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CHANGES IN THE HOARDING BEHAVIOUR OF TWO HONEY BEE SUBSPCIES IN RELATION TO THE COLLECTION OF BEE VENOM DURING DIFFERENT SEASONS

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ABSTRACT
The present study addresses the potential effects of the collection of bee venom from two different subspecies (Carniolan and Italian honeybees) during different seasons (spring, summer, autumn and winter) on the hoarding behavior of honeybees which represented by rate of sugar feed intake consumed by the colonies. The honeybees' colonies were fed with water and honey syrup (50%) in plastic feeders; 1litter of honey syrup was added to the feeders before and after bee venom collection by 1hr for recording the amount of syrup taken from the feeder. The metabolic sugar consumption of the group was estimated by subtracting the amount consumed from the total honey syrup taken from the feeder. Results showed that, the Italian hybrid showed significant sugar feed intake after bee venom collection than the Carniolan hybrid during winter season followed by the autumn while summer showed the lowest intake rate. The high hording behavior rate in winter may be due to the severe weakness of the colonies and their severe need for the sugary food in such period due to the lack of flowering crops at this time of the year.

INTRODUCTION

Honeybees' colonies depend on specific sources to fulfill their carbohydrate and protein needing. Such sources are naturally presented by nectar and pollens **(Brodschneider and Crailsheim, 2010).** A typical honeybee's colony can consume high amount of nectar/pollen per year **(Rodney and Purdy, 2020).** Artificial feeding especially sources for carbohydrates are presented to bee colonies during specific period of the year such as winter and dearth periods **(Tawfik *et al*., 2020).** A good example for the artificial sugar feeding is sugar syrup which is used as the basic alternative to nectar by many beekeepers. In fact, sugar syrup based on sucrose is considered as the typical artificial feeding to bee colonies **(Brodschneider and Crailsheim, 2010).** Number of feeding methods have been developed due to the importance of the artificial feeding to honeybee colonies including external and internal feeding **(Virgiliou *et al*., 2020).**

There are a number of behaviors related to bee feeding such as scout behavior by foraging bees to locate nectar/syrup sources **(El-Banbi,1984**), foraging behavior which enables bees to collect food from different sources from the ambient environment to the colonies **(Kumar and Govindaraj, 2013)**. The hoarding behavior is represented by the amount of sucrose solution removed from a feeding container per bee per day which was used to measure hoarding rate and can be impacted directly the colony biological activity in storage nectar and honeybee which affects consequently the honey productivity by the colony

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(Kulinčević and Rothenbuhler 1973; Kulincevic *et al.*, 1974; Rinderer and Baxter, 1979). Moreover, hoarding behavior is not the only aspect of bee behavior that effects the production of a honey, crop, other include length of life, rate of broad rearing and disease resistance. A likely function of hoarding efficiency is clear in context of seasonally varying nectar availability (**Crane, 1990; Rinderer, 1982).**

There are high number of bee subspecies **(Sheppard *et al.*, 1997).** In Egypt, Carniolan, Italian and other subspecies/hybrids of honeybees are existed **(Abou-Shaara, 2009**). The variations between bee subspecies in their hoarding behavior have not been well studied so far. On the other side, the collection of bee venom from bee colonies is done by some beekeepers to produce bee venom which is considered as a valuable product. The collection of bee venom from colonies is basically dependent on temporary electrical shocks to bee workers **(Badawy, 2016**). It is expected that the collection of bee venom could interrupt colony behaviors including hoarding behavior depending on bee venom quantity and quality of different bee subspecies. This point has not been studied yet. Therefore, the present study aimed to highlight the effects of bee subspecies and the collection of bee venom over four seasons on the hoarding behavior of honeybees.

