INSECT PEST RISK ANAYLISIS OF CUT FLOWERS IN BANGLADESH

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INSECT PEST RISK ANAYLISIS OF CUT FLOWERS IN BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled, '**INSECT PEST RISK ANAYLISIS OF CUT FLOWERS IN BANGLADESH'** submitted to the Department of Entomology, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN ENTOMOLOGY** embodies the result of a piece of bona fide research work carried out by **Mohammad Shihabur Rayhan**, Registration No. **09-03427** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

Further certify that such help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by his.

Dated: June, 2016
Dhaka, Bangladesh

....
Prof. Dr. Md. Razzab Ali
Supervisor

Dedicated to

My

Beloved Parents

ABBREVIATIONS AND ACRONYMS

Abbreviation		Full meaning
AAEO	:	Assistant Agriculture Extension Officer
AEO	:	Agriculture Extension Officer
BADC	:	Bangladesh Agriculture Development Corporation
BARI	:	Bangladesh Agricultural Research Institute
BBS	:	Bangladesh Bureau of Statistics
BRAC	:	Bangladesh Rural Advancement Committee
DAE	:	Department of Agricultural Extension
DD	:	Deputy Director
FAO	:	Food and Agriculture Organization
FGD	:	Focus Group Discussion
FLO	:	Field Level Officer
IPPC	:	International Plant Protection Convention
JAEO	:	Junior Agriculture Extension Officer
NGO	:	Non Government Organization
PRA	:	Pest Risk Analysis
SAAO	:	Sub-Assistant Agriculture Officer
UAO	:	Upazila Agriculture Officer
USA	:	United States of America
USDA	:	United States Department of Agriculture
WTO	:	World Trade Organization

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SAU, Dhaka

INSECT PEST RISK ANAYLISIS OF CUTFLOWERS IN BANGLADESH

ABSTRACT

The study was conducted in the 20 upazilla of 10 selected major flower growing districts of Bangladesh during the period from December 2016 to February 2017 to find out the present status and diversity of insect pests of cutflowers, their risks and management options. The data were collected through interview of 500 cutflower farmers considering 25 cutflower farmers from each upazilla and 60 field level officers of DAE including one UAO, one AEO and one SAAO from each upazilla. The data were analyzed using computer program SPSS 20.0 version. The major sources of flowers seeds were the self produced seeds, seed retailer and local nursery. Most of the flowers farmers (90.20%) faced problems with diseases infection of the produced flowers. Other majors problems faced during flowers cultivation were insect pest, lack of propagating materials and weed attack. The rose and marigold were the most susceptible flowers types to insect pest and diseases. Most of the flowers (94.82%) was infested in field by aphid**.** Among these insect pests, aphid and red mite were identified as major pests in field and caused damage with high infestation intensity, respectively. Other was identified as minor insect pests of flowers caused damaged with low infestation intensity. Leaves and flowers are the most vulnerable parts of flower plants which were infested by aphid, whitefly, red mite and thrips. To control insect pests in flower fields, 99.80% farmers used to apply insecticides. Additionally, other control options like application of irrigation, hand picking and IPM in the fields were observed specially for controlling insect and mite pests. So for, 95% flower farmers got assistance and advices from pesticides dealers while controlling these pests. Moreover, DAE, NGO's and neighboring experienced and skill farmers were also helped in flower production.

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CHAPTER I

INTRODUCTION

Flower is the symbol of beauty and serenity. Flowers have been regarded as an embodiment of human taste and aesthetics. This unique and unparalleled nature of flowers has given rise to its commercial transaction all over the world. Bangladesh is a country of cultural heritage and not far behind in promoting this agricultural product. With the rising demand of flower cultivation is increasing in this country. Thus, Bangladesh has ventured to enter this growing export market. Flowers and foliage are flowers or flower buds (often with some stem and leaf) and leaves, branches etc that have been cut from the plant bearing it. It is usually removed from the plant for indoor decorative use. Typical uses are in vase displays, wreaths and garlands. Bangladesh is highly suitable for flowers and foliage production due to its favorable climate, topography and other conditions like labor cost and relatively low capital investment in contrast with high value addition, the cultivation of flower for the purpose of commercial use was started in a large scale from the early 80's. Growth of commercial flower production can be traced back to the early 70s that got impetus in the mid 80s when large-scale commercial production started in Jhikargachaupazila of Jessore district (Sultana, 2003). Till then the traditional flower marketing system is increasing, many shops have been established, but the scenery of flower business is very poor. The substantial amount of flower cultivation is now still limited to the area of panishara and its adjacent places in Jessore (Hossain and Rahman, 1994). According to the Bangladesh Flower Growers and Exporters Association (BFA), around 10,000 hectares of land are under flower cultivation in our country (Hossain and Rahman, 1994).

Cut flowers and foliage preferably are orchid, rose, gerbera, tuberose, gladiolus, carnation, lily, chrysanthemum, marigold etc. (Mitul, 2011). Rose is the principal cut flower grown all over the country. These are used for offerings at places of worship, for the extraction of essential oils and also used in garlands. Gladiolus is the next most important cut flower crop in the country. Gladiolus is planted in a phased manner so that harvest can be done continuously. In some fields, old plants are left for bulb production; generally yellow, pink, red and dark red varieties are popular (Dahlani, 1997). Gerbera is also an important commercial cut flower in Bangladesh. In recent production of this flower is increasing. Tuberose, a very popular cut flower crop in Bangladesh, is grown mainly in Jessore. In Jessore, about 80 percent of total flower cultivated area is occupied by only tuberose. Both single land double flower varieties are equally popular. Other main cut flower item is orchid. Its production is confined mainly in the Mymensingh and Savar. Among the traditional crops grown for loose flowers, the largest area is under marigold, grown all over the country. In most parts of the country only local varieties are grown in generations.

To satisfy the market demand, various flowers, such as chrysanthemum, tuberose, and gladiolus have been imported from India and orchids, gerbera, anthurium and thai rose from Thailand every year. In 2012, there is demand for Cut flowers, worth about USD 8.0 million, in Bangladesh of which USD 5.0 million is locally produced and rest of the amount is imported mainly from China and Indonesia. Besides, Bangladesh imports a huge amount of artificial flowers per year to meet local demands. Artificial flowers are imported mainly from China and India (AER, 2010).

Flowers are infested by arrange of insect pests which can affect the production and quality of flowers as well as the cost of production of the flowers. The introduction of insect pests, plant diseases, weeds and other pest associated with the commodity is brought about mainly during the accelerated agricultural development in different countries, when plants and plant materials were brought into, or sent out with little or no concern for the insect pests, diseases, weeds and other pests that were transported along with them. The type and severity of infestation differs from season to season, category of flowers and between different regions. The most significant insect pests of flowers are aphid (*Macrosiphum rosae*), rose flower beetle (*Euphoria sepulcralis*), thrips (*Scirtothrips dorsalis*), tortryx moth (*Lozotaenia forsterana*), metallic flea-beetles (*Altica* spp), japanese beetles (*Popillia japonica*), scale insect (*Aulacaspis rosae*) etc (Ali *et al.*, 2016).

The introduction of insect pests is brought about mainly during the accelerated agricultural development in different countries, when plants and plant materials were brought into, or sent out with little or no concern for the insect pests, that were transported along with them. There are many instances of accidental introductions of insect pests from one country to another. Extensive damages, often sudden in nature, have been caused not by indigenous pests, but with exotic ones introduced along with plants, plant parts or seeds in the normal channel of trade or individual interest. But there is no comprehensive list of insect pests of in different flowers along with the status and damage intensity in Bangladesh. Therefore, the incidence, distribution and infestation severity are need to be investigated. In this context, the insect pest risk analysis of flowers in Bangladesh is indispensable. Thus, the assignment on insect pest risk analysis of flowers in Bangladesh will be conducted aiming to identify pests for the flowers grown areas and evaluate their risk as well as to identify risk management options.

Objectives of the Research Work

Considering the above facts and points, the present research program has been designed with the following objectives:

1. To record the major and minor insect pests of cutflowers;
2. To conduct risk analysis for insect pests of cutflowers in Bangladesh;
3. To document the control measures against insect pests of cutflowers practiced by the farmers.

