Barriers to Successful Beekeeping: Insights from the Jammu Region of Jammu and Kashmir

Abstract

This study focusedon the constraints faced by the beekeepers of Jammu region of Jammu and Kashmir, evaluating constraints perceived by the beekeepers identified from KrishiVigyanKendras (KVKs) who have been involved in beekeeping for thelast five years at leastand the beekeepers taken were eight in number. HenryGarrett's ranking and Chi-square test were used for analyzing the data. Findings indicated that production constraints were primarily due to thedisease of honey bees (74.80), death of thecolony (66.40), and heavy rainfall (63.40). Marketing constraints includedthefluctuating price of raw honey (71.40), unorganized and unregulated markets (62.40) and lack of government concern or support forthemarketing of honey (54.40). Economic constraints featuredthehuge cost of investment is ranked first with anaverage score of54.00, followed by no insurance with anaverage score of53.00 and lack of credit supply for costly implements used in processing, packaging and quality testing (52.00). Chi-square test revealed that certain constraints such as, the lack of beehive equipments and materials in the local market (17.16), the death of the colony (9.39), pesticide poisoning(10.58), non-availability of quality testing labs (14.55) and no insurance (10.94)were showing significance and were dependent of geographical differences. By addressing all these constraints through targeted interventions could significantly enhance the viability of beekeeping.

***Keywords**:KVKs, constraints, Henry Garrett'sranking, colony, raw honey, significant.*

Introduction

Apiculture is the cultivation and care of honeybees to extract honey from them. The management of the honey bee colonies or hives is beekeeping (or apiculture). The honey-bee which is a social species lives in big settlements of up to 100,000 individuals. An apiarist or beekeeper keeps bees for the collection of sweet honey and beeswax, or for pollination of crops. A bee garden is known as a beehive or "bee yard." Beekeeping is a scientific insect breeding process capable of producing honey and wax (Kumar and Sharma, 2014; Vasukidevi*et al.*, 2021). Apiculture as a venture is relatively acceptable by people of all ages, genders, religion and class. It is comparatively cheap compared to other income-generating activities. Beekeeping includes the collection and taking care of bees, pollination of field crops by bees, the study of bee products and the breeding of bees for honey production either in a small or large scale. Beekeeping for honey production is a profitable agricultural enterprise nowadays in all parts of the world. It is an important foreign exchange earner for those who export honey and beeswax (Islam *et al.*, 2016; Agboola *et al.*, 2021). Around 1.8 million tonnes of honey were produced worldwide in 2021. The largest producer is China with an annual production of 486,000 tonnes. It was followed by Turkey (96,300 tonnes) and Iran (77,200 tonnes) according to the Food and Agriculture Organisation.India is one of the top nations exporting honey worldwide. India's organic honey has made its way to markets in the United States, United

Kingdom, Japan, France, Italy, Spain, and other countries. About 74,413 million tonnes of honey worth Rs. 1221.17 crores was exported by India in 2021–22. The US, Saudi Arabia, Canada, Bangladesh, and Qatar are some of the main export markets. The National Bee Board (NBB) in India is actively engaged in promotion and development of beekeeping.On the National Bee Board, there are presently about 13,000 beekeepers registered and employ more than 3 lakh, rural people.Khadi and Village Industries Commission (KVIC) took the task of further development of the beekeeping industry to uplift the financial status of people living in extremely interior rural areas by introducing and popularizing scientific beekeeping. The State Khadi & Village Industries Boards (KVIB) and Non-Government Organizations (Beekeeping NGOs) registered with KVIC and KVIB are taking part in beekeeping programs in the country. According to the reports of theInternational Market Analysis Research and Consulting Group (IMARC Group), the Indian apiculture market size reached 25,760.90 million rupees in 2023 and expects the market to reach 63,474.60 million rupees by 2032, exhibiting a growth rate (CAGR) of 10.2 percentduring 2024-2032. Growing demand for honey and other bee products, the increasing awareness of the health benefits of honey, and the surging need for organic food products represent some of the key factors driving the market.Rising Kashmir newspaper (2023) reported that beekeeping or apiculture has been one of the age-old traditions in Jammu and Kashmir, which is now turning into a lucrative business with governments' progressive policies and initiatives. The J&K UT administration, through its KrishiVigyanKendras (KVKs) and Department of Agriculture, is imparting technical skills among the farmers. Jammu and Kashmir government has launched a Rs 46.65 crore `Promotion of Beekeeping' project to increase the annual honey production to 66100 quintal in the UT and the population of bees will be enhanced by 333.00percent (1,43,000). The total honey production in India in the year 2023-24 was 146.30 thousand metric tonnes and for Jammu and Kashmir UT, production has increased from 2.30 thousand metric tonnes in 2020-21 to 3.14 thousand metric tonnes in 2023-24 (Report of India stat, 2024).

