COMPARATIVE STUDY OF POLLEN TRAPS ON IMPROVEMENT IN POLLEN COLLECTION TECHNOLOGY

RASHID MAHMOOD*, SAIMA ASAD**, GHULAM SARWAR*, FARIDA IFTIKHAR* AND ZAID ABDUL QADIR***

*Honeybee Research Institute, National Agricultural Research Centre, Islamabad, Pakistan
** PMAS-Arid Agriculture University, Department of Economic, Rawalpindi
***University of Agriculture, Entomology Department, Faisalabad

ABSTRACT: After designing new pollen trap a trial was laid down in March, 2011 in the premises of HBRI, NARC, Islamabad on sixteen honeybee colonies. All the colonies selected were alike with respect to number of frames and bees present in them. The colonies were divided into four groups. On the first group the Gujranwala (local) pollen trap was clipped while on the second group the newly devised HBRI trap was clipped, on the third group bottom board pollen trap was fitted and on the fourth group Chinese pollen trap was clipped. The pollen drops down through the screens into pollen tray. The weight of pollen collected was compared and it was found that newly design pollen trap (second group) highly significant differ as compared to other three groups (Gujranwala, bottom board, china trap). The total yield of pollen from Gujranwala trap, HBRI, fixed bottom board and the china clipped trap in gm were found to be 83.00 ± 3.92 (Mean ± SE) ,121.50 ± 2.87 (Mean ± SE), 79.50 ± 2.33 (Mean ± SE), 66.00 ± 1.78 (Mean ± SE) respectively. The honey extracted from bee hives with all types of pollen traps was compared and no difference was observed in honey yield.

Key words: Honeybee, *Apis mellifera*, Pollen, pollen trap, honey yield, Sarsoon.

INTRODUCTION

Pollen traps called pollen guards were first used by Farrar (1934) to prevent bees from bringing pollen into the hive. Todd and Bishop (1940) improved these guards by changing the grid from perforated metal to 5-mesh hardware cloth. For pollen identification studies Nye (1959) constructed a trap that fit underneath the hive and had an opening on the side for removing the tray filled with pollen. A trap that was inserted in the front entrance for obtaining small samples of pollen in short time was developed by Stewart and Shimanuki (1971). The use of pollen trap in pollen studies is not a new phenomenon. Wille *et al*., (1985) reported that the weight of pollen collected by a colony, which is calculated from amounts collected in pollen traps, varies from 10 to 25kg/year.

Pollen traps vary greatly in design and positioning on the hive, but the basic principle is same i.e. a grid to remove the pollen from the bees and a tray to collect them. Moisture in the pollen may be a serious problem in areas where humidity is high, so the traps should be weather proof and installed carefully to keep out moisture. Pollen should only be collected from disease free colonies and trapping should be done only during pollen flow of one quarter pound per day. During major nectar flows, pollen trapping is un-profitable as grids slow down bee activity which ultimately reduces honey production (Nelson, 1987).

Freshly trapped pollen is perishable and it may be dried, frozen, or mixed with other material and stored. For drying the pollen should be spread on porous surface at a depth of one-half inch in an enclosed ventilated room and allow it to air dry. More rapid drying can be achieved in oven at 100° F maximum. It can also be stored by putting it in paper bags in deep freezers below freezing temperatures.

Pollen eating age in the worker bees ranges from emerging to 18 days old. However, the maximum amount of pollen consumption occurs when bees are 5 days old. The content of fresh weight of emerging bees is 13% and 15.5% of fresh weight of 5 days old bees (Dietz, 1975). Therefore, the amount of pollen inside the hive is a crucial factor for the proper development of health honeybee and strong bee colony. Therefore, young worker must consume a large amount of pollen in the first two weeks of their adult life. The key indicators for the proper health and development of bees are vitamin A, B1 B2, B6 and folic acid and mineral such as iron, manganese and zinc in the pollen (Dietz, 1975; Vivino and Palmer; 1994).

