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Cow Urine – *Sanjivani* for Honeybees: Success Stories of Beekeepers

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Abstract

Honeybees are best known for the honey they produce. But the principal economic role of honeybees in nature is to pollinate hundreds and thousands of flowering plants and ensure seed set in quantity and quality. India is rich in diverse vegetation which is suited for the tremendous expansion of beekeeping but proper bee disease management is essentially required for increasing the honey production and crop yield. The honeybee Apis mellifera *has adapted to different climates, plays an important role in crop pollination, and yields large amounts of honey and other bee products. During 2006–12, experiments were conducted on the efficacy of cow urine against the bacterial disease European foulbrood in* A. mellifera *colonies in the apiaries of different beekeepers in Uttarakhand. The beekeepers reported that spraying 50 to 100 ml of pure cow urine per beehive showed rapid recovery in disease infection in 8–10 days after spraying. They also observed promotion of growth of brood, increase in egg laying tendency of queen bee, and enhancement in cleaning (grooming) activities of adult workers. The disease did not recur when cow urine was sprayed regularly in the colonies at 10- to 15-day intervals. Cow urine does not contaminate beehive products. The present studies revealed that cow urine can serve as a potential eco-friendly measure for management of diseases in honeybee colonies and is a suitable alternative to conventional chemicals such as thymol, sulfur, etc. It is safe, eco-friendly, readily available, almost free of cost to farmers and does not have any adverse effect on the brood and the bees in honeybee colonies. Several beekeepers in India have adopted this novel technique and have benefitted with successful bee management and high honey production.*

Honeybees are wonderful creatures which have fascinated mankind since the dawn of civilization. The art of their management in easily maneuverable hives and extracting surplus honey is called beekeeping. A wide array of people showed interest in a relationship with this marvelous insect. Besides producing sweet honey, beeswax and several other products of medicinal and commercial value, the honeybee enhances crop productivity and helps in conservation of global biodiversity by propagation of plant species, and maintains stability of ecosystems.

Beekeeping in India has been practiced from time immemorial and is mentioned in epics such as Rigveda (8000 BCE), Ramayana (5000 BCE), and Upanishads (1500–1000 BCE). This agro-based industry does not require any raw material from the artisan like other industries. The raw material is in the form of nectar and pollen from flowers which is freely available in nature. Beekeeping is a decentralized, forest and rural agriculture based industry. It is of considerable importance as a village industry. It can provide underemployed persons with full employment and extra income. It is highly suited for women, children, and even illiterate and physically handicaps because of the light nature of work. The landless cultivators in particular can add extra income to their principal source of income.

In order to harness honeybees for the benefit of mankind, sound knowledge of their habits, requirements, and management is essential. The success of beekeeping depends on understanding the biology and behavior of honeybees, proper management techniques including knowledge of their diseases and enemies, and equipment for handling them. Honeybees like all other creatures suffer from many diseases and are attacked by various pests, predators, and enemies such as viruses, bacteria, parasitic mites, wax moths, predatory wasps, birds, and animals.

Bacterial diseases in honeybees

There are two types of bacterial diseases found in bee colonies: (i) American foulbrood; and (ii) European foulbrood (EFB). In India, bees suffer from EFB disease only. It is a destructive brood disease caused by *Melissococcus plutonius,* a gram-positive, non-spore forming, rod-like bacterium (Shimanuki and Knox, 1997). In India, this disease was reported for the first time in *Apis cerana* during 1970 which killed 25–30% of the colonies in Karad areas of Maharashtra. However, in *A. cerana*, the disease reappeared after a long period of almost three decades in Himachal Pradesh and killed about 60% of the colonies during 2002 (Rana *et al.,* 2004). In *Apis mellifera*, the first incidence of EFB in India was reported in Himachal Pradesh and Dharwad area of Karnataka during 1998 (Singh and Garg, 2000) and in Punjab during 1999 (Gatoria *et al.*, 2000). The clinical signs of the disease are an irregular brood pattern with swollen and twisted larvae having opaque and creamy white to pale yellow guts, which finally turn brown to black, dry up to soft scales, and emit vinegar-like odor (Morton and Brown, 1996).