CHAPTER II

REVIEW OF LITERATURE

Cutflowers: A Cutflowers can simply be defined as any flower that is cut from the plant, thorns trimmed, and are ready to be used in a fresh flower arrangement. Cutflowers are available at the florist or can be cut from the home garden.

At present, the vast majority of cutflowers are imported from overseas. Leading producers include the Netherlands, Columbia, Kenya, and Israel. Flowers imported from overseas are largely roses, carnations, gerbera daisies, garden mums, and orchids. These flowers ship reasonably well and make up the bulk of the flowers used in arrangements by most florists. Most of the flowers that local growers focus on are those that do not ship well or have shorter postharvest vase lives. These flowers have come to be termed "specialty cut flowers." Examples of specialty flowers include sunflowers, zinnia, lisianthus, dahlia, ageratum, and peonies to name but a few on this long list. Local growers can readily develop a market niche with these flowers by using the advantage of longer vase life if produced locally, higher percentage of usable flowers, and a wider choice of colors and varieties.

Increasing demand for a wide variety of locally grown, fresh-cut flowers has kept this market growing in volume for years. Producing fresh-cut flowers is not for everyone, however, as they have special production requirements, as well as a fairly short shelf life. Any grower considering flower production should also be aware of the relatively short field growing and marketing season, especially those in the northern United States.

People all over the world realize that flowers enhance the quality of life and influence human feelings more than words or other gifts. Globalization, cultural exchanges, and celebrations enhancing fraternity such as New Year, Valentine's Day, Memorial Day, Mothers' Day, Fathers' Day, Christmas, and weddings have induced people globally to use flowers as a means of sharing their feelings. Above all, these celebrations have acquired one to one pairing with flowers in some cases, e.g. roses to Valentine's Day and carnations to Mother's Day. Increased use of flowers and ornamental plants makes marketing of flowers a lucrative business (Belwal and Chala, 2008)

2.1 General review on cutflowers

A common use is for floristry, usually for decoration inside a house or building. Typically the cut flowers are placed in a vase. A number of similar types of decorations are used, especially in larger buildings and at events such as weddings. These are often decorated with additional foliage. In some cultures, a major use of cut flowers is for worship; this can be seen especially in south and Southeast Asia. Sometimes the flowers are picked rather than cut, without any significant leaf or stem. Such flowers may be used for wearing in hair, or in a button-hole. Masses of flowers may be used for sprinkling, in a similar way to confetti. 27 garlands (especially in south Asia), and wreaths (in Europe and the Americas) are major derived and value added products.

2.2. Origin and distribution of cutflowers

Rose has been symbols of love, beauty, war, and politics. The rose is, according to fossil evidence, 35 million years old. In nature, the genus rosa has some 150 species spread throughout the Northern Hemisphere, from Alaska to Mexico and including northern Africa. Garden cultivation of roses began some 5,000 years ago, probably in China. The rose have a cosmopolitan distribution (found nearly everywhere except for Antarctica), but are primarily concentrated in the Northern Hemisphere in regions that are not desert or tropical rainforest. Tuberose is a native of Mexico from where it spread to different parts of the world during 16th Century. Tuberose is grown commercially in a number of countries including India, Kenya, Mexico, Morocco, France, Italy, Hawaii, South Africa, Taiwan, North Carolina, USA, Egypt, China and many other tropical and subtropical areas in the world. *Gladiolus* (from Latin, the diminutive of *gladius*, a sword) is a genus of perennial cormous flowering plants in the iris family (Iridaceae) (Manning and Goldblatt, 2008). The genus occurs in Asia, Mediterranean Europe, South Africa, and tropical Africa. The center of diversity is in the Cape Floristic Region (Manning and Goldblatt, 1998). The genera *Acidanthera*, *Anomalesia*, *Homoglossum*, and *Oenostachys*, formerly considered distinct, are now included in *Gladiolus* (Goldblatt, 1989). About 10 species are native to Eurasia. There are 160 species of *Gladiolus* endemic in southern Africa and 76 in tropical Africa. *Gerbera,* a genus of plants in the Asteraceae (daisy family. Gerbera is native to tropical regions of South America, Africa and Asia. The first scientific description of a Gerbera was made by J. D. Hooker in Curtis's Botanical Magazine in 1889 when he described *Gerbera jamesonii*, a South African species also known as Transvaal daisy or Barberton Daisy. Chrysanthemums, sometimes called mums or chrysanths, are flowering plants of the genus *Chrysanthemum* in the family Asteraceae. They are native to Asia and northeastern Europe. Most species originate from East Asia and the center of diversity is in China. Common marigold plants in the genus *Tagetes. Tagetes* is a genus of annual or perennial, mostly herbaceous plants in the sunflower family (Asteraceae or Compositae. It was described as a genus by Linnaeus in 1753. The genus is native to North and South America, but some species have become naturalized around the world. One species, *T. minuta*, is considered a noxious invasive plant in some areas (Arora and Sing, 1980). Most species of lily are native to the temperate northern hemisphere, though their range extends into the northern subtropics. The range of lilies in the Old World extends across much of Europe, across most of Asia to Japan, south to India and east to Indochina and the Philippines. In the New World they extend from southern Canada through much of the United States. *Aster* is a genus of flowering plants in the family Asteraceae. The genus *Aster* once contained nearly 600 species in Eurasia and North America, but after morphologic and molecular research on the genus during the 1990s, it was decided that the North America species are better treated in a series of other related genera (Arora and Saini, 1976).

2.3. Flowers in Bangladesh

Flowers and foliage are flowers or flower buds (often with some stem and leaf) and leaves, branches etc that have been cut from the plant bearing it. It is usually removed from the plant for indoor decorative use. Typical uses are in vase displays, wreaths and garlands. This unique and unparalleled nature of flowers has given rise to its commercial transaction all over the world. Bangladesh is not far behind in promoting this agricultural product. People purchase flower in various occasion. With the rising demand of flower cultivation is increasing in this country. Thus, Bangladesh has ventured to enter this growing export market.

Today the trade of flowers is a promising trade and a number of florists have sprung up who sell flowers. In view of marketing prospect of flowers, a vast agricultural land has been turned into a flower growing area and the farmers are now in a position to make available any quantum of flowers for export according to the market requirements. In Bangladesh, the cultivation of flower for the purpose of commercial use was started in a large scale from the early 80's. Till then the traditional flower marketing system is increasing, many shops have been established, but the scenery of flower business is very poor. The substantial amount of flower cultivation is now still limited to the area of panishara and its adjacent places in Jessore (Hossain and Rahman, 1994). Before 1983, the space in front of the High Court Mazar was the venue for the flower trade. Now it has spread too many other specific areas of the Dhaka city. In 1999 there were 530 flower shops in Dhaka city. At present the number of flower shops is more than a thousand throughout the country. Moreover, there are a good number of hawkers and none descript youngsters selling the flowers in different places of Dhaka and other big cities on temporary basis to maintain their livelihood. A good number of flower shops are also established in district towns. At least 26 business enterprises and 6 associations are directly engaged in growing and export of flowers in Bangladesh. This number has increased now days. Two decades have passed, but flower marketing cannot progress at expected rate. Many underdeveloped countries like Kenya earns more than 40 million US dollar from exporting flower. On the other hand, Bangladesh has huge potentiality to export flower besides domestic production and sales. Now the study will be developed for the purpose of drawing current condition, prospect and problem of flower marketing. Based on prior research, it is found that there is huge potentiality in flower business in Bangladesh although several constraints are responsible to hinder the business.

2.4. Species of flowers cultivated in Bangladesh

Several species of flowers are grown in the world. These differ in appearance, petal structure, size and color, time of maturity, cooking and marketing qualities, yield, and resistance to pests and diseases. A species that grows well in one area may do poorly in another.

There had been cultivated different types of flowers in Bangladesh. The major types of cutflowers are Rose, Orchid, Gerbera, Tuberose, Gladiolus, Carnation, Lily, Chrysanthemum, Marigold, Gypsophila, Aster, Dalhia, Jesmine (Ali, *et al.,* 2016).