There was an increase in sugar feed intake after treatment by bee venom collector, thus may referred to that the alarming or stimulation of worker honeybees by electrical impulses from bee venom collectors, resulting in an increase in worker hoarding behavior. Additionally, during the collecting treatment, worker honeybees secreted protein (venom) from their bodies, which necessitated compensating by increasing hoarding behavior **(Metwally, 2016).**

MATERIALS AND METHODS

Study Location

The experiment was conducted in the apiary of Honeybees Research Center at the Experimental Research Station Agriculture Research Center, El-Arish, North Sinai Egypt, in different seasons of year (spring, summer, autumn and winter). The field experiment was carried out in 2017-2018**.**

Honeybee Colonies

The current study investigated some factors affecting bee venom of two hybrid honeybee strains (Carniolan and Italian honeybees; ten colonies for each strain, each strain was divided into three groups one of them served as control). Each colony in this experiment was managed to be equal in the strength including from eight to nine frames and headed with a queen of the same age before the data was recorded.

Venom Collector Device (VCD) from the Tow Hybrid Colonies

Bee venom was collected from the tow hybrid colonies by using the Impulses of Venom Collector Device (VCD) for 30 minutes of two hybrids during 30 days collection period of honeybee before and after bee venom collection period during different seasons (spring, summer, autumn and winter) of the year by using device board over frames position for each Group **(Badawy, 2016).**

Hording Behavior Evaluation from the Tow Hybrid Colonies

The honeybee colonies were fed with water and honey syrup (50%) in plastic feeders; 1litter of honey syrup was added to the feeders before and after bee venom collection by 1hr for recording the amount of syrup taken from the feeder. The metabolic sugar consumption rate of the group was estimated by subtracting the amount consumed from the total honey syrup taken from the feeder by using a 30cm ruler **(Moritz and Hillesheim 1989).**

Statistically Analysis of the Experiments

The randomized factorial design (**Snedecor and Cochran, 1972**) was used. The analysis of variance, t-test, F-test and correlation, moreover, separation of means among treatments by LSD, was analyzed by SASS program.

RESULTS AND DISCUTION

Effect of the Collection of Bee Venom from Two Subspecies Over Two Years on Hoarding Behaviour

Carniolan honeybees

Results in Table 1 indicate that there was a positive effect of hoarding behavior of honeybees' workers before and after bee venom collection from Carinolain hybrid "*Apis mellifera carnica*". The hoarding behavior rate was increased by about 0.54%, 0.30% for 2017 and 2018, respectively). In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased by about 5.62, 4.43 cm syrup/colony/1hr compared to before bee venom collection.

Italian honeybees

Results in Table 2 indicate that there was a positive effect of hoarding behavior of honeybees' workers before and after bee venom collection from Italian hybrid "*Apis mellifera ligustica*". The hoarding behavior rate was increased by about 0.47%, 0.52% for 2017 and 2018, respectively. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased by about 7.29, 7.43 cm syrup/ colony/ 1hr compared to before bee venom collection.

Comparison between the two subspecies of Carniolan and Italian honeybees

Results in Table 3 indicate that there was a positive effect of hoarding behavior of honeybees' workers before and after bee venom collection from two hybrid carinolain bees "*Apis mellifera carnica*" and Italian bees "*Apis mellifera ligustica*". The hoarding behavior rate was increased by about 0.54%, 0.30% for 2017 and 2018 from Carniolian bees and 0.47%, 0.52% for 2017 and 2018 from Italian bees, respectively. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased by about 7.29, 7.43 from Italian bees and 5.62, 4.43from Carniolian bees cm syrup/ colony/1 hr., compared to before bee venom collection.

