Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 585-588

Received: 23-03-2020
Accepted: 25-04-2020

Anurag Sharma
Krishi Vigyan Kendra, Chamba at Saru, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Rajeev Raina
Krishi Vigyan Kendra, Chamba at Saru, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Renu Kapoor
Krishi Vigyan Kendra, Chamba at Saru, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Kehar Singh Thakur
Krishi Vigyan Kendra, Chamba at Saru, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Manish Thakur
Krishi Vigyan Kendra, Chamba at Saru, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Corresponding Author:
Anurag Sharma
Krishi Vigyan Kendra, Chamba at Saru, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Mud hive technology: New innovation for the conservation of indigenous bee, *Apis cerana indica* in Chamba district of Himachal Pradesh

Anurag Sharma, Rajeev Raina, Renu Kapoor, Kehar Singh Thakur and Manish Thakur

Abstract
Indian honey bee, *Apis cerana*, is a part of natural heritage of mountain community and is known as indigenous bee. It is an excellent pollinator of mountain crops and helps in the maintenance of biodiversity. Indigenous methods of keeping bee colonies in log and wall hives are still common in Himachal Pradesh. This bee is under threat in hills due to replacement of *kuccha* house with *pucca* house, intensive use of insecticides and decrease in forest covers. Thus the present study focuses and targets on providing traditional but modern and scientific bee hives for its conservation. Fixed mud hives are constructed from the locally available material like clay, straw, fresh cow dung, stones etc., which are easily available to farmers. These mud hives are economical to the farmers and are having benefits over traditional wall hives or modern ISI hives. Scientific beekeeping with *A. cerana* is possible in these hives, which was otherwise not possible with traditional hives. Conservation of these bees is also helpful to the orchardists for enhancing the productivity of apple up to 69.50%.

Keywords: *Apis cerana*, benefits, Chamba, fixed mud hives, Kullu, pollinator, traditional hives

1. Introduction
Apis cerana Fabricius (also known as the Asian honeybee, Asiatic bee, Asian hive bee, Indian honeybee, Indian bee, Chinese bee, Mee bee, Eastern honeybee, and Fly Bee) is endemic to most of Asia where it has been used for honey production and pollination services for thousands of years [1]. *A. cerana* has been described as the exact equivalent of its European/African sister species *A. mellifera*, the European honeybee, showing wide range and capacity for variation and adaptation. Similar to *A. mellifera*, *A. cerana* occupies a large range with varied climatic conditions, from cool regions in higher latitudes and altitudes, to dry, semi-desert environments, as well as tropical climates [2]. Similar to *A. mellifera*, *A. cerana* occupies a large range with varied climatic conditions, from cool regions in higher latitudes and altitudes, to dry, semi-desert environments, as well as tropical climates [2]. *A. cerana* is a part of the natural heritage of mountain communities. It is an excellent pollinator of mountain crops and helps in the maintenance of biodiversity. Indigenous methods of keeping bee colonies in log and wall hives are still common in Himachal Pradesh[3]. Beekeeping can contribute significantly to improving agricultural productivity of crops through pollination services [4, 5]. Most importantly, beekeeping can provide opportunities for marginalized groups, such as women and the landless poor, to access alternative income streams without exacerbating environmental and land tenure issues [6, 7, 8, 9].

The Chamba District is situated between north latitude 32° 11′ 30” and 33° 13′ 6” and east longitude 75°49 and 77° 3′ 30”, with an estimated area of 6522 square Kilometers and is surrounded on all sides by lofty hill ranges. The territory is wholly mountainous with altitude ranging from 2,000 to 21,000 feet. The traditional wall and log hives are facing huge threat from the urbanization. Due to urbanization, old *kuccha* houses which provided natural wall hives to *A. cerana* in tribal and rural area of Chamba valley are being replaced by *pucca* houses. This lone factor is one of the major contributors for the decline in the population of this bee in these areas. In Hindu Kush Himalayan range, beekeeping with *A. cerana* is being replaced by *A. mellifera* at such a fast rate that population of native *A. cerana* is declining to a level that is no longer viable. These countries include Afghanistan, Bhutan, Myanmar, Nepal, India, Bangladesh, and Pakistan [10].