2.5. Production areas and major flowers and foliages in Bangladesh

According to the Bangladesh Flower Growers and Exporters Association (BFA), around 10,000 hectares of land are under flower cultivation in our country. It was also reported that Jessore is the region which accounts for the maximum volume of flower cultivation. Tuberose, rose, orchid and marigold are among the major flowers that make up Bangladesh's floral basket for exports.

Flowers are now cultivated in about 10 thousand hectares of land, mainly in the Godkhali union of Zikorgasa upzilla under Jessore district. About 4000 farmers produce mainly various types of rose, tube rose, gerbera, gladiolus and some orchids. In Godkhali, the cultivation of flowers was started in 1983. Most of the tuberose and rose supplies come from Jhikargachha of Jessore and Savar of Dhaka, marry gold from Chuadanga and orchid from Mymensingh and Manikganj district. Cut flowers give three to four times' higher return than any other crop. Currently about 1,50,000 people are directly involved in flower cultivation or business in Bangladesh.

Bangladesh is highly suitable for cut flower and foliage production due to its favorable climate, topography and other conditions like labour cost and relatively low capital investment in contrast with high value addition.

Table 2.1. Name of flowers and main production areas in Bangladesh

Name of flowers	Scientific name	Family	Production area
Orchid	*Vanda teres*, *Aerides* spp.	Orchidaceae	Hilly areas of Chittagong Hill Tracts, Mymensingh and Sylhet
Rose	*Rosa* spp.	Rosaceae	Gazipur, Savar, Jesshore, Dhaka, Satkhira.
Gerbera	*Gerbera jamesonii*	Asteraceae	Jessore
Tuberose	*Polianthes tuberose*	Asparagaceae	Jessore, Satkhira, Bogra, Comilla, and Chittagong
Gladiolus	*Gladiolus dalenii*	Iridaceae	Dhaka, Jesshore, Gazipur,
Carnation	*Dianthus caryophyllus*	Caryophyllaceae	Savar, Gazipur
Lily	*Lilium candidum*	Liliaceae	Narshingdi
Chrysanthemum	*Chrysanthemum indicum*	Asteraceae	Savar, Gazipur
Marigold	*Tagetes patula*	Asteraceae	Jessore, Narayanganj, Savar
Gypsophila (Baby's breath)	*Gypsophila paniculata*	Caryophyllaceae	Savar, Gazipur
Aster	*Aster* spp.	Asteraceae	Savar, Gazipur
Dahlia	*Dahlia pinnata*	Asteraceae	Dhaka, Savar, Gazipur, Bogra
Jasmine	*Jasminum officinale*	Oleaceae	Jessore, Narayanganj, Savar

Source: Mitul, 2011

2.6. Flower trades in Bangladesh

Today the trade of flowers is a promising trade and a number of florists have sprung up who sell flowers. Before 1983, the space in front of the High Court Mazar was the venue for the flower trade. Now it has spread too many other specific areas of the Dhaka city. A little distance away from the Shahbagh road corner towards the west lays the Katabon area which has the biggest concentration of flowers shops in the city. Not only small-scale flower vendors are now widespread and visible at several shops with neatly displayed flowers in shelves are found throughout the country particularly in Dhaka and other division and few district cities.

The flowers are kept either at the trader's homes or in the closets behind the foot-paths. Suppliers bring truckloads of flowers to Dhaka from Jessore, Savar and other places every morning. Some flowers are imported from India and Thailand.

The traders said some 20 types of flowers are available at Shahbagh .The local ones include rose, tuberose (Rajanigandha), marigold (Gada), Lotus, Gladiolus and Chandramallika. The imported ones are ones are Jarbera and Orchid.

In 1999 there were 530 flower shops in Dhaka city. At present the number of flower shops is more than a thousand throughout the country. A good number of flower shops are also established in district towns. At least 26 business enterprises and 6 associations are directly engaged in growing and export of flowers in Bangladesh. This number has increased now days. The important flower shops and nurseries in Dhaka are given below:

Table 2.2. Important flower shops and nurseries in Dhaka

Name of flower shops	**Address**
Chameli	Katabon, Dhaka University Market, Dhaka
GolapBitan	Savar Bus stands
Karabi	Shahbag, Dhaka
Madukari	Shahbag, Dhaka
Sunflower	Shahbag, Dhaka
Madhabi	Shahbag, Dhaka
Chanchal	Mirpur road, Dhaka

2.6.1. Domestic market of flowers in Bangladesh

The demand for flowers in the domestic market is increasing. The current volume of production is inadequate to meet the demand for domestic consumption. Several varieties of flowers such as chrysanthemums, tuberoses, gladioluses, orchids, gerberas, anthuriums, and Thai-roses are imported. BDT 2-3 million are spent every year to import flowers, ornamental foliage etc. Flower imports increased 5-folds between 2002 and 2007, and the trend is expected to continue unless domestic production can keep pace with the increasing domestic demand. The demand-supply gap of 30% is mainly for the upscale urban population of Dhaka. To meet the demand of this high-end clientele, retailers prefer imported flowers. Therefore, there are ample opportunities for local flowers to meet the demand of domestic consumption (Khan, 2013).

2.6.2. International Market of flowers

India, Pakistan, Italy, Portugal, Saudi Arabia, the United States, South Korea, the Philippines, Singapore, Japan, Germany, Britain, Denmark and France. Our stake in the global trade of Cut flowers is negligible i.e. 0.3 per cent. We have good potential in the production of Cut flowers due to favorable environment and fertile land; it's a cash cow crop for the farmers. The global-market of floriculture is currently facing a 6% annual growth rate, rising from a USD 100 billion dollar industry in 2003 to around USD 181 billion dollars by 2014. The floral export basket for Bangladesh consists of tuberoses, roses, orchids, and other types (BBS, 2014). Currently, country's flower market is estimated to be valued at about EUR 95 million. According to a report by Bangladesh Sangbad Sangstha (BSS), the industry exceeded its target by 10.6% during the FY2011-12, earning USD 35.02 million. According to Bangladesh Export Promotion Bureau (BEPB), this growth-rate for FY2013-14 exceeded 15%.

In Bangladesh, export of cut flower and foliage has exceeded the target by over 10 per cent as entrepreneurs found it to be an emerging industry of high potentials that widens the export market. "Export of flowers and floral products has seen an impressive growth over the years contributing to the GDP (gross domestic product) as the entrepreneurs are trying to tap a strong demand for the non-conventional product in global market," as reported by Export Promotion Bureau (EPB). EPB also reported that the country exported cut flowers and foliage worth $35.02 million during July-March 2011-12 financial year an amount which was 10.6 per cent more that the export target.

Dhaka Flower Merchant Welfare Association (DFMWA) reported that appropriate training for the people involved in flower production, cutting, packaging and preservation and marketing could boost the industry provided cold storage, air conditioned vehicles for flower transports and subsidy in air cargo freight charges were provided. The DFMWA also reported "There is no slab system in Biman for flowers and ornamental plants though it is available for vegetables, sometimes flowers are damaged before reaching destination as Biman often does not maintain its proper flight schedule".

2.7. Import of flowers into Bangladesh

To satisfy the market demand, various flowers, such as chrysanthemum, tuberose and gladiolus have been imported from India and orchids, gerbera, anthurium and Thai rose from Thailand every year. Bangladesh has to spend roughly Tk. 2-3 million in importing flowers and ornamental plants from abroad.

Larger share of export receipts of cut flowers and ornamental foliage, live trees and plants by Bangladesh in 2009-2010 was from European countries, while larger share of import expenses for the same period was from China and Indonesia. Table 2.3 shows country-wise import expenses (from FY 2005-06 to 2009-10) of Cut Flowers and Ornamental Foliage, Live trees and Plants by Bangladesh.

A study conducted in 2012 shows that, there is demand for Cut flowers, worth about USD 8.0 million, in Bangladesh of which USD 5.0 million is locally produced and rest of the amount is imported mainly from China and Indonesia. Besides, Bangladesh imports a huge amount of artificial flowers per year to meet local demands. Artificial flowers are imported mainly from China and India.

