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Oviposition Seasonality and Site Preference of the Predaceous Mantid, *Sphodromantis viridis* Forskal (Mantodea: Mantidae).

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ABSTRACT

Oviposition seasonality of the predaceous mantid, *Sphodromantis viridis* Forskal data showed that, the females laid its egg masses during the period April - October. The highest oviposition percentage was obtained during May and September. Oviposition site selection was determined on fourteen plant species with a total of 172 trees and several grasses and field crops. Females laid their egg masses on the stems, branches and even, but rarely, on the leaves, with a preference of Acacia tree (*Acacia arabica* Willd.) and Tamarix tree (*Tamarix nilotica* Ehrenb). Most egg masses (59.6%) were oviposited on the stems while 36.44 and 3.96% were laid on the branches and leaves of the plants, respectively.

Key Words: Oviposition seasonality, site preference, *Sphodromantis viridis*.

INTRODUCTION

Many preference studies have been done on different herbivore insects, but few have examined whether predaceous species exhibit preferences for oviposition sites or not. Where and when a female insect deposits its eggs, is often the most important factor determining offspring success (Thompson 1988, Minkenberg *et al.*, 1992). Although many species of herbivores insects have been studied to explore the relationship between preference of ovipositing females for certain host plants and subsequent performance of their offspring on those hosts (e.g., Wiklund 1975, Rausher 1984, Bernyas 1990 and Auerbach and Alberts 1992) few researches have considered oviposition seasonality and site selection by predaceous insects. Ovipositional site selection by insects is often made to balance vulnerability of eggs to natural enemies with foraging profitability of emerging larvae. Insect eggs are vulnerable to predation and parasitism. Although they cannot rely the escape and aggressive behaviors of mobile stages, an array of morphological and chemical defensive devices have evolved (Hinton 1981). For example, eggs may be laid on stalks (Duelli and Johnson 1991) or covered by excrement (Damman and Cappuccino 1991) or protected by armor or oil (Eisner *et al.* 1996). Furthermore, females can increase egg survival through maternal care or selection of less exposed oviposition sites (Edmunds 1974, Hinton 1981). Choosing a suitable ovipositional site also ensures that emerging larvae are usually fragile and can be subject to desiccation and starvation. In grasslands, praying mantids are often considered the most diverse and numerically abundant group of predatory insects (DeBach and Rosen 1991). Improved understanding of the environmental factor influencing their distribution and abundance in natural and agricultural ecosystem may lead to habitat management practices that conserve and enhance the beneficial use of these generalist predators.

This study was proposed to clarify the seasonal occurrence and oviposition site selection of the predator insect, *Sphodromantis viridis* Forskal (Mantodea: Mantidae) for its egg masses.

MATERIALS AND METHODS

Study Area and Field Survey

Research was conducted at twenty fourth field sites, with an area of 850 X 1250 meter. This area was chosen carefully at El-Ezizia village, Fayoum province, where no insecticides are used. Plant communities bordering the fields ranged from simple herbaceous vegetation to mature trees. Based on a preliminary work on *S. viridis;* it was observed that the females usually oviposit on the shrubs and mature trees. Data were collected from 172 examined trees and numerous grass and field crops. The examined trees were belonging to fourteen species (Table 1). The sample trees were situated along the field crops and along a stream bank, where tree heights ranged from 1.5 to 5 meters. Surrounding field crops were cotton, wheat, barely, berseem (clover), tomatoes, maize, beans, cabbage, rice, etc.

Oviposition Seasonality

Seasonal occurrence of the oviposited *S. viridis* egg masses were studied through 24 month period beginning from January 2001 till December 2002. Oviposition data were obtained from the chosen plants twice / month through the days 12 – 15 and 26 – 29 of each month.

Oviposition Site and Preference

Plant species were examined carefully twice/month. The examinations depend upon visual observation. Firstly at the beginning, all experimental plant species were examined and each observed *S. viridis* egg mass detected was labeled to prevent repetition or confusion. For each site and examined date, the total numbers of observed egg masses were recorded. Tree trunk (stems), branches and leaves of preferred host plants were examined to detect the most sites preferred by *S. viridis* for oviposition.

Statistical Analysis

A one-way analysis of variance (ANOVA) and Duncan multiple range test of means (Duncan, 1955) were used.

Table (1): Alphabetical list of examined tree varieties at El-Ezizia village, Fayoum.

