J. Plant Prot. and Path., Mansoura Univ., Vol.7 (6), 357– 360, 2016

Efficiency of Sampling Techniques for Collecting Hymenopterous Insects Inhabiting Rice Nurseries

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ABSTRACT

Four sampling techniques; pitfall traps, water pan traps and sweep net (in 2014 and 2015 rice seasons) and light trap (in 2015 season) were used to collect arthropods from rice nurseries. The traps were fixed during the nursery duration; April – May. Results of the first three traps revealed the occurrence of 42 and 81 hymenopterous individuals, in the first and second seasons, respectively. Most of the captured insects were found belonging to families Diapriidae (32 individuals in 2015 season), Eulophidae (8 individuals in 2014 season), Figitidae (11 individuals in the second season), Formicidae (12 individuals in the second season) and Mymaridae (13 individuals in the first season). The most efficient tool, in 2014 season, was water pan trap that collected 61.90% out of total catch, followed by pitfall trap (23.81%). This situation was reversed in the 2015 season, with pitfall trap occupying the first rank (51.85%), followed by water pan trap (41.98%). However, in both seasons, the sweep net technique captured the lowest catch. The modified light trap, used only in 2015 season, collected mainly *Cataglyphis* sp. (Formicidae), followed by *Trichopria* sp. (Diapriidae). The variable catches, in the current investigation, could be attributed to the type of the trap, insect behavior, and to the population density of the target insects.

Keywords: Hymenopterous insects, rice nurseries, sampling methods.

INTRODUCTION

Rice crop is a very important cereal crop in Egypt, as well as in most of world countries. Rice plants are liable to infestation with about 100 insect species, however, only 20 species are considered of economic losses (Sherif 1996). Insect pests of different orders attack the rice plants, meanwhile these orders have natural enemies that have a vital role to keep the balance in rice ecosystem (Sabet et al. 2012). Hymenopterous insects are inhabiting rice fields, and represent an important component of rice fields either as insect pests or as natural enemies (Ooi and Shepard. 1994). From the biological control point of view, it is necessary to maximize the role of hymenopterous parasitoids to manage the insect pests in rice ecosystem (Yaherwandi, 2012).

To manage insect pests, it is important to understand the population dynamics of these insects, and to get predictions of their future abundance (Leather and Watt 2005)

To monitor these population fluctuations, variable sampling techniques should be adopted. Gullan and Cranston (2005) reported that when selecting an appropriate sampling method, it is important to consider the design of the respective sampling tools and their costs, as well as the ecological traits and habitat conditions of the target taxa. The capture effectiveness of sampling methods and their improvements were studied by several authors (Campos *et al*. 2000; Axmacher and Fiedler 2004; Sabu and Shiju 2010). The design of the trap greatly affects the captured fauna (Heathcote 1957, Niemelä *et al.* 1986). The behavior of an insect determines the used trap or sampling technique (Leather and Watt 2005).

The current investigation was conducted to evaluate the efficiency of sampling traps in collecting hymenopterous insect predators and parasitoids from rice nurseries.

MATERIALS AND METHODS

This experiment was carried out to evaluate sampling techniques for surveying hymenopterous insects from rice nurseries. Two locations were assigned for this study at Kafr El-Sheikh Governorate, Egypt; the experimental farm of Rice Research and Training Center, Sakha Agricultural Research Station, and El-Sabein village, Sidi Salem district, during 2014 and 2015 rice seasons. Sampling process lasted for nursery duration; from 17th of April up to mid- May.

I. Sampling techniques:

1- Sweep net (Fig. 1a):

Weekly sampling of insects were conducted using the conventional sweep net. The samples were taken by walking diagonally through the nursery areas, and five double strokes were achieved every week. The trapped insects were emptied into a glass jar, and transferred to the laboratory.

2- Water pan traps (Fig. 1b):

Five plastic plates, 15 cm in diameter and 8 cm deep, were set floating on water without covers and filled with water to 5 cm height. Formalin 3% was used as preservative plus some drops of detergent added to break the surface tension. The traps were set continuously and weekly emptied. The trapped insects were sieved through a fine textile and collected.

