Pesticides Use Patterns in Litchi (*Litchi chinensis* sonn.) Orchards at Ishwardi, Pabna, Bangladesh

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Abstract
Ishwardi Upazilla, Pabna is known as the capital of litchi in Bangladesh. Litchi is suffered from various kinds of insect infestations, diseases and natural calamities. This study was conducted on the growers of litchi at Ishwardi Pabna to identify the pesticides use pattern in litchi orchards. A structured questionnaire survey was carried out to collect the data among the litchi growers. The litchi grower expressed that fruit borer (*Conopomorpha sinensis*) attacks of litchi releases unpleasant odor and drastically lowers its market value. The major constraints of litchi cultivation are burning of litchi skin due to heat waves, unseasonal rain in the months of April-May and drought. Other constraints are mite and litchi leaf rollers infestation. The litchi growers used more than 15 types of pesticides during pre-flowering, flowering, litchi developing and harvesting periods against insect pests. Out of these pesticides, Cypermethrin was the top use insecticides. The litchi growers also used Profenophose, Difenoconazole, Azoxystrobin + Difenoconazole, and Thiamethoxam+ Chlorantraniliprole in litchi orchards. All of these pesticides are harmful to human health and environment.

Keywords: Flowers, Insecticides, Litchi growers, Pesticides

Introduction

Litchi sinensis sonn. is an essential tropical and evergreen fruit tree species in Bangladesh. It belongs to the family Sapindaceae, also known as a commercial fruit worldwide. Its demand increases at home and abroad every year due to its taste and nutritious status (Singh *et al*., 2019; Srivastava *et al*., 2015). The harvesting period of litchi is quite short (Nath *et al* 2016). China is the largest producer of litchi all over the world. Actually, litchi is native to China and is distributed to other tropical regions of the world. Litchi is one of the most popular fruits, and it grows well almost everywhere in Bangladesh. The major litchi-growing areas of Bangladesh are the greater Rajshahi, Dinajpur Rangpur, and Pabna districts (Siddiqui, 2002). Dinajpur produces high-quality litchi, but the production is higher in the Pabna district (DAE, 2021). Ishwardi Upazila of Pabna is known as the capital of litchi production due to its quantity. Edaphic and climatic conditions of Ishwardi upazila are favorable for litchi cultivation. The number of litchi orchards is expanding in different regions of the country for higher demand and prices comparable to other fruits in the market. In 2019, over eighty thousand metric tons of litchi were produced from over thirty-one thousand acres of litchi orchards in Bangladesh (BBS, 2020). Litchi is propagated through seedlings and vegetative propagation. However, vegetative propagation is much more favorable than seedlings due to its quality and early harvesting. Recently, some high-yielding varieties of litchi have been cultivated in different regions of Bangladesh which are recognized by the authority of the government, such as Bombay, Bedana, China -3, BARI Litchi-1, BARI Litchi-2, and BARI Litch-3, etc. But unfortunately, the production of litchi is hampered by the infestation of different insects and pests. Among them, litchi fruit borer (*Conopomorpha sinensis*) is the main damaging insect (Kumar *et al*., 2021). The litchi fruit borer causes severe damage to litchi fruits and leaves (Srivastava *et al*., 2001). When this pest infests a crop, the fruits release an unpleasant odor and drastically lower their market value (Jha and Sen-Sarma, 2003). Recently, it has been the most destructive pest for litchi in changing climate scenarios (Srivastava *et al*., 2015). Litchi mite (*Aceria litchii*) and litchi leaf roller (*Dudua aprobola)* have been identified as another major threat to litchi production (Hameed *et al*.,1999; Singh *et al.*, 2001). The litchi leaf roller causes severe damage to litchi foliage (Badiyala & Garg,1990). Pests and insects damage the production of litchi in different ways. In this case, the growers of litchi use different types of pesticides and insecticides to prevent the quality and quantity of litchi from attack by pests and insects. Several scientists have worked on pests and insects of litchi all over the world (Taher *et al*., 2022). Some researchers have worked on pests and insects, which is estimated to be insufficient work in the study area. Moreover, research should be done on the pesticides and insecticides that play a vital role in improving the growth, development, and production of litchi fruits. Therefore, the present study has made an attempt to study the insect infestation, disease incidence and pesticide use pattern in litchi orchards in the Ishwardi area Pabna.

Materials and Methods

Description of study site

Ishwardi is the upazila under the Pabna district, known as the capital of the litchi growing area after the Dinajpur district. Three unions (Solimpur, Sahapur, and Pukshi) under Ishwardi Upazila were selected for this survey (**Fig. 1**). The sandy loam soil of the Ganges basin and the dry conditions of this area are suitable for litchi gardening. Most of the land is occupied for litchi cultivation in this area. In 2019, over 80,000 mt of litchi were produced from over 31,000 acres of litchi orchards

in Bangladesh (BBS, 2020). The Department of Agriculture Extension (DAE) reports that 3,150 ha of the 4,721 ha of land put under litchi cultivation current year (2024) at Ishwardi Upazila, Pabna. The varieties of litchi grown in this area are Bombay, China-3 Mozaffarpuri and Ati varieties (Source: Agricultural Extension Office, Pabna, 2024).