During the past ten years, beekeepers in North India have used the antibiotic terramycin to control EFB and sulfur, formic acid, apistan strips, methyl salicylate, and oxalic acid for mite control and due to the frequent use of these synthetic chemicals in beehives several beekeepers have lost their bee colonies. Therefore, the success of beekeeping largely depends on the ability of beekeepers to take suitable measures to control diseases and natural enemies of honeybee. Considering the hazardous effects of chemicals used for bee disease management and to reduce the ill effects of chemicals on honeybees, we carried out research on the efficacy of cow urine, an

eco-friendly animal product, on honeybee disease management.

Background

Cow (*Bos indicus*) is considered the most valuable animal in all Vedas and is called the "Mother of all". The use of *gomutra* (cow urine) in India can be traced back to the Vedic times (8000–1000 BCE). In Vedas and Dharmashastras [Hindu laws documented in Smritis starting with Manusmriti (200 BCE)], cow urine has been well documented as a purifying substance and as an ingredient of *Panchagavya* (milk, urine, dung, ghee, and curd of cow). *Panchagavya* is the main ingredient of many Ayurvedic preparations. Cow urine is believed to have therapeutic value. Ancient Indian scriptures such as Manusmriti, Charaka Samhita, and Sushruta Samhita mention the rational use of these animal products for diseases of the liver, gastrointestinal system, heart, lungs, and others. According to Sushruta Samhita and Ayurveda Samgraha, urine of cow is beneficial and better than that of other animals for medicinal and other purposes. Cow urine is used as a folk remedy by the majority of rural population all over India.

Kumar and Sehgal (1998) reported the use of cow urine as antipathogenic material. Fugro (2000) conducted an experiment in Konkan region of Maharashtra to test the efficacy of cow urine against diseases of chili. Among organic pesticides and manures tested, cow urine was found to be the best to control leaf curl and dieback caused by the fungus *Colletotrichum capsici*. The highest removal of sclerotia (92.33–93.53%) was obtained from 20% and 30% cow urine with rubbing and significantly high seed germination and seedling growth was recorded in cow urine treated seeds.

Achliya *et al.* (2004) reported that cow urine is an important component of some Ayurvedic formulations which are used to treat various diseases and disorders. They checked the antimicrobial activity of cow urine and found that it inhibited the in-vitro growth of bacteria, viz., *Staphylococcus aureus, Salmonella typhi, Bacillus subtilis, Pseudomonas aeruginosa, Escherichia coli, Bacillus cereus,* and *Micrococcus luteus.*

Neem leaves and cow urine decoction was found promising to control the hairy caterpillar *Spilarctia obliqua* (Purwar and Yadav, 2004). On the basis of available literature, we used cow urine for the first time in honeybee disease management.

Field experiments on bacterial disease in honeybee

Field experiments were conducted during 2006–12 on the efficacy of cow urine in comparison with the antibiotic terramycin at the apiaries of 23 beekeepers at five locations of Tarai (Dineshpur, Pantnagar) and Bhabar (Ramnagar, Haldwani, Banbasa) regions of Uttarakhand in India. The efficacy of desi cow breed urine was tested against EFB caused by *Melissococcus plutonius* in *A. mellifera* colonies in Langstroth beehive having 5–6 frames strength. The experimental colonies were naturally infected with EFB (Fig. 1) and no hard chemicals were used in these colonies. In each colony one frame was selected which was heavily infected with EFB disease and

There are two types of bacterial diseases found in bee colonies: American foulbrood and European foulbrood (EFB). In India, bees suffer from EFB disease only.

an area of 10 × 10 cm (100 cm^2) having (approx. 400 cells) was marked with nail polish. Each colony was randomly assigned spraying of different treatments of cow urine and terramycin. Spraying of cow urine (25–100%) at 10–15 ml/bee frame or hive frame and terramycin sugar syrup (125 mg/L/colony) were carried out twice on the selected and marked highly infected area (100 cm^2) with a plastic hand sprayer (Flit pump); terramycin sugar syrup (125 mg/L/colony) was also given twice to the infected colony. Second spraying/feeding was done 7 days after first spraying/feeding. Six treatments and one untreated control were tested. Each treatment had three replications.