The honeybees collected pollen mostly in the morning hours of the day during all seasons. It has been found from the experiment that the production of brood and store of pollen started to decline from the months of summer seasons. So, there will be a chain effect on the development of weak bees especially due to the lack of pollen. Therefore, the quantity and quality of incoming pollen in the hive is critical for the production of brood and beehive products. Spring season has been found the best time for the production of brood, pollen and other hive products. Therefore, it is very important to feed bees

sufficiently with protein rich food containing vitamins and minerals throughout the rainy season to keep bees in normal condition (Neupane and Thapa, 2005).

After thawing pollen can be kept only for a few hours and should be further processed as soon as possible. The pollen is best dried in an electric oven, where humidity can continuously escape. The maximum temperature is 40c and the drying time should be as short as possible in order to avoid losses of volatile compounds, until the humidity is 6% or lower. Such pollen remains stable during storage for one year or longer will reduce the free radical scavenging capacity of pollen (Collin *et al*., 1995).

MATERIALS AND METHODS

The present work has been carried out in Honeybee Research Institute, National Agricultural Research Centre Islamabad, Pakistan during March 2011. We went under a series of steps before designing a new type of trap for collection of pollen from HBRI trap. The design and location of the pollen trap on the hive may be changed to meet the prevailing needs and climatic conditions. Ease of installation, colony manipulation, minimum disturbance and cleanliness of pollen should be given special attention while designing pollen trap. Four different types of pollen traps were used in this experiment. Every pollen trap was unique in its own character and was different in shape and size. i.e.

T1= (Gujranwala (local) pollen trap
T2= newly HBRI pollen trap
T3= Bottom board pollen trap
T4= Chinese pollen trap

The bees enter the hive through an opening at the front of hive and while passing through the mesh grid, most of the pollen pellets dislodged from the hind-legs of the returning bees and fall into a tray covered by screen that allows the pollen pellets but not the bees to pass. The size of holes is also a crucial factor as it must not damage bees or restricts normal flight activity of the bees.

New design pollen trap have benefit fixed on both langstroth (moderen) and Afghan bee hives. It is hoped that this new design of pollen trap produces reliable consistent results and overcome some of the problems encountered with other designs of traps.

Pollen collection: After designing the new trap a trial was laid down on 07/03/2011 in the premises of HBRI on sixteen colonies. All the colonies selected were alike with respect to number of frames and bees present in them. The colonies were divided into four groups. Three groups of four colonies had the Gujranwala trap, the newly devised HBRI trap and Chinese trap fitted at the entrance and one group bottom board trap was fixed respectively. Bee colonies were placed on *Brassica compestris* (Sarsoon), at that time crop on bloom with rich in pollen. Each trap was fixed on the hives at 9.00 am and removed at 4.00 pm. The experiment was continued for four weeks and data was taken once a week.

A total of 64 samples of pollen were collected from the hives by using four types of pollen trap at one week interval through out the experiment. These pollen samples were removed from the hind legs of honeybees on a rack fitted in a tray inside the trap, as bee's passes through the trap the loads on their legs fell down. *Brassica compestris* (Sarsoon) in bright yellow colour pollen loads were collected, weighed and spread on the clean white paper for cleaning. The pollen collected each day was stored in plastic bottles and weighed.

Statistical analysis: All data recorded during the study were analysed by using computer based software MSTAT C (Freed and Eisensmith, 1986). Analysis of Variance techniques were applied to test the significance of data using least significance difference test (LSD) at 5% probability level (Montgomery, 2001).

RESULTS AND DISCUSSION

The dependence of honeybees on pollen in several ways is well documented (Stanley and Linskens, 1974; Wille *et al*., 1985). Pollen is used primarily as a source of essential amino acids required by honeybees (De Groot, 1953) in protein synthesis. In our study we worked on the newly devised pollen trap fitted on *Apis mellifera* colonies which is equally fitted in both types of Langsroth and Afghan bee hive without disturbing the bee activities. The brood rearing capacity of *A. mellifera* is known to be improved by the addition of pollen ash to a chemically defined diet (Herbert and Shimanuki, 1978). The nutritional status and biochemical composition of the royal jelly as influenced to a large extent by the type of pollen nutrition, may affect the composition of food fed to honeybee larvae's (Stanley and Linskens, 1974).