The other factors which are responsible for the decline of *A. cerana* populations are rapid transition of forests into agriculture plantations, short-cycle forestry stands [11]. The indiscriminate use of insecticides in apple orchards is also one of the major factors responsible for decline in bee population in Chamba valley. Damage to honey bee colony by application of pesticides not only depends by toxicity of chemical substances, number and methods of insecticides application, time of application, weather, but also by type of nectar, type of food flower collected, season of damage and number of honeybee in colony [12]. The decline in pollinator population and diversity presents a serious threat to agricultural production and conservation and maintenance of biodiversity in many parts of the country. One indicator of the decline in natural insect pollinators is decreasing crop yields and quality despite necessary agronomic inputs. Examples can be found in Himachal Pradesh in northwest India, where despite all agronomic inputs, production and quality of fruit crops, such as apples, almonds, cherries, and pears, is declining. Extreme negative impact of declining pollinator populations can be seen in other areas of Himachal and Jammu and Kashmir where farmers disappointed with the very low yields and quality of apples as a result of poor pollination have chopped off their apple trees [13].

It has been analysed that decline of honeybee population is due to application of insecticides like organochlorine, carbamate, organophosphorus and pyrethroid. □e damage to honey bee colony by application of pesticides not only depends by toxicity of chemical substances, number and methods of insecticides application, time of application, weather, but also by type of nectar, type of food □ower collected, season of damage and number of honeybee in colony [4]

Bee keeping with *A. cerana* in Chamba valley represents the traditional heritage of mountain community. But today it is in danger. Keeping in view the importance of traditional beekeeping and to conserve the local bees, mud hive technology was introduced in Chamba valley during 2019. The mud hives are well popularized and adopted in Kullu valley of Himachal Pradesh which are being innovated by the faculty of Dr. Yashwant Parmar University of Horticulture and Forestry, Nauni, Solan.

2. Material and Methods

This present study has been conducted in Chamba district of Himachal Pradesh. This study was funded by NABARD, Chamba. NABARD has supported the project for the training component and also for providing equipments, tools and hives to the trainee farmers. Under this program, trainings on beekeeping were provided to the farmers. The farmers were also trained for the construction of fixed mud hives. Fixed mud hive is modern bee hive for *A. cerana* which is permanent structure and is cost effective. This hive has the qualities of both modern ISI hives as well as the traditional hives. It is made up of easily available local material including clay, cow dung, stones, grass, straw and wooden sticks. These low cost mud hives have been named as “fixed beehive” because these are fixed at one place and cannot be shifted from one place to other like ISI wooden beehives. However, the frames are movable and can be shifted from one fixed hive to another as well as from fixed hives to ISI wooden hives. These hives have given satisfactory results in Kullu Valley of Himachal Pradesh and thus the same model has been replicated in Chamba valley. The material required for the construction of these permanent mud hives is mentioned in Table 1.

Table 1: Material required for construction of fixed mud hive

Clay soil	40kg
Fresh Cow dung	5 kg
Wheat/ Paddy straw	2 kg
Stone pebbles	10-12 kg
Wooden or iron inner Interface	15 x 13 inch (l x b)- ½” wide planks
Roof of bee hive	
Rectangular wooden frames	22” x 24”. ½” wide wooden plank
Iron wire mesh	22” x 24”
Dry grass (For roof)	4 kg
Wire/ rope to tie dry grass	300 gm
Iron spikes (½ inch)	200 gm
Wooden Planks	10 (ISI standards)
Dummy Board	1 (ISI standards)
Size of Bee Hive	
Outer dimensions of hives	24” x 22” x 13” (l x b x w)
Inner dimensions of hives	15” x 13” x 09” (l x b x w)
Width of wall	4½”
Height of roof	7½”

