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Farmers' Perception on Importance of Pollinators and Pollination in Karnataka State

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ABSTRACT: The study was conducted in Kolar and Chikkaballapura districts of Karnataka state during 2020-2021 to analyse the perception level of farmers on importance of pollinators and pollination. A total of 120 (60 small and 60 big) crop growers were selected by using simple random sampling technique from twelve villages from two districts. Personal interview method was used to collect data and appropriate statistical tools were applied to analyse the data. Among small farmers, it is observed that majority of the farmers perceived that only honey bees are the beneficial insects useful for the pollination activity with (Rank I) followed by observation of reduced crop yield due to non visit of pollinators (Rank II).In case of big farmers, perception towards extension training programmes would change the view of farmers on importance of pollination and conservation of pollinators was (Rank I) along with community driven pollinator monitoring for efficient management of pollinators. Pollinator population decline (Rank II). The findings revealed that more than two-fifth (43.33 %) of farmers were with good perception level followed by poor (31.67 %) and better (25.00 %). Ex-post facto research methodology was used to conduct the current study, making it unable to overcome respondents' memory bias. The study is restricted to just two districts in the state of Karnataka as a result of the discovery that it has its own time and resource limitations. However, a lot of thought and attention went into it to make this study as complete, scientific, and objective as possible. By educating farmers about their barriers to pollinator conservation and the solutions presented to overcome those barriers, the insights gained by this study will aid in their ecological and socioeconomic betterment. By educating farmers about their barriers to pollinator conservation and the solutions presented to overcome those barriers, the insights gained by this study will aid in their ecological and socioeconomic betterment.

Keywords: Pollinators, Pollination, Farmers, Perception.

INTRODUCTION

Agriculture is an integral part of India since ancient times. Agriculture is one of the most crucial industry contributing to the country's economy and plays a crucial part in the overall socio- economic aspects of India.

Pollination is a mutually beneficial interaction between plants and pollinators. Generally, the delivery of pollen occurs as a product of eating; insect pollinators are seeking nectar (carbohydrate) or pollen (protein) and their specific behaviour and anatomy allows them to pick up and distribute pollen between flowers [Pollination is a mutually beneficial interaction between plants and pollinators. Ecologically, insects play many different roles as pests, predators and parasites, pollinators, decomposers and scavengers and so forth (Sima and Srivastava 2012).

Generally, the delivery of pollen occurs as a product of eating; insect pollinators are seeking nectar (carbohydrate) or pollen (protein) and their specific behaviour and anatomy allows them to pick up and distribute pollen between flowers [Status of Pollinators in North America, 2007]. The ecosystem service of crop pollination contributes 35 percent of the global food supply of worth $190.5 billion per year (Gallai *et al.*, 2009; Ollerton *et al.*, 2011).

Services of pollinators, particularly insects, like honey bee is of great importance in increasing the quality and yield of commercially grow crops. Insects are highly diversified organisms on earth comprising beetles, wasps, butterflies etc. (Nishchith *et al.*, 2021). However, they are neglected because insects which are studied are usually determined by visible economic considerations, and public and private funding agencies usually tend to encourage control of pests rather than encouragement of pollinators. In addition, they bring overall ecosystem resilience and play a great role in conserving biological diversity in agricultural and natural ecosystems. Pollination reduces the yield variability and increases the crop stability.

Duara (2017) hypothesized that availability of flowering plants, timing, length of flowering is

influenced by habitat and there is a direct relationship between availability of flowering plants and associated insect species diversity.

The Food and Agriculture Organization (FAO) of the United Nations estimated that currently, there is global loss of pollination services around $302 billion reduction in the value of production across all sectors and regions representing a 0.39 per cent reduction from the 2004 baseline. This was due to human related impacts such as habitat destruction, land use change, use of chemicals (pesticides and herbicides), climate change, and invasive species like Varroa destructor on honey bees. These also introduced a reduction of both in terms of number and species of native insect pollinators of crops and wild plants. Pollinators are considered ecological keystones; because a major threat to pollinators results in destruction of habitat and loss of forage.

According to a prior study by Kasina *et al.* (2009), farmers who have updated their understanding of pollination are more receptive to conservation efforts. Therefore, achieving the sustainability goals requires strong collaboration with research scientists and efficient extension services (Muchagata and Brown 2000; Gurung, 2003).

