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A new device ND (2×1) for collecting bee venom and pollen grains

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Abstract

This study was conducted in the Department of Plant Protection, Faculty of Agriculture, Sohag University, during two consecutive years, 2021 and 2022. In this research, we designed a new device to collect bee venom in an innovative way, and it works to collect bee venom in both horizontal and vertical directions. We designed this device in this way when we found the bees escaping to It moves higher by moving from the horizontal plate to the hive wall, and then we designed the vertical plate sequentially with the horizontal plate, and gave valuable results for each plate, as shown in the average amount of bee venom during the year / range of the two plates is 676.3 and 684.26 mg in the years 2021 and 2022 respectively. The device has another feature, which is to collect pollen grains on the same device without removing it from the hive, by withdrawing the plates for the poison and adding pollen collection plates. The total average for the colony was 60.6233 and 63.06673 grams. During the years 2021 and 2022, respectively.

Keywords: Bee venom – Pollen grains – New device – Honey bee products - Horizontal and Vertical plates.

INTRODUCTION

Bee venom has been known for a long time for its many medical benefits, especially for those suffering from rheumatic pain. It has been observed that workers rarely suffer from joint pain and rheumatism (Jae-Dong *et al*., 2005). However, most of the devices that are placed inside the hive to ensure more bees land on them turn out to be very harmful to the bees' well-being, leading to killing large numbers of bees. It is recommended that the device be outside the hive as this allows the device to be removed once the aggregation process is complete, reducing the hives exposure to the pheromone, Whale Lab (2019). This necessitated the design of a bee venom device outside the hive. In this research, we designed a device to produce bee venom in an innovative way, and it collects bee venom in both the horizontal and vertical directions. That's when we found the bees escaping from the horizontal plate to the wall of the hive, so we designed the vertical plate with the horizontal plate, and it gave valuable results for each plate, while all previous devices presented by the researchers were designed only with horizontal plates. Some placed them outside the hive, and others placed them inside the hive. Another advantage is that the device can be used to collect pollen by replacing the poison plates with pollen collection plates. This device collects two honey products (bee venom and pollen), reducing the cost of the pollen trap while saving time. The study aims to: A new device, ND (2x1) for production some honeybee products, the most important characteristics of this device are:

1. It is a lightweight device that is easy to carry and transport.
2. It works with batteries without the need for electricity in the bees' location.
3. It can be easily installed outside the hive.

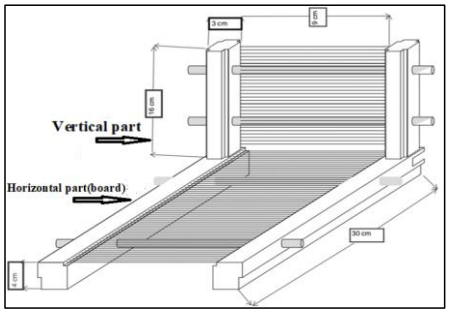
MATERIALS AND METHODS

The current study was conducted in the Department of Plant Protection, Faculty of Agriculture, Sohag University, and the applied part was implemented in a private apiary in Naga Hammadi district in Qena Governorate during two consecutive years, 2021 and 2022. The hybrid Carniolan bee was chosen to begin the experiment planned through this study, and bee venom device was placed for one hour, from 3-4 pm in the case of collecting the venom, and from 4-5 pm in the case of collecting pollen, for three groups from the hives. The strength of the colonies was equal to 5, 7, 9, and 8 combs during the winter, spring, summer, and autumn, respectively. The number of measurements per month was 3 times, with an average of 9 times per season.

The device consists of two parts, horizontal and vertical as follows: -

a. The horizontal plate (board):

It represents the base of the device, containing a device for collecting bee venom and a trap for collecting pollen. It consists of two pieces of wood, one piece with dimensions ranging from 4 to 30 cm. in both width and length, respectively. These two pieces are installed parallel to each other with a diameter of 12 mm. Its dimensions are 16 ×30 cm, and positive and negative electrical wires are installed on it. The distance between one wire and the other is 5 mm, as in the picture (1), recorded by Bolsta Ribak *et al.* (1995).



picture (1): A sketch drawing of the new device, ND (2×1).

b. The vertical plate:

It represents the vertical plate of the device, and contains only the bee venom collection device. It also consists of two pieces of wood with dimensions of 3:16 cm., for both width and length respectively. They are fixed parallel to each other using two tensioners with a tighten of 12 mm to tighten the wires. The positive and negative electrical wires are installed on them and connected to the wires of the horizontal plate

mentioned above. The vertical front plate is suspended on the plate horizontal. The horizontal and vertical plates resemble a book in the process of opening and closing, as shown in picture (1).

c. Glass plates:

There is an internal channel for the horizontal and vertical plates with a width of 9 cm and glass plates of sizes 9 ×30 cm and 9 ×16 cm, respectively, are installed on them, Fakhim, (1998).

d. Device electricity:

The electrical part consists of four 3.7-volt pen batteries connected together in series so that the end result is 16-volt direct current. The advantage of these batteries is that they are rechargeable and inexpensive. The price of one battery reaches 25 Egyptian pounds. It is also lightweight and easy to transport with the device anywhere in the apiary.

e. Device work:

The worker bees pass over electrical wires, causing them to receive an electric shock that stimulates them. They sting on a glass plate covered with a plastic sheet. Then the venom is collected after drying it with a blade and is packed in an airtight container and kept away from the sun. Bahraini *et al*. (2000).

