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# SEASONAL ABUNDANCE OF IMPORTANT SOME SPIDER GROUPS IN RICE AGRO-ECOSYSTEM

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## INTRODUCTION

Spiders are very important biocontrol agents in rice agro-ecosystem and play a major role as potential defender by suppressing the pest population to a safe level which emphasize the concept of Integrated Pest Management in modern Agriculture. Three years' routine field sweeping from 1989 to 1991 revealed that the spider complex alone contributed about 57.98%, 61.0% and 55.6% yearly population out of the following predators like *Cyrtorhinus lividipennis* Reuter ; *Ophionea nigrofasciata* (Schmidt-Goebel ) ; *Paedarus* sp. ; *Micraspis* sp , *Harmonia* sp. ; *Menochilus* sp. ; *Agriocnemis* spp. including diversified spider groups respectively (Rice Annual Report, 1989-91). Among the spider species only seven groups of spiders were taken into account in the present study.

*Lycosa* spp (Family-Lycosidae), both adults and spiderlings, are generally noticed in the colar region of the paddy hills and are efficient hunters. They directly attack preys like stem borer moths, plant and leaf hoppers and can consume 5-15 in number a day. *Atypena* (=*Callitrichia*) spp. (Family-Linyphiidae) prefer wetland habitat and make webs within the tillers near basal region. They consume 4-5 preys, mainly leaf and plant hoppers, per day. *Oxyopes* spp. (Family-Oxyopidae) hide in the crop canopy and are waiting for their preys, mostly moths. As soon as the latter comes within the striking range it grabs them and thus can consume 2-3 moths/day. *Phidippus* spp. (Family-Salticidae) wait in a small retreat web in the rice foliage looking for their preys. Their daily diet comprises of 2-8 hoppers. *Tetragnatha* spp (Family-Tetragnathidae) are also a dweller of wetland habitat, wait for their preys in weak ring shaped webs in the crop canopy. When a hopper hits the web it goes for action and consume 2-3 preys daily. *Araneus* spp (Family-Araneidae)—late colonizers of rice field, capture flying insects like hoppers, butterflies, grass hoppers, etc. sitting in their circular webs (Shepard et al, 1987) *Thomisus* spp (Family-Thomisidae) with the restricted mobility, are found in the upper crop canopy zone. They catch the prey with extreme swiftness as soon as it comes within striking range (Rod and Ken, 1984).

In the present work efforts have been made to make a comparative study among

the above mentioned spider groups with special reference to their seasonal abundance, variation in the trend of population fluctuation and dimension in relation to the time scale and crop stage.

*Method* : During the period from March, 1991 to February, 1992 routine collection of spiders was made at 7.30 A.M. by a standard sweepnet with 30 complete strokes twice a week ( Tuesday and Friday ) covering seedbed, main field and the levies depending on the crop season. The enmeshed spiders were chloroformed, groupwise separated and counted. Fortnightly catch consisting of 4 days' collection for each spider group, as well as the spider complex, were computed and the mean values of spider population for each of the 24 fortnights were estimated (Table—1) and subjected to "Probit Analysis" (Finney, 1972). The analysis was preferred for the easy transformation of sigmoid relationship, based on cumulative values, into rectilinear relationship which enabled to pinpoint the maximum sensitive points depicting the peak period of activity of the spiders in time scale by minimising the operational errors. The probit regression lines (PRL) for different groups and the spider complex were worked out separately and had been delineated in Fig-1. showing the maximum sensitive time point in respect of 50% population (MT-50) and the estimated time point of the 50% population actually found (ET-50). The flatness and steepness of the PRL expressed the degree of variation in the population fluctuation of the spider spp. and the closeness and remoteness of the ET-50 from the MT-50 depicted the nature and trend of temporal distribution and population activities towards Boro or Aman season in relation to the crop stage and the prey substrates acting as major pests.

*Results and Discussion* : The present work, based on the critical study of different spider groups, revealed that though the spider complex maintained a stable population throughout the year, the different groups were active at different times of the season showing their prey preference at the different stages of crop growth.