The weight of pollen collected from the Gujranwala (local) entrance clipped pollen trap, newly devised HBRI trap , bottom board and Chinese trap were ranged from 75-95 gm, 114-128 gm, 75-84 gm and 61-69 gm, respectively. The total weight of pollen collected in four week for Gujranwala (local) entrance clipped pollen trap, newly devised HBRI trap, bottom board and Chinese trap were 333gm, 486 gm,318 gm and 264 gm, respectively (Fig.1).The total pollen collected from all the traps was 1.4 kg. When the mean weight of pollen collected was compared and it was found that they were significantly different from each other (at 5% level of significance). The mean yield of pollen from Gujranwala trap, HBRI, fixed bottom board and the china clipped trap in gm were found to be 83.00 ± 3.92 (Mean± SE) ,121.50 ± 2.87 (Mean± SE), 79.50 ± 2.33 (Mean± SE), 66.00 ± 1.78 (Mean± SE) respectively.(Fig.2)

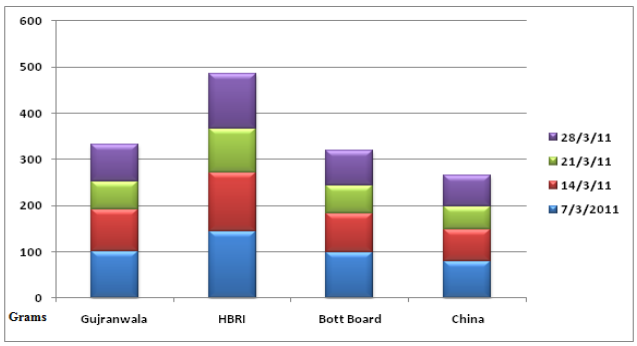

Fig.1. Column Chart showing comparison of pollen collected date wise with amount.

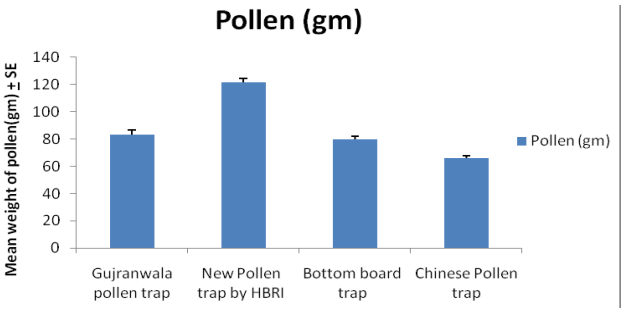

Fig.2.Mean weight of pollen collected from various pollen traps.

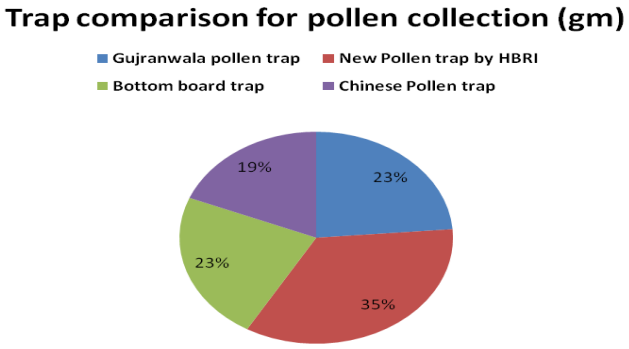

Figure 3: Pie Chart showing trap comparison of pollen collected.

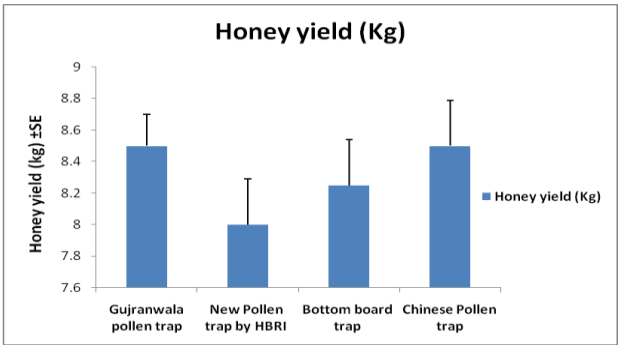

Fig. 4. The wieght of honey harvested from hives fitted with pollen traps.