A decline in pollinating insects in India is resulting in reduced yields and could limit people's access to a nutritional diet. Indian researchers said there was a clear demarcation that productivity and population of pollinators are linked. They also explained about impact in long run on GDP due to pollination service decline. Maintaining pollination services to assure present and future food production is currently a major challenge in the design of sustainable agro-ecosystems. Over the years, majority of the farmers perceive that there have been changes in the precipitation and temperature levels and farmers should be able to cope-up with the negative effects and mitigate through various strategies (Badekhan *et al.*, 2021) and one of the negative effects is decline in pollinators and pollination services. Thus, conservation of pollinators has become critical for United Nations Sustainable Development Goals. Information regarding farmer's knowledge and perception about pollinators' role and as well as the methods used to encourage them is need of the hour and highly relevant to impact the way farmers involve in environment conservation programmes through managing their farms.

As the farmers are the custodians and ultimate beneficiaries of agricultural biodiversity, they contribute decisively in its conservation and sustainability. However, without enhancing their comprehension of agricultural biodiversity and persuading them of its significance, it is difficult to persuade them to invest in conservation and sustainability. Conservation of pollinators for improved livelihood is one of such dimensions which needs farmers' attention (Krishna, 2007).

Sustainable agroecosystems should encourage ecological balance and food production, and including farmers' local knowledge and perceptions is important to achieve both objectives. More research is required to understand farmers' views and knowledge of the benefits that insect pollinators make to agroecosystems (Smith & Sullivan 2014). The ultimate managers of the agricultural landscape are farmers on a local and regional scale, thus its critical to understand their perspectives in order to build new and long-term solutions from a science-management-practice standpoint.

MATERIALS AND METHODS

Ex- post facto research design was adopted for the study. Kolar and Chikkaballapur districts of Karnataka were identified as locale for present study. These districts are situated in the western part of Bangalore division. Both, agriculture and horticulture are prime occupations of the people in this region. Farmers of these districts extensively grow tomato, potato, carrot, chilli, mango, pomegranate, sapota, etc. as cash crops along with agricultural crops, mulberry and dairy farming. The study area was purposively selected because of diversified farming system and high production along with high productivity of various crops especially horticulture crops. One potential taluk was selected from each district. Srinivasapura taluk from Kolar district and Chintamani taluk from Chikkaballapur district were selected purposively as they have more area under horticultural crop production. Six diversified villages from each taluk were selected for the study. From each village, ten farmers were randomly selected. Thus, 120 farmers were selected from 12 diversified villages of two potential taluks.

The independent variables selected for the study were age, education, land holding, experience in farming, annual income, social participation, mass media exposure, extension participation, extension contact, participation in training programmes, value orientation, risk orientation, achievement motivation, scientific orientation and cosmopoliteness.

Scale was developed to measure the perception level of farmers on importance of pollinators and pollination in crop production. The final scale of 28 items/statements administered to the respondents along a four point continuum representing 'strongly agree', 'agree', 'disagree' and 'strongly disagree' with weightage of 4, 3, 2 and 1, respectively. The perception score of a respondent was calculated by adding up the scores obtained by him/her on all items/statements. The perception score of this scale ranges from a minimum of 28 to a maximum of 112. Higher score on this scale indicates that the respondent has higher level of perception towards importance of pollination and pollinators.

It refers to process of interpretation or becoming aware about importance of pollination and pollinators through senses and achieving the understanding.

Collection and editing of items: A list of 35 items/statements reflecting the perception about importance of pollination and pollinators was prepared through extensive review of literature and discussion with social scientists as well as entomologists.

