ATTRACTIVENESS OF DIFFERENT TRAP COLORS TO INSECT PREDATORS OF HONEYBEE IN ERBIL

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ABSTRACT

A study was carried out in the Grdarasha Research Station-College of Agricultural Engineering Sciences-Erbil-Kurdistan region-Iraq, to survey insect predators attacking Honeybee hives using Traps and assess the attractiveness of four colors of Trap to catch insect predators of honeybees around the honeybee Hives, as well as to study the seasonal incidence of trapped predators in relation to weather factors during the time period between July and November, 2022. The tested colors were Red, yellow, white, and Blue. The RCBD design was utilized in the experiment. The result showed that there were two types of wasp which caused a major risk on honeybee hive and apiary; those were Red wasp and yellow Wasp, Vespa orientalis and Polistes versicolor. The seasonal incidence study showed that the population of predatory wasps reached the peak in the month October 11.55 wasps/ trap. The evaluation of different trap colors for both types of predatory wasps revealed that the most attractive color was Blue followed by yellow and the least attractive one was white and followed by the red color.

Keywords: apiary, bee, Natural enemy, predator, Trap, wasp

1.   INTRODUCTION

Honey bee, Apis mellifera, is not only important honey producer, but they are also significant pollinators of orchard and agricultural crops (Gilliam, 1997; Olofsson and Vásquez, 2008). In recent years, Honey bees and their health have become a key topic due to principal role they play in flower pollination and production of food. It is often thought that mankind will not remain for a long period once honeybees are extinct. This is belong its principal role in food production, particularly, human essential foods, which are dependent on pollination via insects (Montenegro et al., 2003; Klein et al., 2007). There is a link tying honey bees and food security of the world together; therefore, the decline of management of honey bees and other wild pollinator losses are of increasing question, since crop pollination in some countries are equally affected (Aizen et al., 2008).

Over the last few decades, losses of bee colonies have been increased mostly in the Northern parts of the world possibly due to a significant number of interacting threats, such as habitat losses, nutritional deficiencies, pathogens, pests and pesticides (Neumann, 2010). Predators of honey bee are considered as major threats on honey bee life and its production (Gidey et al., 2012).

From the most important predators include Oriental hornet, Vespa orentalis, belong to the family vespidae and within order hymenoptera (Archer, 2012; Smith-Pardo et al., 2020). This wasp is one of the key pest insects attacking bee colonies in many areas (Gomaa and Abd El-Wahab, 2006;

Haddad et al., 2006; Ishay, 1967; Klein and Adler, 1996). Foraging workers and guard bees are being attacked at entrances of hives by the wasps. This leads to weaken strong colonies and the productivity is decreased (Matheson et al., 1989; Sihag, 1992; Bacandritsos et al., 2006). In addition, weak beehives also face many problems especially predation on brood and robbing by yellow paper wasp, Vespula vulgaris L., (Laurino et al., 2019). The yellow paper wasps affect heavily on the Apis mellifera for sweet honey and lead to reduce economic outcome in the world (Clapperton et al., 1989).

Various methods have been phased in, for quantitative sampling. The traps are widely utilized to monitor the presence of Vespa velutina, as an complementary method for limiting its impacts (Lioy et al., 2020). Some Authors have used the color pan traps effectively, despite, it is clear that Hymenopteran insects are affected by various colors (Abrahamczyk et al., 2010). Different trapping methods like bait-traps and their combinations for capturing social wasp species were used (Sorvari, 2013).

A few researches have been conducted on the natural enemies of honey bee and using color traps in the Kurdistan region of Iraq, so this study focuses on determining the predators attacking honeybee hives, attractiveness of the color of traps to predator wasps, the population density of predators attacking honey bee hives and around the apiary.

2.   MATERIALS AND METHODS

2.1.   Study design and sampling:

The research was carried out in the apiary of the Grdarasha station-Erbil. It was started from 15 July to 15 October 2022 by using different trap colors.

2.2.   Trap design:

The traps were made from plastic by cutting and changing the queen excluder to a closed box shape then the bottom of the boxes were cut in circle shape. A funnel shape net was attached inside the boxes using a wire net and the bottom of the net was the same size of the circle hole, while the top of the net was smaller, to prevent wasps from escaping through the hole after they entered the traps. A medium sized plastic buckets was placed under the boxes to provide food for the wasps. The food was consisted of the old comb with sugar syrup. It was placed through two small holes which were previously made in each bucket, to facilitate the entrance of the wasps to reach the food through these holes; the sugar syrup was renewed twice a week through these holes by using medical syringes.

2.3.   Experiment design:

The study was performed by using R.C.B.D., with three replications for testing four different colors of the trap. The used trap colors were yellow, blue, red and white. These colored traps gained by painting the traps using four mentioned colors above, then left for three days to dry completely and to remove the smell of paints so that they would not affect our research. The traps were placed in the apiary as shown in figure (1) at a distance of two meters from the honey bee hives and at a height of 1.20cm above the ground.