It can be concluded that the means of the four traps are different. Whereas the HBRI trap gave highest pollen mean as compared to remaining traps. Chinese trap produced the lowest mean in the study of the traps. Gujranwala trap and the bottom board did not differ in their pollen potential (table1).

As described in pie chart, it was clear that on an average 23%, 35%, 23% and 19% pollen were collected by using Gujranwala, New HBRI, Bottom board and Chinese pollen traps, respectively (Fig. 3).

Bobrzecki and Wilde, (1987) also found that amount of pollen did not lower the amount of honey produced which is in agreement with our results as we also did not find any difference in the amount of honey harvested from hives fitted with different traps (at 5% level of significance). The mean weights of honey (kg.) produced from colonies (Gujranwala, Newly HBRI, bottom board, china trap) were 8.5 ± 0.20 (Mean± SE), 8.0 ± 0.29 (Mean± SE), 8.25 ± 0.29 (Mean± SE) and 8.5 ± 0.29 (Mean± SE) respectively (Fig.4). Our results also confirmed from Shazia *et al*., 2010 honey extracted from hives fitted with pollen traps, no difference was observed in honey yield. The results of experiment were also found in confirmation with Goodman 1974 and McLellan 1974 whose reported little or no effect on brood rearing by the collection of pollen.

Butler and Simpson 1953, Moeller 1977 and Duff and Furgalla 1966 reported that brood rearing and colony development may be adversely affected. Rashad and Parker (1958) reported that although pollen traps increased the pollen collected by a colony by 80%, it also reduced honey production by 41%. Hussien (1982) observed a highly significant positive correlation between amount of pollen collected and brood rearing. Colonies with pollen traps produced less honey and reared less brood than control colonies. Non trapped colonies collect more pollen and rear more brood than trapped colonies (EL-Dakhakhni *et al*., 1986). Duff and Furgala 1986 showed that honey production was significantly less for continuously trapped treatments. Data showed that brood rearing in non trapped colonies was more active than in trapped colonies throughout different seasons. It could be mentioned that the highest average of worker brood in trapped and non trapped colonies were observed in summer. Non trapped colonies were more active in brood rearing than trapped colonies (Abou EL Naga *et al*., 2008). This contrary to our findings perhaps continous collection of pollen per day but in our study, we collect pollen per week in sarsoon field, when crops are in full bloom with abundance of pollen.

The newly designed trap used in our study fit at the existing entrance of the hive which allows the bees to have easy free access without getting crowded or aggressive. This ensures that they can replenish or collect their own pollen stores in good quantity. This trap is designed for beekeepers to allow them to keep the trap on both type of bee hives but collect the pollen on alternate weeks without disturbing bees and avoid labour of

putting and removing trap every time. The surplus pollen should be collected at weekly interval and stored properly as a by-product for feeding colonies when required.

Conclusion: The three pollen traps Gujranwala trap, Bottom board and china trap are not significantly different from one another. While the HBRI trap was significant from all the other three traps. HBRI trap was the better and showed the best result than the other three traps.

Acknowledgments: We acknowledge Mr. Maqbool Ahmad, Principal Scientific Assistant, Mr. Qurban, Senior Scientific Assistant and Mr. Tahir Mahmood Bee Attendant, Honey Bee Research Institute for designing and testing the new pollen trap at various stages of invention. We are also thankful to Mr Riaz, Scientific Assistant,Mr. Zafar Iqbal, Bee Attendant and Ziad Abdul Qadir, (Internee) for collecting pollen from traps.

REFERENCES

Abou El Naga, A.M., H. M. Fathy, H.K. El-Serafy and D. Mandouh (2008). Influence of using pollen traps on amounts of brood and stored pollen in honeybee colonies (*Apis mellifera* L.). J. Agric. Sci. Mansura Univ. 33(4):2881-2889.

Bobrzecki, J. and J. Wilde (1987). The influence of pollen trapping by 3 types of pollen traps on the development and productivity of honeybee colonies. CABI Abstracts. Akademia Rolniczo-Techniczna, Olsztyn, Poland.

