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# SPIDERS OCCURRING IN THE EGYPTIAN RICE FIELDS AND ADVERSE EFFECT OF INSECTICIDES

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## ABSTRACT

Spiders (Or: Araneae) occurring in the Egyptian rice fields at the Experimental Farm of Rice Research and Training Center (RRTC) were surveyed during 1999 and 2000 rice seasons. Identified specimens by the aid of International Rice Research Institute (IRRI) revealed the occurrence of 11 spider species belonging to 6 families, i.e. Araneidae, Salticidae, Clubionidae, Theridiidae, Tetragnathidae and Philodromidae. All identified species are recorded for the first time in rice fields in Egypt. Application of insecticides proved to be hazardous to these spiders. Monocrotophos used as spray was more toxic (eliminating 56.40% of spider population) than carbofuran as granules (35.61% spider reduction). Since the Egyptian rice fields are rich in predatory fauna, especially spiders, it is recommended to avoid, or minimize, the insecticidal application. If necessary, granulated insecticide formulation is relatively safer to predatory spiders than spray one.

**Key words : Egyptian rice fields, Spiders, Predators, Insecticides**

## INTRODUCTION

The predacious insects of rice have been studied and catalogued, but the spiders have received very little attention. Spiders (Or: Araneae) are widely spread and diverse group occupying nearly every terrestrial habitat. Because all spiders are obligate carnivores, and because insects constitute their principle prey, the community roles of spiders are of concern to entomologists.

Predatory spiders feed on planthoppers, leafhoppers, dipterous insects (whorl maggot and others) and rice stem borer **(Barrion and Litsinger, 1980).** These predators have many attributes that make them highly effective biocontrol agents. **Agnew and Smith (1989)** reported that they attack a large range of pest species throughout their development, are relatively long-lived, and don't emigrate in large numbers during periods of low prey densities.

The dense occurrence of spiders could be figured in the light of fact that population densities of spiders are estimated to range from 27,000 to 5 million individuals/ha in some habitats **(Bristowe 1958).** The wolf spider, *Lycosa pseudoannulata* (Boes & Stran), confined in a small arena in the laboratory, killed up to 90% of 130 yellow borer larvae in one day **(Than Htun, 1976)**, and was recognized as a major regulator of brown plant-hopper populations **(Stapley, 1976). Negm and Hensley (1967)** classified the spiders as the second most important group of predators, after ants, in sugar-cane ecosystem .In general, the predatory spiders often act as a buffer to prevent pest population from reaching critical levels **(Riechert, 1974).**

Because the rice growers are usually worried about the insect infestations in their fields, they tend to use insecticides even at low levels of infestation. As the spiders colonize rice fields early and rapidly, the early-season insecticide applications should reduce the numbers of spiders throughout the season. Since spider webs are efficient collectors of agrochemical sprays, this could result in the spiders consuming large quantities of pesticides when their webs are saturated after spraying **(Samu *et al.*, 1992, Wisniewska and Prokopy, 1997).** The two latter authors found that spider populations dropped to approximately zero in insecticide-treated orchards, whereas their populations remained nearly the same in the untreated ones. Generally, insecticide misuse results in destruction of predators and parasitoids, and consequently in resurgence of several rice pests including the rice stem borers **(Lim *et al.*, 1980).** Broad-spectrum insecticides are highly suppressive to natural enemies, unfortunately there are very few selective insecticides which favor natural enemies **(Chatterji *et al.*, 1976).** Laboratory experiments conducted by **Chiu and Cheng (1976)** showed that carbamates were generally more toxic to the spiders than organophosphates, while the most toxic compound was carbofuran to *Lycosa pseudoannulata* and BPMC to *Oedothorax inseticepts*, and the authors indicated that BPMC, carbaryl, acephate, monocrotophos and disulfoton were relatively safe for the two spiders. In laboratory studies in Japan on the mechanisms of selective toxicity of pyridafenthion to *Nephotettix cincticeps* and its predator, the spider, *Pardosa astrigera* L., **Miyata and Saito (1982)** found that low cuticular penetration and low antiacethylcholine esterase activity were involved in low toxicity against the spider.

The survey of spiders occurring in the Egyptian rice fields has not attracted the researchers, so this investigation was carried out. Also, the hazardous effect of insecticides, commonly applied in rice fields, on trhese beneficial spiders was studied.