3. Results and Discussion

3.1 Preparation method

These hives can be made on the raised platforms in areas where the runoff during rains is very high. The raised platforms of dimensions 25” x 25” x 12” can be made either by cementing the bricks or can be made with locally available stones/ wooden planks, arranged on one another without cementing. These raised platforms will be useful in preventing the direct contact of run-off water to these hives. Cemented drains of 2” x 3” can be made around these platforms which can be filled with water to avoid entry of ants and other insects to these hives. To construct these hives, mixture of cow dung, straw and clay is prepared and water is sprinkled over them to keep them moist for a night. Next day, paste of these materials is made by adding more water. Care must be taken to make the paste material soft and not to make it hard. Avoid over watering as it will make it difficult while constructing bee hives. Wooden interface (dimensions as mentioned above) is filled with this mixture. Raised platforms can be made with the locally available stones, hence reducing the cost of cements and bricks. An entry hole is kept inserting small wooden piece (3” x 2” x 1”) or pipe for the movement of bees. An additional hole (4” x 4”) is kept either on back or in front for the circulation of air. The material is kept overnight for proving strength to the structure. The interfaces and wooden pieces are removed after minimum of 24 hours from filling. After removing these interfaces the brood chamber is ready for keeping the bees in hive. Wire mesh is placed in the bigger whole (4” x 4”) to restrict the entry of other bees and wasps to the hive. The roof of these hives is made after the setting of the brood chamber. Brood chamber is plastered with mixture of clay and cow-dung once and twice to provide final finishing. This plastering is also essential to fill the minor cracks on the side walls and on the floor of the brood chamber. This brood chamber can accommodate twelve frames of *A. cerana* bees. The roof is made either by dry grasses or by wooden planks having covered with tin sheets or easily readily available material. The chosen material must be able to stop the rain water to drain into the bee hive. After the completion of the hive, bees with brood frames can be shifted. Inner cover is made of the wooden plants (ISI standards). Gunny bags can also be kept

over these inner covers. These fixed mud hives have been constructed in Chamba district at different locations. These mud hives possess character of both traditional be hives and ISI modern hives as honey bees are reared on ISI modern frames. These honey bees can be moved on the wooden modern boxes to other places as per the need. Further, inspection of bees, honey extraction and other scientific techniques can be practiced on these hives which are otherwise not possible with the traditional wall hives or log hives.

Krishi Vigyan Kendra, Chamba in association with NABARD, Chamba has given training to around 300 farmers on beekeeping and constructing these fixed mud hives for the conservation of indigenous bees, *A. cerana*. About 100 fixed mud hives have been constructed, free of cost, to these trainee farmers under this project. The other farmers have shown their interest in this technology and as explained above, it is very easy and requires locally available material, the other farmers have come up willingly for the construction of these mud hives. These fixed mud hives have given them opportunity and place to catch the swarms of the bees, which otherwise was not possible in lack of hives. Honey bees are known to be excellent pollinators and hence conservation of these bees in turn increases the productivity of apple. Apple productivity can be increased up to 69.50% due to bee pollination [14]. Farmers are getting aware about the importance of honey bees and are working in association with one another for the conservation of these bees.

3.2 Benefits of fixed mud hives

As these hives are made of clay, cow-dung, straw, these are preferred and liked by Indian honey bees. Compared to traditional wall hives and modern wooden hives, the bee population increases 2-3 times more in these fixed mud hives. The bees rarely abscond in this hive, while absconding is a major problem in ISI wooden hives. Fixed mud hives can control and maintain the bee temperature of hives compared to wooden ISI hives. In winter, the temperature in this low cost beehive is 2-3ºC higher, while in summer it is 6-8ºC lower as compared to temperature recorded in wooden ISI hives. This technology is cost effective as it is twice lesser than the wooden hive. Most of the material required for the construction of these hives is readily available with the farmers and that too free of cost. Farmers can easily construct fixed mud hives after undergoing minimum five-day training with *A. cerana* in hills.

3.3. Expenditure for the construction of fixed mud hives

As most of the material like clay, cow-dung, straw, stones are freely and easily available with farmers, the expenditure involves the purchase of wooden planks (ISI standards), wire mesh, rope and iron spikes from the market. Thus the total cost involved for the construction of these fixed mud hives does not exceed Rs. 1000 per hive. The benefits of these hives are much compared to the cost involved.

