The Pharma Innovation Journal 2023; 12(1): 1259-1262

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(1): 1259-1262

www.thepharmajournal.com
Received: 09-10-2022
Accepted: 13-11-2022

N Aparna
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Sunita Yadav
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Deepika Kalkal
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Ritu Bhall
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Kapil
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Rahul Saini
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Corresponding Author:
N Aparna
Department of Entomology, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Effect of electrical bee venom extraction on fecundity of *Apis mellifera* L. colony

N Aparna, Sunita Yadav, Deepika Kalkal, Ritu Bhall, Kapil and Rahul Saini

Abstract
The experiment was conducted at apiary, Department of Entomology, CCSHAU, Hisar, Haryana in three seasons i.e. winter, spring, and summer from December 2020 to June 2021. Bee venom was extracted from colonies of different bee frame strength using a bee venom extractor of model SB-BVC manufactured from DPS Tech Smart Pvt. Ltd., New Delhi, with different exposure periods. The effect of electrical shock on fresh egg rearing was observed in all the experimental colonies. No marked difference was observed due to varying durations of exposure to the bee venom extractor. Though colony growth parameter was in proportional with the bee strength, duration of exposure had no significant effect on honey bee colony fecundity.

Keywords: Brood rearing, exposure period, frame strength, venom extraction

1. Introduction
Honey bee venom is an acidic liquid secreted by females of the honey bee colonies which doesn't have any characteristic odour and colour [1]. Upon drying it acquires yellowish powder form and turns into brown when oxidized. Bee venom is the release of an exocrine gland i.e. the venom gland from branched secretory cells and stored in a poison sac. When honey bee experiences any external danger stimuli, venom release occurs through the stinging apparatus [2].

Along with the produce of venom gland, bee venom also has the produce of other exocrine glands, such as alarm pheromones like isopentyl acetate (IPA) from the koschevnikov gland and 2-heptanone (2HPT) from the mandibular gland [3, 4, 5]. The release of alarm pheromone along with bee venom triggers various reactions in honeybee colonies like stress and behavioural responses in bees, which possibly can affect the beehive routine activities. Various researchers had conducted studies on the effect of bee venom extraction on behaviour and activities of honey bee colonies. No adverse effect on honey bee colonies was observed due bee venom extraction as studied by [6, 7, 8, 9]. Some researchers observed reduction in brood area as a result of bee venom extraction [4, 10, 11, 12] and some observed positive results in brood activity [13]. Gholamian *et al.* observed that the venom collection by the venom apparatus used out of the hive had significant differences in general behaviour in comparison with the control [14].

Studies have shown that electrocution leads to trigger defensive reaction along with production of alarm pheromone. As production of bee venom is a high income generating field, the side effect of its production on honeybee colonies' growth and vigour is important. For a bee venom extractor to be efficient, these effects should be minimum or none. The present study deals with the efficacy of the apparatus used for bee venom extraction by considering effect of electrocution on honey bee colony growth and performances. This study provides the knowledge about effect of electric method on fecundity of colonies due to electric shock method implied on colonies.

2. Material and Methods
The investigation was carried out in the Apiary of Department of Entomology, Choudhury Charan Singh Haryana Agricultural University (CCSHAU), Hisar in three seasons i.e. winter, spring and summer. For the present investigation, 18 experimental honeybee colonies and 6 control colonies of *A. mellifera* L. for each experimental season with respective honey bee strength i.e. 12 honeybee colonies with strength of 6 bee frames per colony and another 12

honey bee colonies with strength of 10 bee frames per colony were taken. The treatment details of the experiment were T_1 (6 frames/colony for 30 min), T_2 (6 frames/colony for 45 min), T_3 (6 frames/colony for 60 min), T_4 (6 frames/colony for 0 min), T_5 (10 frames/colony for 30 min), T_6 (10 frames/colony for 45 min), T_7 (10 frames/colony for 60 min) and T_8 (10 frames/colony for 0 min). Each treatment was replicated three times in each season.

Bee venom from experimental honey bee colonies was collected using electrical bee venom extractor of model SB-BVC manufactured from DPS Tech Smart Pvt. Ltd., New Delhi. This bee venom extractor is used to provide intermittent electric shock of 9V to the honey bees through the parallel electric wire grid made of steel.