Table 2.3. Country-wise import Expense of cut flowers and ornamental foliage, live trees and plants of Bangladesh

Country	Year-wise import (Taka in thousands)				
	2005-06	2006-07	2007-08	2008-09	2009-10
China	24	501	473	2378	7944
Germany	0	2737	0	0	0
Hong Kong	0	7160	0	0	132
India	857	1282	537	5762	5732
Indonesia	472	0	0	0	0
Japan	0	0	0	5142	0
Netherlands	0	0	0	0	1849
Korea, Republic of	0	0	0	129	0
Malaysia	0	0	0	4654	0
Pakistan	525	1348	644	3999	801
Singapore	0	0	0	606	0
Thailand	2596	1116	2030	10587	2473
UK	0	2781	0	0	0
USA	0	0	0	0	125
Total	4474	16925	3684	33257	19056

Source: Annual Import Payments 2005-06 to 2009-10, Statistics Department, Bangladesh Bank

2.8. Insect pests of flowers in Bangladesh

The fifteen arthropod pests including 14 insect and one mite pests as pest for Bangladesh. The insect pests flowers included the flower aphid (*Macrosiphum rosae*), whitefly (*Bemisia tabaci*), scale insect (*Aulacaspis rosae*), flower mealybug (*Pseudococcus* spp.), thrips (*Scirtothrips dorsalis*), leaf miner (*Liriomyza sativae* Blanchard), flower gall midge (*Cotarinia* spp.), june beetle (*Melolontha melolontha*), metallic flea beetle (*Altica* spp.), flower beetle (*Euphoria sepulcralis*), leaf eating beetle (*Macrodactylus subspinosus*), leaf eating bee (*Megachile* spp.), bristly rose slug/sawfly (*Cladius* spp.), tobacco caterpillar

(*Spodoptera litura*), two-spotted spider mite (*Tetranychus urticae*). But the incidence of Japanese beetle (*Poppilla japonica*), and tortryx moth (*Lozotaenia forsterana*) were not reported by the farmers and other experts in Bangladesh. Among these insect and mite pests of flowers, aphid, thrips and two spotted spider mite are more damaging than others. The pest status of all these insect and mite pests was minor and caused low level of infestation.

2.9. Insect pests of flowers in worldwide

A number of insect pests have been reported damaging cut flower and foliages. Among these the important pests are aphid, rose flower beetle, Japanese beetle, june beetle, metallic flea beetle, cut worm, rose slug sawfly, leaf miner, tortrix moth, scale insect, thrips, mealy bug, white fly, red spider mites.

Western flower thrips (*Frankliniella occidentalis*) is distributed in many Asian countries including India (CABI/EPPO, 1999; EPPO, 2014; Kaomud Tyagi and Vikas Kumar, 2015), Thailand, Sri Lanka (CABI/EPPO, 1999; EPPO, 2014), Japan (Nakahara, 1997; CABI/EPPO, 1999; EPPO, 2014), China (EPPO, 2014; Reitz et al., 2011; Zhang et al., 2003), Iran (EPPO, 2014).*F. occidentalis* is naturally abundant in many wild flowers throughout western North America from southern California (and presumably Mexico) into Canada. In the late 1970s and 1980s, it spread across the USA and Canada. It reached the Netherlands in 1983 and then spread outwards across Europe (Kirk and Terry, 2003). The main host of *F. occidentalis* includes orchid, safflower, *Chrysanthemum morifolium,* roses, Gerbera, gypsophila, Zinnia, Begunia, Poinsettia, balsam. *F. occidentalis* reproduces throughout the year producing as many as 12-15 generations per year. Each female lays between 20 and 40 eggs. The eggs are inserted in the parenchyma cells of leaves, flower parts and fruits, and hatch in about 4 days at 27°C. Adult thrips have been observed entering closed chrysanthemum buds, presumably to lay eggs, a behavior pattern which makes control very difficult (Bryan & Smith, 1956; Lublinkhof& Foster, 1977)

Chrysanthemum leaf miner (*Liriomyza trifolii*) has presented all the countries bordering the Mediterranean. *L. trifolii* originates in North America and spread to other parts of the world and in India, it was first reported in 1991 (EPPO, 2014). A detailed review of its spread is given in Minkenberg (1988). The main host of *L. trifolii* includes Ageratum, Aster, marigold, Callistephus, safflower, Chrysanthemum morifolium, Dahlia, Gerbera (*barbeton daisy*), sunflower, carnation, gypsophila (baby's breath), Zinnia, salvia (sage), garlic, Begunia. Peak emergence of adults occurs before midday (Musgrave et al. 1975). Female flie puncture the leaves of the host plants causing wounds which serve as sites for feeding or oviposition. Feeding punctures cause the destruction of a larger number of cells and are more clearly visible to the naked eye. About 15% of punctures made by *L. trifolii* contain viable eggs (Parrella *et al.,* 1981). Eggs are inserted just below the leaf surface. Carnation tortrix moth (*Cacoecimorpha pronubana*) is indigenous to the Mediterranean region. *C.pronubana* presents in France, Germany (intercepted only), Greece, Ireland, Italy, Netherlands, Poland (unconfirmed), Portugal, Slovenia, Spain, Switzerland, Tunisia, UK (including Guernsey and Jersey), Japan (Carter, 1984; EPPO, 2014; CABI/EPPO, 2014), Azerbaijan (Maharramova, 2011; CABI/EPPO, 2014), Israel (Wysoki,, 1989; EPPO, 2014; CABI/EPPO, 2014) and Turkey (Kaça and Ulusoy, 2008; EPPO, 2014; CABI/EPPO, 2014). The large-bodied females cannot fly easily and only males are normally active. Eggs are laid on smooth surfaces, especially glass, the first batch, usually of 150-250 eggs, being the most important. The larvae emerge within a few seconds and, being positively phototactic, quickly move or are carried in wind to the young growing points or flowers. Here, they spin silk around two to three terminal leaves or petals, and feed on the upper surface, so making numerous holes; the parenchyma may be mined. By the end of the third larval instar, the whole leaf is attacked and surrounded by a dense.

CHAPTER III

MATERIALS AND METHOD

3.1. Study Area

The survey was conducted in some selected major cutflowers growing districts of Bangladesh namely Dhaka, Gazipur, Manikgonj, Narayangonj, Tangail, Mymensingh, Jessore, Jhenidah, Chuadanga and Khulna. In the survey program, at least 25 cutflowers farmers were interviewed from each upazilla of district. Thus a total of 500 farmers were interviewed for data collection.

3.2. Study design

The survey was conducted in the 10 major cutflowers growing districts of Bangladesh. A total of 20 upazillas were selected under 10 sampled districts and 25 flowers growers were interviewed in each upazilla through pre-tested questionnaire. Thus, a total of 500 flower growers were interviewed from 10 sampled districts. On the other hand, a total of 60 field level officers (FLO) of DAE were also interviewed through pre-designed questionnaire considering one UAO, one AEO and one SAAO from each upazilla under 10 sampled districts.

3.3. Study Indicators

The researcher has proposed the following variables/indicators to be considered:

1. Demographic **:** Name, Age, Sex
2. Social **:** Education, Profession
3. Study related indicators:

- Farm size, variety of flowers cultivated
- Occurrence and severity of insect pests of flowers
- Potential risk and economic damage caused by these pests

- Status of insect pests of flowers
- Effective measures practiced by the farmers in controlling the insect pests of flowers
- Suggestions for improving management options for controlling insect pests of flowers in Bangladesh.

