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# Species Composition and Quantitative Analysis of Tetragnathid Spiders, Tetragnathidae (Araneae) in Rice Fields

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## Abstract
A survey was conducted to bring out the species composition and abundance of family Tetragnathidae during different stages of crop growth in rice ecosystem. The study resulted in documenting eleven species of tetragnatha spiders, out of which the dominant one was *Tetragnatha mandibulata* Walckenaer, followed by *Tetragnatha maxillosa* Thorell and *Tetragnatha javana* Thorell and the least represented species was *Dyschiriognatha* sp. The weekly survey resulted in collecting the highest population during the sixth week of both Kharif (4.30 spiders) and Rabi (5.00 spiders) seasons. With respect to the different growth phases of the crop, the reproductive phase yielded the maximum population during Kharif and Rabi seasons, which recorded a mean number of 16.19 and 19.90 spiders respectively. Tetragnathid spiders were abundant and found throughout the crop season in the paddy fields.

**Keywords:** Spiders, Predators, Species, Tetragnathidae

## 1. Introduction
Rice is a crop infested with hundreds of pests, and hence pest control is the major problem in rice cultivation. In the current scenario of organic farming and no-pesticide crop production, biological control is gaining more attention and thus the natural enemies too. Spiders are the most important group of non-insect predators effectively controlling the insect pests in any agro ecosystem and play a crucial role in reducing the pest populations. Spiders are abundant and potential predators and are most common in the paddy fields (Tanaka, 1989; Sudhikumar *et al.*, 2005) [1, 2]. Among them, family Tetragnathidae was the most abundant (Vungsilabutr, 1988) [3]. Quantitative analysis of spiders in rice ecosystem revealed that *Tetragnatha* spp. were found maximum in number (Okuma, 1979, Chatterjee and Datta, 1979, Kamal *et al.*, 1990 Thakur *et al.*, 1995) [4, 5, 6, 7]. Among the different species reported, *Tetragnatha mandibulata* Walckenaer had high prevalence in rice ecosystem (Bhardwaj & Pawar, 1987) [8]. Inspite of their importance and common occurrence, very little efforts have been made to document the tetragnathid spider fauna in South Kerala. With this view in mind, we made extensive surveys to reveal the species composition and for quantifying the population of the spiders coming under the family Tetragnathidae.

## 2. Materials and Methods
The study was carried out for two cropping seasons, during the Kharif and Rabi of 2015, in an extensive wet land rice growing tract in Trivandrum district, South Kerala, India. Ten locations were selected and from each locations, three sampling units were selected randomly. Observations were taken at weekly intervals from one week after transplanting, up to the harvest of the crop. From each sampling unit, samples were collected by sweepnet and *in-situ* count made by visual counting. 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) [9] and Bayot *et al.*, 1990 [10] and ten sweeps were taken from one sampling unit. *In-situ* counting was made from twenty hills per sampling unit, leaving the border rows. The samples were brought to the laboratory in separate polythene bags, with a slip containing information about the locality, sampling units and date of collection. In the laboratory the spiders were sorted according to the size, colour and external appearance and killed using chloroform, identified on species and genus level and family level based on the available keys and literature described by Tikader (1987) [11] and Barrion and Litsinger (1995) [12] and preserved in 70 % alcohol. The data was analysed using suitable statistical methods of analysis (Panse and Sukhatme, 1967) [13].

## 3. Results and Discussion

From the survey, it was observed that tetragnathids were the most predominant group of spiders in rice fields. All the ten locations yielded a good number of spiders belonging to family Tetragnathidae. The total number of tetragnathids collected during Kharif season came to about 1161 spiders and that during Rabi season was 1295 spiders. The Rabi season recorded more tetragnathids when compared to Kharif season. The tetragnathid spiders encountered during the present investigation included *Tetragnatha mandibulata* Walckenaer, *Tetragnatha maxillosa* Thorell, *Tetragnatha javana* Thorell, *Tetragnatha viridorufa* Gravely, *Tetragnatha fletcheri* Gravely, *Tetragnatha cochinensis* Gravely, *Tetragnatha andamanensis* Tikader, *Tetragnatha vermiformis* Emerton, *Tetragnatha* spp., *Dyschiriognatha dentata* Zhu and Wen and *Dyschiriognatha* sp. *Tetragnatha mandibulata* was the dominant species with a maximum population of 418 spiders during Kharif and 515 spiders during Rabi, out of which the females dominated over the males, followed by *Tetragnatha maxillosa* and *Tetragnatha javana. Dyschiriognatha* sp. had the lowest number during both seasons, nine and two spiders during Kharif and Rabi respectively. The total population of different tetragnathid species is given in Fig.1.

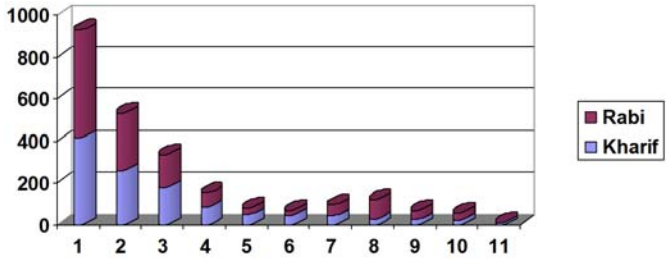


**Fig 1:** Total population of different tetragnathid spiders collected during Kharif and Rabi seasons

1. *Tetragnatha mandibulata*
2. *Tetragnatha maxillosa*
3. *Tetragnatha javana*
4. *Tetragnatha viridorufa*
5. *Tetragnatha fletcheri*
6. *Tetragnatha cochinensis*
7. *Tetragnatha andamanensis*
8. *Tetragnatha vermiformis*
9. *Tetragnatha* spp.
10. *Dyschiriognatha dentate*
11. *Dyschiriognatha* sp.