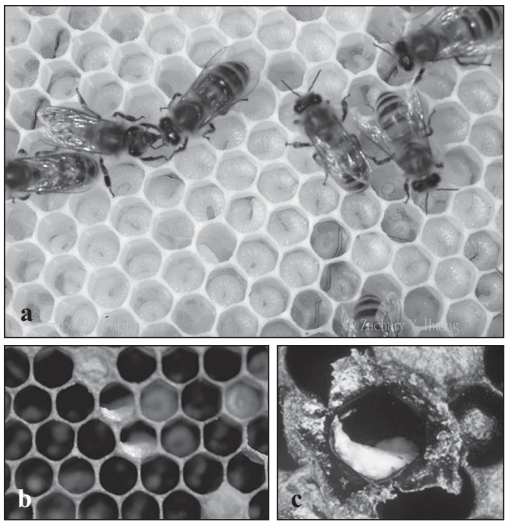

Figure 1. Honeybee colonies: (a) healthy; (b) infected; and (c) close-up of infected cell.

The recovery in infection was calculated by the formula given below:

$$\text{Recovery (\%) of infection} = \frac{\text{No. of recovered cells after spraying}}{\text{Total no. of infected cells}} \times 100$$

Observations were recorded on EFB infection level at 3, 5, and 7 days after first and second spraying.

Results and discussion

Cow urine at 50% per beehive showed rapid recovery from the disease in 8–10 days after spraying and promoted growth of brood. The application of 25–100% cow urine and terramycin at 125 mg/L sugar syrup/colony caused significant reduction in EFB infection in *A. mellifera* colonies over control. Recovery from EFB infection was 100% and observed in 10–12 days after application of cow urine at 75% and 100% at different locations. Infection recovery with cow urine at 50% was 61% to 70.67% and with cow urine at 25% was

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47.17% to 53.84% (Table 1) whereas in terramycin sugar syrup (125 mg/L/colony) spraying treatment, recovery in infection was 42.34% to 53.84% followed by 39.67% to 47.16% in terramycin sugar syrup (125 mg/L/colony) feeding treatment. In untreated control of EFB infected bee colonies no recovery in bacterial infection was observed. All treatments proved superior to untreated control. In control bee colonies, the infection level of EFB increased gradually with development of the colony and newer healthy brood cells were infected and the colonies totally perished after some time. However, in the cow urine treated honeycombs the disease did not recur. Other beneficial effects of cow urine on settlement of bees during robbing, aggressiveness, increase in egg laying tendency of queen bee, and enhancement in adult cleaning (grooming) activities were also observed.

Field experiments were conducted during 2006–12 on the efficacy of cow urine in comparison with the antibiotic terramycin at the apiaries of 23 beekeepers at five locations of Tarai (Dineshpur, Pantnagar) and Bhabar (Ramnagar, Haldwani, Banbasa) regions of Uttarakhand in India.

Similar results were obtained by Tiwari and Mall (2007) and Chand and Tiwari (2012) when they sprayed 25–100% cow urine in the EFB infected honeybee colonies at Pantnagar during March–May 2006 and at different locations in Uttarakhand during

Table 1. Effect of cow urine (desi breed) and terramycin on infection recovery of bacterial European foulbrood in honeybee *Apis mellifera* colonies at different locations in Uttarakhand during 2006–12.

Treatment	Infection (%) before spraying	Recovery (%) in infection				
		Pantnagar	Dineshpur	Haldwani	Banbasa	Ramnagar
T_1 - Cow urine (25%)	100	53.84	53.17	49.10	48.34	47.17
T_2 - Cow urine (50%)	100	70.67	61.00	67.50	66.17	66.67
T_3 - Cow urine (75%)	100	100.00	100.00	100.00	100.00	100.00
T_4 - Cow urine (100%)	100	100.00	100.00	100.00	100.00	100.00
T_5 - Terramycin sugar syrup (125 mg/L/ colony) feeding	100	44.17	47.16	40.67	39.67	41.17
T_6 - Terramycin sugar syrup (125 mg/L/ colony) spraying	100	44.51	44.34	42.34	49.00	53.84
T_7 - Control	100	0.0	0.0	0.0	0.0	0.0

2009–10. Tiwari (2014) reported the original and novel research findings of her work on the use of plant and animal origin products for honeybee mite infestation management in Uttarakhand. Cow urine from desi and Jersey cows and powders of *ajwain* (*Trachyspermum ammi*) seeds and neem leaves were used to manage mite infestation in honeybee *A. mellifera* colonies. The use of cow urine in beekeeping is a novel approach throughout the world. It is cost-effective with no residual activity and could be recommended as a novel technology for the management of EFB disease and mite infestation in honeybee colonies.