Figure (1) The Trap and Trap arrangement in the apiary

2.4.   Sampling:

Sampling of insect predators of honey bee was carried out weekly. This was performed by counting insects catch inside a trap for each color, replication and type of predator in isolate. The sampling started from the first week of the establishment of traps in Apiary until 15-10-2022.

2.5.   Identification of Samples

The samples of the insect predators were collected from traps and sent to the Agricultural Research Center of Erbil- Plant Protection Department –Insects Museum. The insect samples were identified by comparing with identified samples reserved in museum.

2.6.   Statistical Analysis

The obtained data from this study were subjected to Excel program and means were worked out to create charts and to further analytical processes, the means were compared with each other using SPSS Program version 26(SPSS, 2018).

3.   RESULTS AND DISCUSSIONS

3.1.   Predators of the honeybee caught by using color traps

The pie chart below shows the types of insect predators attacking honeybee in and around the Apiary and Hives in Grdarasha research station field-Erbil city during the period of July to October, 2022 (Figure 2).

According to the chart (Figure 2), there were two types of predator wasps caught by using traps, Red wasp (Vespa orientalis) and Paper wasp (yellow wasp) (Polistes watti), which the first attacks honeybee individuals around hives and the later attacks the honey produced by honey. In this study, it was revealed that the most abundant insect predator was a Red wasp which occupied 67% of all caught wasps during the study it was more abundant than the other type of predator, Yellow Wasp, which occupied less percentage of caught insect predators, 33%.

Observations in this study are supported by Bekele et al. (2017) who stated that the wasps create a great risk on honeybee hive and beekeeping,
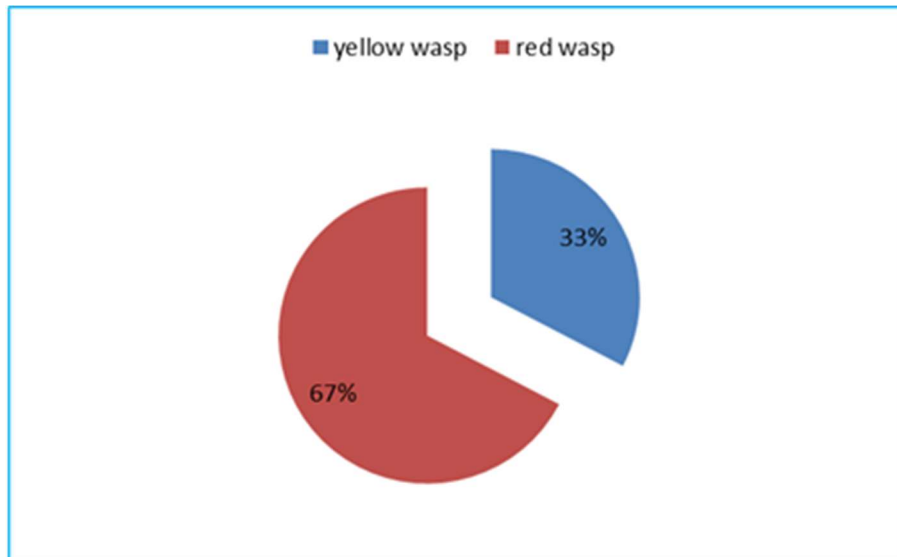

Figure (2) percentage of two predator wasps captured in Apiary, Erbil city – 2022

3.2. Effect of Weather factors on seasonal incidence of insect predators of Honeybee

Table (1) provides data information about the seasonal population of honeybee insect predators around honeybee hives in relation to weather factors (Temperature and relative humidity), in Grdarasha Apiary, Erbil city-2022.

According to the table (1), the lowest number of catch was in the first week of the sampling which was 6.33 ± 0.79 wasps/ trap in July when the mean Temperature and relative humidity in this month were 35 C° and 32% respectively. The number of catch increased gradually towards the end of the experiment period. The catch number reached to its peak in the first week of October which was 12.91 ± 2.24 and the average number in the month was 11.55 wasps/ trap while the mean temperature and relative humidity were 31C° And 47% Respectively.

Based on statistical analysis and the Duncan test of 0.5 significant levels, there are significant differences between sampling dates especially between months, during the sampling periods in the current study. The findings of this study are mirror those reported by Varshneya et al. (2009) who observed that activity of predatory wasp was reached to its highest level between the last two weeks of September to the early weeks of October two years of study. Taha (2014) in an investigation showed that the workers of V. orientalis were caught from June to February, while the peak was recorded in October.