Summary

The results showed that the mean number of hoarding behavior was significantly ($P \leq 0.05$) increased after bee venom collecting process by using electrical impulses device for 30 min from Italian hybrid compared with Carinolain hybrid. This is because that the increase in feed consumptions after bee venom collection may be due to alarming or stimulation of worker honeybee by electrical impulses from bee venom collector which increased the worker hoarding behavior. In addition, during collecting process the worker honeybees secreted protein (venom) from their body which increased the hoarding behavior **Rinderer and Baxter, (1980**) found that the hoarding intensities and efficiencies of European bees were increased. The current results come parallel to **Omar (2011) and Rybak *et al.* (1995)** who showed that the optimal best results were obtained when venom collected for 1 hr., at early morning, before bee flight or 2 hr., when foraging was occurring. On the same manner, the present results are in agreement with **El-Shaarawy *et al.* (2007**) who showed that the sugary nutrition has an important effect in bee venom production and the biological activities of honeybees' workers. **El-Bahnasy (2017)** found that Italian hybrid was recorded the highest venom weight (0.078 and 0.076 g/col.) for 2015 and 2016, respectively. However, **Simics (1995)** indicated that the honeybees' colonies were relatively unaffected during or after the collection period of bee venom.

Table 1. Effect of hording behavior range of Carinolain honeybee strain and before and after bee venom collection period every 30 days during 2017-2018 years

Strain	Day_C	Year	Hording behavior range of Carinolain honeybees strain workers before and after bee venom collection for 30 days during two years of 2017 and 2018 (cm syrup/colony/1hr)				
			Hording before	Hording before percent	Hording after	Hording after percent	Increasing in hording behavior rate(%)
Carinolain	30 Day	2017	2.6b 2±0.24	36.95	5.62a ±0.34	41.24	0.54%
		2018	3.14b ±0.32	44.48	4.43a ±0.25	46.86	0.30%

Table 2. Effect of hording behavior range of Italian honeybee strain and before and after bee venom collection period every 30 days during 2017-2018 years:

Strain	Day_C	Year	Hording behavior range of Italian honeybees' strain workers before and after bee venom collection for 30 days during two years of 2017 and 2018(cm syrup/colony/1hr)				
			Hording befor	Hording before percent	Hording after	Hording after percent	Increasing in hording behavior(%)
Italian	30 Day	2017	3.81a ±0.3	53.86	7.29a ±0.45	33.90	0.47%
		2018	3.52a ±0.28	49.71	7.43a ±0.41	32.57	0.52%

Table 3. Effect of hording behavior range of different honeybees strain and before and after bee venom collection period every30days during 2017-2018 years

Strain	Day_C	Year	Hording behavior range of different honeybees' strain workers before and after bee venom collection for 30 days during two years of 2017 and 2018 (cm syrup/colony/1hr)				
			Hording before	Hording before percent	Hording after	Hording after percent	Increasing in hording behavior(%)
Carinolain	30 Day	2017	2.6b 2±0.24	36.95	5.62b ±0.34	41.24	0.54%
		2018	3.14b ±0.32	44.48	4.43b ±0.25	46.86	0.30%
Italian	30 Day	2017	3.81a ±0.3	53.86	7.29a ±0.45	33.90	0.47%
		2018	3.52a ±0.28	49.71	7.43a ±0.41	32.57	0.52%

Effect of Collection Bee Venom from Two Subspecies Over Four Seasons on Hoarding Behavior

Carniolan honeybees

Results in Table 4 indicate that there was a positive effect on hoarding behavior of honeybees' workers before and after bee venom collection from Carinolain hybrid "*Apis mellifera carnica*". The hoarding behavior rate was increased in winter season by about 47.00%, 19.33% for 2017 and 2018, respectively followed by the autumn season, and the lowest was in summer. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased in winter season by about 8.33, 6.33 cm syrup/colony/1hr compared to before bee venom collection.

Italian honeybees

Results in Table 5 indicatee that there was a positive effect on hoarding behavior of honeybees' workers before and after bee venom collection from Italian hybrid "*Apis mellifera ligustica*". The hoarding behavior rate was increased in winter season by about 45.00%, 48.67% for 2017 and 2018, respectively followed by autumn season, and the lowest was in summer. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased in winter season by about 10.33, 10 cm syrup/colony/1hr compared to before bee venom collection.