Organic technique developed for honeybee disease management

Basic steps

1. Use cow urine (preferably desi cow breed).
2. Spray pure cow urine gently on the brood and the bees with one hand distance from the hive frame.
3. Use plastic hand sprayer only. Flit pump costing ₹ 40–80 is commonly used.
4. Do not use knapsack sprayer which is used in the field to spray insecticides on crops.
5. Spray cow urine at the hive entrance and all around to repel the robber bees, predatory wasps, and ants.
6. If mite infestation is very high, place sticky paper on the bottom board and spray cow urine on the infested bee comb and remove the sticky paper (with dropped mites) after 2–3 days of spraying.
7. Do not use any chemical or antibiotic along with cow urine.
8. Do not spray cow urine during honey extraction.
9. Extract honey from super chambers to maintain purity of honey.

Recommendations

Spray 50–100 ml pure cow urine per beehive at 15-day intervals to make the disease infected honeybee colonies healthy and strong with no adverse effect on the working efficiency of worker bees, egg laying capacity of queen bee, and quality of honey.

Spraying of cow urine should be done during off-season (from April to September). If cow urine spraying is required during honey flow season then extract honey from supers (honey chambers) or do not spray cow urine 10 days before honey extraction.

Adoption of cow urine technique for beekeeping

The experiments conducted on use of cow urine in honeybee colonies at five locations of Uttarakhand during 2006–12 were successful. Feedback was received from the beekeepers by visiting their areas or through post regarding the success achieved by them in controlling bee diseases in *A. mellifera* colonies. According to them the use of cow urine against almost all microbial diseases of honeybees was promising. Also, wasp attack, robbing amongst the bees, and

stinging tendency of bees were reduced. Data on use of cow urine by the beekeepers of different areas in Uttarakhand, duration of its use, increase in number of bee colonies by using cow urine to control diseases of bees, and increase in honey production were also collected. These data again confirmed that cow urine is the safest, cheapest, and easily available natural product for bee disease management which controls bee diseases and increases honey production.

Beekeepers are using this technology since 2008 till date at different locations in Uttarakhand and Uttar Pradesh. They collect about 40–50 kg honey per hive under commercial (migratory) beekeeping. Observations were made by the beekeepers after spraying pure cow urine in honeybee colonies and the following feedback was received:

- There was rapid and 100% recovery in bacterial infection and brood growth was promoted.
- The worker bees started working more efficiently and they took out unhealthy larvae from the infected cells and cleaned the brood area. Then, the queen bee laid eggs in these cells.
- No adverse effects were observed on the healthy brood (eggs, larvae, pupae), newly hatched eggs, egg laying capacity of queen bee, and worker bee activities.
- Due to regular spraying of cow urine in the colonies at 10- to 15-day intervals, recurrence of disease was also not observed.
- Some additional positive effects of spraying of cow urine are: protection of colonies from robbing and wasp attack, and marked reduction in the stinging capacity of worker bees.
- Cow urine does not contaminate beehive products.
- It is helpful in managing almost all types of microbial problems such as bacterial, viral, and fungal diseases as well as indirect control of mites in the honeybee colonies, as the brood becomes healthy and the worker bees work efficiently.
- The chemicals used for killing the microbes have had a bad effect on the production of bee larvae but cow urine surpasses such effects.
- On the onset of honey flow season, stored empty bee frames were dipped in pure cow urine for one hour and dried under shade. Replacing these in the beehives provide protection from the attack of diseases and pests of honeybees.

Several beekeepers, both men and women, in the Indian states of Uttarakhand, Uttar Pradesh, Rajasthan, Punjab, Haryana, Bihar, and West Bengal have adopted this eco-friendly novel technique that we developed and have benefitted with successful bee management and high honey production (Fig. 2).

Success stories of beekeepers

PC Joshi, Uttarakhand

Puran Chandra Joshi and his wife Neema Joshi of Madhuban Colony, Talla Lohariyasaal, Haldwani, Nainital district,

Figure 2. Adoption of cow urine for bee management: (a) Dr Ruchira Tiwari (extreme right) with beekeepers at apiary site in Dineshpur, Uttarakhand; and (b) Ms Yashoda Verma spraying cow urine in beehive in Ramnagar, Uttarakhand.

Uttarakhand have established *Aadarsh Madhuvaatika* (Model Apiary) by spraying cow urine at 15-day intervals on the brood and bees. Neema Joshi sprays cow urine everyday in her apiary to purify it (Fig. 3).