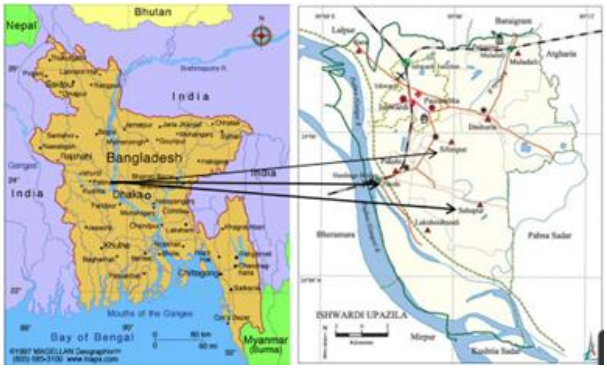

Fig. 1: Map of Study site

Questionnaires Survey

The study was conducted among litchi growers of three Unions (Solimpur, Sahapur, and Pukshi) under Ishwardi Upazila of Pabna District. The survey was conducted on 3,150 ha of land under the litchi cultivation. There were 15,500 of litchi growers at Ishwardi but it was not possible to take interview to all of them due to time and budget constraints. Therefore, the sample size was determined using Taro Yamane's mathematical formula with 95% confidence level. The formula is given below:

$$n = \frac{N}{1 + Ne^2}$$

Where, n=Sample size, N= Number of Litchi grower =15500, e=allowable error %=0.091

$$\therefore n = \frac{N}{1+Ne^2} = 15500/1+15500(0.091)^2 = 120.15 = 120$$

So, a total 120 litchi growers were interviewed during this study following structured questionnaire.

Data analysis

After questionnaire survey, all data was entered into computers. The data was elicited if there was a problem (suspicion input, false input). To analyze the collected data and information, necessary statistical methods were used. For data analysis, MS- Excel 2010 was used. Data were converted into percentages and compiled in tables, pie chart, column graph etc.

Results and Discussions

This study observed that litchi production was lost by insect infestation, drought, irrigation, hot weather, disease, and heavy rain at Ishwardi, Pabna. The present study revealed that litchi production was reduced by 5%, 38%, 45%, 40% and 55% due to insect-infestation, lack of irrigation, drought, disease and hot weather, respectively (**Fig. 2**). The present study found that farmers used 15 types of pesticides consisting of eight groups. Cypermethrin was the highest, followed by Profenophos, Chlopyrifos, Organophosphate, Propineb, Phophoester, Lamdacyhalothrin, and Metalaxyl, respectively.

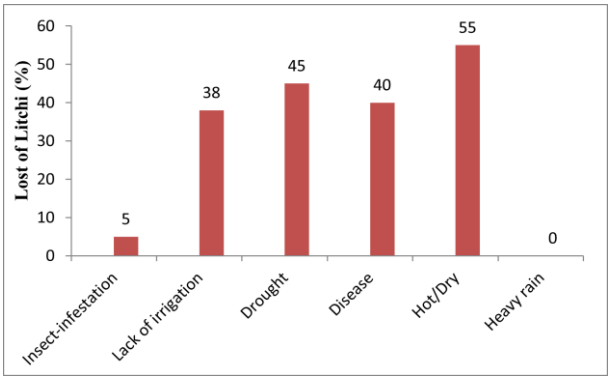

Fig. 2. Loss of litchi by different constraints

The farmers used these pesticides at different doses and various ways. The study revealed that about 38% of farmers used Cypermethrin in litchi orchard. The study observed that 22%, 15%, 10%, 4%, 4%, 4%, and 3% of farmers used Profenophos, Chlopyrifos, Organophosphate, Propineb, Phophoester, Lamdacyhalothrin, and Metalaxyl, respectively (**Fig. 3**).

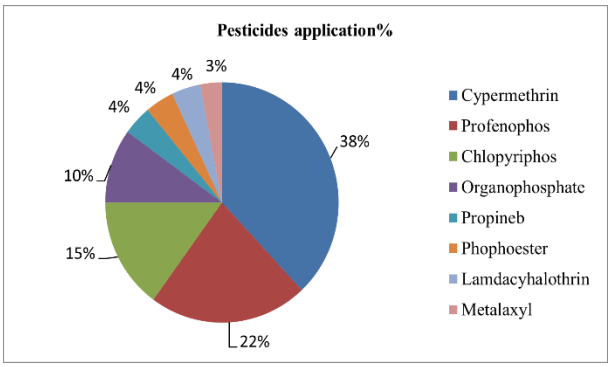

Fig. 3. Kinds of pesticides applied in litchi orchard

The farmers of the study area used pesticides in litchi orchards for three periods such as before flowering (**Fig. 4**), after flowering (**Fig. 5**), and during mature to harvesting period (**Fig. 6**).