Comparison between the two subspecies bees over four seasons

Results in Table 6 indicate that there was a positive effect on hoarding behavior of honeybees' workers before and after bee venom collection from two hybrid Carniolian bees "*Apis mellifera carnica*" and Italian bees "*Apis mellifera ligustica*". The hoarding behavior rate was increased in winter season by about 47.00%, 19.33% for 2017 and 2018 from Carniolian bees and 45.00%, 48.67% for 2017 and 2018 from Italian bees, respectively followed by autumn season, and the lowest was in summer. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased in winter season by about 10.33, 10 from Italian bees and 8.33, 6.33 from Carniolian bee's cm syrup/colony/1hr compared to before bee venom collection.

Summary

The results showed that the mean number of hoarding behaviors was significantly ($P \leq 0.05$) increased after bee venom collecting process by using electrical impulses device from Italian hybrid in winter season compared with other seasons. In winter there was a severe need of the colonies for artificial feeding due to the lack and scarcity of flowering crops at this time of the year.

Effect of the Collection of Bee Venom from Two Subspecies Over Months of the Year on Hoarding Behavior

Carniolan honeybees

Results in Table 7 indicate that there was a positive effect on hoarding behavior of honeybees' workers before and after bee venom collection from Carinolain hybrid "*Apis mellifera carnica*". The hoarding behavior rate was increased in December by about 47.00%, 19.33% for 2017 and 2018, respectively followed by in November, September and October, respectively and the lowest in June, July withdrawals. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased in December by about 8.33, 6.33 cm syrup/colony/1hr compared to before bee venom collection.

Table 4. Effect of hording behavior range of Carinolain honeybees strain before and after bee venom collection period every30 days over four seasons during 2017 and 2018 years

Strain	Day_C	Year	Season	Hording behavior range of Carinolain honeybees strain workers before and after bee venom collection for 30 days over four seasons during two years of 2017 and 2018				
				Hording befor	Hording before _percent	Hording after	Hording after percent	Increasing in hording behavior
Carinolain	30 Day	2017	Autum	2.89b ±0.31	40.78	5.89b ±0.35	34.11	0.50%
			Summer	1.78c ±0.15	24.89	4.44c ±0.18	56.33	59.44%
			Winter	4.33a ±0.33	61.67	8.33a ±0.67	17.33	47.00%
		2018	Autum	3.89b ±0.2	55.22	4.67b ±0.29	42.00	14.22%
			Summer	1.78c ±0.28	24.89	3.56c ±0.18	64.44	49.78%
			Winter	5.0a ±0.58	71.00	6.33a ±0.33	8.67	19.33%

Table 5. Effect of hording behavior range of Italian honeybees strain before and after bee venom collection period every30 days over four seasons during 2017 and 2018 years

Strain	Day_C	Year	Season	Hording behavior range of Italian honeybees strains workers before and after bee venom collection for 30 days over four seasons during two years of 2017 and 2018				
				Hording befor	Hording befor _percent	Hording after	Hording after percent	Increasing in hording behavior
Italian	30 Day	2017	Autum	4.33b ±0.29	61.44	8.33b ±0.24	14.67	47.33%
			Summer	2.67c ±0.29	37.44	5.22c ±0.28	43.22	47.89%
			Winter	5.67a ±0.33	80.33	10.33a ±0.33	63.67	45.00%
		2018	Autum	3.89b ±0.39	54.89	8.44b ±0.29	22.00	54.11%
			Summer	2.67c ±0.29	37.44	5.56c ±0.18	39.67	51.67%
			Winter	5.03a ±0.58	71.00	10a ±0.58	43.00	48.67%

Table 6. Effect of hording behavior range of different honeybee strains before and after bee venom collection period every30days over four seasons during 2017 and 2018 years