Relevancy test: 35 items/statements were sent to 110 judges in State Agricultural Universities, Central Agricultural Universities, Indian Council of Agricultural Research institutions, and Karnataka State Department of Agriculture with the instructions to critically evaluate each item/statement as to its relevancy to measure the perception of farmers on the importance of pollinators and pollination and give their response on a four point continuum, namely, most relevant (MR), relevant (R), less relevant (LR) and not relevant (NR) with the score of 4, 3, 2 and 1, respectively. 75 judges could all answer in good time. The relevancy score for each item or phrase was calculated by summing the scores from the 75 judges' ratings on the rating scale. From the data so gathered "Relevancy Percentage", "Relevancy Weightage" and "Mean Relevancy Score" were worked out for all the 35 items/statements by using the following formulae:

Relevancy %={(MR*4)+(R*3)+(LR*2)+(NR*1)/ maximum possible score}*100

Relevancy weightage=(MR*4)+(R*3)+(LR*2)+(NR*1) / maximum possible score

Mean relevancy score = (MR*4)+(R*3)+(LR*2)+(NR*1) / maximum possible score

Using these three criteria the individual statements were screened for their relevancies. Accordingly, items/statements having relevancy percentage of more than 70 per cent, relevancy weightage of more than 0.70 and Mean Relevancy score of more than 2.0 were considered for the final selection. By this process, 28 statements were isolated in the first stage which were suitably modified and written as per the comments of judges wherever applicable.

Item analysis: To delineate the items/statements based on the extent to which they differentiate the perception items/statements about agriculture as favourable or unfavourable, item analysis was carried out on the items/statements selected in the first stage. For item analysis, the respondents were arranged in ascending order. Twenty-five per cent of the subjects with the highest total score and 25 per cent with the lowest total scores were selected. These two groups provided the criterion groups in terms of which item analysis was conducted and critical ratio was calculated by using the following formula:

$t=X_H- X_L \div\sqrt{(X_H{}^2- (X_H)^2/n)*(X_L{}^2 - (X_L)^2/n)/ n(n-1)}$

Where, H = Individual scores in the high group

L = Individual scores in the low group

$\sum x^2_H$ = Sum of squares of the individual score on a given statement for high group

$\sum x^2_L$ = Sum of squares of the individual score on a given statement for low group

n = Number of respondents in each group

$\sum$ = Summation

T = Extent to which a given statement differentiate between the high and low group.

Based on the item analysis ('t' value), 28 items/statements were retained in the scale to measure the perception of farmers on importance of pollination and pollinators. Twenty- eight items/statements selected in the final perception scale.

A pilot study was conducted in non-sample area in Warangal district of Telangana state interviewing 30 farmers utilizing 28 statements for measuring perception of farmers on importance of pollination and pollinators.

Reliability. Reliability in its true sense refers to precision of the scale constructed for any purpose. It is otherwise called extent to which repeated measure produces the same result. In any social science research newly constructed scale has to be tested for its reliability before it is used. The split-half method was employed to test the reliability of the perception scale. The value of correlation co-efficient was 0.8739 and this was further corrected by using Spearman Brown formula and obtained the reliability co-efficient of whole set. The 'r' value of the scale was 0.9327, which was highly significant at one per cent level indicating the high reliability of the scale. It was concluded that the perception scale constructed was reliable.

1. Half test reliability formula

$$\mathbf{r^1_2 = (N*\sum XY)-(\sum X)(\sum Y) \div \sqrt{[N*\sum X^2- (\sum X)^2] - [N*\sum Y^2- ((\sum Y)^2]}}$$

Where,

$\sum$X=sum of the socres of the odd number items

$\sum$Y=sum of the scores of the even numbers items

$\sum$X2= sum of the squares of the odd number items

$\sum$Y2= sum of the squares of the even number items

2. Whole test reliability formula

$r_{12}= 2.r_{1/2}/ 1+r_{1/2}$

Where, $r_{1/2}$ =half test reliability

3. Validity formula

$V = \sqrt{r11}$

Validity: Validity is the ability of the tool to measure what it has been designed to measure. A scale's validity is the property that guarantees that the test results measure the variable it was designed to measure. Generally, the methods used to determine the validity of a scale are content or construct validity and statistical validity.

RESULTS AND DISCUSSION

Among small farmers, it is observed that majority of the farmers perceived that only honey bees are the beneficial insects useful for the pollination activity with (Rank I) followed by observation of reduced crop yield due to non visit of pollinators (Rank II), farmers perceived that new techniques, management practices for conserving pollinators and pollination are to be developed (Rank III). In case of big farmers, perception towards extension training programmes would change the view of farmers on importance of pollination and conservation of pollinators was (Rank I) along with community driven pollinator monitoring for efficient management of pollinators. Pollinator population decline (Rank II) there is a need to develop many new techniques and methods required for conserving the pollinators (Rank III).