PC Joshi started beekeeping in 1994. In 2005, he had 300 colonies which perished in 2006–07 due to mite infestation and EFB disease and only 30 colonies remained. He sprayed cow urine in his honeybee colonies as a part of our experiment and observed miraculous results within a month. By spraying cow urine regularly at 15-day intervals in the brood and on the bees in the apiary, he has established *Aadarsh Madhuvaatika*. He said that he used only pure urine of desi cow in bee colonies and observed improved growth and development of honeybees, which resulted in efficient pollination and increased honey production. In 2013–14, under migratory beekeeping honey production in his apiary was 6 tons.

SK Tomar, Uttarakhand

Surendra Kumar Tomar is a leading beekeeper in the village Changamajhari, Haridwar district, Uttarakhand. He started beekeeping business in the year 2000. He installed the first two boxes for beekeeping in his village with an investment of only ₹ 1500. With proper management of bee colonies, he now has 300 honeybee boxes with 290 honeybee colonies. In 2005–06, he had lost most of his bee colonies due to EFB infection and mite infestation and was left with only 70 colonies. He used oxalic acid, sulfur, and formic acid for the control of diseases but most of the colonies perished which resulted in a great loss. In March 2008, he contacted the author over phone after reading about the efficacy of

The use of cow urine in beekeeping is a novel approach throughout the world.

Figure 3. Ms Neema Joshi uses Flit pump to spray cow urine on bee frames in her apiary in Haldwani, Uttarakhand.

cow urine against the disease of honeybee which appeared in the local newspaper *Amar Ujala*. Use of cow urine and its application technique, dose, and waiting period were described. He then started spraying cow urine on infected bee colonies in March 2008 and observed a miraculous recovery in the infected bee colonies as they became healthy within 10–15 days after spraying. There was indirect control of ecto-parasitic mites, which he found on the bottom board while cleaning of the cells by the workerbees. He also observed that the workers started working actively and cleaned all the punctured and infected cells in the honeybee colonies. The new brood became bright and healthy. He mentioned in his letter to the author that he was totally satisfied with use of cow urine in managing the bee colonies against EFB infection and as a preventive measure too. He said: "I am not using any chemical or antibiotic for bee disease management and have total faith in cow urine as it has a multipurpose effect on the bee colonies." He admitted that he got a benefit of about ₹ 2 lakhs in 2014 out of these colonies by selling honey, beeswax, and honeybee colonies as compared to the previous year (2013) with benefit of only ₹ 80,000.

SC Joshi, Uttar Pradesh

Shekhar Chandra Joshi is a native of Thal, Pithoragrah, Uttarakhand, but presently he is residing in Rampur, Uttar Pradesh. He runs a beekeeping center and provides training under National Bee Board, National Bank for Agriculture and Rural Development (NABARD), and Indian Council of Agricultural Research (ICAR). He won the National Award for commercial beekeeping in 2003. Since 2010 he has managed bee diseases and pests only by spraying cow urine during the off-season. Before spraying cow urine in 2008, he had only 45 beehives. He now has 100 bee colonies and extracts 100 kg honey from each colony (hive) by using this technique and supers (honey chambers). He said: "Cow urine is working like '*Sanjivani*' (immortal or life giving) for bees." In 2013–14, honey production in his apiary was 10 tons. The honey extracted by him has great demand and also fetches more price in the market. He is also exporting honey to European countries after honey testing.

Dayanand Sharma, Uttar Pradesh

Dayanand Sharma is a leading beekeeper in the village Khandeli, Shahabad, Rampur in Uttar Pradesh. He started beekeeping business in 2004 with only 5 bee colonies and increased the bee colonies to 50 by 2006 but due to attack of diseases, the colonies perished and he was left with only 18 bee colonies in August 2008. He too read about the efficacy of cow urine in the newspaper and contacted the author over phone. The author described the cow urine technique and also visited his site at Rampur to demonstrate the application of cow urine in the bee colonies. He was surprised when he observed 100% recovery in EFB infection along with control of ecto-parasitic mite infestation, and nosema (fungal) disease in his bee colonies within 15 days of cow urine application. He now has 110 colonies and gets a benefit of ₹ 1.5 lakhs by selling honey and bee colonies unlike in 2007–08 when there was no benefit as most of the bee colonies perished due to disease attack. In 2013–14, honey production in his apiary was 7 tons. He said: "I am using only cow urine to manage the honeybee diseases as I have three cows. I found it as '*Sanjivani*' (immortal or life giving) for bee health and hive products." He has now developed faith in cow urine as a preventive measure against honeybee diseases and is extending the technology to other beekeepers. Dayanand Sharma is a commercial beekeeper, who also practices migratory beekeeping. During the migratory period of the bee colonies to different states (Punjab, Haryana, Rajasthan), he carries cow urine in a big container (30–40 liters) and sprays it twice a month in bee colonies on the brood and bees as a preventive measure.

