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KNOWLEDGE AND PRACTICE OF PHEROMONE TECHNOLOGIES: A CASE STUDY OF A REPRESENTATIVE DISTRICT IN BANGLADESH

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ABSTRACT

The study was attempted to explore the major factors influencing the extent of practice of pheromone technologies by the Bangladeshi farmers. The empirical data for the study were collected from the farmers of the selected villages of Nilphamari district in Bangladesh. About 70 farmers were selected randomly from 7 villages to collect the assigned data. Interview schedule and previously prepared questionnaire used to gather raw data followed by statistical analysis. The results of the study identified the following factors like lack of knowledge and awareness regarding pheromone, availability of proper pheromone, unscientific use of pesticide; as the major influential factors which can increase the extent of practice of pheromone technologies by the farmers. About 14% of the respondents possessed high level of knowledge in pheromone techniques followed by moderate level knowledge 45 % and 41% possessed low level of knowledge. Taking these findings into account the policy makers can formulate a strategy to increase the extent of practice of pheromone by the farmers for the successful agricultural production in Bangladesh.

Keywords: Pheromone survey, Bangladesh, Use of pesticide.

INTRODUCTION

Insects communicate by means of scents – pheromones, chemicals used for 'signaling'. With these they both locate and identify their mates. Pheromones are communication chemicals (Bauer, 2011). They are natural chemicals emitted in tiny quantities in the form of a vapor by virtually all known insects. It released by an organism into its environment enabling it to communicate with other members of the own species (Anonymous, 2011). They are frequently concerned in the mating process. Each insect species has its own unique signature scent (Allen, 1997). In fact, sex provides us with a powerful means of surveillance and control in the insect world. A female insect typically puffs out a thousand millionth of a gram of her signature several times a minute. Males of her species follow this scent to mate with the female. It follows that if you can identify and then duplicate that scent, you have the means of controlling the males of that species. Recent awareness by governments of the damage caused to the environment by toxic chemicals has ensured that attention will be increasingly directed towards removing these chemicals from our precariously balanced environment.

Pest problem is one of the major constraints for achieving higher production in agriculture crops. Bangladesh loses about 30% of its crops due to pests and diseases each year (BBS, 2007). The use of pesticides in crop protection has certainly contributed for minimizing yield losses. The pesticides which are needed to be applied carefully, only when the threshold limits of the pest population is exceeded. However quite often the indiscriminate and unscientific use of pesticides has led to many problems, such as pests developing resistance resurgence of once minor pest into a major problem besides environmental and food safety hazards (EPA, 2005).

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Country needs to adopt the total integrated pest management system as the insecticide-based management system has failed to control many pests. The pests are becoming resistant to almost all chemical pesticides as the frequency of spraying is gradually increasing while their efficacy is gradually decreasing. Field demonstration results prove that the use of biological agents has no adverse effect on human health and the cost effectiveness of bio-control measures is very attractive, safe & sustainable.

The use of integrated systems of pest control and pest management using pheromones rather than conventional means of spraying insecticides is one such action to minimize the quantities of these toxic substance discharged into the environment. A new generation of products designed to disrupt the insect pest mating activity and thereby reducing insect pest populations are being developed. By disrupting communications between sexes, and hence reducing mating, we diminish subsequent larval infestation and reduce crop damage. The concept of IPM is based on the recognition that no single approach to pest control offers a universal solution, and that the best crop protection can be provided by a fusion of various tactics and practices based on sound ecological principles. Pheromones are a commonly used component of many insect IPM programs.

In view of the several disadvantages associated with the unscientific use of pesticides in agriculture, there is an urgent need for minimizing the use of chemical pesticides in the management of insect pests. Growing public concern ever potential health hazards of synthetic pesticides and also steep increase in cost of cultivation/low profit making by farmers has led to the exploration of eco-friendly pest management tactics such as Integrated Pest Management (IPM).