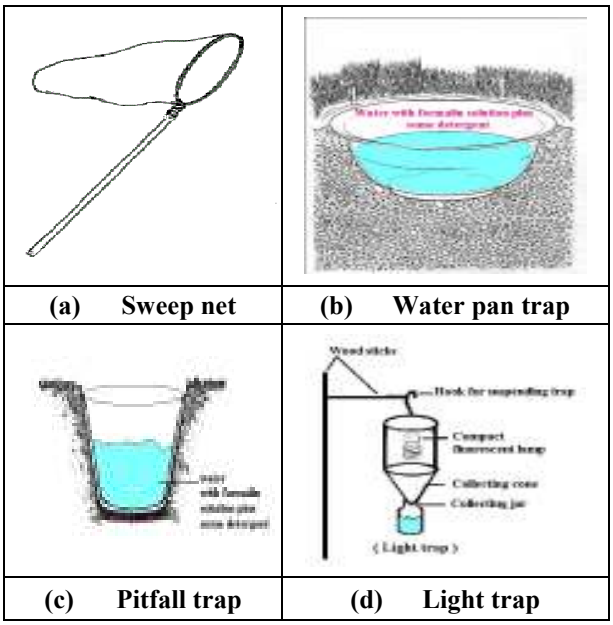
3- Pitfall trap (Fig. 1c):

At each site, five pitfall traps (9 cm diameter and 12 cm height) were fixed into the ground, 5 m apart. Each trap was provided with water to a height of 8 cm. In addition, the trap was provided with 3% formalin and a detergent. The traps were emptied once a week, and the catches were transferred to ethanol (75%) and counted.

4- Light trap (Fig. 1d):

It consists of two main parts; a source of light and recipient to collect the attracted insects. The insects, attracted by light, lie in the recipient that has water and alcohol. The source of light is fixed 5-10 cm above the fluid. The trap is operated by switching the lamp on for

4 hours after sunset, and the trapped insects are collected every morning.



(a) Sweep net **(b) Water pan trap**

(c) Pitfall trap **(d) Light trap**

Figure 1. Sampling techniques

II. Identification of collected hymenopterous insects:

In the laboratory, the catches were water washed, and transferred to glass vials containing 75% ethanol. Then, the specimens were sorted and identified. The hymenopterous insects were identified at Entomology laboratory, Rice Research and Training Center (RRTC). Sakha, Kafr El- Sheikh, Egypt.

RESULTS AND DISCUSSION

1. Efficiency of sampling techniques for collecting hymenopterous insects:

Four sampling techniques, pitfall traps, water pan traps, sweep net and modified light trap were evaluated as methods for sampling hymenopterous insects (predators and parasitoids) from rice nurseries from 17th April up to mid - May in 2014 and 2015 rice seasons (Fig. 1).

In 2014 rice season, the sampling techniques captured 42 individuals of hymenopterous insects, belonging to eleven families (Table 1). twelve species were identified, but four were not identified. The majority of individuals were found belonging to Mymaridae (13 individuals), followed by Eulophidae (8 individuals), and then Scelionidae (6 individuals).

Table (1): Hymenopterous insects with their families, caught by traps from rice nurseries at Kafr El- Sheikh region.

Family / insect species	2014 season				2015 season			
	Pittfall traps	Water pan traps	Sweep net	Total	Pittfall traps	Water pan traps	Sweep net	Total
Bethylidae Unidentified	0	2	0	2	0	0	0	0
Braconidae *Opius hediqusti* Fish. *Cotesia* sp.	0	0	1	1	4	3	2	9
Ceraphromidae *Aphenogomus* sp.	0	1	0	1	2	3	0	5
Diapriidae *Trichopria* spp.	0	0	1	1	18	12	2	32
Encyrtidae Unidentified males	1	1	1	3	0	1	0	1
Eulophidae *Tetrastichus* sp.	0	8	0	8	4	0	0	4
Figitidae *Gronotoma* sp.	0	0	1	1	9	2	0	11
Formicidae *Cataglyphis* sp. *Solenopsis* sp.	0	0	0	0	3	9	0	12
Mymaridae *Camptoptera* sp. *Anagrus* sp.	4	8	1	13	0	2	0	2
Pteromalidae Unidentified	2	2	0	4	1	2	0	3
Scelionidae *Trissolcus* sp. *Telenomus* sp.	2	3	1	6	1	0	1	2
Torymidae Unidentified	1	1	0	2	0	0	0	0
Total	10	26	6	42	42	34	5	81
%	23.81	61.90	14.29	-	51.85	41.98	6.17	-

In 2015 rice season, 81 individuals (insect pests and parasitoids) were surveyed (Table 1). These individuals belong to ten families; twelve species were identified, but four were not identified. The majority of species were those of Diapriidae (32 individuals) followed by Formicidae (12 individuals) and then Figitidiae (11 individuals).