## MATERIALS AND METHODS

Spiders were collected from rice nurseries, levees and paddy fields, using sweep net, pitfall trap and water pan trap throughout the rice season; starting from late May till the beginning of October. The surveyed spiders were kept in glass vials having 75% ethyl alcohol and some drops of glycerine to keep their tissues soft, and labeled for date, site and method of collection. Specimens were identified by Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt, and International Rice Research Institute (IRRI), Philippines to families, genera and in some cases to species.

The residual effect of granulated and spray insecticides on spider populations was studied. In the current investigation, both carbofuran 10G and monocrotophos 40SCW were applied on 26 July at rates of 6 kg and 1.0 lit/ fed, respectively. The spiders were sampled using the sweep net (50 double strokes per sample) from treated and untreated plots. Sampling began just before insecticide treatments and continued 3 weeks post-treatments.

## RESULTS AND DISCUSSION

Results of spider survey conducted in 1999 & 2000 rice seasons revealed the occurrence of 11 species belonging to six families (Table 1). Family Araneidae contained 4 species; *Araneus* sp., *Argiope* sp., *Cyclosa* sp. and *Singa* sp. The latter one was frequently occurring in the paddy field throughout June-September, while the other three spider species were recorded relatively late (by mid-August to September) in rare numbers. Family Salticidae occupied the second rank as for number of encountered species, having three ones. These species were *Bianor* spp., common in both nursery and paddy (from May to September), *Plexippus paykulli* Aud. frequently occurred in the paddy (August-September), while *Cosmophasis* sp. was rarely captured from both nursery and paddy throughout the rice season. Families Clubionidae, and Theridiidae were represented by one predatory spider for each; *Clubiona* sp. (frequent), and *Theridion* sp.(common), respectively . These two spiders were obtained in traps along the rice season. *Tetragnatha* spp. (Tetragnathidae) were commonly occurring in paddy field from July to September, but *Thanatus* spp. (Philodromidae) were rarely detected from mid-August to September.

Table (1): Species of spiders occurring in rice fields at Kafr El-Sheikh region, Egypt (1999 & 2000 rice seasons)

| Family | Taxon | Frequency | Site of occurrence | Period of occurrence |
|---|---|---|---|---|
| Araneidae | *Araneus* sp. | Rare | Field | mid-Aug - Sept |
| | *Argiope* sp. | Rare | Field | mid-Aug - Sept |
| | *Cyclosa* sp. | Rare | Field | mid-Jul - Sept |
| | *Singa* sp. | Frequent | Field | Jun-Sept |
| Salticidae | *Bianor* spp. | Common | Nursery | May-Jun |
| | | | Field | Jun - mid-Sept |
| | *Cosmophasis* sp. | Rare | Nursery<br>Field | May-Jun<br>Jun-Sept |
| | *Plexippus paykulli* Aud. | Frequent | Field | Aug-Sept |
| Clubionidae | *Clubiona* sp. | Frequent | Nursery | May-June |
| | | | Field | July-Sept |
| Theridiidae | *Theridion* sp. | Common | Nursery<br>Field | May-June<br>Jun-Sept |
| Tetragnathidae | *Tetragnatha* spp. | Common | Field | Jul-Sept |
| Philodromidae | *Thanatus* spp. | Rare | Field | mid-Aug - Sept |

Variation in spider species recorded in the current investigation was also indicated by **Alderweireldt and Maeltait (1988)** who recorded the occurrence of the spiders in a wide variety of environments. The spiders were considered as predominant predators in terrestrial ecosystems **(Foelix, 1982 and Sunderland *et al.*, 1985).** The complex of many diverse species of spiders tends to fill many predacious niches in the field **(Agnew and Smith, 1989).**

Populations of the spiders were greatly reduced by the application of insecticides either as granules or sprays (Table 2). On the other hand, the numbers of spiders in the untreated plot increased, in general, progressively till 1 st of August (about one week after treatment), with a number of 77 individuals/ 50 double strokes. The corresponding values were 31 and 20 indiv. for carbofuran granule and monocrotophos spray, respectively. One week after application, the spider populations in the treated plots were relatively recovered, but continued lower than those encountered in the untreated plot. The total encountered spiders throughout the experimental period were 367,248 and 570 indiv. for carbofuran,monocrotophos and untreated plots, respectively. Thus the application of carbofuran eliminated 35.61% of spider population, while monocrotophos was more toxic, eliminating 56.49%.