2.1 Methodology

Bee venom was collected from each colony with the help of bee venom extractor in all three seasons. The observations for colony growth parameters were recorded at 7 days interval after each extraction to study the effect of extraction on honey bee colony performance. Observations were taken using a counting frame as used by [15]. This counting frame was made up of an empty frame on with one inch square cells are made using a plastic wire. Thus the counting frame contains a total of 112 square inch cells (16 columns *7 rows). The counting frame is placed over the normal frames of the experimental colony and the numbers of cells occupied by eggs are conveniently recorded. The square inch of cells occupied with eggs completely or with more than 50% part in the counting frame is considered as one.

2.2. Observations recorded

2.2.1 Fecundity

The numbers of cells containing eggs in all the frames of the colony were counted using the counting frame in square inches. Results from both treatment and control colonies were compared (figure 1).

2.3 Statistical analysis

OPSTAT software of CCSHAU, Hisar was used to analyse the data recorded from the experiment conducted. All the information were tabulated and analysis with the help of two-way ANOVA. The effect of bee venom extraction on honey bee egg brood rearing was analysed using two-factorial ANOVA at 5% level of significance.

3. Results

The relationship between bee venom extraction and fecundity of honey bee colonies under investigation has been shown in table 1 for winter, spring and summer season 0f 2020-21 respectively**.** Significant difference in fresh egg area between 6 and 10 frame hives are observed only during winter viz. 33.67 inch^2, 156.58 inch^2 and 196.42 inch^2 in 10 frame colonies compared to 20.67 inch^2, 42.33 inch^2 and 86.92 inch^2 respectively at 7, 14 and 21 days after extraction (table 1). No significant difference in area with egg brood was noticed due to frame strength in spring and summer season. Duration of exposure to bee venom extractor also had no significant effect on fecundity of experimental colonies. Thus the results provide the conclusion that the venom extraction process has no significant impact on egg laying ability of honeybees. Graph 1 and 2 show the trend on fresh egg area of the colonies in all three seasons due to effect of different frame strength and different duration of exposure.

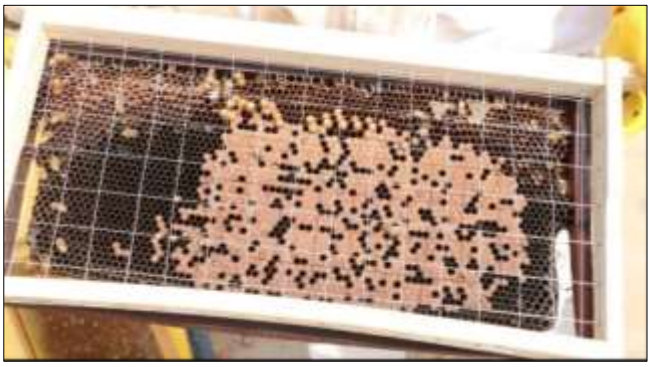
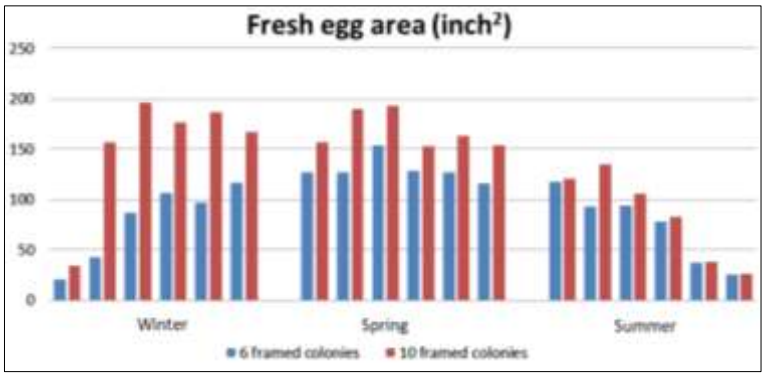


Fig 1: Recording fresh egg area of colony using the counting frame

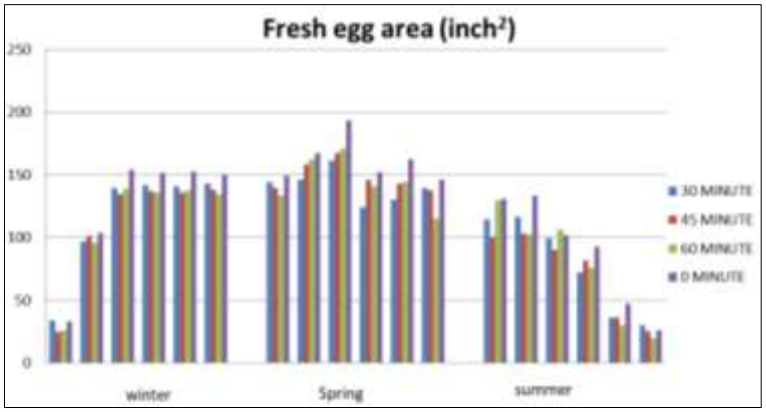
Table 3: Effect of bee venom extraction on fecundity/ fresh egg area (inch^2) during 2020-21