Table (1) the seasonal incidence of honey bee predators during the study period in Grdarasha Apiary

Weeks	Date/month	Number of capture Predator/ traps Mean ± SE	Mean number of predators/ month	Temperature C°/ month	RH/ month %
1	23/7/2022	6.33 ± 0.79 b	6.83	35	32
2	30/7/2022	7.33 ± 0.68 b			
3	6/8/2022	7.25 ± 0.76 b	8.4775	32	29.5
4	13/8/2022	8.08 ± 0.80 ab			
5	20/8/2022	8.00 ± 0.88 ab			
6	27/8/2022	10.58 ± 1.20 ab			
7	3/9/2022	10.16 ± 1.50ab	11.2475	36	37
8	10/9/2022	10.83 ± 1.55 ab			
9	17/9/2022	12.75 ± 1.94 a			
10	24/9/2022	11.25 ±1.58 ab			
11	1/10/2022	12.91 ± 2.24 a	11.55	31	47
12	8/10/2022	12.66 ± 2.46 a			
13	15/10/2022	9.08 ± 1.67 ab			

Different letters in a column are significantly different from each other at 0.05

3.3.   Effectiveness of trap colors to catch predators of honey bee:

3.3.1. The Effect of trap colors on Red wasp

The data provided (table 2) shows the effectiveness of four trap colors to attract insect predator, Red Wasp, during the period starting from July to October, 2022.

According to the table (2), the highest number of red wasps was caught via a blue colored trap which ranged from 5.0 to 23.0 wasp/ Trap and averaged 10.0 wasp/ Trap followed by a yellow colored Trap in which the number of caught Wasps ranged 5.0- 16.0 and averaged 7.58 Wasps/ Trap. Whereas, the lowest number of caught red wasp was in the White colored Trap which ranged from 0.00 to 6.0 and averaged 3.48 Wasps/ Trap. In addition, the Red colored Trap occupied the middle rank by catching 0.0-9.0 and an average of 5.17 Wasps/ Trap.

Based on the statistical analysis and Duncan test, 0.5 significant levels, there are significant differences between all colors of trap used in the current study. The study revealed that the Blue color was the most effective trap color for attracting wasps among the utilized colors in the study. In a similar study carried out by Abdullah et al. (2021) they mentioned that the efficiency of colored traps on attracting wasps was higher than transparent sticky traps, and they further revealed that the mean catch of yellow sticky traps was differed significantly from other trap colors, however the efficiency of the rest of color traps adhesively better than control, in contrary, Rodriguez-Saona et al. (2012) in their study on the effect of sticky trap colors to attract various leafhoppers, stated that the green trap was the most attractive to blunt-nosed leafhoppers, followed by the red and yellow colors; while yellow was superior in attracting sharp-nosed leafhoppers.

Table (2) Number of predator (Red wasp) captured by four different color traps around Apiary in Erbil city - 2022

No.	Treatments/ Trap colors	Number of capture wasp/ traps	
		Range	Mean ± SE
1	Blue colored Trap	5.0 - 23.0	10.10±0.8 a
2	Yellow Colored Trap	5.0 - 16.0	7.58±0.5 b
3	Red Colored Trap	0.0 - 9.0	5.17±0.3 c
4	White Colored Trap	0.0 - 6.0	3.48±0.2 d

Means with different letters in a column significantly different based on Duncan test, 0.5 significant level.

3.3.2. The Effect of trap colors on Yellow wasp

The data provided (table 3) demonstrates the effectiveness of four trap colors for attracting insect predator, Yellow Wasp, during the period starting from July to October, 2022.

According to the table (3), the highest number of yellow predator wasp was collected via a blue colored trap which ranged from 2.0 to 9.0 wasp/ Trap and averaged 4.58 wasp/ Trap. The second high effective color was a yellow colored Trap in which the number of caught Wasps ranged 2.0 to 6.0 and averaged 3.25 Wasps/ Trap. Whereas, the lowest number of caught red wasp was in White colored Trap which ranged from 1.0 to 5.0 and averaged 2.30 Wasps/ Trap, and the Red colored Trap occupied the middle rank by catching 2.0 - 5.0 and an average of 2.64 Wasps/ Trap. Depending on the statistical analysis and Duncan test, 0.5 significant levels, there are significant differences between all colors of the traps used in the current study. The study revealed that the Blue color was the most effective Trap color for attracting wasps among the utilized colors in the study. In contrast, Atakan and Pehlivan (2015) conducted a research on attractiveness of different colors of traps to pollinators, they stated that the significant number of collected insects were captured by white traps while, green, and blue traps were in a lower level in attracting catch species.

Table (3) Number of predator (Yellow wasp) captured by four different color traps around Apiary in Erbil city - 2022

No.	Treatments/ Trap colors	Number of capture wasp/ traps	
		Range	Mean ± SE
1	Blue colored Trap	2.0 - 9.0	4.58±0.3 a
2	Yellow colored Trap	2.0 - 6.0	3.25±0.2 b
3	Red colored Trap	2.0 - 5.0	2.64±0.1 bc
4	White colored Trap	1.0 - 5.0	2.30±0.1 c

Means with different letters in a column significantly different based on Duncan test, 0.5 significant level.

4.   CONCLUSIONS

Honeybee predators are among the most significant barriers of productivity of honeybee and bee keeping, especially social wasps. In this research, two types of Wasps were collected by using color box traps. The study revealed that the red wasp is the most abundant predator wasp attacking the honeybee around hives in the apiary. In the current study it has been found that the wasp predators are exist prior to the summer season and the highest population is in October. The study also concluded that the blue colored trap was the most attractive trap to collect a predatory wasp and it can be used a control technique to honeybee predators, in particular, the wasps.

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