Stem borers are usually controlled by carbofuran as recommended, but this insecticide is highly toxic to spiders and damselflies (**Khuskal *et al.*, 1979**). Higher mortalities of spiders were reported for monocrotophos and carbofuran; 82.70 and 47.83%, respectively (**Mesbah and Sherif, 1999**). Despite the insecticides generally reduce the populations of spiders, **Mangan and Byres (1989)** reported that carbofuran application did not cause a permanent extinction of spiders. **Legner and Oatmen, (1964) and Mansour *et al.*, (1980)** reported that spider population increased by the end of the season, but was considerably lower than that in the unsprayed orchards.

**Table (2): Effects of insecticides on spider populations in rice fields at Kafr El-Sheikh region, Egypt (1999 rice season)**

| Sampling date | Days after treatment | Number of spiders/ 50 double Strokes | | |
|---|---|---|---|---|
| | | Insecticide formulation [b] | | Untreated |
| | | Granule | Spray | |
| Jul. 26 [a] | - | 25 | 15 | 22 |
| 27 | 1 | 5 | 1 | 24 |
| 28 | 2 | 17 | 4 | 77 |
| 29 | 3 | 22 | 4 | 48 |
| 31 | 5 | 52 | 51 | 73 |
| Aug. 1 | 6 | 31 | 20 | 77 |
| 4 | 9 | 34 | 25 | 52 |
| 7 | 12 | 63 | 34 | 60 |
| 10 | 15 | 38 | 31 | 50 |
| 14 | 19 | 41 | 42 | 37 |
| 17 | 22 | 35 | 31 | 50 |
| **Total** | | **367** | **248** | **570** |
| **Reduction %** | | **35.61** | **56.4** | - |

**a Samples taken just before treatments**
**b Granule : Carbofuran, Spray: Monocrotophos**

In the current investigation, all identified spiders are new records for the Egyptian rice fields. The authors think that these spiders, in addition to unidentified ones, play as buffer to regulate populations of many rice insects such as leafhoppers, planthoppers, maggots, and rice stem borer. The beneficial role of spiders may interpret why the populations of minor pests are still kept at their low levels. Accordingly, the conservation of these spiders is crucial to keep the natural balance in the rice ecosystem. This could be mainly done by minimizing the application of insecticides. If there is a necessity to use such insecticides during insect outbreaks, this should be practiced using the granules that prove to be less toxic than sprays.

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## الملخـــــص العربـــــى

جرى حصر العناكب المفترسة فى حقول الأرز التابعـة لمركـز بحـوث الأرز بسخا خلال عامى ١٩٩٩ ، ٢٠٠٠ . استخدمت المفاتيح التقسيمية لتصنيـف العناكب إلى عائلاتها ، كما صُنفت إلى الأجناس فى بعض الحالات ، ثم أرسـلت العينات إلى معهد بحوث الأرز الدولى بالفلبين (IRRI) لمزيد من تعريف الأنـواع التى تم جمعها.أمكن تعريف أحد عشر نوعاً من العناكب (تُسجل لأول مـرة فـى حقول الأرز المصرية)، تنتمى إلى ست عائلات هى :

Araneidae, Salticidae, Clubionidae, Theridiidae, Tetragnathidae and Philodromidae

كما دُرس التأثير الضار للمبيدات الشائعة الاستخدام فى حقول المزارعيـن على تعداد العناكب المتواجدة بحقول الأرز ، ظهر أن استخدام المبيدات (بصورتيـها المستحلبة والمحببة) كانت شديدة الضرر على العناكب حتى الأسـبوع الأول مـن المعاملة . وبعد ثلاثة أسابيع من إجراء المعاملات كان مبيـد النوفـاكرون ٤٠ % قابل للاستحلاب (١ لتر/ف) قد قضى على ٥٦,٤٠ % من تعـداد العنـاكب فـى الحقـول المعاملـة ، كمـا قضـى مبيـد الفيـورادان ١٠% محبـب (٦ كجم/ف) على ٣٥,٦١% من التعداد .

ونظراً لغنى حقول الأرز المصرية بالأنواع المختلفة من الأعداء الحيويـة ، خصوصاً العناكب المفترسة ، علاوة على الأضرار الشديدة التى تسـببها المبيـدات لهذه الأعداء ، فإنه ينصح بعدم استخدام المبيدات بكافة صورها إلا فى الضـرورة القصوى ، على أن يكون ذلك فى صورة محببات لأنها أكثر أماناً علـى الأعـداء الحيوية فى حقول الأرز من صورة الرش.