There are so many technological gap in agricultural production occurred in Bangladesh from top to bottom level. The pheromone technology in agricultural production is not so much popular and well known to date. There are very limited reports available on pheromone practices in Bangladesh. The dissemination of such knowledge to farmer level is also very limited in respect of Bangladesh. Although this technology is more helpful to control pest insects to enhance our crop economy without hampering the unwanted problems. Since Bangladesh has agro based economy, integration of farmers with pheromone technologies and their practices in crop protection programs is of vital importance. Farmer's participation in the new technology may be considered as one of the components of realizing the actual potentialities in our agricultural production.

From the above discussion specific objectives of the study were:

1) to determine the knowledge on pheromone technologies in target area of agriculture,

2) to identify the problems encountered by the farmers in using pheromones,

3) to explore the important factors affecting the extent of pheromone technologies in Bangladesh,

MATERIALS AND METHODS

The researcher took proper care in using appropriate techniques for data gathering throughout the study. The total study took the period from November 2010 to April 2011. Interview schedule having both closed and opened-ended questions were used to collect required information.

Location of study and sampling

The study was conducted in 7 villages of Magura and Garagram union in Kishoreganj upazila under Nilphamari district. The selected farmers earned a huge income from agricultural production (mostly rice and vegetables). All of the villages are in good road communication from concerned upazila & district and surrounding upazilas. The lists of all farmers of the selected 7 villages were collected concerned upazila agriculture office with the help of UAO (Upazila Agriculture Officer), AUAO (Assistant Upazila Agriculture Officer). Total number of farmers (who engaged in both rice and vegetables cultivation) were 768 where sampling rate was 37%. The interviewees were selected based on stratified random sampling technique. Thus 70 farmers were chosen to conduct the study. The distribution of selected respondents is shown in Table 1.

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Table 1: Distribution of selected famers based on their villages.

Union Parishod	Name of village	Total population	Respondents
Garagram	Garagram	37	11
	Doliram	35	7
	Khamat garagram	40	13
Magura	Kochua	51	9
	Shah para	33	8
	Jummapara	29	12
	Dolapara	40	11
Total	7 villages	284	70

Variables of the study

To achieve the objectives of the study an interview schedule was carefully designed to collect the required information from the selected farmers. The dependent variable of this study was knowledge on pheromone technology in crop production activities in farms/crop fields. For measuring the knowledge on pheromone technologies and techniques on practices pheromone, problems faced during using the technology, 21 questions listed in the interview schedule. Each statement contains 1 mark. The statements were arranged randomly in the scale to assess the knowledge on pheromone technologies. Statements were applied on the respondents. For correct answer respondents will be given full mark. If respondents are unable to provide the answer then he or she will get zero mark. Finally total marks of 21 statements are calculated and measure knowledge on pheromone technology in crop production.

The independent variables of this study were age, education, farm size, crop cultivation area, annual income, introductory information on pheromone for insect control, training on pheromone technology, merits of pheromone techniques and experience in pheromone practices in crop field. Ages of all respondents were determined by the number of years from their date of birth to the date of interview. Based on the available information of respondent's age, they were categorized into the following: Young group considered age ranged from 20 to 30 years; medium 31 to 45 years; old- more than 45 years. One score was assigned for each and every complete year of the age. The level of education of the respondents were categorized into 3 groups like, illiterate (cannot read and write), primary level (class i-v), and secondary level (class vi-x or up). A score of one was given for every year of schooling. Based on collected data on farm size of the farmers were categorized into land less (homestead area only), marginal (0.02-0.20 ha), small (0.20-1.00 ha), medium (1.00-2.50 ha) and large (3 ha and above) [BBS, 2007].

Area under crop cultivation was measured by the area of land under farmer's management for grains and vegetable cultivation. The area was estimated in terms of full benefit to farmers or his / her family. The unit of measurement was in acre. Annual income of the respondents was measured in Bangladeshi currency (BDT) on the basis of total yearly earning from agriculture and non-agriculture sources of his/her family. Yearly earning from agricultural and non-agricultural sources was added to calculate the actual amount of annual income of the farmers.