With respect to pooled farmers, majority of farmers perceived that honey bees are the only beneficial insects useful for pollination (364 mean score) followed by perception on importance of training programmes by extension and related departments to make farmers aware about the significance of pollinators and the need to conserve them (363 mean score). Rank III (358

mean score) was given to the statement that interprets the importance of new techniques and methods required for management of pollinator population.

The above depicted results are consistent with the results of study conducted by Violeta *et al.* (2020) "**Do farmers care about pollinators? A cross-site comparison of farmers' perceptions, knowledge, and management practices for pollinator-dependent crops"** which indicated that aa total of 92.7% of respondents agreed that pollinator insects are essential for agricultural production, while 73.4% of respondents said that pollinator populations were declining on their farms. On a scale of 1 to 10, we discovered that farmers had a modest level of understanding regarding pollinators (6.1 1.8).

Table 1: Perception of farmers on importance of pollination and pollinators (n=120).

Sr. No.	Particulars	Small farmers (n_1=60)		Big farmers (n_2=60)		Total farmers (n=120)	
		Mean score	Rank	Mean score	Rank	Mean score	Rank
1.	Do you agree that some insects act as pollinators	169	VIII	171	X	340	IX
2.	Do you agree that more than half of the plant species on earth propagated by seeds are dependent on insect pollination	173	VI	165	XIV	338	X
3.	Do you agree that visitation by pollinators to flowers reduces the crop productivity	181	II	175	VII	356	IV
4.	Do you agree pollinators are necessary for increasing the production in crops	135	XVIII	133	XX	268	XXVI
5.	Do you agree that frequency of pollinators visit has reduced in recent years	174	V	162	XVI	336	XII
6.	Do you agree that spraying pesticides in your field make beneficial insects fly away from the field	165	XI	169	XI	334	XIV
7.	Do you agree that pesticides kill both beneficial and non-beneficial insects	169	VII	175	VII	344	VII
8.	Do you agree honey bees are the only beneficial insects useful for pollination	182	I	182	III	364	I
9.	Do you agree that decline in pollinator population might not be one of the reasons for the reduction of crop yield	164	XII	172	IX	336	XII
10.	Do you agree that loss incurred in crop production due to decline in pollinator population is negligible	174	VIII	173	VIII	347	VI
11.	Do you agree that the yield depends entirely on the soil fertility and other environmental factors like rain, temperature etc.	165	XI	172	IX	337	XI
12.	Do you agree that food we eat cannot be obtained without participation of pollinators	173	VI	168	XII	341	VIII
13.	Do you agree that mutual association of insects and flowers is essential	142	XVII	141	XX	283	XIII
14.	Do you agree that pollinators visit the field only for nectar collection	158	XIII	171	X	329	XVI
15	Do you agree that pollinators get benefitted by pollination activity	168	IX	167	XIII	335	XIII
16	Do you agree that quantity and quality of the crop can be increased by effective pollination	135	XVIII	163	XV	298	XX
17	Do you agree that pollinators can be considered as farmer's friends	149	XVI	177	V	326	XVII
18	Do you agree that pollination services are not being recognized	158	XIII	173	VIII	331	XV
19	Do you agree that pollinators should be treated as critical input for crop production	142	XVII	151	XVIII	293	XXII
20	Do you agree that for realizing yield potential of a crop, contribution of pollinators is high	150	XV	181	IV	331	XV
21	Do you agree that pollinators are important in maintaining the stability of crop ecosystem	142	XVII	176	VI	318	XIX
22	Do you agree that pollination services provided by insects have high economic value	131	XIX	147	XIX	278	XXIV
23	Do you agree that population of pollinators is declining in the recent years	155	XIV	186	II	341	VIII
24	Do you agree that pollinators are affected by biotic and abiotic stress conditions	142	XVII	169	XI	311	XXI
25	Do you agree that protection of pollinators is the need of the hour	164	XII	155	VII	319	XVIII
26	Do you agree community driven pollinator monitoring could be useful for more efficient management of pollinator population	167	X	188	I	355	V
27	Do you agree that techniques required for conserving pollinators population and their management are to be developed	176	III	182	III	358	III
28	Do you agree that extension training programmes would help in pollinator identification and their management more effectively	175	IV	188	I	363	II