As for trap efficiency in collecting hymenopterous insects, data are also presented in Table (1). In 2014 season, water pan trap collected the highest percentage of insects (61.90% out of total), followed by 23.81 and 14.29% in pitfall trap and sweep net, respectively. The superior catch of water pan is due to collecting eight individuals of eulophids (*Tetrastichus* sp.), and another eight individuals of mymarids (*Camptoptera* sp. and *Anagrus* sp.).

In 2015 season, the majority of individuals (18) are belonging to diapriids (*Trichopria* spp.) which made the pitfall trap the most efficient technique in collecting the hymenopterous insects, with a value of 51.85% out of total, followed by water pan trap (41.98%), and then, sweep net (6.17%). The water pan trap came in the second rank, because of collecting 12 individuals belonging to diapriids. However, in both seasons, sweep net appeared as the least efficient technique in collecting the hymenopterous insects. Generally, it could be reported that the efficiency of a trap in collecting the target insects is greatly affected by the sampling technique itself, as well as by the dominant insects in the location. Accordingly, water pan trap occupied the first rank in the first season, but occupied the second rank in the second one. A reverse situation was found concerning the pitfall trap. These findings are in agreement with those of Hendawy *et al*. (2016) who found the water pan trap is the highest efficient technique, as it trapped 51.47% of total available insects, followed by pitfall trap (27.94%) while sweep net occupied the last rank, with 20.58% of total insects.

2. Efficiency of light trap for collecting hymenopterous insects from rice nurseries:

Data presented in Table (2) showed that the efficiency of the modified light trap (Fig1. d) in collecting hymenopterous insects, throughout the rice nursery duration; April – May 2015.

Throughout the rice nursery duration, the modified light trap caught 32 hymenopterous individuals, either as pests or as parasitoids. The majority of captured insects (22 individuals) were belonging to Formicidae with two species; *Cataglyphis* sp. (21 individuals), and *Solenopsis* sp. (one individual). The second rank (five individuals) was occupied by *Trichopria* sp. (Fam.: Diapriidae). The other parasitoids and hyperparasitoids were captured as only one or two individuals. The 32 collected insects were found belonging to six families (mainly Formicidae), and were identified as seven species.

Table (2): Hymenopterous insects captured by the modified light trap, throughout rice nursery field duration, 2015 season.

Sampling date	Family	species	No.	%	Status
April - May 2015	Diapriidae	*Trichopria* sp.	5	15.63	Parasitoid
	Eulophidae	*Tetrastichus* sp.	2	6.25	Parasitoid
	Figitidae	*Gronotoma* sp	1	3.13	Hyperparasitoid
	Formicidae	*Cataglyphis* sp	21	65.63	Pest/Predator
		Solenopsis sp	1	3.13	Pest/Predator
	Ichneumonidae	*Gelis* sp	1	3.13	Hyperparasitoid
	Scelionidae	*Trissolcus* sp.	1	3.13	Parasitoid
Total	6	7	32	-	-

These results are in agreement with those of Miranda *et al*. (2014) in the Philippines, who collected flying insects by light trap from paddy field. They found that the light trap involved varying size sample which is good for comparing seasonal and yearly catches of insects. Variable catch density of the traps for different insect species could be attributed to the trap design (Niemela *et al*., 1986) and to the behavior of an insect (Leather and Watt, 2005). The same observation was reported by Gullan and Cranston, (2005). Yaherwandi (2012) indicated into the necessity of maximizing the role of hymenopterous parasitoids to manage the harmful insect pests in rice ecosystems.

REFERENSES

Axmacher, J. C. and K. Fiedler (2004). Manual versus automatic moth sampling at equal light sources: A comparison of catches from Mt. Kilimanjaro. Journal of the Lepidopterists' Society, 58: 196-202.

Campos, W. G.; D. B. S. Pereira and J. H. Schoereder (2000). Comparison of the efficiency of flight-interception trap models for sampling Hymenoptera and other insects. Anais da Sociedade Entomológica do Brasil, 29: 381- 389.

Gullan, P. J. and P. S. Cranston (2005). The insects: an outline of entomology. Chapter 17, Methods in entomology: collecting preservation, caution, and identification. Hoboken, NJ: Wiley-Blackwell.