To gather data on farmer's introductory knowledge on pheromone in insect control, 5 questions asked to all of the farmers relating pheromone type, method of application, name of insect and their pheromones, merits of pheromone using. Based on one correct answer respondents will get one score. The data on training received by the respondents on pheromone tactics in insect control was collected. It was operationalized by the number of days that a farmer had received training during their crop production. It was indicated by the total number of days of training received by a farmer under different training programs. Pheromone control farming experience of a farmer was measured by the number of years a respondent engaged in integrated crop management (formerly integrated pest management) and use of pheromone trap in crop field. The measurement included from the year of starting of first pheromone using in crop field till the year of data collection. Inputs and credits facilities of the respondents were measured by local currency (BDT).

The extent of practice of pheromone technology by the selected farmers was the dependent variable of this study and was operationalized on the basis of the extent of a farmer's use in pest control activities

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during their crop production. Respondents were asked to what extent they practice different pheromone and trap for insect control in crop field. A 4-point rating scale was used to measure the extent of practice of pheromone by the farmers. They were asked to indicate whether their extent of practice was either very high, high, low, or never. Points were awarded for each response, sufficient scoring as the highest (3, 2, 1 and 0 respectively). According to Sarker & Itohara (2008), practice index of pheromone technology was computed. The organized questionnaire made to cover the individual characteristics, related to the access to information sources, technology characteristics and awareness regarding environmental and health hazard issues.

The measurements of problems faced in the way of practices pheromone tactic to harmful pest control during crop cultivation was done. Author gained experience through consultation with experts pre-testing experience and reviewing previous research findings. Finally, a list of 10 problems prepared in the regard. A scale was prepared to indicate the extent to which each of the ten problems was applicable in the case of a respondent. The responses were obtained through a 5- point scale: 'superlative', 'high', 'medium', 'low' and 'not at all'. Problems were assigned to these responses as 4, 3, 2, 1, and 0 respectively. The problem confronted score of respondents could range from 0 to 30. Problem Confrontation Index (PCI) was calculated according to the method used by Islam et al. (2010). Thus PCI of any problem could range from 0 to 300, where 0 indicated no problem at all and 300 indicated very high problem.

Data collection and statistical analysis

Gathered data were properly compiled, tabulated, analyzed and arranged based on objectives of this study using interview schedule. Full cooperation was obtained from all concerned authority of respective agriculture office, all respondents. Interview conducted for data collection from 23rd December 2010 to 10th February 2011. The SPSS-package was used to perform the data analysis.

RESULTS AND DISCUSSION

The mean age of the respondents was 23.33 years with a range, from 20 to 54 years. The standard deviation was 5.66 which mean the age level of the respondents indicated the moderately heterogeneous group (Table 2). It revealed that the highest proportions (39%) of the respondents were between 31-45 years of age, followed by farmers of 20-30 years of age (34%). The old farmer participants were 27% of total respondent (Table 2). Among the three age categories, the total number of participants not so much differed from each other. The average education of the respondents was 4.33 and with a standard deviation of 23.33 (Table 3). Only 6% of the respondents had no education, 76% respondents had primary level education which was most of the studied farmers covered. There was a significant heterogeneous group available among the farmers based on education level (Table 3). Farm size ranged from 0.022 to 0.964 ha. The average farm size of the farmers was 0.64 ha with a standard deviation of 0.19 (Table 4). The half of the studied population is small farm holders. The average farm size was the highest in small farm (Table 4).

Table 2: Distribution of respondents based on their age level.

Category	Age limit	Respondent		Mean	Standard deviation
		Number	Percentage		
Young	20-30	24	34	23.33	5.66
Middle	31-45	27	39		
Old	More than 45	19	27		
Total		70	100		

Table 3: Distribution of respondents according to their educational level.

Category	Respondent		Mean	Std. Deviation
	No.	%		
Illiterate	5	6	6.33	28.28
Primary	53	76		
Secondary	12	18		
Total	70	100		

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Table 4: Distribution of farmers according to their farm size.