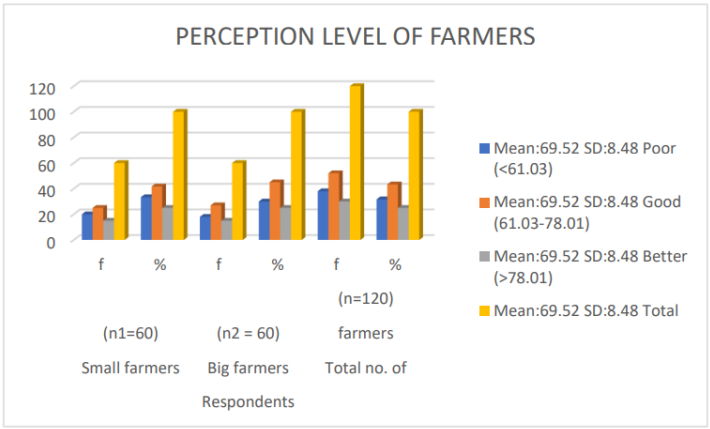
SA – Strongly Agree; A – Agree; DA – Disagree; SD – Strongly Disagree

Table 2: Overall perception of farmers towards importance of pollinators and pollination (n=120).

Perception level	Category	Respondents					
		Small farmers (n_1=60)		Big farmers (n_2 = 60)		Total no. of farmers (n=120)	
		f	%	F	%	f	%
Mean: 69.52 SD: 8.48	Poor (<61.03)	20	33.33	18	30.00	38	31.67
	Good (61.03-78.01)	25	41.67	27	45.00	52	43.33
	Better (>78.01)	15	25.00	15	25.00	30	25.00
	Total	60	100	60	100	120	100

Reducing insecticide use (53.2% of respondents), diversifying crops (42.8%), and increasing fallow fields (39.1%) were the methods for promoting pollinators that were most frequently used. Farmers' knowledge of and present use of pollinator-friendly techniques were significantly influenced by factors like education, age, worry about the pollinator catastrophe, and professional dedication to agriculture.

Slightly more than two- fifth (43.33 %) of the respondents belonged to good level of perception followed by poor (31.67 %) and better (25.00 %) level of perception about importance of pollination service and the pollinators conservation. In case of small farmers the trend observed was little high than two-fifth (41.67 %) of them belonged to good category sequenced by poor (33.33 %) and better (25.00 %) levels of perception. Among big farmers, seventy percent of the farmers come under good to better perception category. The results are inline with the study "Farmers' Knowledge and Attitudes Toward Pollination and Bees in a Maize-Producing Region of Zimbabwe: Implications for Pollinator Conservation" (Gugulethu *et al.*, 2020) in terms of knowledge level where the results showed that the majority of respondents (67%) confirmed knowledge of pollination (χ^2=96.043, p<.001), and the probability of knowing pollination was higher for those who depended on media compared with extension and school education as a source of farming information (p<.001) and are also consistent with results of the study conducted by Pudasaini *et al.* (2016) on "Farmers perception on effect of pesticide on insect pollinators" which stated that majority of the farmers are aware of decline in insect pollinators and one of the reasons was use of chemicals in the field. However, the results of the present study were in contradiction to the results of the study conducted by Theodore (2011) on "Farmers perception of pollinators importance in coffee production in Uganda" which reported that majority (90%) were unaware about the role played by bees in pollination. Vallarasu *et al.* (2022) studied farmer perception and pesticide usage pattern in snake gourd and ridge gourd grown in Tamil Nadu.



Graph 1. Perception of farmers on importance of pollinators and pollination.

