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Evaluation of the Efficiency of Different Types of Bee Pollen-Collection Traps in Honey Bee Colonies During Summer Season

Eman H Abd El Salam[1*], Mahmoud AM Ali [1], Naglaa A Ghazala[2]
1- Plant Protection Dept, Fac of Agric, Ain Shams Univ, P.O. Box 68, Hadayek Shoubra 11241, Cairo, Egypt
2- Bee Research Dept, Plant Protect Inst, Agric. Research Center, Giza, Egypt

*Corresponding author: emanhamdy424@yahoo.com

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Abstract: The efficiency of three different types of pollen-collection traps namely, Front Drawer Pollen Traps (Type, 1), Bottom Pollen Traps (Type,2) and Plastic Slide Traps (Type,3) were evaluated. The data indicated that in type 2, which had Bottom Pollen Traps, a significantly high amount of bee pollen was collected (383.30g/colony) followed by type 1, (179.37g/colony) while type 3 had the lowest amount of collected bee pollen (123.80 g/colony). The highest amount of bee pollen collected during summer was from type (2) during 20 -29 July, followed by that from the same group during the periods 1-10 July and 9-18 August, and then type (1) during the period 20-29 July. The results also revealed that the lowest amount of bee pollen collected by the traps was during the last week of August and September.

1 Introduction

Pollen grains are the male spores found in the anthers of flowers, which are rich in vitamins, minerals and proteins, which are essential for growth and act as building materials for the growth and tissue repair for honeybee colonies. They are also used to feed larvae, young worker bees and broods (Somerville 2000, Brodschneider and Crailsheim 2010, Mesbah et al 2017). Bee pollen is flower pollen collected by all worker honeybees for the purpose of feeding their larvae. The flower pollen is collected as granules carried on the hind legs of worker bees after being mixed with bee saliva and some enzymes (Mărgăoan et al 2010) Pollen collection is a rather new development, and a pollen trap is used to collect pollen. By scraping it from the legs of each bee as it enters the hive (Kaplan et al 2016). Special pollen traps (Komosinska-Vassev et al 2015) were used to collect pollen baskets. The purpose of installing pollen traps is to obtain a portion of the pollen loads on the hind legs of field bees returning to the hive. Several different types of pollen traps have been established: type I exit, bottom plate, slide, and top frame in which perforated nets or nets with suitable small holes are used. Size about 5 mm, national data have reported that the amount of pollen collected from a single colony in 1 day may reach 50-250 g within a year; one bee colony gives 1 to 7 kg of bee pollen. A honeybee colony can collect 15-40 kg of pollen annually (Zuluaga et al 2015). Bee Pollen Traps were used by (Gazala and Nowar 2014) for pollen collecting for three days only and removed them and found that the greatest amounts of pollen were collected in the summer season (1731.44 g./ colony). The climatic conditions of the area and the prevailing needs of the colony have clear effects when designing and installing the pollen trap to suit the needs of the colony. The aim of this study is to evaluate different types of Bee Pollen-Collection Trap during summer (Maize flowering season).

2 Materials and Methods

The present work was conducted in an apiary belonging to the Honeybee Research Department, Plant Protection Institute Qunatir, Qaluobia Governorate to evaluate the efficiency of types of pollen-collection traps in pollen production during summer (from July until September) 2018 in the maize flowering season.

2.1 Honeybee colonies

Eighteen hybrid Carniolan honey bee colonies (*Apismelli feracarnica* L.) with the same colony strength were selected for this study; each one had eight combs covered with adult honey bees, six combs of broods and two combs of honey and pollen. They were divided into three groups with each group having six honeybee hives.

2.2 Pollen-Collection traps

Three different types of the pollen-collection trap were evaluated in this study for pollen production as follows:

Front Drawer Pollen Traps (Type 1): Fitted on the entrance of the beehives with a diameter of 4.7-5 mm **(Fig 1)**.

Bottom Pollen Traps (Type 2): Seated under the disks of beehive pores on the bottom board with a diameter of 4.6 mm **(Fig 2)**.

