *C. melanostomum* was collected occasionally during vegetative and reproductive stages from border weeds, individual plant and within the crop canopy. *Cheiracanthium* sp. was found during vegetative stage occasionally from the crop canopy.

Clubionidae

Clubionids are two clawed hunting spiders, usually seen in plants in rolled leaves. Two species viz., *Matidia* sp. and *Clubiona* sp. represented the family Clubionidae. *Matidia* sp. was recorded occasionally during vegetative and reproductive stages from within the crop canopy. *Clubiona* sp. was collected during the vegetative, reproductive and maturity stages occasionally from field bund, border weeds and within the crop canopy.

Table 1: Spiders documented from the rice fields and their guild structure, crop stage and frequency of occurrence and habitat.

SI No.	Spider species	Occurrence		Habitat
		Crop Stage	Frequency	
A	Web Builders			
I	Orb Web Weavers			
a	Family Tetragnathidae			
1	<i>Tetragnatha mandibulata</i> Walckenaer	N,V,F,M	RE	BW,FB,PP,CC
2	<i>Tetragnatha maxillosa</i> Thorell	N,V,F,M	RE	BW,FB,PP,CC
3	<i>Tetragnatha javana</i> Thorell	N,V,F,M	RE	BW,FB,PP,CC
4	<i>Tetragnatha viridorufa</i> Gravely	N,V,F,M	RE	BW,FB,PP,CC
5	<i>Tetragnatha vermiformis</i> Emerton	V,F,M	RE	BW,FB,PP,CC
6	<i>Tetragnatha andamanensis</i> Tikader	V,F,M	F	BW,FB,PP,CC
7	<i>Tetragnatha fletcheri</i> Gravely	V,F,M	O	BW,PP,CC
8	<i>Tetragnatha cochinchinensis</i> Gravely	N,V,F,M	O	BW,FB,PP,CC
9	<i>Tetragnatha</i> spp.	V,F,M	O	BW,FB,PP,CC
10	<i>Dyschiriognatha dentata</i> Zhu & Wen	V,F,M	O	PP,CC
11	<i>Dyschiriognatha</i> sp.	V,F,M	R	PP,CC
b	Family Araneidae			
12	<i>Argiope anasuja</i> Thorell	V,F,M	RE	BW,FB,PP,CC
13	<i>Argiope aemula</i> Walckenaer	V,M	O	BW,PP,CC
14	<i>Argiope catenulata</i> Doleschall	V,F,M	O	BW,FB,PP,CC
15	<i>Argiope pulchella</i> Thorell	V,F,M	O	BW,PP,CC
16	<i>Neoscona rumpfi</i> Tikader & Biswas	N,V,F,M	RE	BW,FB,PP,CC