A critical analysis of above data indicates that majority of the farmers had good to better level of perception regarding the importance of pollinators and pollination process. The most important reason behind the trend shown by both big and small farmers might be due to significant percentage of the farmers were under medium level of knowledge and this knowledge aspect will affect the perception of individual directly in the process of their interpretation about the importance of pollination process, the services provided by the pollinators and the importance of conservation of pollinators. It is evident that nearly one third of the farmers are having poor level of perception and the probable reason for the poor perception might be that the farmers were unaware of the insects that are beneficial especially helping in fruit set in majority of the crops, followed by lack of interest in maintaining the ecological balance and sustainability which made the farmers to have low level of perception regarding the significance of pollinators and pollination process in crop production. Lack of knowledge regarding the consequences of anthropological activities on the nature might also be one the reason for their negligence. Hence, efforts should be made by the concerned development departments to create awareness and to change the perception of farmers about importance of pollination and crop specific pollinators through appropriate training strategies

Association of personal, socio-economic and psychological characteristics of farmers with their Perception level. In order to know the association between personal, socio-economic and psychological characteristics and the perception level of farmers on importance of pollination and pollinators, the chi-square test was employed and tested for its statistical significance. The data in Table 3 reveals that small, big and total farmers on importance of pollination and pollinators. Irrespective of the landholding, characteristics like education, mass media exposure, extension participation and extension contact had shown a positive and significant association at one per cent level of significance.

Table 3: Association of personal, socio-economic and psychological characteristics of farmers with their Perception level (n=120).

Sr. No.	Independent variables	Small farmers (n_1=60)	Big farmers (n_2=60)	Total Farmers (n=120)
		Chi-square statistic	Chi-square statistic	Chi-square statistic
1.	Age	3.28^{NS}	5.65^{NS}	06.91^{NS}
2.	Education	28.49**	30.87**	31.98**
3.	Farming experience	3.82^{NS}	5.57^{NS}	05.59^{NS}
4.	Annual income	3.18^{NS}	4.36^{NS}	4.67^{NS}
5.	Social participation	10.67*	11.36*	11.54*
6.	Mass media exposure	27.82**	30.58**	31.42**
7.	Extension participation	23.74**	28.36**	30.60**
8.	Extension contact	25.69**	30.75**	33.20**
9.	Participation in training programmes	11.65*	12.93*	13.93*
10.	Value orientation	10.21*	10.39*	10.44*
11.	Risk orientation	9.65*	10.28*	10.79*
12.	Achievement motivation	11.58*	11.96*	13.54*
13.	Scientific orientation	10.72*	11.24*	13.00*
14.	Cosmopoliteness	9.87*	10.62*	10.91*

NS- Non-Significant; *- Significant at 5 per cent level; **- Significant at 1 per cent level.

Whereas social participation, participation in training programmes, value orientation, risk orientation, achievement motivation, scientific orientation and cosmopoliteness were found have positive and significant association at five per cent level of significance and the remaining characteristics like age, farming experience and annual income were found to be non-significantly associated with the perception level of farmers.

Education and Perception about importance of pollination and pollinators. Farmers who are literate are better able to comprehend the ecological services that are offered in nature for their benefit, make decisions based on that understanding, and put those decisions into practice on their farms in order to preserve those free services. Education raises farmers' levels of knowledge in terms of their capacity to organize and plan, which affects their ability to perceive and, in turn, influences their ability to make decisions and manage their farms in a way that is beneficial for the environment.

Mass media and Perception about importance of pollination and pollinators. Mass media has an inevitable role in creating awareness and increasing knowledge and changing the perception of farmers about new technologies and innovative practices. Mass media exposure was found to be associated significantly at one per cent with perception level of the farmers. Growers with higher mass media exposure are able to get enlightened with knowledge of importance in maintaining the ecological balance which further changes the ability of farmers to interpret the significance of pollinators in a positive way for further sustainable crop production and productivity and conserving aspects related to pollinators which help them for proper planning and decision making in taking up of farm operations to enhance their macro climate around their farms.

Extension participation, Extension contact and Perception about importance of pollination and pollinators. The study also revealed that extension participation and extension contact are positively and significantly associated with perception level of farmers in regard to importance of services provided by pollinators and their conservation as need of the hour. The cause of this positive association is that more the contact with extension personnel and participation in extension activities like field days, demonstrations, trainings and other awareness programmes related to enhancing the knowledge and gives the farmers an opportunity to perceive the practices related to enhancing the pollinators population in a preferrable manner and importance in regard with recognizing the significance of pollination process in increasing the crop production, productivity and practices to be adopted for conserving the pollinators. The contact with extension agents would make the farmers the earliest individuals to know the beneficial technologies and change their interpretation about technologies so as to adopt for future sustainability of their farmlands.