Statistical analysis:

Data of pollen were subjected to one-way analysis of variance (ANOVA) at 5% probability. The data from year one and year two, and from horizontal and vertical were compared using the paired t-test at 5% probability with the aid of the SAS program, SAS Institute, (2002).

RESULTS AND DISCUSSION

1. Bee venom collected using the new device:

The present data in Tables (1 and 2) show mean of bee venom for horizontal and vertical parts per colony to all seasons during years 2021 and 2022, LSD and P value through seasons. The results showed that the average weight of bee venom collected during the four seasons of autumn, summer, spring, and winter during the year 2021 is as follows: 85.900 ,326.333 ,240.100 and 23.973 mg, respectively. While the same weight during the second year 2022 were 97.100, 342.333, 222.600 and 22.23 mg, respectively. While the statistical analysis of the results showed that statistical analysis of the values during the different seasons showed that the differences were significant, and the summer season achieved the highest value, followed by spring, autumn and winter. While the p value was 0.0001 during two seasons, and it was highly significant. It was found that there are significant differences between Seasons. The mean weight of bee venom in Tables (1and 2) were very low due to the weak density of bees as a result of the winter conditions and the lack of nectar sources. The high rates of bee venom production in spring season were due to the large number of blooming flowers in this season, the availability of nectar sources, the increase in bee density, in addition to the weather factors suitable for collection of bee venom. The increase in bee venom production rates in summer season is due to the increase in the strength of the colony, the increase in the flight of worker bees, and the increase in their density as a result of the increase in blooming flowers during this season, the availability of sources of nectar, in addition to the weather factors suitable for collection. in addition to, one of the most important reasons for the decline in results for the autumn season was may be due to the increase in red wasp attack rates, which affected the rate of worker bees leaving to collect nectar and pollen and a decline in the density of bee colonies due to the decrease in flowers in the fields.

Table (1): Mean weight (mg.) of bee venom collected by a new device during 2021, 2022, seasons.

Year	Plates shape	Season				P. value
		Winter	Spring	Summer	Autumn	
2021	Horizontal	16.20	158.66	224.66	58.70	0.0001***
	Vertical	7.77	81.53	102.03	27.23	
	Total	23.973	240.100	326.333	85.900	
	L.S.D.	17.481				
2022	Horizontal	15.43	150.33	205.00	64.63	0.0001***
	Vertical	6.79	72.26	137.33	32.46	
	Total	22.227	222.600	342.333	97.100	
	L.S.D.	26.197				

Presented data in Fig. (1) Shows the total weight \colony: and the mean /colony per year of bee venom for since 2021 and 2022 by placing we device to collect bee venom on the hive and the average general for all seasons of the colony. The total weight/colony was 676.3 and 684.26 mg during 2021 and 2022, respectively. And mean ± SE was 169.077± 36.299 and 171.065 ± 36.967 during 2021 and 2022, respectively, when compared to previous research the average colony was 760.3 mg / colony when the device was placed inside the hive. recorded that by Mohanny (2005). And 0.225 mg / colony recorded that by Sanad (2013) when the device was placed for 2 hours. The amount of bee venom was in 2014 = 170 mg, in 2015 =200 mg The strength of the colony was 10 combs. Omar (2017) recorded that the average of colony in the year = 0. 45 mg\colony\year. Hussein (2019) also stated that when the device was placed for 30 minutes, the general average = 51.3 mg. Omar (2020) stated that the general average for the colony = 74.16 mg. Allen Goy (2021) stated that when the device was placed for an hour, the average year was 55.34 mg. And the strength of the colony ranges between 5.5: 6.0 mg.

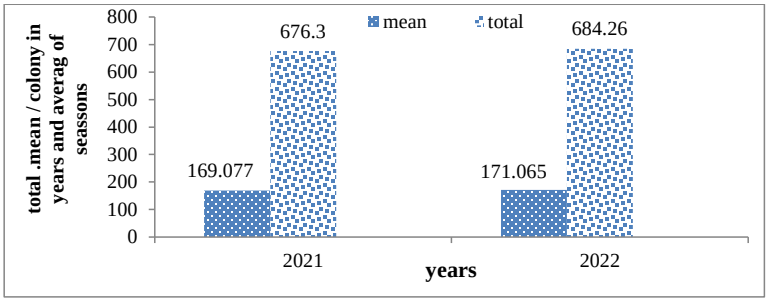


Fig. (1) Total weight mg /colony of bee venom during years 2021 and 2022.