Buttler, C.G. and J. Simpson (1953). Bees as pollinators of fruit and seed crops. Rept. Rothamsted Exp. Stn. pp.167-175.

Collin, S., T.Vanhavre, E. Bodart and A. Bouseta (1995). Heat Treatment of Pollens: Impact on Their Volatile Flavor Constituents. J. Agric. Food Chem. 43 (2):444–448.

De Groot, A. P (1953). Protein and amino acids requirements of the honeybee (*Apis mellifera*). Physiol Comp Oecol. 3: 197-285.

Dietz, A (1975). Nutrition of adult honeybees In: C.P. Dadant, M.G. Dadant and J.C. Dadant (eds.) The Hive and The Honeybee. Dadant and Sons, Inc. Hamilton, USA. pp. 125-156.

Duff, S.R. and B. Furgala (1986). Pollen trapping honeybee colonies in Minnesota. Part II: Effect on foraging activities, honey production honey moisture content and nitrogen content of adult workers. Am. Bee. J. 126(11): 755-758.

El-Dakhakhni, N.M., Z. Zhenishen, and M.B. Shawar (1986). Effect of honey strength on flight activity and productivity of honeybee colonies. Bul. Soc. Egypt. pp 66.

Farrar, C. L (1934). Bees must have pollen. Gleanings Bee Cult. 62: 276-278.

Freed, R. D. and S.P. Eisensmith (1986). MSTAT Microcomputer Statistical program Michigan State University of Agriculture and Applied Science, Michigan, USA.

Goodman, R.D (1974). The rate of brood rearing in the effect of trapping on honeybee colonies. Aostral. Beekeep.76:39-41.

Herbert, A. W and B. Shimanuki(1978). Mineral requirements for brood-rearing by honey bees fed a synthetic diet. J. Apic. Res.17: 118-122.

Hussein, M. H(1982). The pollen flora of Assiut, Egypt. Assiut J.Agric. Sci. 13(6):173-183.

Mclellan, A.R (1974). Some effects of pollen traps on colonies of honeybees. J. Apic. Res.13(2): 143-148.

Moeller, F.E.(1977). Managing colonies for pollen production Procs. XXVI Int. Apic. Congr. 232-239.

Montgomery, D.C (2001). Design and Analysis of Experiments. 5th Ed. John Willy and Sons, New York. p. 64-65.

Nelson, D. L (1987). The effect of continuous pollen trapping on sealed brood, Honey production and gross income in Northern Alberta. Am. Bee. J.127(31):648-650.

Neupane, K.R and R.B. Thapa (2005). Pollen collection and brood production by honeybees (*Apis mellifera* L.) under Chitwan condition of Nepal. J. Inst. Agric. Anim. Sci. 26:143-148.

Nye, W.P (1959). A modified pollen trap for honeybee hives. J. Econ. Ento. 52: 1024-1025.

Rashad, A. E. and R.L. Parker (1958). Pollen as a limiting factor in brood rearing and honey production. Trans. Kansal. Acad. Sci. 61:237-248.

Shazia, R., E.S. Waghchoure, R. Mahmood, G. Sarwar, F. Iftikhar, and M.S. Munawar (2010). Comparative study on improvement in pollen collection technology. Halteres. 2:1-6.

Stanley, R. G. and H.F. Linskens (1974). In: Pollen: biology, bio-chemistry, management. Springer-Verlag, NewYork. pp100-109.

Stewart, J. D. and H. Shimanuki (1971). Rapid-sample pollen traps for honey bees. J. Econ. Ento. 63: 1350.

Todd, F .E. and R.K. Bishop (1940). Trapping honeybees gathered pollen and factors affecting yields. Econ. Ento. 33: 866-870.

Vivino A.E. and L.S. Palmer (1944). The chemical composition and nutritional value of pollens collected by bees. Arch. Biochem. 4:129-136.

Wille, H., A. Imdrof, G. Buhlmann, V. Kilchenmann and M. Will (1985). Pollen gathering and population dynamics of three liebfled bee colonies. Revue Suisse de Zoologie. 92: 897-914.