Social participation, Cosmopoliteness and Perception about importance of pollination and pollinators

The level of perception of farmers was shown to be significantly and favorably correlated with both social participation and cosmopoliteness. Higher levels of cosmopoliteness and social engagement among crop growers ensure that there is ample opportunity for the exchange of information, ideas, and sentiments related to society outside the farm, which may change farmers' perspectives on the value of undervalued ecological services and strengthen their cognitive abilities and decision-making skills so that they will adopt the same perspective if it will benefit them in the long run. By engaging in various activities in society, farmers are encouraged to engage in healthy competition to reach their set goals in terms of increased productivity and build leadership skills. Crop growers are also encouraged to visit successful farm units in order to comprehend and learn how to put into practice the

strategies adopted for pollinator conservation and so maintain the stability and sustainability of their production.

Value orientation, Risk orientation and Perception about importance of pollination and pollinators. The Table 03 also depicts that value orientation and risk orientation are associated with perception level of farmers on importance of pollinators in a positive and significant manner. The conceivable reason for above association of value orientation with perception level might be that the farmers have concern about the contributions done by nature for the benefit of mankind and also solicitude towards the pollinators. The risk orientation would help to gather recent updated information related to different cropping practices which help them naturally to conserve the pollinators. So, the farmers with high risk orientation would take up the risk of going to different farming practices by developing a favourable perception towards natural and organic farming leaving out the chemical farming to enhance the pollinator activity.

Participation in training programmes and Perception about importance of pollination and pollinators. Participation in educational programs about pollination and pollinators was positively and significantly correlated with farmers' perception levels. Farmers have the opportunity to increase their knowledge through training, which allows them to develop a proper perspective on the value of pollinators and enhances their abilities to operate effectively and efficiently. Therefore, farmers who have participated in more training and awareness programs on the value of pollination and pollinators in enhancing crop yield have greater perception levels.

Achievement motivation and Perception about importance of pollination and pollinators. Achievement motivation was associated in a significant and positive manner to the perception level of farmers. The inference drawn about the significant association of achievement motivation is due to the reality that the farmers expectancy for increase their crop production, productivity, incentive worth of success and maintain the ecological balance for sustainable yields in the future with minimum resources they would try to understand the importance of pollinators in balancing the ecological cycle there by gets motivated to take the decision to go for natural farming or other practices for protecting the process of pollination and pollinators population even though the practices might involve moderate risk of reduced yield in first few years of adoption. The reason of taking this decision would be high need of achievement of goals which are above than all other aspects and this achievement motivation requires a proper channel of knowledge, awareness and importantly the way the significance is perceived and interpretated by the farmers about the notable aspects and additional benefits provided by pollinators.

Scientific orientation and Perception about importance of pollination and pollinators. The study found a strong and favourable correlation between farmers' perceptions and their scientific approach. The most likely explanation for the aforementioned trend is that scientific orientation enables farmers to transform their negative perspective into a positive perception of the modern practices and technologies created to preserve the stability of the ecosystem and protect the natural services provided by nature. To improve the environmentally friendly and productive crop cultivation, which unquestionably necessitates knowledge acquisition and understanding of all the aspects related to pollination and pollinators and the significance of their role in balancing the ecosystem, farmers with a high scientific orientation will have a positive attitude toward taking up new farming techniques that are modified versions of existing techniques.

CONCLUSIONS

The study was undertaken to know the perception level of farmers on importance of pollinators and pollination in Kolar and Chikkballapur district of Karnataka. Though the districts have distinct crop diversification, the results suggest that there is still lot of scope for improvement through conservation of pollinators. Government has a obligation to reinforce the concerned organisations to conduct capacity building programmes on regular basis to the farmers on significance of conserving pollinators, their services provided to the nature and the crop production. There is a need to educate the farmers about importance of pollination services and conservation of pollinators through practices like crop rotation, IPM, educating farmers to take up disease tolerant varieties like BRG-5 in redgram (wilt tolerant), BSH-53 in sunflower (tolerant to powdery mildew), seed treatment with bioagents like Trichoderma can reduce the disease incidence in turn results in more yield and conservation of pollinators.