Plastic Slides Traps (Type 3): Made from plastic material as a plastic slide with pores 4-5 mm in diameter (Similar to a piece of queen excluder along the entrance of the beehive) **(Fig 3)**.

2.3 Pollen collection

The pollen-collection traps were left for 10 days in all tested groups for pollen-collection and removed for another 10 days during the experimental period (from July 1 to September 27, 2018). The bee pollen was collected from the pollen-collection traps in each group separately and the amount of bee pollen collected from each group was weighed.

2.4 Statistical analysis

The experimental design involved repeated measurement analysis. Results were analyzed, using SAS **(SAS 2006).** The general linear modules procedure was used to test for differences (alpha= 0.05) along with the application of the least significant differences as a mean separation test.

3 Results and Discussion

Data in **Table 1** show the amount of bee pollen (g) collected from different types of bee pollen collection traps during the summer season. The total amounts of bee pollen (g) collected from Front Drawer Pollen Traps (Type; 1), Bottom Pollen Traps (Type; 2), and Plastic Slide Traps (Type; 3) were, 5381, 11515, and 3714 g, respectively with averages of 1076.20, 2303 and 742.8 g during summer season (from July1toSeptember[27]) 2018. The results indicated that (Type, 2), traps collected significantly more bee pollen than the others, followed by (Type, 1), and then, (Type, 3).

Table 2 shows the mean amounts of bee pollen (g /colony) and the amounts of bee pollen in (g/colony/day) collected from honeybee colonies in groups 1, 2, and 3. The average amounts of bee pollen (g/hive) collected were 179.37, 383.30, and 123.80g /colony for groups, 1, 2, and 3, respectively. The amounts of bee pollen collected (g/colony/day) in groups; 1, 2, and 3 were 17.93, 38.38, and 12.38 g/colony/day respectively. It can be concluded that group (2), which had Bottom Pollen Traps (Type,2) had the highest mean amount of bee pollen followed by group (1) which had Front Drawer Pollen Traps (Type,1) while, group (3) which had the Plastic Slide Traps (Type,3) had the lowest amount of bee pollen. The same trend was obtained for the bee pollen collected per colony per day for the aforementioned groups.

Mahmood et al (2013) found that the total yields of pollen from the Gujranwala trap, HBRI, fixed bottom board, and china-clipped trap (in g) were 83.00 ± 3.92, 121.50 ± 2.87, 79.50 ± 2.33, and 66.00 ± 1.78 respectively. Gazala and Nowar (2014) found that the largest amount of bee pollen was collected in summer. On the other hand, the current data disagree with results reported by El-Kazafy et al (2019) who found that the largest amount of pollen was collected from bees during May (440.77 and 425.33 g/colony), followed by August (327.73 and 335.62 g/colony), and then March (305.33 and 284.80 g/colony). While the lowest trapped pollen loads were obtained during January (131.92 and 115.66 g/colony), followed by December (136.36 and 125.65 g/colony) in 2015 and 2016. Our data also conflict with the results by Mesbah et al (2017) who found that the highest amount of trapped pollen was in August, which could be due to the difference in the region as well as the difference in the type of trap used and the different environmental conditions. A comparison was made