Extension programs

Mr Michael Wilhelm Guenter Dreyer, Yoga and Meditation teacher, Psychological Ayurveda Counselor, and beekeeper from Bremen, Germany saw a video film on Internet (YouTube) on the author's research on "Use of cow urine in honeybee disease management". He was highly impressed and appreciated this work. He visited the Department of Entomology at GB Pant University of Agriculture and Technology (GBPUAT), Pantnagar on 21 February 2012 to discuss and learn about the novel technique that we developed for beekeeping (Fig. 4). He took samples of cow urine of different breeds available at Pantnagar like Sahiwal, Hybrid, Holistin, Jersey, etc. for conducting experiments on management of honeybee diseases and natural enemies in Bremen. He tested our organic technology on beehives during February 2012 to August 2013 and found cow urine spray effective in bee disease management (Fig. 5). About 220 kg of honey was extracted from only 9 beehives in Bremen during honey flow season (2013) in comparison to only 50–60 kg of honey extracted during 2011–12 before spraying cow urine. Mr Dreyer presented a paper on cow urine technology for bee management to the members of Beekeepers Association "De Immen" at Bremen, Germany in September 2012.

Five Beekeepers from Nepal visited GBPUAT, Pantnagar during *Kisan Mela* in October 2012. The cow urine technology

Figure 4. Dr Ruchira Tiwari (extreme left) demonstrating the technology of using cow urine in bee disease management to Mr Michael Dreyer (extreme right) from Bremen, Germany at apiary site in Dineshpur in Uttarakhand.

was demonstrated to them at the apiary site in Pantnagar and at the apiary sites of beekeepers in Dineshpur and Haldwani, who have adopted this technology since 2008. The beekeepers from Nepal visited Pantnagar during *Kisan Mela* in subsequent years and interacted with Indian beekeepers to share their experiences and findings on the use of cow urine for honeybee disease management (Fig. 6).

Marketing of organic honey

DSL Pvt. Ltd., a manufacturer of Ayurvedic and Homeopathic medicines in Lucknow, Uttar Pradesh has collected honey samples for quality testing, from the apiary sites of the beekeepers from Uttarakhand and Uttar Pradesh who have adopted this organic approach in bee management. The apiary sites tested were Haldwani, Dineshpur, Kashipur, Banbasa, and Dhanuari (Haridwar) in Uttarakhand and Rampur, Badaun, and Moradabad in Uttar Pradesh. According to the standard parameters for honey quality testing of Ayurvedic Pharmacopoeia of India by the Government of India, the collected honey samples were tested for moisture content, sugar level, heavy metals (cadmium, lead, arsenic, mercury, etc.), and microbial counts. All the collected samples were found pure. Hence, the company showed interest in purchasing honey from these

Figure 5. Apiary in Bremen, Germany (left); cow urine sprayed for bee disease management (right).

Figure 6. Beekeepers from India and Nepal who adopted cow urine technology for bee management, at the stall *Madhumakhi Pradarshini* (Honey Fair) in October 2013 at Pantnagar.

beekeepers according to their demand by paying higher price for honey compared to the market price. Thus, beekeepers of these areas have adopted cow urine as a cheap, safe, and easily available natural product of animal origin for having multipurpose benefits in honeybee management.

Innovation

The technique that we developed is a novel approach. Cow urine can serve as a potential eco-friendly measure for disease management in honeybee colonies and can be a suitable alternative to conventional chemicals such as thymol, sulfur, etc. It is also safe, eco-friendly, readily available, almost free of cost to beekeepers and has a long-term beneficial impact without having any adverse effect on the brood and bees in honeybee colonies. This novel approach in apiculture has great potential of adoption not only all over India but also in other countries for organic honey production.

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