3.4. Development of questionnaire/instruments for data collection

According to the sample design, 560 respondents were covered under the study, of which 500 respondents participated for face-to face interview and the selection of respondents were made on a stratified sampling technique for sampled districts and simple random sampling technique within the sampled districts. There are two types questionnaire were prepared for two types of data collection such as (a) respondents' survey for flowers farmers and (b) respondents' survey for field level officers of DAE and these are given below:

3.5. Respondents survey

The respondents' survey was conducted in the 20 selected upazillas under 10 selected districts of Bangladesh. The face to face interview was conducted among 500 flowers farmers and they filled up a set of pre-designed questionnaire (**Appendix-1)** encompassing issues about the above mentioned study indicators. The face to face interview was also conducted among 60 FLOs and they filled up a set of pre-designed questionnaire (**Appendix-2).**

3.6. Respondents distribution in the sampled upazilla and districts

The sampled 500 flowers farmers and 60 field level officers of DAE were selected from 20 upazila under 10 major flowers growing districts of Bangladesh. The distribution of sampled respondents has been presented in the following table:

Table 3.1. District and upazila wise respondent distribution in the study area

District	Upazilla	No. of cutflowers farmers	No. of field level officers
1. Dhaka	1. Savar	25	3
	2. Dhamrai	25	3
	3. Keranigonj	25	3
2. Gazipur	4. Kaligonj	25	3
	5. Sreepur	25	3
	6. Sadar	25	3
3. Manikgonj	7. Singair	25	3
	8. Sadar	25	3
4. Narayangonj	9. Sonargaon	25	3
5. Tangail	10. Modhupur	25	3
6. Mymensingh	11. Sadar	25	3
	12. Muktagacha	25	3
7. Jessore	13. Jhikorgacha	25	3
	14. Sarsha	25	3
	15. Sadar	25	3
8. Jhenidah	16. Kaligonj	25	3
	17. Court Chandpur	25	3
9. Chuadanga	18. Sadar	25	3
	19. Alamdanga	25	3
10. Khulna	20. Fultala	25	3
Total	**20**	**500**	**60**

3.7. Data collection

Direct personal interview approach was adopted for collection of primary data. The researcher was personally contacted with the flowers farmers in the respective upazilla under 10 sampled flowers growing districts. When found the target respondents and the researcher were started interview by explaining the objectives of the study to the respondents. After getting respondents, the researcher was filled up each question of the questionnaire one by one and obtain desired information. The field level data collection was conducted for a period to be started from December 2016 to February 2017. After the completion of data collection, all filled up questionnaires were preserved according to the category of respondents for processing and data analysis.

3.8. Data Analysis

Data on different parameters were analyzed through computer software SPSS version 20. As soon as collected from the field, the filled up questionnaires were coded and data entry were completed using SPSS and MS Access computer packages as well as the data were analyzed for tabulation of the primary data into data tables.

CHAPTER IV

RESULTS AND DISCUSSION

The results obtained from the studies have been presented below sequentially in various forms and thus interpreted and discussed the findings systematically in line with the objective of the study.

4.1. Farmers' knowledge on insect pests of cutflowers, their risks and management

The results of the farmers' knowledge on insect pests of cutflowers and their risks have been discussed under the following sub-headings:

4.1.1. Gender of the farmers

The field survey was conducted among 500 cutflowers farmers in 10 major cutflowers growing districts. Out of 500, most (94%) of the cutflowers farmers were male, while only 6% cutflowers farmers participated in the study were female.

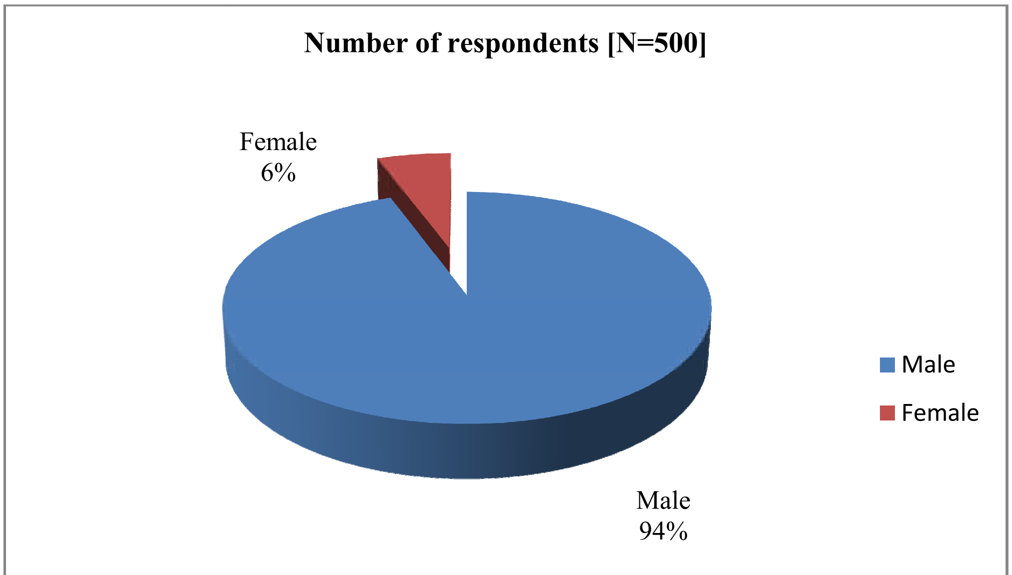

Figure 1. Gender of cutflowers farmers participated in the field survey

4.1.2. Categories of farmers

Out of 500 cutflower growers participated in the field study, maximum 40.60% of them (203) were medium farmers, whereas 37.60% farmers (188) were under small category and the lowest proportion (14.60%) of cutflowers farmers were under large farmers category.

Table 4.1. Categories of the farmers participated in the survey

Age range	Number of respondents [N=500]	% response
Small flower growers	188	37.6
Medium flower growers	203	40.6
Large flower growers	73	14.6
Flower businessmen	36	7.2
Total	**500**	**100**

4.1.3. Cultivation of flowers and income

Commonly cultivated flowers: The maximum (69.97%) farmers of flowers cultivated rose in their field, whereas 63.07% farmers reported that they cultivated marigold. This was followed by gladiolus which was cultivated by 37.53% farmers; while 24.48% farmers cultivated chrysanthemum, 23.74% farmers cultivated tuberose, 21.90% cutflowers cultivated dahlia and only 5.52% farmers cultivated jasmine and rest of the farmers cultivated orchid in their field.

Land used for flower cultivation: The maximum land used for flower cultivation was for gladiolus and the average land size used for gladiolus cultivation was 34.84 decimal. This was followed by tuberose cultivation (16.62 decimal), rose (15.62 decimal), gerbera (15.05 decimal), marigold (13.18 decimal) and soon. The minimum land size used for flower cultivation was for aster (4.98 decimal).

Profit from flower cultivation: The average maximum profit per acre flower cultivation was earned by the flower farmers from gladiolus and it was about 99,860 taka per acre. This was followed by profit from gerbera (90,581 taka/acre), rose (77,999 taka/acre), orchid (66,961 taka/acre), marigold (53,436 taka/acre) and soon. On the other hand, average minimum profit was earned from lily cultivation (25,871 taka/acre).

Table 4.2. Commonly cultivated flowers by the farmers according to their land size and profit

Cutflower types	% farmers cultivated each flower	Average land area under cutflower cultivation (decimal)	Average profit (Tk/acre)
Gladiolus	37.53	34.84	99860
Tuberose	23.74	16.62	59143
Rose	69.97	15.62	77999
Gerbera	27.76	15.05	90581
Marigold	63.07	13.18	53436
Orchid	5.36	9.01	66961
Dalhia	21.90	6.92	38504
Jesmine	5.52	6.59	39453
Carnation	0.86	6.60	26000
Lily	5.34	6.10	25871
Chrysanthemum	24.48	5.99	46011
Aster	11.38	4.98	61061

4.1.4 . Sources of flowers seeds/seedlings used for cultivation

The flowers farmers used seeds/seedlings from different sources for cultivation. Most (71.20%) farmers (356) used flowers seeds by their own produced seeds and/or own grafted seedlings. Whereas, 47.40% farmers (237) collected flowers seeds/seedlings from retailer, 39.70% farmers (198) collected from local nursery; 28.40% farmer collected seeds from different companies. Other sources of flowers seeds/seedlings for cultivation were importers (22.80%), Research Organization (18.30%), and NGOs (6.00%).