Material and Methods Used

Locale of the study:

The study was conducted in the Jammu region of Jammu and Kashmir UT. Firstly, alist of progressive farmers was procured from the KrishiVigyanKendras (KVKs) of theJammu region and purposively selectedonly those farmers who were doing beekeeping agro-enterprisefrom minimum last five years and thereby only eight progressive farmers were chosen out of ten farmers in the list by employing the proportional method of sampling.

Data collection:

The primary data were collected through a well-structured and pre-tested schedule by personally interviewing the progressive farmers trained underKVKs of Jammu region especially KVKs of Jammu, Samba and Kathua, as the farmers doing beekeeping, contained in the list were from these KVKs only and were having atleast five years' experience in this agro-enterprise,.Secondary data were collected from various official websites, annual reports, statistical digest of J&K, research articles, newspapers etc.Collected data were further tabulated and analyzedby using suitable statistical tools.

Method of analysing the data:

Suitable statistical methods and tools given below were used for analyzing the collected data in this study. Thecollected data wereanalyzedthrough Henry Garrett's Ranking technique to find out the frequency distribution of the problems so that we can find out which constraint is mostly faced by the farmers and ranking of the constraints was done accordingly. As per this method, the farmers were asked toassignarankforeachcategoryoftheconstraintsproposedtothem (Kumar *et. al*., 2021).Thepercentpositionforeachrankwascalculatedwiththehelpofthefollowingformula:

$$\text{Percent Position} = \frac{R_{ij} - 0.5}{N_j} \times 100$$

Where,

R_{ij}=Rankgivenfortheithfactorbythejthrespondent,

N_j=Numberoffactorrankedbythejthrespondent

Thereafter, theChi-Square test was used to test theindependence of theconstraintsamongselecteddistricts. Biswal (2024) defined that thechi-squared test (χ^2) is utilized to examine discrepancies between the data distributions that are observed and those that are expected. It is also known as Pearson's chi-squared test as it was developed in 1900 by Karl Pearson for the analysis of categorical data and distribution. P stands for probability here. To calculate the p-value, the chi-square test is used in statistics. The different values of p indicate the different hypothesis interpretations, are given below:

H_O: states that the observed constraints among the districts are independent to each other.

If, P>.05; H_0: Hypothesis Accepted,

H_1: This implies that there is no significant difference of constraints among the districts and are showing dependence on each other

If, P≤ 0.05; then, hypothesis (H_0) rejected

The formula for chi-square can be written as;

$$\chi^2 = \sum \frac{(\text{Observed value} - \text{Expected value})2}{\text{Expected value}}$$

Or,

$$\sum \frac{(Oi - Ei)2}{E_i} \square \chi^2 \textbf{ (R-1) df}$$

Where,

O_i is the observed value of average score of each constraint
E_i is the expected value of average score of each constraint
R is the number of Districts
df is the degree of freedom

Results and Discussion

Production Constraints:

Table 1 depicted that the most influential constraints which were affecting the production process of the beekeepingwere death of thecolony with an average score of78.00 (Rank I), followed by diseases of honey beeswith amean score of75.00 (Rank II) and lack of beehive equipment and materials in the local marketwith average score 72.00 (Rank III) in theJammu district of Jammu region.Forthe Samba district, diseases of honey bees with an average Garrett score of81.00 (Rank I), followed by death of colony withan average score of69.00 (Rank II) and the heavy rainfall with an average score of 62.00 (Rank III), were the most severe constraints which have been faced by the beekeepers. For theKathua district, heavy rainfall (81.00),adulteration (69.00) and diseases of honey