Fig 1. Front Drawer Pollen Traps

Fig 2. Bottom Pollen Traps

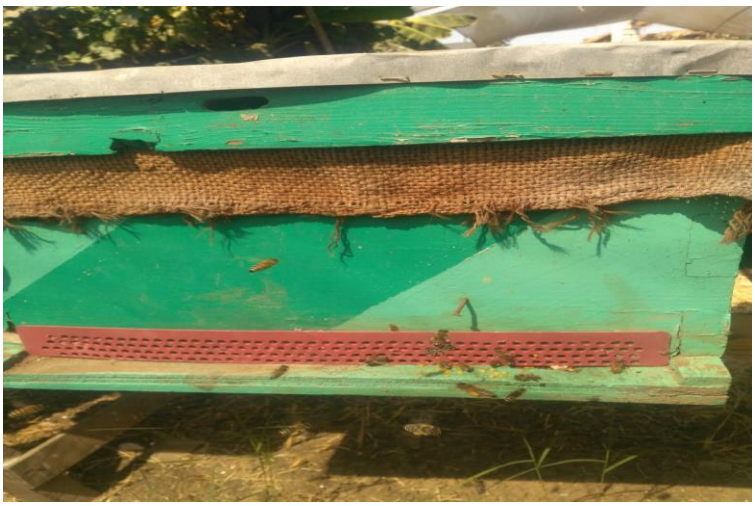

Fig 3. Plastic Slides Traps

Table 1. Total amount of bee pollen (g) collected from different types of bee pollen-collection traps during summer season, 2018

Period of Inspection	Pollen Traps			Total amount of bee pollen collected (g)
	Front Drawer Pollen Traps (Type, 1)	Bottom Pollen Traps (Type, 2)	Plastic Slide Traps (Type, 3)	
1-10/7/2018	1602	2669	1106	5377
20-29/7/2018	1813	5048	1302	8163
9-18/8/2018	1014	2601	643	4258
29/8 7/9/2018	307	418	168	893
18-27/9/2018	645	779	495	1919
Total	5381	11515	3714	20610
Mean	1076.2	2303	742.8	

Table 2. The average amount of bee pollen (g/colony and g/colony/day) collected from different types of bee pollen-collection trap during the summer season, 2018(mean ± s.e)

Period of Inspection	Pollen Trap			Mean ± S.E
	Front Drawer Pollen Traps (Type, 1)	Bottom Pollen Traps (Type, 2)	Plastic Slide Traps (Type, 3)	
1-10/7/2018	267±27.21cd (26.70)	444.83 ± 46.06b (44.48)	184.33 ± 23.15c-f (18.43)	298.70 ± 32.06b
20-29/7/2018	302.17±68.04c (30.21)	841.33 ± 100.72a (84.13)	217 ± 58.57c-e (21.70)	453.49 ± 79.25a
9-18/8/2018	169 ± 38.93d-g (16.90)	433.5 ± 89.09b (43.35)	107.17 ± 26.76e-h (10.72)	236.55 ± 46.64b
29/8 7/9/2018	51.17 ± 7.73gh (5.11)	69.67 ± 9.66f-h (6.97)	28 ± 4.16h (2.80)	49.60 ± 5.82c
18-27/9/2018	107.5 ± 7.07e-h (10.75)	129.83 ± 8.87e-h (12.98)	82.5± 4.95f-h (8.25)	106.61 ± 6.08c
Mean ± S.E	179.37 ± 23.40b (17.93)	383.30± 57.57a (38.38)	123.80± 18.03b (12.38)	

Valuesin brackets are average amounts of bee pollen (g/colony/day)
L.S.D for Traps = 58.29
L.S.D for Date = 75.245
L.S.D for Interaction (Time x traps) = 130.33

between a trap installed at the entrance and the newly invented, repaired lower trap. The average pollen yield (g) obtained from the entranced trap and the fixed bottom traps are 12.55 ± 1.66 and 22.5 ± 1.25 respectively (Raja 2010). Ismail et al (2013) found that in the first year in summer, the total weight of trapped pollen was 1299.97 g (mean 92.86 g/colony/week) with a peak in July, and in the summer of the second year, the total weight of trapped pollen was (1010.13 g mean 77.70 g/colony/week) with also a peak in July. (Lau et al 2019) used traps to collect bee pollen from honeybee colonies by placing them at the entrance of the beehive and concluded that in a honeybee colony of 10,000 to 15,000, adult honeybee workers need about 13.40 to 17.80kg of pollen per year.

4 Conclusion

In summary, our data showed that beekeepers can obtain bee pollen in this experimental area during summer using any of the bee pollen-collection traps evaluated, but the most suitable type (Type 2).

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