The spider complex, consisting of seven spider groups, maintained a fairly high population from the first of March and the ET-50 & MT-50 points were in the first fortnight of June and first fortnight of August (PRL-4) respectively. This signified that the spider complex was comparatively more active in Boro season (March to June) than Aman season (July to December). Incidentally boro paddy harboured a high population of major insect pests like stem borer, leaf folder, leaf and plant hoppers especially Brown Plant Hopper and catered the spider complex with those pests. The PRL of the spider complex, slightly flat in nature, indicated more variation in the population fluctuation throughout the year. It revealed that the peak and fall of the population were more dependant on the availability of their respective prey substrates in the time scale and the crop stage.

Table 1—*Fortnightly population of the spider groups (mean of 4 days' collection*±2SE) *for the year 1991-92.*

| *Time scale* Month | Fortnight | *Thomisus* spp. | *Lycosa* spp. | *Oxyopes* spp. | *Phidippus* spp. | *Antypena* spp. | *Tetragnatha* spp. | *Araneus spp.* | *Spider complex* |
|---|---|---|---|---|---|---|---|---|---|
| March | 1 | 4.50±0.70 | 3.25±1.60 | 2.00±1.10 | 6.50±1.72 | 1.00±1.00 | 1.75±1.04 | 0.00±0.00 | 19.00±2.08 |
| 1991 | 2 | 0.25±0.66 | 2.00±1.46 | 1.25±1.14 | 2.75±1.66 | 1.00±0.84 | 5.00±1.80 | 0.00±0.00 | 12.25±2.04 |
| April | 3 | 0.50±0.70 | 3.25±1.50 | 1.50±0.70 | 0.75±0.68 | 1.00±1.32 | 10.25±3.18 | 0.00±0.00 | 17.25±3.50 |
| | 4 | 1.50±1.06 | 5.00±1.46 | 5.00±0.84 | 1.25±0.90 | 4.25±1.04 | 10.75±1.44 | 0.00±0.00 | 27.75±1.98 |
| May | 5 | 2.25±1.50 | 0.75±0.90 | 0.25±0.66 | 0.25±0.66 | 1.25±0.90 | 0.75±0.90 | 1.00±1.10 | 6.50±0.92 |
| | 6 | 1.50±1.06 | 1.75±2.18 | 2.00±1.10 | 1.25±1.14 | 3.75±3.68 | 3.00±1.26 | 1.75±1.22 | 15.00±2.04 |