Data on the population of Tetragnathidae recorded during the vegetative, reproductive and maturity phases of paddy during the Kharif and Rabi seasons is presented in Table-1. The population of spiders recorded from the ten locations were almost on par. The mean tetragnathid population observed during the Kharif season ranged from 11.30 – 14.57 spiders, the highest mean population of 14.57 spiders was recorded from the fourth location, followed by the seventh location. Rabi season recorded a mean population in the range of 13.93 – 17.37 spiders. The highest mean population of 17.37 spiders was collected from the first location and the lowest from the second location (13.93 spiders).The mean number of tetragnathids collected during the reproductive phase of Kharif season (16.19 spiders) was more when compared to the vegetative 14.98 spiders) and maturity (7.73 spiders) phases, whereas Rabi season yielded a higher mean population of 19.90 spiders during the reproductive phase, followed by the vegetative (16.95 spiders) and maturity (8.75 spiders) phases. The mean population of tetragnathids during the vegetative, reproductive and maturity phases of Kharif and Rabi seasons ranged between 13.00-16.70, 13.20-18.10, 6.00-9.30 and 14.40-24.40, 18.70-22.70, 7.70-10.00 spiders respectively.

**Table 1:** Mean population of Tetragnathid spiders collected during the vegetative, reproductive and maturity phases of paddy during Kharif and Rabi seasons.

| Locations selected | Vegetative phase | | Reproductive phase | | Maturity phase | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | Kharif | Rabi | Kharif | Rabi | Kharif | Rabi | Kharif | Rabi |
| **L1** | 15.20 | 24.40 | 14.60 | 18.70 | 8.00 | 9.00 | 12.60 | 17.37 |
| **L2** | 15.00 | 14.40 | 13.20 | 18.70 | 5.70 | 8.70 | 11.30 | 13.93 |
| **L3** | 13.00 | 16.00 | 17.60 | 18.80 | 7.70 | 9.30 | 12.77 | 14.70 |
| **L4** | 16.30 | 18.10 | 18.10 | 18.70 | 9.30 | 7.70 | 14.57 | 14.83 |
| **L5** | 13.40 | 17.40 | 16.70 | 22.70 | 7.90 | 8.30 | 12.67 | 16.13 |
| **L6** | 14.70 | 16.80 | 16.30 | 18.70 | 9.30 | 7.90 | 13.43 | 14.47 |
| **L7** | 16.70 | 17.00 | 17.00 | 20.00 | 7.70 | 9.60 | 13.80 | 15.53 |
| **L8** | 15.30 | 15.10 | 16.90 | 21.70 | 8.00 | 10.00 | 13.40 | 15.60 |
| **L9** | 15.90 | 14.90 | 16.40 | 21.70 | 7.70 | 8.40 | 13.33 | 15.00 |
| **L10** | 14.30 | 15.40 | 15.10 | 19.30 | 6.00 | 8.60 | 11.80 | 14.43 |
| **Mean** | 14.98 | 16.95 | 16.19 | 19.90 | 7.73 | 8.75 | | |

The data on weekly survey of tetragnathid spiders throughout the crop period during the Kharif and Rabi seasons is given in Table-2. The weekly survey during the Kharif season yielded a mean population of tetragnathids ranging between 0.40-4.30 spiders per week. Significantly higher mean weekly population of 4.30 spiders was collected during the sixth week followed by seventh (4.10 spiders) and eighth weeks (4.00 spiders).The lowest population was recorded on the first week (0.40 spiders).

**Table 2:** Mean weekly Tetragnathid population collected throughout the crop period during Kharif and Rabi seasons

| Crop seasons | W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 | W11 | W12 | W13 | W14 | W15 | W16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Kharif** | 0.40 | 0.80 | 2.40 | 3.10 | 3.90 | 4.30 | 4.10 | 4.00 | 3.40 | 2.70 | 2.00 | 1.70 | 1.70 | 1.50 | 1.40 | 1.30 |
| **Rabi** | 0.50 | 1.00 | 2.70 | 3.50 | 4.20 | 5.00 | 4.80 | 4.50 | 3.60 | 2.90 | 4.10 | 2.00 | 1.90 | 1.80 | 1.60 | 1.40 |

Rabi season yielded a slightly higher number, 0.50 – 5.00 spiders per week. Significantly higher mean weekly population was reported in the sixth week (5.00 spiders) as in the Kharif season and the lowest mean population was recorded in the first week (0.50 spiders).

## 4. Conclusions

Tetragnathid spiders were collected from the field throughout the crop period and the study revealed the abundance and diversity of Tetragnathid spiders in the rice ecosystem during various crop growth stages. Similar observations were made earlier (Kamal *et al*., 1990, Thakur *et al*., 1995) [6, 7]. Eleven species of tetragnathids were documented during the study. Among which *Tetragnatha mandibulata* was the dominant species. Tetragnathids are orb web weavers which were the major group of spiders in rice eco system (Sudhikumar and Sebastian, 2001; Sebastian *et al.*, 2005) [14, 15]. The diversity of family Tetragnathidae and abundance of the spiders in rice ecosystem must be positively correlated with pest suppression and biological control of pests. Hence conservation of spiders in rice ecosystem is important.

## 5. References


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