Table 1: Production constraints perceived by the beekeepers under study area

Particulars	Jammu		Samba		Kathua		Overall	
	Average Score	Rank	Average Score	Rank	Average Score	Rank	Average Score	Rank
Lack of proper adoption of technological knowledge and skilled human labor.	25.50	VIII	19.00	IX	31.00	VIII	23.80	IX
Shortage of beehives and forage.	25.00	IX	31.00	VIII	19.00	IX	26.20	VIII
Diseases of honey bees.	75.00	II	81.00	I	62.00	III	74.80	I
Lack of beehive equipment and materials in the local market	72.00	III	38.00	VII	38.00	VII	39.20	VII
Death of colony.	78.00	I	69.00	II	44.00	VI	66.40	II
Heavy rainfall.	56.00	IV	62.00	III	81.00	I	63.40	III
Inability in the part of beekeepers to move their colonies to other places.	41.00	VI	47.00	VI	50.00	V	46.20	VI
Pesticide Poisoning.	28.00	VII	49.50	V	55.00	IV	53.20	V
Adulteration.	55.00	V	50.00	IV	69.00	II	55.80	IV

bees (66.40) wereranked as I, II and III respectively. On an overall basis, we have found that thediseases of honey bees withan average Garrett score of 74.80 (Rank I) followed by thedeath ofcolonywith an average Garrett score of 66.40 (Rank II) and the heavy rainfall with an average score of 63.40 (Rank III) were the most persistent problems existed in the study area. Others

problemswerealso having significant impact on production such as adulteration, inability in the part of beekeepers for moving their colonies to other places and pesticide poisoning.

Marketing Constraints

Table 2 revealed that the major marketing problems were thefluctuating price of raw honey with Garrett score 78.00 (Rank I), followed by unorganized and unregulated markets with an average score of 61.50(Rank II) and unavailability of aquality testing labwith an average score of53.50 (Rank III). In the Samba district,fluctuating price of raw honey, lack of government concern and support for the marketing of honey and unorganized and unregulated markets with an average score of72.00, 67.50 and 61.50 were rankedas rank I, rank II and rank III respectively. Unavailability of quality testing lab (78.00), unorganised and unregulated markets (66.00) and fluctuating price of raw honey (57.00) have been ranked as rank I, rank II and rank III respectively for Kathua district. On an overall basis, the unfixed price of raw honeywas ranked higher with an average score of 71.94 followed by unorganized and unregulated markets (Rank II) and lack of government concern and support for the marketing of honey (Rank III).

Table 2. Marketing Constraints perceived by the beekeepers under study area

Particulars	Jammu		Samba		Kathua		Overall	
	Average score	Rank	Average score	Rank	Average score	Rank	Average score	Rank
Fluctuating price of raw honey	78.00	I	72.00	I	57.00	III	71.40	I
Lack of government concern and support for the marketing of honey	43.50	IV	67.50	II	50.00	IV	54.40	III
Unorganized and unregulated markets	61.50	II	61.50	III	66.00	II	62.40	II
Lack of proper storage containers and facilities	34.00	VII	42.00	V	21.00	VII	34.60	VI
Lack of information about honey market	43.00	V	46.50	IV	43.00	V	44.40	V
Cumbersome procedure for registration as a firm for sale of honey in retail	35.50	VI	21.00	VII	34.00	VI	29.40	VII
Unavailability of Quality testing lab	53.50	III	38.50	VI	78.00	I	52.40	IV

Economic Constraints

Table 3. depicted the economic problemswhich have been faced by the beekeepers, three major problems are the high cost on investment with an average Garrett score of67.50, followed by the higher labor cost(62.50) andlack of credit supply for costly implements used in processing,