Scientific name (Order: Family)	Common name	Examined numbers
Acacia arabica Willd. (Leguminosae: Mimosaceae)	Acacia	6
Albizzia Lebbek Meikle (Leguminosae: Mimosaceae)	Lebbek	4
Casuarina equisetifolia Linn. (Verticellatae: Casuarinaceae)	Casuarina	5
Citrus sinensis Pers. (Terebinthales: Rutaceae)	Orange tree	6
Eucalyptus rostrata Cav. (Myrtales: Myrtaceae)	Camphor	7
Olea chrysophylla Lam. (Ligustrales: Oleaceae)	Olives tree	18
Phoenix dactylifera Linn. (Spadiciflorae: Palmae)	Date palm	25
Phragmites australis Cav. (Glumiflorae: Graminae)	Hagna	30
Prunus domestica Linn. (Rosales: Rosaceae)	Plums	4
Psidium guajava Linn. (Myrtales - Myrtaceae)	Guava	8
Ricinus communis Linn. (Tricoccae: Euphorbicaceae)	Castor oil	15
Salix subserrata Ryd. (Salicales: Salicaceae)	Mallow	17
Tamarix nilotica Ehren. (Parietales: Tamaricaceae)	Tamarix	22
Vitis vinfera Kuntze (Terebinthales: Vitaceae)	Grapes	5
Grasses and field crops		Numerous

RESULTS AND DISCUSSUON

Seasonal Occurrence

Percentages of the oviposited *S. viridis* egg masses per month are shown in Fig. (1). Visual observations of the oviposited egg masses recorded through the 2 years showed that the date was a significant factor in oviposition. Egg masses were recorded only in the seven months from April to October. Highest abundance percentage was obtained during May (20.8 and 17.2%) and September (18.1 and 19.9%) in the two years 2001-2002 of the study, respectively. Lowest abundance of the mantid egg masses were obtained during October (6.5 and 5.1%) and no egg masses were found during the period lasted from November to March.

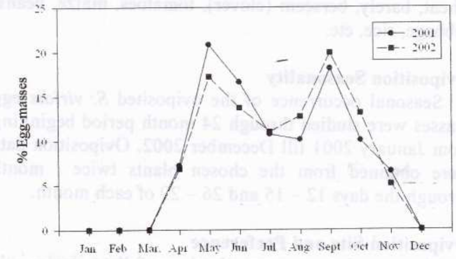

Fig. (1): Seasonal occurrence of oviposited egg-masses of *S. viridis* in 2001 and 2002.

Host Plant Selection

Through the range of the survey, 172 trees (fourteen species) and many grasses and field crops were examined. Table (2) shows the mean number of *S. viridis* egg masses observed / plant species during different months of the years 2001-2002. Egg masses number differed according to the plant species selected for oviposition (Tables 2 and 3). The highest number of egg masses/tree was recorded on Acacia tree (*Acacia arabia* Willd.). Statistically, significant differences (P<0.05) were obtained by comparison the mean number of oviposited egg masses/ the plant species.

Oviposition Site Selection

Ovipositional sites were firstly divided into three plant parts (stem, branches and leaves). Percentage of egg masses oviposited on each site are shown in Table (3). Observed data indicated that, 59.6% of *S. viridis* egg masses examined was laid on stems (trunks) of the plants and 36.44% were laid on the branches while only 3.96% were laid on the leaves. Obtained data also showed that *S. viridis* females oviposited nearly on the stems and branches of the examined plants and only on the leaves of Date palm (*Phoenix dactylifera* Linn) and Hagna (*Phragmites australis* Cav.

In conclusion, the present study was carried out in a natural agricultural area containing a wide variety of plants and trees, with resource patches of varying quality scattered throughout. Further, the target insect predator (*S. viridis*) has a great mobility and powerful attitude. The study has clarified the oviposition preference for *S. viridis* females among different plant species. Field-observed preferences differed from that of the laboratory which excludes many of the environmental effects that may influence oviposition behavior under field conditions. Numerous studies have identified variety of biotic and abiotic influences that alter oviposition behavior as: sun versus shade effects (Rausher 1979, Williams 1983; Moore *et al*., 1988), enemy free space (Denno *et al*.. 1990; Rossi *et al*., 1994), resource reliability (Williams 1983), and variation in host plant chemistry (Marino *et al*. 1993).

Under field conditions, *S. viridis* oviposition pattern was more abundant in the hot months (April-October) while no oviposition was recorded through the cold months (November-March). On the other hand, the highest percentage of oviposition was recorded during April and September. This may be due to the fact that many insects hibernate in the cold session and no oviposition takes place.

Table (2): Means of oviposited egg masses of *S. viridis* on different plant species from January to December 2001 and 2002..