Heathcote, G. D. (1957). The comparison of yellow cylindrical, flat and water traps, and of Johnson suction traps, for sampling aphids. Annals of Applied Biology, 45: 133–139.

Hendawy, A.S.; S.S. Awadalla and M.M. Ismael (2016). Evaluation the efficacy of sampling methods for survey spiders at Kafr El-Sheikh governorate rice nurseries. J. Plant Prot. & Path., Mansoura Univ. 7(2): 157-160.

Leather, S. R. and A. D. Watt ; (2005). Sampling theory and practice. PP 1-15. Leather, S. R. Insect Sampling in Forest Ecosystems . Blackwell Science Ltd.

Miranda, J.L.; B.D. Gerardo and B.T. Tanguilig (2014). Pest detection and extraction using image processing techniques. International journal of computer and communication engineering, 3(3): 189-12

Niemela, J.; E. Halme; T. Pajunen and Y. Haila (1986). Sampling spiders and carabid beetles with pitfall traps: the effect of increased sampling effort. Ann. Entomol. Fenn. 52.

Ooi, R. A. C. and B. M. Shepard. 1994. Predators and parasitoids of rice insect pests. In: Biology and Management of Rice Insects. E.A. Heinrichs (ed.). Wiley Eastern Limited (New Delhi) and IRRI (Philippines). pp. 585-612.

Sabet, H. S.; H. S. Sabet and A. Biglari (2012). Acceptance of biological control of rice stem borer and its effect in reducing pesticides. International Journal of Agriculture and Crop Sciences, 4 (16): 1212-1214.

Sabu, T. K. and R. T. Shiju (2010). Efficacy of pitfall trapping, Winkler and Berlese extraction methods for measuring ground-dwelling arthropods in moist-deciduous forests in the Western Ghats. Journal of Insect Science, 10: 1-17.

Sherife, M. R. (1996). Yield losses in the Egyptian rice fields occurred by rice stem borer in relation to cultivar acreage and light trap catches. J. Agric. Sci., Mansoura Univ., 21 (2): 4537-4545.

Yaherwandi (2012). Community structure of hymenopterous insects Hymenoptera associated with Brassicaceae and non-crop vegetation. Nusantara Bioscience, 4 (1): 22-26.

كفاءة المصائد في جمع حشرات غشائية الأجنحة من مشاتل الأرز

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استخدمت مصائد الحفرة, والمصائد الطافية, وشبكة جمع الحشرات (في موسمي ٢٠١٤, ٢٠١٥) , والمصيدة الضوئية (في موسم ٢٠١٥) لجمع حشرات غشائية الأجنحة من مشاتل الأرز. تم جمع٤٢, ٨١ فردا من الحشرات في موسمي ٢٠١٤, ٢٠١٥ علي التوالي باستخدام طرق الجمع الثلاث الأولي. كانت أغلب الحشرات تنتمي إلي عائلة Diapriidae (٣٢ فردا في موسم ٢٠١٥), و عائلة Eulophidae (٨ أفراد في موسم ٢٠١٤), و عائلة Figitidae (١١ فردا في موسم ٢٠١٥), و عائلة Formicidae (١٢ فردا في موسم ٢٠١٥) و عائلة Mymaridae (١٣ فردا في موسم ٢٠١٤). أثبتت المصائد المائية أنها الأكفأ في جمع الحشرات غشائية الأجنحة في موسم ٢٠١٤ (٦١.٩٠%) تلتها مصائد الحفرة (٢٣.٨١%), بينما كان الوضع معكوسا في العام التالي. حيث جمعت مصائد الحفرة ٥١.٨٥% من الحشرات تلتها المصائد المائية (٤١.٩٨%). وعموما فقد كانت شبكة جمع الحشرات هي الأقل كفاءة في كلا الموسمين. وبخصوص المصيدة الضوئية, كانت أغلب الحشرات المنجذبة تنتمي إلي عائلة Formicidae (*Cataglyphis* sp.), وعائلة (*Trichopria* sp.) Diapriidae. ويمكن أن ينسب التفاوت في كفاءة المصائد المختلفة في جمع الأنواعالحشرية، إلي نوع المصيدة نفسها, وكذا إلي طبيعة سلوك الحشرات المستهدفة, وكثافة تعدادها في الحقل.