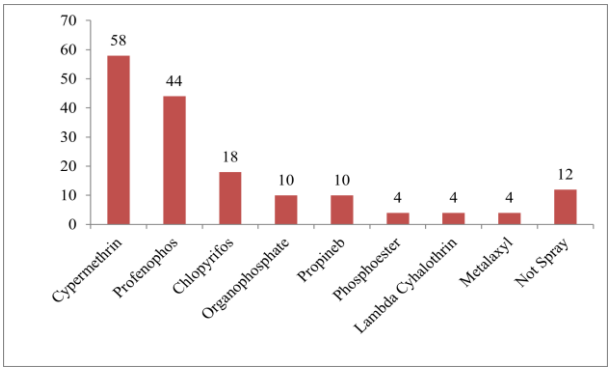

Fig. 4. Pesticides used before flowering period

Before flowering, farmers mainly used insecticides (Cypermethrin, Profenophos, Chlopyrifos) in the litchi orchard in the study area (**Fig. 4**). During flowering period, farmers were found to apply both insecticides

(Cypermethrin) and fungicides (mancozeb) to control the insect as well as fungus (**Fig. 5**).

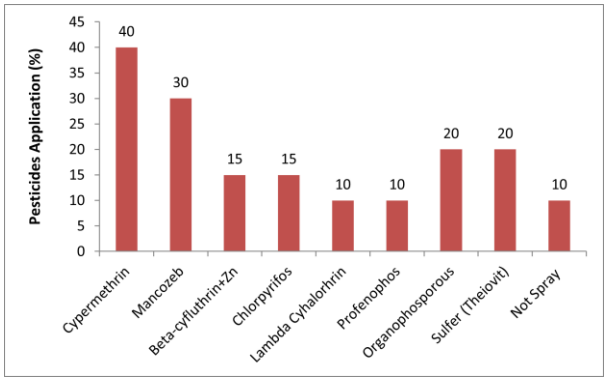

Fig. 5. Pesticides used after flowering period

Different kinds of insecticides and fungicides (Azoxystrobin +Difenoconazole and Thiamethoxam+ Chlorantraniliprole) used during growing to harvesting period to keep the fruits fresh and attractive for the consumers (**Fig. 6**).

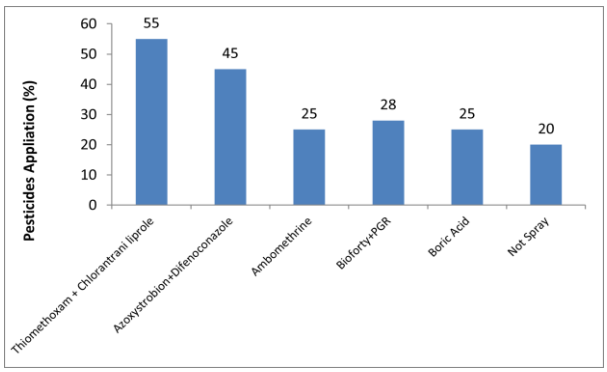

Fig. 6. Pesticides used during mature to harvesting period

Actually, pesticides were used to control the insect and improve the quality of litchi. The chemicals used as before the flowering period were Cypermethrin, Profenophos, Chlopyrifos, Organophosphate, Propineb, Phosphoester, lambdacyhalothrin and Metalazyl. A total of 8 chemical groups were used by the farmers to control pests and insects of litchi orchards in the growing season. A study was conducted (Bari *et al*., 2017) on the chemicals used in litchi of six different areas in Gazipur and Rajshahi regions and found that Ripcord, Cymbush 250EC, Melathion 85E and Regent 4SC, etc. were used in litchi orchards before flowering period to control pest and insects which hamper the growth and development of litchi. The findings of the present study indicated that farmers used different kinds of chemicals in litchi orchards of Ishwardi area. Actually, pesticides were used to control the insect and improve the quality of litchi. The chemicals used as before the flowering period were Cypermethrin, Profenophos, Chlopyrifos, Organophosphate, Propineb, Phosphoester, lambdacyhalothrin and Metalazyl. A total of 8 chemical groups were used by the farmers to control pests and insects of litchi orchards in the growing season. A study was conducted (Bari *et al*., 2017) on the chemicals used in litchi of six different areas in Gazipur and Rajshahi regions and found that Ripcord, Cymbush 250EC, Melathion 85E and Regent 4SC, etc. were used in litchi orchards before flowering period to control pest and insects which hamper the growth and development of litchi. The findings of the present study indicated that farmers used different kinds of chemicals in litchi orchards of Ishwardi area. The farmer applied more than eight groups of insecticides in litchi orchard. Farmers used Cypermethrin, Cyhalothrin, Beta-cyfluthrin, and Clorpyriphos from the protection of insect, and mancozeb and organophosphorus used from the protection of fungus.