Table 4.3. Sources of flower seeds/seedlings usually used for cultivation

Sources of purchasing flower seeds/seedlings	Number of respondents [N=500]	Response (%)
1. Own seeds/grafted seedling	356	71.20
2. Neighbors	101	20.20
3. Company	142	28.40
4. Local nursery	198	39.70
5. Seedlings importer from neighboring countries	114	22.80
6. Research Organization	91	18.30
7. NGOs	30	6.00
8. Seed retailer	237	47.40
9. Others	31	6.20
Multiple response		

4.1.5. Major problems faced by farmers during flowers cultivation

Most (90.20%) of the flowers farmers asserted their opinion that disease infection was the major problem faced by the farmers. This was followed by insect pest attack (70.80%) in field of flowers followed by lack of propagating materials (65.80%), weed infestation (65.0%) and lack of irrigation facilities (21.0%). On the other hand, the lowest proportion of farmers reported that the high price of pesticides (0.8%) followed by lack of farmers' training (2.20%) and lack of flower marketing facilities (4.20%) were the problems faced by the farmers during cultivation of flowers.

Table 4.4. Farmers' opinion on major problems faced during flowers cultivation

Major problems	Response on major problems	
	No. of respondent [N=500]	% Response
1. Insect pest attack in field	354	70.80
2. Weed infestation	325	65.00
3. Disease infection	451	90.20
4. Lack of propagating materials	329	65.80
5. Lack of irrigation facilities	105	21.00
6. Lack of marketing facilities	21	4.20
7. Lack of farmers training facilities	11	2.20
8. High price of pesticides	4	0.80
Multiple response		

4.1.6. Susceptibility of flowers to pests

Susceptibility to insect pests: According to the farmers' opinion, maximum 71.22% farmers reported that the rose was susceptible to insect pests followed by marigold as reported by 54.81% farmers; gladiolus was susceptible to insect pests as reported only by 33.24% farmers. Whereas, only 29.16% farmers informed that the garbera was susceptible to insect pests.

Susceptibility to diseases

Among 500 flowers farmers, maximum 64.35% farmers reported that Rose was susceptible to diseases. This was followed by Marigold as asserted by 57.30% farmers followed by gladiolus 47.73% followed by Tuberose was susceptible to diseases as reported by only 33.75% farmers which was followed by Gerbera 32.16%. Whereas only 23.61% farmers reported that chrysanthemum was susceptible to diseases followed by dalhia as reported by only 22.11% farmers.

Susceptibility to weeds

Among 500 flowers farmers, maximum 57.9% farmers reported that rose was susceptible to weeds. This was followed by marigold as asserted by 40.35% farmers followed by chrysanthemum (32.22%) and gerbera (30.57%) were susceptible to weeds. Whereas only 26.34% farmers reported that gladiolus was susceptible to weeds followed by dahlia (24.75%).

Table 4.5. Farmers' response on susceptibility of different flowers to different categories of pests

Flowers types	Status of susceptibility to pests [%]		
	Insect pests	**Diseases**	**Weeds**
Orchid	12.6	13.71	9.12
Rose	71.22	64.35	57.9
Gerbera	29.16	32.16	30.57
Tuberose	19.29	33.75	17.88
Gladiolus	33.24	47.73	26.34
Carnation	7.44	7.41	12.69
Lily	8.49	10.65	16.26
Chrysanthemum	17.16	23.61	32.22
Marigold	54.81	57.3	40.35
Gypsophila	3.81	4.56	6.51
Aster	12.15	12.57	15.63
Dalhia	15.27	22.11	24.75
Jasmine	6.24	6.09	9.75
Multiple response			

4.1.7. Occurrence of insect pests of flowers in field condition

4.1.7. 1. Occurrence of insect pests in orchid

According to the opinion expressed by the flowers farmers, out of 500, 31.80% farmers (159) reported that the orchid was infested by aphid, which was followed by whitefly infestation as reported by 22.20% farmers. Whereas,13.8% farmers reported that the orchid was attacked by scale insect, followed by red mite (12.60%), leaf eating beetle (8.40%), thrips (1.80%) and metallic flea beetle (0.60%).

Table 4.6. Farmers' response on occurrence of insect and mite pests of orchid in field

Name of insect and mite pests	Response on pests incidence	
	Number	% response
Aphid	159	31.8
Whitefly	111	22.2
Leaf eating beetle	42	8.4
Thrips	9	1.8
Scale insect	69	13.8
Red mite	63	12.6
Multiple response		

4.1.7. 2. Occurrence of insect pests in rose

According to the opinion expressed by the flowers farmers, out of 500, most (62.80%) of the farmers (314) reported that the rose was infested in the field by aphid, which was followed by thrips infestation (39.80%). Whereas, 36.20% farmers reported that the rose was attacked by red mite, followed by rose flower beetle as reported by 34.80% farmers, followed by whitefly (32.20%), scale insect (21.00%), junebeetle (8.40%), metallic flea beetle (6.80%) and gall midge (0.80%).

Table 4.7. Farmers' response on occurrence of insect pests of rose in field

Name of pests	Response on pests incidence	
	Number	% response
Aphid	314	62.80
Rose flower beetle	174	34.80
Whitefly	161	32.20
June beetle	42	8.40
Metallic flea beetle	34	6.80
Thrips	199	39.80
Scale insect	105	21.00
Gall midge	4	0.80
Red mite	181	36.20
Multiple response		

4.1.7. 3. Occurrence of insect pests on tuberose

According to the opinion expressed by the flowers farmers that in tuberose cultivation thrips was the major problem. Out of 500 farmers, 49.2% farmers (246) reported that the tuberose was infested in the field by thrips, which was followed by aphid infestation as reported by 43.2% farmers. Whereas 12.60% farmers reported that the tuberose was attacked by red mite followed by whitefly as reported by 11.4% farmers, followed by leaf miner (7.20%). According to the farmers' opinion, leaf eating beetle, june beetle, scale insect and metallic flea beetle had minor infestation capacity of tuberose in field condition.

Table 4.8. Farmers' response on occurrence of insect pests of tuberose in field

Name of insect and mite pests	Response on pests incidence	
	Number	% response
Aphid	216	43.2
Whitefly	57	11.4
June beetle	3	0.6
Metallic flea beetle	3	0.6
Leaf miner	36	7.2
Leaf eating beetle	9	1.8
Thrips	246	49.2
Scale insect	3	0.6
Red mite	63	12.6
Multiple response		

4.1.7. 4. Occurrence of insect and mite pests in gladiolus

According to the opinion expressed by the flowers farmers, among the insect pests thrips causes major infestation in gladiolus cultivation. Out of 500, most (73.20%) of the farmers (366) reported that the gladiolus was infested in the field by thrips, which was followed by leaf miner infestation as reported by 60.00% farmers. Whereas 33.6% farmers reported that the gladiolus was attacked by red mite, followed by whitefly (33.00%) and aphid (28.20%). On the other hand, leaf eating beetle, june beetle and scale insect had minor infestation capacity in gladiolus cultivation.

Table 4.9. Farmers' response on the occurrence of insect and mite pests of gladiolus in field

Name of insect and mite pests	Response on pests incidence	
	Number	% response
Aphid	141	28.2
Whitefly	165	33
June beetle	51	10.2
Leaf miner	300	60
Leaf eating beetle	84	16.8
Thrips	366	73.2
Scale insect	6	1.2
Red mite	168	33.6
Multiple response		

4.1.7. 5. Occurrence of insect pests on carnation

According to the opinion expressed by the flowers farmers, aphid and thrips were major problem in carnation cultivation but all the insects had minor infestation capacity. Out of 500 farmers, most (25.00%) of the farmers (125) reported that the carnation was infested in the field by aphid and thrips, which was followed by scale insect and gall midge infestation as reported by 9.00% farmers.

Table 4.10. Farmers' response on occurrence of insect pests of carnation in field

Name of insect pests	Response on pests incidence	
	Number	% response
Aphid	125	25.0
Thrips	125	25.0
Scale insect	45	9.0
Gall midge	45	9.0
Multiple response		

4.1.7. 6. Occurrence of insect pests in lily

According to the opinion expressed by the flowers farmers, all the insect pests that attack lily in field condition had minor infestation capacity. Out of 500, most (28.80%) of the farmers (144) reported that the lily was infested in the field by aphid, which was followed by thrips infestation as reported by 15.00% farmers. Whereas, according to the opinion expressed by the farmers that other insect pests like whitefly, scale insect and june beetle rarely infested lily in field condition.