17	<i>Neoscona bengalensis</i> Tikader & Bal	V,F,M	O	BW,PP,CC
18	<i>Neoscona mukerjei</i> Tikader	V,F,M	O	BW,PP,CC
19	<i>Neoscona</i> spp.	V,M	O	BW,PP,CC
20	<i>Araneus ellipticus</i> Tikader & Bal	V,F,M	F	BW,FB,PP,CC
21	<i>Araneus</i> spp.	V,M	O	PP,CC
22	<i>Eriovixia laglaizei</i> Simon	V,F,M	O	BW,FB,PP,CC
23	<i>Eriovixia</i> sp.	V	R	CC
24	<i>Larinia</i> sp.	V,M	O	PP,CC
25	<i>Cyrtarachne keralaensis</i> Sunil & Sebastian	V,F,M	O	PP,CC
26	<i>Cyrtophora citricola</i> Forskal	V,M	R	CC
27	<i>Gasteracantha geminata</i> Fabricius	M	R	CC
II	Scattered Line Weavers			
c	Family Theridiidae			
28	<i>Theridion</i> spp.	N,V,F,M	RE	BW,FB,PP,CC
III	Sheet Web Builders			
d	Family Linyphiidae			
29	<i>Linyphia</i> spp.	V,M	R	PP,CC
e	Family Agelenidae			
30	<i>Agelena</i> sp.	V	R	PP,CC
B	Hunters			
IV	Stalkers			
f	Family Salticidae			
31	<i>Telamonia dimidiata</i> Simon	V,F,M	RE	PP,CC
32	<i>Bianor carli</i> Reimoser	V,M	RE	FB,CC
33	<i>Bianor</i> sp.	V	O	CC
34	<i>Plexippus paykulli</i> Savigny & Audouin	V,F,M	O	BW,FB,PP,CC
35	<i>Plexippus</i> sp.	V,M	O	CC
36	<i>Bavia kairali</i> Samson & Sebastian	V,M	O	BW,FB,CC
37	<i>Thiania bhamoensis</i> Thorell	V	O	CC
38	<i>Epeus indicus</i> Proszynski	V,F,M	O	BW,FB,CC
39	<i>Carhottus viduus</i> C.L. Koch	V	O	CC
40	<i>Carhottus</i> sp.	V,M	O	FB,CC
41	<i>Hyllus semicupreus</i> Simon	N,V,M	O	BW,FB,CC
42	<i>Hyllus</i> sp.	V,M	O	BW,FB,CC
43	<i>Myrmarachne plataleoides</i> O.P. Cambridge	V,M	O	BW,FB,CC
44	<i>Myrmarachne</i> sp.	V	R	CC
g	Family Oxyopidae			
45	<i>Oxyopes javanus</i> Thorell	N,V,F,M	RE	BW,FB,PP,CC
46	<i>Oxyopes shweta</i> Tikader	V,F,M	RE	BW,PP,CC
47	<i>Oxyopes sunandae</i> Tikader	V,M	F	PP,CC
48	<i>Peucetia viridiana</i> Stoliczka	V,F,M	RE	BW,FB,PP,CC
V	Ground Runners			
h	Family Lycosidae			
49	<i>Pardosa pseudoannulata</i> Boesenberg & Strand	V,F,M	RE	BW,FB,PP,CC
50	<i>Pardosa sumatrana</i> Thorell	V,F,M	F	FB,PP,CC
51	<i>Pardosa amkhaensis</i> Tikader & Malhotra	V,M	O	CC