Strain	Day_C	Year	Season	Hording behavior range of different honeybees strains workers before and after bee venom collection for 30 days over four seasons during two years of 2017 and 2018				
				Hording befor	Hording befor _percent	Hording after	Hording after percent	Increasing in hording behavior
Carinolain	30 Day	2017	Autum	2.89b ±0.31	40.78	5.89b ±0.35	34.11	0.50%
			Summer	1.78c ±0.15	24.89	4.44c ±0.18	56.33	59.44%
			Winter	4.33a ±0.33	61.67	8.33a ±0.67	17.33	47.00%
		2018	Autum	3.89b ±0.2	55.22	4.67b ±0.29	42.00	14.22%
			Summer	1.78c ±0.28	24.89	3.56c ±0.18	64.44	49.78%
			Winter	5.0a ±0.58	71.00	6.33a ±0.33	8.67	19.33%
Italian	30 Day	2017	Autum	4.33b ±0.29	61.44	8.33b ±0.24	14.67	47.33%
			Summer	2.67c ±0.29	37.44	5.22c ±0.28	43.22	47.89%
			Winter	5.67a ±0.33	80.33	10.33a ±0.33	63.67	45.00%
		2018	Autum	3.89b ±0.39	54.89	8.44b ±0.29	22.00	54.11%
			Summer	2.67c ±0.29	37.44	5.56c ±0.18	39.67	51.67%
			Winter	5.0a ±0.58	71.00	10.0a ±0.58	43.00	48.67%

Table 7. Effect of hording behavior range of Carinolain honeybees strain before and after bee venom collection period every30 days over months of the year during 2017 and 2018 years

Strain	Day_C	Year	Month	Hording behavior range of Carinolain honeybees strain workers before and after bee venom collection for 30 days over months of the year during two years of 2017 and 2018				
				Hording befor	Hording befor percent	Hording after	Hording after percent	Increasing in hording behavior rate
Carinolain	30 Day	2017	August	1.67e ±0.33	23.33	4.67e ±0.33	54.67	63.33%
			December	4.33a ±0.33	61.67	8.33a ±0.67	17.33	47.00%
			July	1.67f ±0.33	23.33	4.33f ±0.33	57.67	61.67%
			June	2.0g ±0.00	28.00	4.33g ±0.33	56.67	53.33%
			November	3.67ab ±0.33	52.00	6.0ab ±0.58	27.33	37.33%
			October	3.0c ±0.58	42.33	6.33c ±0.33	28.33	52.67%
			September	2.0d ±0.00	28.00	5.33d ±0.88	46.67	60.33%
		2018	August	1.0e ±0.00	14.00	3.33e ±0.33	69.00	69.00%
			December	5.0a ±0.58	71.00	6.33a ±0.33	8.67	19.33%
			July	2.67f ±0.33	37.33	3.67f ±0.33	60.33	25.00%
			June	1.67g ±0.33	23.33	3.67g ±0.33	64.00	55.33%
			November	3.67a ±0.33	52.00	5.0a ±0.58	40.00	23.33%
			October	4.33b ±0.33	61.67	4.33b ±0.33	42.67	0.00%
			September	3.67c ±0.33	52.00	4.67c ±0.67	43.33	19.33%

Italian honeybees

Results in Table 8 indicate that there was a positive effect on hoarding behavior of honeybees' workers before and after bee venom collection from Italian hybrid " *Apis mellifera ligustica*". The hoarding behavior rate was increased in December by about 45.00%, 48.67% for 2017 and 2018, respectively followed by in November, September and October, respectively and the lowest was in June, July. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased in December by about 10.33, 10 cm syrup/colony/1hr compared to before bee venom collection.

Comparison between the two subspecies over months of the year

Results in Table 9 indicate that there was a positive effect of hoarding behavior of honeybees' workers before and after bee venom collection from two hybrid: Carniolian bees "*Apis mellifera carnica*" and Italian bees "*Apis mellifera ligustica*". The hoarding behavior rate was increased in December by about 47.00%, 19.33% for 2017 and 2018 from Carniolian bees and 45.00%, 48.67% for 2017 and 2018 from Italian bees, respectively followed by in November, September and October, respectively and the lowest was in June, July. In addition, the results showed that the mean number of hoarding behavior after bee venom collection was significantly increased in December by about 8.33, 6.33 from Italian bees and 10.33, 10 cm syrup/ colony/1 hr., from Carniolian bees compared to before bee venom collection.