Table4.11. Farmers' response on occurrence of insect pests of lily in field

Name of insect pests	**Response on pests incidence**	
	Number	**% response**
Aphid	144	28.8
Whitefly	45	9.0
June beetle	3	0.6
Thrips	75	15.0
Scale insect	27	5.4
Multiple response		

4.1.7. 7. Occurrence of insect and mite pests in chrysanthemum

According to the opinion expressed by the flowers farmers that aphid was the major insect pest that infested chrysanthemum in field condition. Among the 500 flowers farmers, most (43.80%) of the farmers (219) reported that the chrysanthemum was infested in the field by aphid, which was followed by leaf minor infestation as reported by 25.20% farmers, followed by thrips (24.60%) farmers. Whereas, according to the farmers opinion all other insects like whitefly, leaf eating bee, scale insect, gall midge and red mite had little infestation in chrysanthemum cultivation.

Table 4.12. Farmers' response on occurrence of insect pests of chrysanthemum

Name of insect and mite pests	**Response on pests incidence**	
	Number	**% response**
Aphid	219	43.8
Whitefly	90	18.0
Leaf miner	126	25.2
Leaf eating beetle	33	6.6
Thrips	123	24.6
Red mite	30	6.0
Multiple response		

4.1.7. 8. Occurrence of insect and mite pests in marigold

According to the opinion expressed by the flowers farmers that leaf minor was the major insect pest that infested marigold in field condition. Among the 500 flowers farmers, most (42.80%) of the farmers (214) reported that the marigold was infested in the field by leaf minor, which was followed by flower beetle infestation as reported by 21.40% farmers, followed by aphid (20.40%) farmers. Whereas, according to the farmers opinion all other insects like thrips, whitefly, saw fly, leaf eating beetle and red mite had little infestation in marigold cultivation.

Table 4.13. Farmers' response on occurrence of insect pests of marigold in field

Name of insect and mite pests	Response on pests incidence	
	Number	% response
Aphid	102	20.40
Whitefly	52	10.40
Saw fly	19	3.80
Leaf miner	214	42.80
Leaf eating beetle	55	11.00
Thrips	67	13.40
Red mite	75	15.0
Multiple response		

4.1.7. 10. Occurrence of insect and mite pests in aster

According to the opinion expressed by the flowers farmers that aphid was the major insect pest that infested aster in field condition. Among the 500 flowers farmers, most (48.00%) of the farmers (240) reported that the aster was infested in the field by aphid, which was followed by thrips infestation as reported by 38.00% farmers. According to the farmers opinion all other insects like whitefly, Leaf eating beetle and red mite had little infestation in aster cultivation.

Table 4.14. Farmers' response on occurrence of insect and mite pests of aster in field

Name of insect and mite pests	Response on pests incidence	
	Number	% response
Aphid	240	48.0
Whitefly	45	9.0
Leaf eating beetle	15	3.0
Thrips	190	38.0
Red mite	45	9.0
Multiple response		

4.1.7. 11. Occurrence of insect pests on dalhia

According to the opinion expressed by the flowers farmers that aphid was the major insect pest that infested dalhia in field condition. Among the 500 flowers farmers, most (51.00%) of the farmers (255) reported that the dalhia was infested in the field by aphid, which was followed by flower beetle infestation as reported by 38.40% farmers, followed by thrips (28.20%) farmers, followed by leaf miner (25.20%) farmers. Whereas, according to the farmers opinion all other insects like whitefly, metallic flea beetle, leaf eating bee, leaf eating beetle and red mite had little infestation in dalhia cultivation.

Table 4.15. Farmers' response on occurrence of insect pests of dalhia in field

Name of insect and mite pests	Response on pests incidence	
	Number	% response
Aphid	255	51
Flower beetle	192	38.4
Whitefly	36	7.2
Metallic flea beetle	9	1.8
Leaf miner	126	25.2
Leaf eating beetle	105	21
Thrips	141	28.2
Red mite	66	13.2
Multiple response		

4.1.7. 12. Occurrence of insect pests on jasmine

According to the opinion expressed by the flowers farmers that aphid was the major insect pest that infested jasmine in field condition. Among the 500 flowers farmers, most (26.00%) of the farmers (130) reported that the jasmine was infested in the field by aphid, which was followed by flower beetle and leaf eating beetle infestation as reported by 18.00% farmers. Whereas, according to the farmers opinion all other insects like whitefly, metallic flea beetle and leaf miner had little infestation in jasmine cultivation.

Table 4.16. Farmers' response on occurrence of insect pests of jasmine in field

Name of pests	Pest incidence	
	Number	% response
Aphid	130	26
Flower beetle	90	18
Whitefly	50	10
Metallic flea beetle	40	8
Leaf miner	10	2
Leaf eating beetle	90	18
Multiple response		

4.1.8. Infestation status of insect pests of flowers in field condition

According to the opinion expressed by the flowers farmers that aphid was the major insect pest in field condition. Among the 500 flowers farmers, most (47.41%) of the farmers reported that aphid was major insect pest of flower cultivation in field condition, which was followed by thrips (34.83%) and red mite (27.41%) reported by farmers. On the other hand, 40.00% farmers reported that leaf minor was a minor insect pest of flower cultivation in field condition, which was followed by flower beetle (37.41%) and whitefly (32.41%).

Table 4.17. Infestation status of insect and mite pests of flowers in field condition

Name of Insects pest	Pest status		
	Major (%)	Minor (%)	No infestation (%)
Aphid	47.41	37.93	0.00
Flower beetle	12.41	37.41	0.17
Whitefly	20.34	32.41	0.00
Leaf miner	18.10	40.00	0.17
Leaf eating bee	17.07	32.24	0.00
Leaf eating beetle	13.62	29.14	0.69
Thrips	34.83	39.64	0.00
Scale insect	9.83	18.97	0.00
Red mite	27.41	32.91	0.17
Multiple response			

4.1.9. Infestation severity of insect pests of flowers in field condition

Out of 500 farmers, majority (52.24%) of them stated that aphid caused damage on flower with high infestation intensity. The flower beetle caused with low infestation as reported by 63.45% farmers. All other insects also caused damage with low infestation intensity on different flowers as reported by 37.26 to 92.24% farmers.

Table 4.18. Infestation severity of insect pests of flowers in field condition

Name of Insects pest	Severity of infestation			
	High (%)	Medium (%)	Low (%)	Total
Aphid	52.24	22.59	25.17	100.0
Flower beetle	8.62	27.93	63.45	100.0
Whitefly	12.93	26.21	60.86	100.0
June beetle	3.62	4.14	92.24	100.0
Metallic flea beetle	2.24	7.93	89.83	100.0
Saw fly	7.07	6.21	86.72	100.0
Leaf miner	17.07	23.62	59.31	100.0
Leaf eating bee	18.62	14.66	66.72	100.0
Leaf eating beetle	16.03	18.10	65.87	100.0
Thrips	26.03	36.71	37.26	100.0
Scale insect	11.03	8.62	80.35	100.0
Gall midge	4.66	5.69	89.65	100.0
Red mite	30.86	19.98	49.16	100.0

4.1.10. Vulnerable stages of flowers plants to insect pests in field condition

According to the opinion expressed by the farmers, flowers plants were attacked in different stages by specific pest. Among the insect pests aphid and thrips attacked flowers at all stages of the flowers plants but mostly at seedling stages as reported by maximum 50.34% and 35.5% farmers, respectively. Whereas, aphid, red mite, thrips leaf miner and whitefly mostly attacked the flowers plants at vegetative stages as reported by 62.24%, 55.52%, 53.09%, 52.41% and 41.72% farmers, respectively. Additionally aphid and thrips attacked flowers at it inflorescence stage reported by most (40.34%) and (39.83%) farmers respectively.