52	<i>Pardosa</i> spp.	V	F	CC
53	<i>Lycosa tista</i> Tikader	V,M	F	CC
54	<i>Lycosa</i> sp.	V,F,M	F	BW,CC
VI	Ambushers			
i	Family Thomisidae			
55	<i>Thomisus projectus</i> Tikader	V,F,M	RE	BW,FB,PP,CC
56	<i>Thomisus pugilis</i> Stoliczka	V,F,M	O	BW,FB,PP,CC
57	<i>Thomisus</i> sp.	F,M	R	PP,CC
58	<i>Misumena</i> sp.	V,F,M	O	BW,FB,CC
59	<i>Runcinia</i> sp.	F,M	O	BW,CC
60	<i>Xysticus</i> sp.	F,M	O	BW,CC
VII	Foliage Runners			
j	Family Miturgidae			
61	<i>Cheiracanthium danieli</i> Tikader	V,F,M	O	CC
62	<i>Cheiracanthium melanostomum</i> Thorell	V,F	O	BW, PP,CC
63	<i>Cheiracanthium</i> sp.	V	O	CC
k	Family Clubionidae			
64	<i>Matidia</i> sp.	V,F	O	CC
65	<i>Clubiona</i> sp.	V,F,M	O	BW,FB,CC

RE: Regular F: Frequent O: Occasional R: Rare

N: Nursery V: Vegetative F: Reproductive M: Maturity

FB: Field Bunds BW: Border Weeds CC: Crop Canopy PP: Individual plant

4. Discussions

Among the spiders documented, seventeen species viz., *T. viridorufa*, *N. rumpfi*, *Agelena* sp. *B. carli*, *E. indicus*, *B. kairali*, *T. bhamoensis*, *C. viduus*, *M. plataloides*, *Matidia* sp., *C. danieli*, *Runcinia* sp., *Xysticus* sp. *Misumena* sp., *T. projectus*, *T. pugilis* and *P. amkhaensis* were recorded for the first time from the paddy fields of Kerala. The other dominant species were *T. maxillosa* *A. anasuja*, *N. rumpfi*, *T. dimidiata*, *B. carli*, *O. javanus*, *P. viridans*, *P. pseudoannulata* and *T. projectus*. As generalists, spiders are ingenious predators and their inherent ability to regulate pest numbers is ineffable and thus heaves the role of these carnivorous arthropods in rice pest management. Sixty five species distributed in the two major foraging groups viz., hunters and web builders and seven guilds were recorded from the rice fields. Though high population of the web builders prevailed in the fields, the species – wise distribution indicated that the hunters constituted 53.85 per cent of the total spider species, while the web builders contributed 46.15 per cent of the species. Spiders were collected from diverse habitats within the paddy field. Most of the spiders were collected from the crop canopy. They were also recorded from the field bunds, border weeds, and in the flood water. This is in agreement with similar observations made by Kamal *et al.* (1990) ^[9], Tandon and Abraham (2000) ^[10], Mathirajan (2001) ^[11]. And Fang *et al.* (2003) ^[12]. Obviously the seven guilds of spiders possessing diverse prey capturing techniques play a key role in the regulation of pest population in rice fields. Moreover most of the wet land paddy field inhabiting spiders possesses amazing adaptations which enable better survival of the spiders. In short, the diversity within the different species, within the family, between the families, between the genera and between the guilds, in predation, prey capturing, adaptation and habitat selection are factors which render spiders, as potential dominant predators in agro ecosystems.

5. References

- Premila KS. Major Predators in rice ecosystems and their potential in rice pest management. Ph. D. thesis, Kerala Agricultural University, Thrissur, 2003; 43:57-72.
- Kaur S, Shenhmar M, Brar KS. Spider fauna of paddy in Punjab. *Insect Environment*. 2001; 7(1):24-25.
- Sudhikumar AV, Mathew MJ, Sunish E, Sebastian PA. Seasonal variation in spider abundance in Kuttanad rice agroecosystem, Kerala, India (Araneae). *European Arachnology*. 2005; 1:181-190.
- Singh BB, Singh R. Systematics and Ecology of Spiders (Araneae: Arachnida) in Rice Land. LAP Lambert Academic Publishing. 2012, 42-64.
- Reissig WH, Heinrichs EA, Litsinger JK, Moody K, Fielder L, Mew TW, *et al.* Illustrated guide to Integrated Pest Management in Rice in Tropical Asia, International Rice Research Institute, Los Banos, The Philippines. 1986, 411.
- Bayot RG, Cayabyab BF, Benigno EA, Ebuenga MD, Penalba FE. Monitoring populations of the brown plant hopper, *Nilaparvata lugens* (Stal), the green leafhopper, *Nephotettix virescens* (Distant) and spiders in rice at Maquiapo, Guagua, Pampanga. *Philippines Entomologist*. 1990; 8(2):779-786.
- Tikader BK. Handbook of Indian Spiders. Calcutta, Zoological Survey of India, 1987, 251.
- Barrion AT, Litsinger JA. Riceland spiders of South and South East Asia. CAB. International U.K. 1995, 60.
- Kamal NQ, Odud A, Begum A. The spider fauna in and around the Bangladesh Rice Research Institute farm and their role as predator of rice insect pests. *Philippines Entomologist* 1990; 8(2):771-777.
- Tandon PL, Abraham V. Weed plants as refuge of some key crop pests. *Insect Environment*. 2000; 5(4):180-181.
- Mathirajan VG. Diversity and predatory potential of spiders in cotton and rice ecosystem applied with Thiamethoxam. Ph.D. Thesis submitted to Tamil Nadu Agricultural University, Coimbatore-3, 2001, 92.
- Fang LY, Xiang GD, Ren ZG. The community dynamics of predatory arthropods in both weed habitat and paddy field from a double cropping paddy in Guangdong. *Acta Entomologica Sinica*. 2003; 46(5):591-597.