| June | 7 | 0.50±0.70 | 1.00±0.00 | 3.00±1.52 | 1.00±0.84 | 2.75±1.22 | 0.25±0.66 | 0.75±0.68 | 9.25±2.28 |
| | 8 | 0.75±1.14 | 0.75±0.66 | 3.50±1.78 | 0.25±0.66 | 2.25±4.68 | 0.00±0.00 | 0.50±0.92 | 8.00±2.66 |
| July | 9 | 0.00±0.00 | 0.25±0.66 | 1.25±0.90 | 0·00±0.00 | 0.50±0.70 | 0.25±0.66 | 0.25±0,66 | 2.50±1.34 |
| | 10 | 0.00±0.00 | 0.25±0.66 | 0.75±0.66 | 0.25±0.66 | 0.25±0.66 | 1.35±1.14 | 0 00±0.00 | 2.75±1.44 |
| August | 11 | 0.00±0.00 | 1.25±0.68 | 1.25±0.68 | 0.00±0.00 | 0.25±0.66 | 0.75±1.14 | 0.00±0.00 | 3.50±1.42 |
| | 12 | 0.00±0.00 | 0.75±0.90 | 0.75±0.90 | 0.00±0.00 | 0.00±0.00 | 1.25±0.90 | 0.00±0.00 | 2.75±1.50 |
| September | 13 | 0.00±0.00 | 1.75±0.66 | 1.75±1.18 | 0.25±0.66 | 0.25±0.66 | 2.75±2.18 | 0.00±0·00 | 6.75±1.38 |
| | 14 | 0.25±0.66 | 1.50±1,06 | 1.50±0.70 | 0.00±0.00 | 0.00±0.00 | 2.50±0.92 | 0.25±0.66 | 6.00±1.66 |
| October | 15 | 0.25±0.66 | 0.25±0.66 | 0.75±0.90 | 0.25±0-66 | 1.75±1.22 | 3.25±1.82 | 0.00±0.00 | 6.50±1.62 |
| | 16 | 0.00±0.00 | 0.75±0.90 | 1.25±0.90 | 0.25±0.66 | 0.00±0.00 | 1.50±0.70 | 0.00±0.00 | 3.75±0.90 |
| November | 17 | 0.00±0.00 | 1.25±0.68 | 1.50±0.74 | 0.50±0.74 | 1.00±0.50 | 2.75±0.68 | 0.00±0.00 | 7.00±0.84 |
| | 18 | 0.00±0,00 | 2.25±1.28 | 1.75±0.68 | 0.00±0.00 | 0.25±0.66 | 2.25±0.18 | 0.00±0.00 | 6.50±1.06 |
| December | 19 | 0.00±0.00 | 9.50±2.22 | 6.75±2.56 | 1.25±1.14 | 3.50±1.74 | 5.00±1.00 | 1.00±1.10 | 27.00±3.68 |
| | 20 | 0.00±0.00 | 1.00±1.36 | 4.50±7.24 | 0·00±0.00 | 2.00±1.86 | 2.75±1.76 | 0.25±0.66 | 10.50±2.94 |
| January | 21 | 0.00±0.00 | 1.50±2.74 | 1.25±1.68 | 0.00±0.00 | 0.25±0.66 | 0.25±0.66 | 0.00±0.00 | 3.25±1.84 |
| 1992 | 22 | 0.00±0.00 | 0.25±0.66 | 0.25±0.66 | 0.25±0.66 | 1.50±1.62 | 0.25±0.66 | 0.00±0.00 | 2,50±1.94 |
| February | 23 | 0.25±0.66 | 0.00±0.00 | 0.00±0.00 | 0.25±0.66 | 0.50±0.92 | 0.00±0.00 | 0.25±0.66 | 1.25±1.48 |
| | 24 | 0.00±0.00 | 2.00±0.84 | 2.50±0.92 | 0.75±0.68 | 0.75±0.66 | 1.25±0.18 | 0.00±0.00 | 7.25±0.90 |