Category of Farm	Responded Farmers		Farm Size		Mean	Stad. Dev.
	No.	%	Range	Avg.		
Landless	11	16	N/A	N/A		
Marginal	24	34	0.022-0.362	0.294	0.64	0.19
Small	35	50	0.414-0.964	0.712		

The average area under crop cultivation of the respondents was 0.20 ha with a standard deviation of 0.05 ha. Area under cultivation range from 0.03 ha to 0.135 ha. The percent distribution of landless with homestead, marginal and small farmers was 16%, 34% and 50%. Majority of the respondents was small farm holders. On an average, Crop (mostly rice and vegetable) cultivation area was 0.736 ha for small farm holder, 0.381 ha for marginal farm holder and 0.21 ha for landless farm. Annual income ranges from 30,500 Tk. to 1,87,300 Tk. The average annual income of the respondents was 76,140 Tk. with a standard deviation of 27,135 Tk. The respondents were classified into three categories namely low income (less than 40,000Tk.), medium income (40,000-80,000 Tk.) and high income (more than 80,000 Tk.). Majority of them (about 58%) fell in the medium income group. A few (11%) were classified as high income group.

During practicing pheromone technology during crop production, the experience of the respondents range from 1 to 35 years with and the average experience of the respondents were 1.30 years (Table 5). About 70% had very low pheromone practices in crop cultivation, 16% had low experience, 7% had medium experience, 6% had high experience and 1 % had very high experience (Table 5). Only 1% of the farmers had been farming with pheromone technology for long time. The knowledge of pheromone farming score of the majority farmers (90%) was very low. On the other hand, 7% farmers had low knowledge and only 3% had fair knowledge on different aspects of pheromone technique for pest control. No one had good and excellent knowledge categories found (Table 6).

Table 5: Distribution of experience on pheromone technology among the respondents.

Categories	Respondents		Mean
	No.	%	
Very low (less than 5 years)	49	70	
Low (5-10 years)	11	16	
Medium (11-16 years)	5	7	1.30
High (17-22 years)	4	6	
Very high (23-35 years)	1	1	
Total	70	100	

Table 6: Profile on knowledge of pheromone technology among the farmers.

Knowledge Category	Respondents		Mean
	No	%	
Excellent (> 4)	0	0	
Good (3-4)	0	0	
Fair (2-3)	2	3	0.11
Low (1-2)	5	7	
Very low (0-1)	63	90	
Total	70	100	

The mean environmental awareness score of the pheromone using was 7.28 and majority (83%) of the respondents had low to medium level environmental awareness while only 17% of the farmers had high environmental awareness (Table 7). Likewise, more than half (53%) of the farmers had medium level health awareness with an average score of 5.22 (Table 8). Farmer's knowledge and awareness on environmental issues have definite and clear-cut impact on their extent of practice of pheromone

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technology. Farmers having higher knowledge and awareness regarding environmental problems are always eager to practice agricultural technologies that are friendly to the environment.

Table 7: Profile of the farmer's environmental awareness issues.

Level	Respondents		Mean
	Number	Percentage	
Low	22	31	7.28
Medium	36	52	
High	12	17	
Total	70	100	

Table 8: Profile of the farmer's health awareness issues.

Level	Respondents		Mean
	Number	Percentage	
Low	12	17	5.28
Medium	37	53	
High	21	30	
Total	70	100	

To promote the new technology in agricultural production or use of new technique in crop production education and awareness of farmers is important issue. To understand the environmental hazardous situation due to over use of agro-chemicals knowledge and awareness is crucial. Naturally, highly educated farmers are much aware regarding these issues rather than non-educated and primary educated farmers. An individual having awareness regarding health issues always try to take food that is safe for his health. It means that people who are aware regarding his personal health has greater preference of pesticide free food than pesticide contaminated food.

Most of the farmers use more pesticide to control pest for crop cultivation. If the farmers are aware about environmental pollution caused by pesticide and it's also cause for human health hazard then they would be more depend on pheromone technology. However, it is well established that for creating more awareness motivation can play important role for this purpose. If the Government, non-governmental organizations and mass media will take initiative to create awareness among the farmers regarding the potentiality of pheromone component and its merits then people of Bangladesh will get food without poisons. Thus it is essential to increase the awareness about the pheromone, its simple use along with the availability in market.