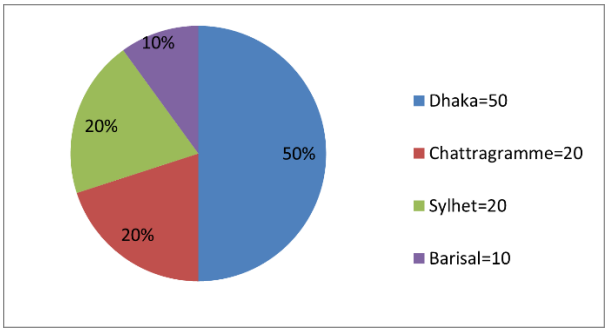

Fig. 7. Litchi marketing district (%)

The combination of sulfur and organophosporus was also used as fungicides. Lambda-cyhalothrin and Profenophos were used against insects. Sometimes, farmers used chemicals as providers of vitamins and growth hormones, which play a vital role in improving the quality and quantity of litchi. Farmers use Pranti vita, vio-fata, and okojen which help to mature fruits and prevent insects and virus infestation (Bari *et al*., 2017). It is reported that Redomil Gold, Bavistin DF (Carbendism), and Neem protect plants from insect and fungus infection. The farmers also used liquid organic fertilizer and seem as vitamins such as Ocojeam and Folimore PGR (Triacontanol) for the development of litchi (Ahad *et a*l., 2010). The harvesting period is sensitive for the cultivation of litchi. This period is rapidly influenced by climatic parameters such as drought, heavy rainfall, hailstorms etc. It was observed that the infestation rate quickly increased with the increase in rainfall. In this case, the farmers used Azoxystrobin +Difenoconazole and Thiamethoxam+ Chlorantraniliprole after heavy rainfall, which controlled the infestation rate quickly. The present study revealed that the farmers use Bio-forty (PGR, 28%), Boric acid (25%), and Ambomethrin (25%) after rainfall (**Fig. 6**). Several scientists (Bari *et al*., 2017) reported that the growers used Torque and CyperTC in litchi, which acts against insects and provides proper ripening of litchi. It is also recorded that ethephon solution was used to improve the quality and quantity of litchi significantly harvesting. Artificially sulphur dioxide is used to produce a persistent red color.

Intervals of Pesticides Application

The farmers followed different types of intervals for pesticides application based on the diseases and insect infestation levels in litchi orchard at Ishwardi area. The doses also varied depending on the infestation of pests. The interval levels are 1-2 days, 3-4 days, 5-6 days, 7-8

days, 9-10 days and 11-12 days. The maximum farmers were found to choose 9-10 days and 7-8 days intervals for spraying pesticides and the few farmers at 11-12 days intervals (Table 1).

Table1. Interval period of pesticides spray

Interval of pesticides spray	Total farmers	Respondent No.	Farmers (%)
1-2 Days	120	42	35
3-4 Days	120	48	40
5-6 Days	120	60	50
7-8 Days	120	72	60
9-10 Days	120	78	65
11-12 Days	120	36	30

Marketing Problems of Litchi

The growers faced severe problems during marketing of litchi at Ishwardi area. The maximum producers were deprived of price due to lack of proper marketing, transportation and communication to sellers and buyers. The grower and trader faced problem due to high transporting costs. Farmers sent more than 50% litchi to Dhaka and the rests were sent to Chattragram (20%), Sylhet (20%) %, and Barisal (10%) in (**Fig. 7**).

Loan facilities of litchi Growers

The growers and traders were not got loan facilities from government bank. They took loan from NGO (25%), Mohajan (25%) and Govt. bank (5%). About 45% litchi growers did not take any loan during litchi cultivation (Figure 8). Ahad *et a*l., (2010) reported that the entrepreneur, cultivar, and trader of the Dinajpur area took loans from Krishi Bank- (4%), BRDP (4%), Co-operative Society (4%), Friends (4%), Grameen Bank (4%), BRAC Bank, (4%), ASA (4%) and only 2% farmers used loan for litchi cultivation.

Conclusions

Litchi growers believe that chemical pesticide plays a vital role in the quality of litchi. They used 15 (fifteen) types of pesticides in litchi orchard during flowering, developing and harvesting periods. Cypermethrin was the top used pesticides during flowering period whereas Thiamethoxam+ Chlorantraniliprole was used in growing and harvesting periods. All of these pesticides are toxic to human health and environment.

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