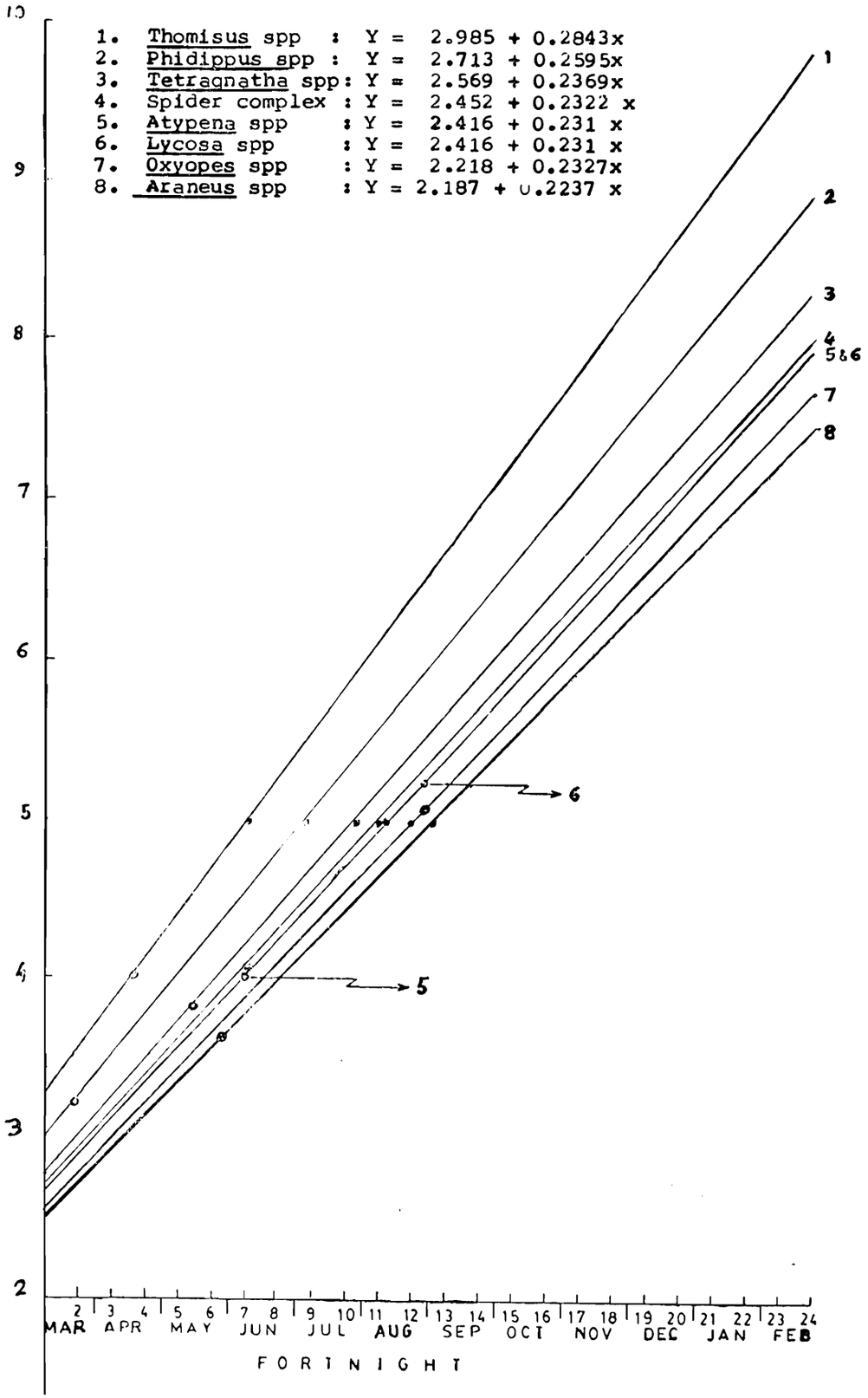


Fig. 1. *Probit Regression of some common spider groups in rice agro-eco system.*

*Lycosa* spp. are wellknown predator group of rice ecosystem having an efficient hunting ability, fast mobility and abundance. This group appeared in early March and maintained a sizable population upto late June covering the entire Boro season. After maintaining a low profile in July, its population increased again from August and continued upto December-covering the Aman season. During January to the first fortnight of February the population was low but from the second fortnight of February it again appeared in the field in good number. This group attained the ET-50 & MT-50, as expressed on the PRL-6, in the first fortnight of September and around the first fortnight of August respectively. The closeness of these two points indicated a uniform temporal distribution of the spider population covering both Boro and Aman season having a wide range of prey spectrum like stem borer moths, major leaf and plant hoppers etc. The regression line exhibited almost the same slope as that of the spider complex (PRL-4) revealing significant variation in the population fluctuation. This was due to the wide adaptibility of this spider group in the different time periods of the season throughout the year with respect to the availability of prey species in relation to different crop growth stages.

*Atypena* spp. are found to predate in the same niche where various plant hoppers, especially Brown Plant Hoppers, are active. Fairly good number of these spiders were enmeshed during March to June and October to February but the ET-50 & MT-50 were in the first fortnight of June and the first fortnight of August respectively. This suggested that *Atypena* spp. were mainly active during the Boro season when plant hoppers actively caused damage to the crop. However, in the Aman season this spider group predated on the hopper complex and later migrated to the boro seedbed which was sown in the late November to mid December. During January and February it continued its activity in the paddy field when the activity of the other spiders was negligible. The PRL-5 superimposed on the PRL-6 expressing the same kind of population fluctuation and distribution as that of *Lycosa* spp. but the remoteness of the ET-50 from the MT-50 revealed that, it was mainly active in the Boro season in contrast to *Lycosa* spp. which was active both in Aman and Boro.