Plant species	Mean ± SE						
	April	May	June	July	August	September	October
Acacia	2.80±0.41a	3.80±0.38a	3.00±0.12 a	2.20±0.45a	2.80±0.48a	4.20±0.52a	2.00±1.2a
Lebbek	1.50±0.28b	1.50±0.42b	0.75±0.45b	0.75±0.42b	0.50±0.20b	0.50±0.21b	0.50±0.21b
Casuarina	1.00±0.22b	1.10±0.24b	0.88±0.32b	1.10±0.21c	0.70±0.31b	1.20±0.31c	0.46±0.3b
Orange	0.14±.040c	0.51±0.13c	0.35±0.17b	0.18±0.09d	0.37±0.1b	0.50±0.17b	0.24±0.1b
Camphor	1.00±0.31b	1.20±0.30b	0.71±0.22b	1.10±0.51b	0.81±0.3b	1.10±0.3c	0.82±0.3b
Olives	0.80±0.34e	1.20±0.30b	0.78±0.16b	0.52±0.22d	2.10±0.2d	1.60±0.8c	0.30±0.12b
Date palm	1.90±0.19b	2.30±0.22b	2.10±0.23c	1.60±0.17c	1.60±0.2c	2.10±0.21d	1.40±0.2c
Hagna	0.16±0.16c	0.50±0.31c	0.33±0.33b	0.16±0.16d	0.50±0.22b	0.33±0.3b	0.24±0.3b
Plums	0.30±0.20c	0.67±0.30c	0.52±0.22b	0.33±0.28d	0.50±0.31b	1.10±0.2c	0.16±0.16b
Guava	0.35±0.14d	0.78±0.22c	0.50±0.24b	0.22±0.11d	0.50±0.21b	0.35±0.2b	0.30±0.1b
Castor oil	0.52±0.12d	0.52±0.12c	0.35±0.16b	0.78±0.20b	0.78±0.2b	0.28±0.2b	0.50±0.21b
Mallow	1.20±0.21b	1.90±0.22b	1.00±0.21b	0.93±0.22	0.95±0.2b	2.00±0.18d	0.85±0.3b
Tamarix	2.40±0.32a	3.10±0.28a	2.10±0.82c	1.60±0.26c	2.60±0.31a	3.20±0.35a	1.20±0.4c
Grapes	0.28±0.17d	0.42±0.17c	0.21±0.12e	0.35±0.16d	0.36±0.1b	0.14±0.1b	0.78±0.1b

Means followed by the same letter, in the same column, are not significantly different (P<0.05).

Table (3): Oviposition site selection of *S. viridis* female on different examined plant species.

Plant species	% Egg masses on		
	Stem (trunk)	branches	leaves
Acacia	10.42	8.13	0.00
Lebbek	5.40	4.21	0.00
Casuarina	3.20	0.00	0.00
Orange	2.41	1.40	0.00
Camphor	3.32	0.00	0.00
Olives	3.40	2.12	0.00
Date palm	4.84	2.90	2.36
Hagna	3.30	1.60	1.60
Plums	2.11	3.12	0.00
Guava	2.20	2.90	0.00
Castor oil	4.22	2.61	0.00
Mallow	3.81	2.42	0.00
Tamarix	7.20	3.80	0.00
Grapes	2.20	1.21	0.00
Grasses	0.00	0.00	0.00
Field crops	0.02	0.00	0.00
Total	59.6	36.44	3.96

Through this study, *S. viridis* females prefer laying their egg masses in sites of the plants, particularly that with high trichome density. According to Norris and Kogan 1980, trichomes constitute outgrowths of the epidermis of stem, branch or leave that effect, mechanically or chemically many of insect oviposition behaviors. In several systems, plant pubescence has been shown to either increase or reduce oviposition in both phytophgous and predaceous insects. Obrycki and Tauber (1985) observed that adult coccinellids were distributed evenly among potato cultivars with different pubescence, but eggs were more abundant on plants with high trichome density. We think that *S. viridis* females have evolved discriminating capacities that enable them to detect most preferable oviposition site.

In conclusion, egg masses of *S. viridis* can be easily recognized and collected for rearing and introducing from many plants especially Acacia plant. Furthermore, more exhaustive studies on the mechanisms of prey location, phytophagous or predaceous insects, ovipositional site and offspring development will provide much valuable information on the plant-predator interactions, in general.

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Figure (2): *Acacia* tree, a preference oviposition site for *S. viridis*.

Figure (3): Egg masses of *S. viridis* oviposited on the trunk and branches of *Acacia* tree.

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