As mentioned in Spring Season by Sanad (2013) the number of dead bees was 40.9 bees. The duration of placing the device was two hours, while the number of dead bees in our device in the first years = 4 bees and 3 bees in the second years when placed for an hour. The number of dead bees in summer season in the first years was 7 bees, and in the second years was 5 bees, table (2) show that. But compared to previous research, the number of dead bees was 50.3 in the summer, as mentioned by Sanad (2013), after the device was placed for two hours, and the number of dead bees in winter and autumn seasons was 0 bees, and compared to previous research, the number of dead bees was 30.7 bees in the autumn season, as mentioned by Sanad (2013). The number of dead bees in spring and summer of two years was 19 bees when we put the device for one hour, when compared to previous research, Mohanny (2005), the number of dead bees 707: 1312 bees and the number of dead bees when the device placed for 2 hour =122.9 worker recorded that by Sanad (2013). And The number of dead bees in the first year = 18.7 and the second year = 24 recorded that by Al-Hussein (2016).

Table (2): Effect of a new device on the dead workers during two seasons.

Season / Year	Winter	Spring	Summer	Autumn
2021	0.00	4.00	7.00	0.00
2022	0.00	3.00	5.00	0.00
Total	19.00			

2. pollen grains collected using the new device:

The panels for collecting pollen were installed on the same a new bee venom device, and the data in table (3) found that there are significant differences between winter and spring and winter and summer. While there are no significant differences between winter and autumn, spring and Summer seasons.

Least significant deference (L.S.D) values during year 2021 were 6.1647 and 4.7375 during 2022, P value was 0.0002 in year 2021 and 0.0001 during 2022.

But there are high differences between the efficiency of the device in the spring and summer compared to the efficiency of the device in the autumn and winter. This is due to the lack of honey combs and the weak bee density as a result of the harsh winter conditions, the lack of nectar sources, and in autumn the scarcity of flowers and the results were very weak, This is due to the increase in oriental hornet attacking the bees, which affected bee density, in addition to the lack of flowers and low temperatures.

The explanation for this is the increase in the numerical density of the bee colony, which increases significantly from spring until the end of summer, and then the individual's density of colony decreases from the beginning of autumn until the end of winter.

Table (3): Mean amount (g) of pollen grains collected by a new device during 2021, 2022.

Year	Season	Winter	Spring	Summer	Autumn	P.value
2021	Total	7.74	26.10	20.6	6.18	0.0002***
	L.S.D.	6.1647				
2022	Total	7.65	26.3	22.06	7.01	0.0001***
	L.S.D.	4.7375				

The data in Fig. (2) show total mean of colony during 2021 was 60.6233 g. and the total mean of colony through 2022 was 63.06673g. while Norbert Harassing Crailsheim, (2005) Studied that and to erect one larva, 25–37.5 mg protein or125-187.5mg pollen). and Raja *et al.* (2010) found that the ruler pollen render (g) keeps from the enrapture adorn and the immovable bottom baggage are 12.55 ± 1.66 and 22.5 ± 1.25, regard fully high collected totality of pollen was during the summertime season while the low signify of calm pollen were in winter season.

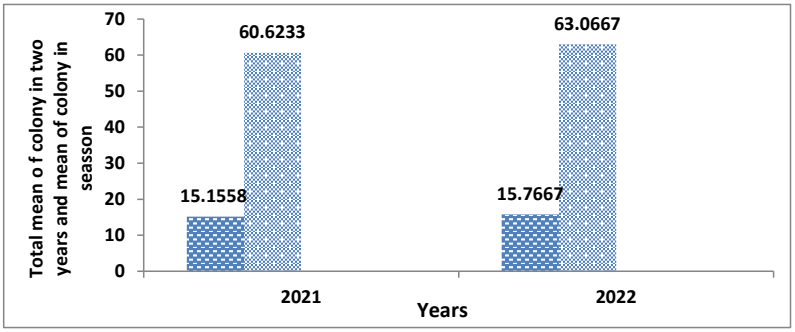


Fig. (2): Mean of amount pollen grains during two years 2021 and 2022

CONCLUSION

In this research, was installed and gave valuable results in the two years. It was the average denomination of four seasson in the first year Autumn, Summer, Spring, Winter 23.973 ±3.3206, 240.100 ± 3.7643, 326.333 ± 7.6231, 85.900 ± 5.241 And in the second year 22.227 ± 1.6333, 222.600 ±14.3932, 342.333 ±2.7285, 97.100 ± 6.3909. Also, the device can be used to collect pollen by replacing poison plates with pollen collection plates. The panels for collecting pollen

were installed on the same bee venom device, and the device was left for one hour, which are secured with 4 mm holes and the strength of the collony was 5, 7, 9, 8 for the following seasons: winter, spring, summer; autumn, respectively. The results were effective for all four seasons, as follows: 60.6233 grams in 2021 and 63.0667 grams in 2022.

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