Summary

The results showed that the mean number of hoarding behaviors was significantly ($P \leq 0.05$) increased after bee venom collecting process by using electrical impulses device from Italian hybrid in December compared with other months of the year. Interestingly there was a significant difference in the sugary feeding of bees in the different months of the year. Where December showed the highest hording behavior rate and mean compared to other months.

Several studies showed and discussed the relationship between bee venom produced by electrical impulses and certain characters of honeybee colonies (*i.e.* bee population, brood, stored pollen, stored honey areas and yield and foraging activity) and the variability of venom quantity collected from colonies at different periods of active season and found significant variations in the amounts of collected venom at different periods of active season, in addition they reported that the amount of venom was high in June compared with that collected in May and July, finally they found positive correlations between venom production and each of the bee population, bee brood, stored pollen, uncapped and capped honey areas and foraging activity. **(Khodairy and Omar, 2003; Badawy, 2016).**

Honeybees require many nutrients that found in the diet in a definite quantity for optimum nutrition. honeybee colonies must be amended with these requirements by the beekeeper **(Alia *et al.*, 2013).**

In conclusion, the high hording behavior (sugar feed intake rate) was showed in the Italian hybrid, after bee venom collection, during winter season especially in December which demonstrated that there are several factors affected the hording behavior such as the aggressiveness of honeybee strain, month of the year, season of the year as well as after bee venom collection where all these factors affect bee consumption rates of artificial sugar feeding.

Table 8. Effect of hording behavior range of Italian honeybees strain before and after bee venom collection period every30 days over months of the year during 2017 and 2018 years

Strain	Day_C	Year	Month	Hording behavior range of Italian honeybees strains workers before and after bee venom collection for 30 days over months of the year during two years of 2017 and 2018				
				Hording befor	Hording befor percent	Hording after	Hording after percent	Increasing in hording behavior
Italian	30 Day	2017	August	3.33d ±0.33	37.33	5.0d ±0.58	45.67	46.67%
			December	5.67a ±0.33	80.33	10.33a ±0.33	63.67	45.00%
			July	2.0ef ±0.58	28.00	5.0f ±0.58	50.00	56.00%
			June	2.67g ±0.33	47.00	5.67g ±0.33	34.00	41.00%
			November	4.67a ±0.33	66.33	8.0a ±0.58	8.67	40.00%
			October	4.33b ±0.67	61.33	8.67b ±0.33	22.33	50.00%
			September	4.0c ±0.58	56.67	8.33c ±0.33	13.00	52.00%
		2018	August	2.67e ±0.33	37.33	5.67e ±0.33	39.00	52.00%
			December	5.0a ±0.58	71.00	10.0a ±0.58	43.00	48.67%
			July	2.67f ±0.33	37.33	5.67f ±0.33	39.00	52.00%
			June	2.67g ±0.88	37.67	5.33g ±0.33	41.00	51.00%
			November	4.0ab ±0.58	56.67	8.67b ±0.33	17.00	53.67%
			October	3.67c ±0.67	51.67	8.33c ±0.88	25.00	56.33%
			September	4.0d ±1.0	56.33	8.33d ±0.33	24.00	52.33%

Table 9. Effect of hording behavior range of different honeybees strain before and after bee venom collection period every 30days over months of the year during 2017 and 2018 years.