Table 3. Economic Constraints perceived by the beekeepers under study area

Particulars	Jammu		Samba		Kathua		Overall	
	Average score	Rank	Average score	Rank	Average score	Rank	Average score	Rank
Lack of credit supply for costly implements used in processing, packaging and quality testing	55.00	III	75.00	I	60.00	II	52.00	III
Financial problems	25.00	V	37.50	V	25.00	V	30.00	V
High cost on investment	67.50	I	42.50	III	50.00	III	54.00	I
No insurance	40.00	IV	55.00	II	75.00	I	53.00	II
Higher labor cost	62.50	II	40.00	IV	40.00	IV	49.00	IV

packaging and qualitytesting (55.00)were ranked as I, II and III respectively,in case of the Jammu district of Jammu region.Same pattern of ranking was shown in the Samba district with lack of credit supply for costlyimplements used in processing, packaging and quality testing having an average Garrett score of65.20 followed by no insurance (55.00) and the high cost on investment (42.50).For Kathua district, no insurance is ranked first with an average score of75.00, followed by the lack of credit supply for costly implements used in processing, packaging and quality testing with an average score of (60.00) andthe high cost on investment (50.00) were ranked as II and III respectively. When talked about the overall farms, the high cost on investmentwas ranked first with an average score of54.00, followed by no insurance (53.00) and lack of credit supply for costly implements used in processing, packaging and quality testing (52.00), which were being ranked as rank II and rank III, respectively.

Test of significance

From the results of table 4., it has been shown that among the production constraints, only the lack of beehive equipment and materials in the local market (17.16), the death of the colony (9.39) and the pesticide poisoning(10.58) were showing significance with significant their chi-square values and depicting their dependencyamong the selected districts. In case of the marketing constraints,

Table 4. Test of independence for the constraints faced by beekeepers under study

Production Constraints	Chi-square value
Lack of proper adoption of technological knowledge and skilled human labor	2.90
Shortage of beehives and forage	2.98
Diseases of honey bees	2.69
Lack of beehive equipment and materials in the local market	**17.16***

Death of colony	**9.39***
Heavy rainfall	5.53
Inability in the part of beekeepers to movetheir colonies to other places	1.07
Pesticide poisoning	**10.58***
Adulteration	3.45
Marketing Constraints	
Fluctuating price of raw honey	3.42
Lack of government concern and support for the marketing of honey	5.73
Unorganized and unregulated markets	0.22
Lack of proper storage containers and facilities	6.95
Lack of information about honey market	0.19
Cumbersome procedure for registration as a firm for sale of honey in retail	4.26
Non-availability of quality testing lab	**14.55***
Economic Constraints	
Lack of credit supply for costly implements used in processing, packaging and quality testing	4.43
Financial problems	3.64
High cost on investment	6.23
No insurance	**10.94***
Higher labor cost	7.20

*significance at 0.05 % level

only the non-availability of quality testing lab (14.55) was found to be significant, thusexhibiting dependency among the districts. In case of the economic problems, no insurance available for the beecolonies was found to be significant and was showing dependencyamong the three districts of Jammu region.

Conclusion:

This study is all about the problems faced by the beekeepers of Jammu region during production and marketing. The constraintsare being analyzedthrough statistical tools. Various constraints like thedisease of the colony, death of the colony, heavy rainfall, adulteration etc. are the major constraints faced during production and the fluctuating price of raw honey, unorganized and unregulated markets, lack of government concern and support for the marketing of honey etc. during the marketing process of honey. Thus,favorablemodifications should be done in order to bring out the proper development of this agro-enterprise such as proper disease management strategies by finding out the causes of diseases occurrence especially, an ectoparasitemite named Varroa destructor cause a huge damage to the bee colonies of *ApisMellifera* species of honeybee. Thus, a proper recommended dose of insecticides can reduce the damage of the colonies by killing the pests. Also, the regularised markets should be present at the regional level, so that the beekeepers can easily sell their honey at fixed rates. The availability of equipments is also an issue of concern to be resolvedfor aneasygoing process of beekeeping, as the beekeepers are used to be worried about the high costs of equipments purchased from other states and thereby the cost of equipments increased due totheir high transportation costs. This, in turn, increases the cost of rearing the beecolonies by beekeepers.Proper

honey testing labs should also be available for testing the quality of honey, which, in turn, will help the beekeepers to market their honey at higher prices. So, all these factors should be considered and the proper managing decisions to tackle all these prevalent problems should be taken, which will in turn, encourage other farmers to take up this agro-enterprise and secure their sustenance by easily making money and profits out of this agro-enterprise.