4. Conclusion

The native bees had been thriving on logs hives, wall hives or other natural material in the hills, however with a change in housing material, increased use of pesticides, fungicides, and host of other reasons, the indigenous bees are facing decline in population. This low cost fixed beehive made from locally available material is useful for reviving the retreating indigenous honey bees and motivating farmers to adopt apiculture as profession. This hive has performed extremely well under Kullu valley conditions in terms of maintenance of temperature, brood rearing, swarming, and safety from diseases and natural enemies and has increased pollination levels and yields also, as the bees reared their brood about three times faster in this hive as compared to ISI wooden hives. These mud hives are useful in the conservation of Indian honey bees which are otherwise under threat due to urbanization and unavailability of modern hives.

5. Acknowledgement

This study was sponsored by NABARD and well supported by the Principal Scientist and Head, and other scientific and technical staff, KVK Chamba of Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, which is gratefully acknowledged. The authors also thank Professor (Entomology) Dr. H.K. Sharma, and Dr. J.K. Gupta, Dr. J.P. Sharma (Retired Scientists, Department of Entomology, UHF, Nauni, Solan) for providing support and guidance for the above investigation.

6. References

1. Anna HK. Ecology, behavior and control of *Apis cerana* with a focus on relevance to the Australian Incursion. Insects. 2013; 4(4):558-592.
2. Ruttner F. Biogeography and Taxonomy of Honeybees. Springer-Verlag Berlin; Heidelberg, Germany, 1988, 284.
3. Nirupama S, Gupta JK, Harish S. Effect of supplementary feeding on *Apis cerana* F. colony development at Katrain in Kullu valley of Himachal Pradesh. Journal of Entomology and Zoology Studies. 2018; 6(5):457-460.
4. Klein AM, Vaissiere BE, Cane JH, Steffan-Dewenter I, Cunningham SA, Kremen C *et al*. Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society B: Biological Sciences. 2007; 274(1608):303-313.
5. Pohorecka K, Bober A, Skubida M, Zdanska D, Toroj K. A comparative study of environmental conditions: Bee management and the epidemiological situation in apiaries varying in the level of colony losses. Journal of Apicultural Science. 2014; 58(2):107-132.
6. Bradbear N. Development of apiculture as a source of rural income with special reference to women: Botswana. Food and Agriculture Organisation of the United Nations (FAO) Beekeeping Project G 3454, Rome, Italy, FAO, 1987, 24.
7. Griffiths E. Women in beekeeping- success and prosperity. Bees for Development Journal. 2009; 112:10–11.
8. Gupta RK, Reybroeck W, Van Veen JW, Gupta A. Beekeeping for poverty alleviation and livelihood security: Technicological aspects of beekeeping. 2014; 1:665.
9. Lloyd D, Somerville D, Schouten C. Using *Apis mellifera* and *Apis cerana* in landless and subsistence communities in Timor-Leste and Indonesia. Report prepared for the Australian Centre for International Agricultural Research (ACIAR). 2016.
10. Verma LR. A framework for research and development on beekeeping with Asian hive bee *Apis cerana*. Honeybee Science. 1994; 15:19-24
11. Oldroyd BP, Nanork P. Conservation of Asian honey bees. Apidologie. 2006; 40:296- 312.

12. Sanjay K, Pashupati N, Prakash CJ, Vinay S. Impacts of insecticides on pollinators of different food plants. Entomology, ornithology & herpetology: Current Research. 2018; 7(2):211-218.
13. Partap U. Cash crop farming in the Himalayas: The importance of pollinator management and managed pollination. Case Study No.10. Biodiversity and the Ecosystem Approach in Agriculture, Forestry. 2003, http://www.fao.org///docrep/005/y4586e/y4586e11.htm.
14. Devinder S, Abrol DP. Beekeeping for poverty alleviation and livelihood security. Technological aspects of beekeeping, Springer Dordrecht Heidelberg New York London. 2014; 1:379-412.