Strain	Day_C	Year	Month	Hording behavior range of different honeybees strains workers before and after bee venom collection for 30 days over months of the year during two years of 2017 and 2018				
				Hording befor	Hording befor percent	Hording after	Hording after percent	Increasing in hording behavior
Carinolain	30 Day	2017	August	1.67e ±0.33	23.33	4.67e ±0.33	54.67	63.33%
			December	4.33a ±0.33	61.67	8.33a ±0.67	17.33	47.00%
			July	1.67f ±0.33	23.33	4.33f ±0.33	57.67	61.67%
			June	2.0g ±0.0	28.00	4.33g ±0.33	56.67	53.33%
			November	3.67ab ±0.33	52.00	6.0ab ±0.58	27.33	37.33%
			October	3.0c ±0.58	42.33	6.33c ±0.33	28.33	52.67%
			September	2.0d ±0.0	28.00	5.33d ±0.88	46.67	60.33%
		2018	August	1.0e ±0.0	14.00	3.33e ±0.33	69.00	69.00%
			December	5.0a ±0.58	71.00	6.33a ±0.33	8.67	19.33%
			July	2.67f ±0.33	37.33	3.67f ±0.33	60.33	25.00%
			June	1.67g ±0.33	23.33	3.67g ±0.33	64.00	55.33%
			November	3.67a ±0.33	52.00	5.0a ±0.58	40.00	23.33%
			October	4.33b ±0.33	61.67	4.33b ±0.33	42.67	0.00%
			September	3.67c ±0.33	52.00	4.67c ±0.67	43.33	19.33%
Italian	30 Day	2017	August	3.33d ±0.33	37.33	5.0d ±0.58	45.67	46.67%
			December	5.67a ±0.33	80.33	10.33a ±0.33	63.67	45.00%
			July	2.0ef ±0.58	28.00	5.0f ±0.58	50.00	56.00%
			June	2.67g ±0.33	47.00	5.67g ±0.33	34.00	41.00%
			November	4.67a ±0.33	66.33	8.0a ±0.58	8.67	40.00%
			October	4.33b ±0.67	61.33	8.67b ±0.33	22.33	50.00%
			September	4.0c ±0.58	56.67	8.33c ±0.33	13.00	52.00%
		2018	August	2.67e ±0.33	37.33	5.67e ±0.33	39.00	52.00%
			December	5.0a ±0.58	71.00	10.0a ±0.58	43.00	48.67%
			July	2.67f ±0.33	37.33	5.67f ±0.33	39.00	52.00%
			June	2.67g ±0.88	37.67	5.33g ±0.33	41.00	51.00%
			November	4.0ab ±0.58	56.67	8.67b ±0.33	17.00	53.67%
			October	3.67c ±0.67	51.67	8.33c ±0.88	25.00	56.33%
			September	4.0d ±1.0	56.33	8.33d ±0.33	24.00	52.33%

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الملخص العربي

تغيرات في سلوك اكتناز تحت نوعين من نحل العسل فيما يتعلق بتجميع سم النحل خلال المواسم المختلفة

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تتناول الدراسة الحالية التأثيرات المحتملة لتجميع سم النحل من نوعين فرعيين مختلفين من النحل (نحل الكرنيولى والنحل الإيطالي) خلال المواسم المختلفة (الربيع، الصيف، الخريف والشتاء) على سلوك اكتناز نحل العسل والذي يمثله معدل سحب التغذية السكرية. تتم تغذية طوائف نحل العسل بالماء وشراب العسل (50%) في مغذيات بلاستيكية. تمت إضافة 1 لتر من شراب العسل إلى المغذيات قبل وبعد جمع سم النحل لمدة ساعة واحدة لحساب كمية الشراب المأخوذة من وحدة التغذية وذلك عن طريق طرح الكمية المستهلكة من إجمالي شراب العسل المأخوذ من المغذي. أوضحت النتائج أن الهجين الإيطالي أظهر كمية كبيرة من التغذية السكرية بعد جمع سم النحل مقارنة بهجين الكرنيولى خلال فصل الشتاء يليه الخريف بينما أظهر الصيف أقل معدلات السحب. قد يكون معدل التغذية السكرية المرتفع في الشتاء بسبب الضعف الشديد للمستعمرات وحاجتها الشديدة للأغذية السكرية في مثل هذه الفترة بسبب قلة المحاصيل المزهرة في هذا الوقت من العام.

الكلمات الاسترشادية: سلالة نحل العسل، جمع سم النحل، سلوك النحل، سلوك الاكتناز.

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