*Tetragnatha* spp. are another important group of defenders, commonly found throughout the year, having a wide range of prey substrates including moths and leaf hoppers. Unlike *Lycosa* spp., *Oxyopes* spp. and *Phidippus* spp. they are stationary feeders and their area of operation is less. Here, the MT-50 & ET-50 on the PRL-3 came in the second fortnight of July and in the middle of May respectively which denoted that it was more prevalent in the Boro season (March to May) as compared to the Aman season (August to December). The PRL-3 was less flat in nature and steeper than those of *Lycosa-Atypena* spp., *Oxyopes* spp and *Araneus* spp. which indicated that the variation in the population fluctuation of *Tetragnatha* spp. was less than those of the above mentioned spider groups.

*Oxyopes* spp. are well established, efficient predators of paddy ecosystem. Here the MT-50 and ET-50 were very close to each other and came on mid way of the PRL-7 in the second fortnight of August and middle of August respectively. This indicated that the spider group was equally active both in Boro and Aman season and was found almost throughout the year. The flatness of this PRL-7 as compared to the others excepting that of *Araneus* spp (PRL-8) suggested that, although it prevailed in the field round the year, it exhibited maximum degree of variation in the population fluctuation in comparison to the other spiders mentioned above.

*Phidippus* spp. prefer dryland habitats but are found in wetland condition also. This group mainly predates on leaf hoppers and other small insects. The regression line (PRL-2) representing this spider group bore MT-50 & ET-50 in the first fortnight of July and the second fortnight of March indicating its special preference for the dry Boro season, although it maintained a low profile throughout the year. The PRL-2 was somewhat different and steeper than those of other spider groups excluding that of *Thomisus* spp (PRL-1) suggesting less variation in population fluctuation.

*Araneus* spp. form webs around the rice canopy and capture various types of insect pests. The MT-50 and ET-50 of this particular group (PRL-8) came at the end of August and in the first fortnight of June respectively. The remoteness of these two points from each other indicated that they were active only in the late Boro season (May-June) and during the remaining part of the year they were scarcely found. This regression line was flattest of all, indicating maximum variation in population fluctuation due to their erratic distribution both in time and space.

*Thomisus* spp. are active at the upper portion of the paddy hills and prey upon the visiting insects. This group attained MT-50 and ET-50 as estimated on PRL-1 in the first fortnight of June and in the middle of April respectively. This suggested that this group was more active during the reproductive phase of Boro rice (April-May) and in the remaining part of the year its occurrence was negligible. This regression line was the steepest of all the probit lines indicating minimum variation in population fluctuation at the time of their occurrence.

The overall analysis highlighted that *Lycosa* spp., *Atypena* spp, *Oxyopes* spp and *Tetragnatha* spp. were more important and active both in the Boro and Aman season, maintained a good population level throughout both the seasons and played a major role in suppressing the insect pest population as compared to the other groups of the spider complex. *Phidippus* spp., *Araneus* spp. and *Thomisus* spp. were less important because their activities were mostly restricted to a part of the crop season and the population levels were very low in the remaining part of the year. The spider complex as a whole maintained a fairly high population level throughout the year whereas other predators under study like *Cyrtorhinus lividipennis*, Reuter, *Ophionea*

*nigrofasciata* (Schmidt-Goebel), *Paedarus* sp, *Micraspis* sp., *Harmonia* sp., *Menochilus* sp and *Agriocnemis* sp. were mostly seasonal in their activities.

The above discussion emphasizes that the palladium of these important defender groups as a part of Integrated Pest Management rests on the judicious use of pesticides in rice agro-ecosystem for maintaining natural balance.

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## SUMMARY

The seasonal abundance of some important spider groups in rice agro-ecosystem was studied in the year 1991-92 by standard sweeping method and analysing the data through Probit Regression. The result showed that *Lycosa* spp., *Atypena* spp., *Oxyopes* spp. and *Tetragnatha* spp. are more important both in Boro and Aman season and maintain a good population level. *Phidippus* spp., *Araneus* spp. and *Thomisus* spp. are comparatively less important because their activities are mostly restricted to a part of the crop season and they maintain a low profile in the remaining part of the year. The spider complex as a whole have a higher population level through out the year than that of the other predators present in the system.

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