Disclaimer (Artificial intelligence):

I, GoldyBhagat, hereby declare that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Acknowledgement:

This study is basically an outcome of the doctoral work of GoldyBhagat, with support from the Indian Council of Social Science Research (ICSSR), New Delhi. The author(s) extend their gratitude to ICSSR for its invaluable financial backing.

References:

Agboola, I.S., George- Onaho, J.A., Ete, J.A. and Ayandokun, A. (2021). Contribution of Apiculture in Social and Economic Development of Nigeria. J. *Appl. Sci. Environ. Manage.*Vol. **25** (9) 1559-1562,DOI:10.4314/jasem.v25i9.2.

Abrol, D.P. 2023. Beekeeping for Sustainable Economic Development of India: Challenges and Opportunities. *J Indian Inst Sci* **103**, 997–1017. https://doi.org/10.1007/s41745-023-00374-9.

Anonymous (2023). 1,43,000 new bee colonies to be set up enhancing honey production to 66100 quintal in J&K. *Rising Kashmir newspaper*, online desk, March 9, 2023.http://www.risingkashmir.in/

Anonymous (2023).Indian Apiculture Market Report by Product Type (Honey, Beeswax), Application (Direct Consumption, Food and Beverages, Pharmaceuticals, Cosmetics, and Others), and Region 2024-2032, *Market research report of IMARC Group*.https://www.researchandmarkets.com/

Anonymous (2024). www.indiastat.com/data/agriculture/apiculture-beekeeping/ Statistics and Growth Figures Year-wise of india.

Biswal, A. (2024). What is a Chi-Square Test? Formula, Examples & Application.*Data Science & Business Analytics*, Simplilearn Solutions.https://www.simplilearn.com/

Islam, M.R. Chhay, L., Milan, M.M. and Nasry, N.B. (2016). The financial analysis of apiculture profitability in Bangladesh.*Asian J. Agric.Exten.Econ. Soc*,.9(2): 1-8, DOI: 10.9734/AJAEES/2016/22985.

Kumar Y and Sharma SK. (2014) Scientific beekeeping for apiculture development. Proceedings of the workshop on Promotion of Honey beekeeping in Haryana, 113-122.https://www.hkkp.org.in/

Kumar, S., Sharma, S.andKumar, S. (2021).ConstraintsAnalysisunderDifferentFarmingSystemsintheHillsofHimachalPradesh. *FrontiersinCropImprovement*, Vol**9**:3747-3752(SpecialIssue-IX), PrintISSN:2393-8234OnlineISSN:2454-6011, http://www.asthafoundation.in/

Mushtaq, R. and Singh, H. (2023). Role of Bee colonies in Honey production for Sustainable Livelihood in Anantnag District of Kashmir Valley, J & K. *Sustainability, Agri, Food and Environmental Research*, (ISSN: 0719-3726), **11**(X): http://dx.doi.org/ 10.7770/safer-V11N1-art2390.

Olagunju, O. E., Ariyo, O. C., Olagunju, O.S. and Alabi O.F. (2022).Contribution of agroforestry practices to rural household food security status in chikun local government area of Kaduna state. Conference paper, *"Proceedings of the 8th Biennial Conference of the Forests & Forest Products Society, Held at the Forestry Research Institute of Nigeria, Ibadan, Nigeria". 14th - 20th August, 2022*.https://www.researchgate.net/

Rana R, Singhal R. (2015). Chi-square test and its application in hypothesis testing.*J PractCardiovascSci*, vol. **1**:69-71.DOI: 10.4103/2395-5414.157577.

S. R. Dash, P. J. Mishra , N. Bar, K. K . Biswas and R. R. Pani. (2022). Constraints Analysis in Adoption of Vegetable Production Technologies in Malkangiri District, Odisha. *Journal of Research in Humanities and Social Science*, Volume **10** ~ Issue 5 pp: 45-53.http://www.questjournals.com/

Satish, S. (2024).Sweet Revolution-Honey Mission. https://www.clearias.com/

Vasukidevi R., Ashok K., Kalaiarasi V. and Babu B. (2021). Apiculture status in India: An overview. *Intern. J. Zool. Invest.* **7**(2): 557-561. https://doi.org/10.33745/ijzi.2021.v07i02.034.