FUTURE SCOPE

The investigation can be carried out in other agroclimatic zones related to the economic benefits in conserving pollinators, as well as to know strategies adopted by the farmers in conserving pollinators in other regions. Experimental studies can be conducted to observe the changes in the behavioural patterns among the farmers.

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Conflict of Interest. None.

REFERENCES

Badekhan, A. and Nayak, M. R. (2021). Assessing Perception and Coping Strategies to Changing Climate by Sample Farmers of Northern Dry Zone of Karnataka. *Biological Forum – An International Journal, 13*(4), 1209-1216.

Duara, P. (2017). Impact of urbanisation on the Plant Pollinator relationship. *International Journal on Emerging Technologies, 8*(1), 136-138.

Gallai, N., Salles, J. M., Settele, J. and Vaissière, B. E. (2009). Economic Valuation of the Vulnerability of World Agriculture confronted with Pollinator decline. *Ecological Economics, 68*, 810–821.

Gugulethu, T., Abel, C. and Robert, M. (2020). Farmers' Knowledge and Attitude Towards Pollination and Bees in a Maize- Producing Region of Zimbabwe: Implications for Pollinator Conservation. *Tropical Conservation Science*, *13*, 1-13.

Gurung, A. B. (2003). Insects–a mistake in God's creation? Tharu Farmers' Perception and Knowledge of Insects: ACase Study of Gobardiha Village Development Committee, Dang-Deukhuri. Nepal. *Agriculture and Human Values, 20*, 337–370.

Kasina, M., Kraemer, M., Martius, C. and Wittmann, D. (2009). Farmers' Knowledge of Bees and their Natural History in Kakamega district, Kenya. *Journal of Apicultural Research, Res., 48*, 126–133.

Krishna, A. (2007). For Reducing Poverty Faster: Target Reasons Before People. *World Development Report*, *35*, 1947–1960.

Muchagata, M. and Brown, K. (2000). Colonist farmers' perceptions of fertility and the frontier environment in eastern Amazonia. *Agriculture and Human Values, 17*, 371–384.

National Research Council (2007). Status of Pollinators in North America; The National Academies Press: Washington, DC, USA.

Nishchith, S., Aswathanarayana Reddy, N., Ramegowda, G. K. and Krishna, H. C. (2023). Studies on Insect Pollinator Diversity, Species Richness, and Evenness on Cucumber (*Cucumis sativus* L.) in the Eastern Dry Zone of Karnataka. *Biological Forum–An International Journal*, *15*(5), 1460-1465.

Pudasaini, R., Thapa, R. B. and Tiwari, S. (2016). Farmers Perception on Effect of Pesticide on Insect Pollinators at Padampur and Jutpani VDC's, Chitwan, Nepal. *International Journal of Applied Sciences and Biotechnology*, *4*(1), 64-66.

Sima and Meera Srivastava (2012). Entomo-Fauna Associated with Bajra Crop as Observed in an Agro-ecosystem in Rajasthan, India. *International Journal of Theoretical & Applied Sciences, 4*(2), 109-121.

Smith, H. and Sullivan, C. (2014). Ecosystem Services within Agricultural Landscapes-Farmers' Perceptions. *Ecological Economics*, *98*, 72–80.

Theodore, M. (2011). Farmers Perceptions of Pollinators' Importance in Coffee Production in Uganda. *Agricultural Sciences*, *2*(3), 318-333.

Vallarasu, S., Suganthi, A., Krishnamoorthy, S. V. and Usha Nandhini Devi, H. (2022). Farmer Perception and Pesticide usage Pattern in Snake gourd and Ridge gourd grown in Tamil Nadu. *Biological Forum – An International Journal*, *14*(2a), 200-208.

Violeta, H., Marina, G. L., Rodrigo, M. S., Sara, P., Daniel, G., Maros, M., Maria, P. M., Juan, A. S. and Jose, A. G. (2020). Do Farmers Care About Pollinators? A Cross-Site of Farmers Perception, Knowledge and Management Practices for Pollinators- Dependent Crops. *International Journal of Agricultural Sustainability*, *19*, 1-14.

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