Fresh egg area (Inch^2/colony)																				
Frame strength	Duration of exposure	Winter season						Spring season						Summer season					
		Extraction -1			Extraction- 2			Extraction -1			Extraction -1			Extraction- 2			Extraction -1		
		7 DAE	14 DAE	21 DAE	7 DAE	14 DAE	21 DAE	7 DAE	14 DAE	21 DAE	7 DAE	14 DAE	21 DAE	7 DAE	14 DAE	21 DAE	7 DAE	14 DAE	21 DAE
6	30 min	15.67*	40.67	92.67	112.00	102.34	121.67	131.33	106.67	151.34	123.34	94	130.33	113.33	87.34	107.00	77.00	36.34	27.00
	45 min	17.67	42.00	83.33	100.84	92.08	109.50	118.33	137.67	153.67	123.33	119.33	111.00	91.33	91.00	85.67	72.33	33.67	25.00
	60 min	20.33	42.00	76.33	96.34	86.34	106.34	116.33	122.33	150.33	126.67	142.33	98.33	134.00	78.67	87.67	73.00	33.33	22.34
	0 min	29.00	44.67	95.33	117.5	106.42	128.50	139.67	140.67	158.34	140.67	151.33	122.67	129.67	115.67	95.00	90.34	43.67	25.67
	Mean	20.67	42.33	86.92	106.67	96.79	116.50	126.42	126.83	153.42	128.5	126.75	115.58	117.08	93.17	93.83	78.17	36.75	25.00
10	30 min	33.67	152.67	185.67	171.34	178.50	164.17	157.00	186.00	171.00	125.00	166.33	148.33	116.00	145.67	92.33	67.33	35.67	33.33
	45 min	32.00	160.67	186.33	173.67	180.00	167.34	161.00	178.33	181.00	169.00	167.33	163.67	110.00	115.33	95.34	91.00	38.67	25.67
	60 min	32.00	150.00	201.33	175.67	188.50	162.84	150.00	202.00	191.00	154.00	145.67	132.00	125.00	126.67	125.33	78.33	27.00	17.00
	0 min	37.00	163.00	212.33	185.67	198.92	172.25	159.00	194.33	228.33	163.00	173.00	169.67	132.33	151.33	108.00	94.67	50.33	26.67
	Mean	33.67	156.58	196.42	176.59	186.48	166.65	156.75	190.16	192.83	152.75	163.08	153.42	120.83	134.75	105.25	82.83	37.92	25.67
Frame strength (A)	CD (P=0.05)	7.813	34.013	27.607	27.843	25.637	33.453	NS	NS	NS	NS	NS	36.321	NS	NS	NS	NS	NS	NS
	SE(m)	2.551	11.106	9.014	9.091	8.371	10.923	13.392	22.988	24.755	20.737	18.512	11.866	12.603	13.762	6.130	5.989	3.044	4.246
Duration of exposure (B)	CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	SE(m)	3.608	15.706	12.748	12.857	11.838	15.448	18.94	32.51	35.009	29.326	26.179	16.772	17.824	19.463	8.669	7.917	4.305	6.005
A X B	CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	SE(m)	5.102	22.212	18.028	18.183	16.742	21.847	26.785	45.976	49.51	41.473	37.023	23.719	25.207	27.525	12.259	11.196	6.088	8.492

*Each data is mean of 3 replications
DAE- days after extraction
NS-Non-significant



Graph 2: Effect of duration of exposure to bee venom extractor on fecundity/ fresh egg area (inch^2) during 2020-21



Graph 2: Effect of duration of exposure to bee venom extractor on fecundity/ fresh egg area (inch^2) during 2020-21

4. Discussions

The fresh egg brood area increased from winter to spring as spring is the active brood rearing period and decreased largely during summer may be due to lack of food sources. The electrical shock used for inducing defensive response in bees had no effect on egg laying capacity of honeybee colonies. The non-significant differences from the analysis had sufficed the conclusion drawn. Similar results such as no significant change in brood area of the colonies had been observed by [6,7,8,9]. Gholamian had also observed that bee venom collection had no effect on survival of the colonies [14]. But some other researchers had observed decrement in brood rearing area after bee venom extraction [4, 10, 11, 12]. Absence of marked difference in fresh egg area of the treatment and control colonies provides a conclusion that the electric shock given to the honey bees for bee venom extraction doesn't create any negative or positive response on fecundity of honey bee colonies. This draws the inference that the bee venom extractor apparatus used for bee venom extraction is safe in colony performance point of view in Haryana agro climatic conditions as it doesn't hamper the egg laying process of honey bees.