The pheromone technology has relatively more complex proportion to pesticide technique during crop production. Its proportion is very much important during applying in field (Vang et al., 2008). Complex technologies are relatively less practiced by the farmers. However, the ability to understand the simplicity of a new technology, farmers requires education, training, demonstration and experience. If one farmer is medium level educated, well trained and experienced then that farmer can easily assess the simplicity of a new technology in a better way than less educated and less experienced farmers. In 1999, Batz et al. reported that relatively high complexity and risk had significant negative influence on the speed of adoption.

Market price and availability of basic elements related to a technology are prime important during its adoption. Pheromone traps are more expensive relatively to the available pesticide. Farmers need to know the total cost related to insect pest control during crop production. It is well established that use of pheromone is cost effective than pesticide tactic to pest control rather than health and environmental issues (Islam et al., 2007, 2009; Mondal, 2010; Cork et al., 2004). Before thinking about adoption, the availability of the pheromone component for specific pest insects would be important things. Availability of such items should be on proper time in proper place played important role to adopt.

CONCLUSION

The age level of majority of the farmers ranged from 31 to 45 years. Most of them were 32 years of age. Education level has significant association with their knowledge on pheromone technology in

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crop protection. Nevertheless the full achievement could not be made due to inadequate pheromone in market, inadequate help from agricultural sector related to pheromone tactic, lack of pheromone, lack of cash money and other problems such as less motivation and understanding. To overcome such important problems for good adoption of pheromone technology Government should have to take necessary action with related organizations.

REFERENCES

Allen, D. C. (1997). Pheromone: Exploiting an Insect's Sense of "Smell". *New YorkForest Owner (NYFOA)*, 35 (4): 3-4. Retrieved from: http://www.dec.ny.gov/docs/ lands_forests_pdf/pheremone.pdf

Annonymous. (2011). Pheromones. Retrieved from: http://users.rcn.com/jkimball.ma. ultranet/BiologyPages/P/Pheromones.html (28 February, 2011).

Batz, et al.,(1999). The influence of technology characteristics on the rate and speed of adoption. *Agric. Econ.,* 21: 121-130.

Bauer, R.T. (2011). Chemical Communication in Decapod Shrimps: The Influence of Mating and Social Systems of the Relative Importance of Olfactory and Contact Pheromones *In:* T. Breithaupt and M. Thiel (eds.), *Chemical Communication in Crustaceans*, Springer Science & Business Media, LLC, pp: 277-296 (2011).

BBS. (2007). Statistical Yearbook of Bangladesh. Bangladesh Bureau of Statistics. Ministry of Planning, Government of People's Republic of Bangladesh, Dhaka.

Cork, et al.,(2004). Commercial adoption of pheromone as a component in ICM of rice in Bangladesh. *Asia:Reports on DFID crop protection programme*, (September 2001-October 2003), 165-168.

EPA (Environment Protection Agency). (2005). Citizen's Guide to Pest Control and Pesticide Safety. *EPA 735-K-04-002*, March 2005 (www.epa.gov), P. 49.

Islam, et al.,(2009). Instrumental analysis of terminal conjugated dienes for reexamination of the sex pheromone secreted by a Nettle moth, *Parasa lepida lepida*. *Biosci. Biotechnol. Biochem.,* 73 (5): 1156-1162.

Islam, et al.,(2010). Knowledge on vegetables production activities by woman members in homestead area under matlab upazila. *Bangladesh Research Publications Journal*, 4 (4): 351-358.

Islam, et al., (2007). Synthesis and Characterization of 2,13- and 3,13-Octadecadienals for the identification of the sex pheromone secreted by a clearwing moth. *J. Chem. Ecol.*, 33: 1763-1773.

Mondal, M.H. (2010). Crop Agriculture of Bangladesh: Challenges and opportunities. *Bangladesh J. Agril. Res.*, 35 (2): 235-245.

Sarker, M.A. & Itohara, Y. (2008). Factors Influencing the Extent of Practice of Organic Farming Technologies: A Case Study of Tangail District in Bangladesh. *American J. Agril. Biol. Sci.* 3(3): 584-590.

Vang, et al.,(2008). 7,11,13-Hexadecatrienal identified from female moths of the citrus leafminer as a new sex pheromone component: synthesis and field evaluation in Vietnam and Japan. *J. Pestic. Sci.*, 33 (2): 152-158.

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