5. Conclusion

Bee venom is an important bee hive product having vast market in skin care and health care. The possible high returns make it important for beekeepers. Thus this experiment dealt with effects of bee venom extraction methods on honey bee colony performance such as fecundity and egg brood rearing of honey bee colonies. The results showed no significant effect on honeybee colony performance due to electric shock employed to the bees during venom extraction. From this, the safety of electrical bee venom extractor can be concluded. Different aspects related to colony performance can be studied for making bee venom extraction a part of bee keeping industry effectively.

6. Acknowledgement

I extend my heartfelt and sincere thanks to my major advisor Dr. Sunita Yadav, Assistant Scientist, Department of Entomology, CCS Haryana Agricultural University, Hisar, for her legitimate deliberation, sustained interest, expert and meticulous suggestions during the course of investigation and compilation of this manuscript. I sincerely thank Department of entomology, CCSHAU, Hisar for providing the research facilities and funding the research.

7. References

1. Devi A, Sangeeta NR, Kaur J. Honey bee venom and its composition: focusing on different *Apis* Species-A Review. Journal of Basic and Applied Engineering Research. 2016;3(1):96-98.
2. Bogdanov S. The Bee Venom Book. Switzerland: e-book Bee Product Science; c2016. p. 1-8.
3. Collins AM, Rinderer TE, Daly HV, Harbo JR, Pesante D. Alarm pheromone production by two honeybee (*Apis mellifera)* types. Journal of chemical ecology. 1989;15(6):1747-1756.
4. Onari P, Zaluski R, de Souza Bovi T, de Oliveira Orsi R, Apitoxin harvest affects population development but not the hygienic behavior of African-derived honey bees. Sociobiology. 2016;63(1):688-692.
5. Free JB, Ferguson AW, Simpkins JR, Al-Sa'ad BN Effect of honeybee Nasonov and alarm pheromone components on behaviour at the nest entrance. Journal of Apicultural Research. 1983;22(4):214-223.

6. Barker SA, Bayyuk SI, Brimacombe JS, Palmer DJ. Characterization of the products of the action of bee venom hyaluronidase. Nature. 1963;199(4894):693-694.
7. Palmer DJ. Extraction of bee venom for research. Bee World. 1961;42(9):225-226.
8. Skubida P, Muszynska J, Rybak M, Marcinkowski J. Bee venom collection and its effect on the general output of the apiary and wintering. Pszczelnicze Zeszyty Naukowe (Poland). 1995;39(2):209-221.
9. Omar REM. Effect of bee venom collection on the measurement of brood rearing activity of honey bee colony *Apis mellifera* L. Middle East Journal of Agricultural Research. 2017;6(2):409-414.
10. Khattab MM, El-Lakwah FA, Darwish AA, Omar RE, El-Ashhab KA. New Methods for Bee Venom Production in Honeybee colonies without chemical used; c2000. p. 137-149.
11. Sanad RE, Mohanny KM. The efficacy of a new modified apparatus for collecting bee venom in relation to some biological aspects of honey bee colonies. Journal of American Science. 2013;9(10):177-182.
12. Nowar EE. Venom glands parameters, venom production and composition of honeybee *Apis mellifera* L. affected by substitute feeding. Middle East Journal of Agriculture Research. 2016;5(4):596-603.
13. Khodairy MM, Omar MOM. The relationship between bee venom Production by electrical impulses and certain characters of hony bee, *Apis mellifera* L. colonies. Assiut Journal of Agricultural Sciences (Egypt). 2003;34(5):115-131
14. Gholamian E, Ebadi R, Tahmasbi GH. The effect of venom collection on some behavioral characteristics and honey yield of honey bee (*Apis mellifera*) colonies and comparing venom collecting apparatuses made in Iran. Pajouhesh-Vasazandegi. 2006;19(3):44-49.
15. Chaudhary OP Performance of *Apis mellifera* Linn. in the north eastern Haryana. Indian Bee Journal. 2003;65(1-2):25-35.