Table 4.19. Response on vulnerable stages of flowers plants to insect pests

Name of Insects pest	Vulnerable stage of flower plants		
	Seedling (%)	**Vegetative (%)**	**Inflorescence (%)**
Aphid	50.34	62.24	40.34
Flower beetle	11.90	27.24	25.52
Whitefly	25.69	41.72	16.55
June beetle	1.55	6.90	8.97
Metallic flea beetle	5.17	12.59	5.34
Saw fly	8.97	8.28	3.97
Leaf miner	38.62	52.41	6.90
Leaf eating bee	22.59	41.21	11.21
Leaf eating beetle	17.76	41.21	3.79
Thrips	35.50	53.09	39.83
Scale insect	8.97	22.76	5.69
Gall midge	6.38	5.34	5.34
Red mite	35.52	55.52	20.84
Multiple response			

4.1.11. Vulnerable plant parts of flowers infested by insect pests in field condition

It was informed by the farmers that the different portion of the plants attacked by various insect pests in field condition. The leaves of flowers plants were most vulnerable for aphids, leaf miners, thrips and whitefly as reported by 65 to 44% farmers. The stems of flowers plants were most vulnerable for aphid and scale insect as reported by 29.48% and 15.34% farmers. Whereas the flower was vulnerable to aphid and thrips that were reported by 62.41% and 60.50% farmers, respectively.

Table 4.20. Vulnerable parts of flowers plants to insect pests in field condition

Name of Insects pest	% response on vulnerable parts of flower plants			
	Leaf	Stem	Flower	Root/tuber
Aphid	65.00	29.48	62.41	0.52
Flower beetle	16.38	7.07	38.10	0.00
Whitefly	44.31	11.90	27.07	0.00
June beetle	6.90	5.17	9.83	0.00
Metallic flea beetle	12.24	0.34	4.66	0.00
Saw fly	13.28	2.07	3.97	0.00
Leaf miner	51.90	2.41	24.48	0.00
Leaf eating bee	43.45	2.93	18.10	0.00
Leaf eating beetle	37.59	5.86	12.24	0.00
Thrips	45.84	9.31	60.50	0.00
Scale insect	16.21	15.34	5.86	0.00
Gall midge	8.10	4.66	4.66	0.00
Red mite	44.98	13.60	39.81	0.17
Multiple response				

4.1.12. Currently more damaging insect and mite pests of flowers and ornamental plants

Majority (55.80%) of the flowers farmers informed that aphid was more damaging insect pest of flowers in field condition than previous infestation, which was followed by red mite (19%) and thrips infestation as reported by 11.2% farmers. However 26% flowers farmers did not provide any response about this issue.

Table 4.21. More damaging insect and mite pests of flowers in field condition

Insect and mite pests	Number of respondents [N=500]	% response
1. Red mite	95	19.00
2. Aphid	279	55.80
3. Thrips	56	11.20
4. Don't know	130	26.00
Multiple response		

4.1.13. Options for controlling insect and mite pests of flowers

Among 500 flowers farmers, 99.80% farmers reported that they applied insecticides in flowers fields to control insect pests of flowers. This control option was followed by application of irrigation (66.80%). Whereas 56.80% farmers collected harmful insect pest by hand picking followed by application of insecticide with irrigation as reported by 46.00% farmers. Other methods used by the farmers to control insect pests of flowers were IPM (28.20%) and perching (27.20%).

Table 4.22. Options for controlling insect pests of flowers

Control options	Number of respondents [N=500]	% response
Spraying of insecticides on the flower trees	499	99.80
Application of granular insecticide at the base of the tree	217	43.40
Application of insecticide with irrigation	230	46.00
Seed treatment	228	45.60
Irrigation	334	66.80
Collect harmful insect pest by hand picking	284	56.80
IPM	141	28.20
Used of balanced fertilizer	224	44.80
Multiple response		

4.1.14. Sources of assistance and services received for controlling insect and mite pests of flowers

Source of assistance and services is the most important factor that can play the vital role in taking the appropriate and effective control options need to be applied for the control of specific insect pest problem. In this study, 95% farmers received assistance and services to control insect pests of flowers from pesticide dealers. This source was followed by DAE officials as reported by 67% farmers, neighboring farmers (54.4%) and NGO officials (38.6%). Whilst, the lowest proportion (5%) of flowers farmers received assistance and services for controlling insect pests of flowers from the officials of research organization.

Table 4.23. Farmers' response on the source of assistance and services received to control insect pests of flowers

Source of assistance and services received	Response on source of assistance and services	
	Frequency [N=500]	% Response
1. DAE officials	335	67.00
2. Officials of research organization	25	5.00
3. NGO officials	193	38.60
4. Pesticide dealers	475	95.00
5. Neighboring farmers	272	54.40
Multiple response		

4.2. Knowledge of Field level officer's on insect pests of flowers, their risks and management

The survey of the field level officer's knowledge on insect pests of flowers and their risks have been discussed under the following sub-headings:

4.2.1. Gender of the field level officer's

Among 60 field level officer's in 10 major flowers growing districts. 95% field level officers (57) were male, while only 5% were female.

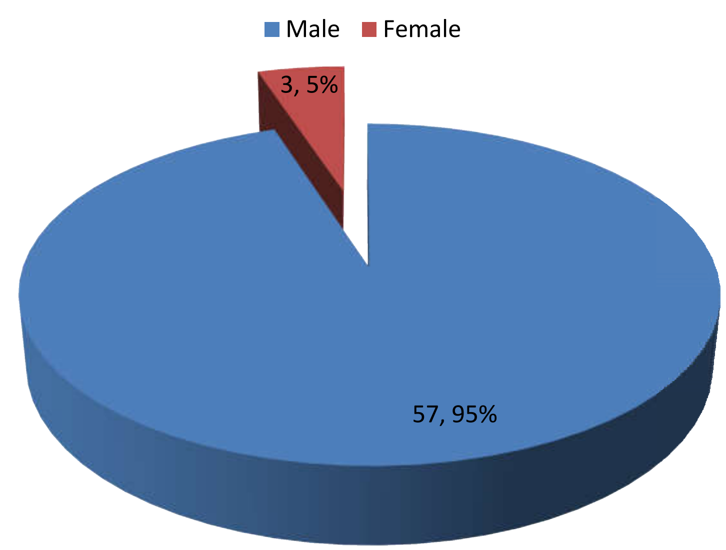

Figure 2. Gender of the local level officers of DAE participated as respondents

4.2.2. Categories of field level officers

In the present study, 33.33% officer (20) were Upazilla Agriculture officer (UAO), whereas 33.33% of them (20) were Agriculture Extension Officers (AEO) and 33.33% of them (20) were Sub-Assistant Agriculture Officers (SAAO).

Table 4.24. Profession designation of the field level officers

Designation	Number of respondents [N=60]	% response
UAO	20	33.33
AEO	20	33.33
SAAO	20	33.33
Total	**60**	**100.00**

4.2.3. Source of flowers seeds/seedlings used by the farmers for cultivation

Flowers farmers used seed of flowers from different sources for cultivation. Field level officers (60) reported that, among the flowers farmers, most (66.67%) of the farmers used seeds from their own seeds and 51.67% farmers used BADC seeds. Whereas, 18.33% farmers collected seeds from neighbors, 16.67% farmers collected from local seed producer. Other sources of flowers seeds for cultivation were importer (15.00%), other company seeds (11.67%) and NGO (11.67%).

Table 4.25. Response on the sources of purchasing seeds/seedlings of flowers usually used for cultivation by the farmers

Sources	Number of respondents [N=60]	Response (%)
1. Farmers' own seed	40	66.67
2. Neighbors	11	18.33
3. BADC	31	51.67
4. Other company	7	11.67
5. Local seed producer	10	16.67
6. Directly from importer	9	15.00
7. Research Organization	2	3.33
8. NGO	7	11.67
9. Seed traders/dealers	13	21.67
Multiple response		

4.2.4. Major problems faced by farmers during flowers cultivation

Out of 60 field level officers participated in the field survey, most (93.33%) of them replied that diseases infection was the major problem in flowers cultivation, which was followed by weed attack (76.67%) and insect pest attack (66.67%) in the field. Other problems for flowers cultivation were lack of propagating materials variety (63.33%), lack of irrigation facilities (43.33%), lack of farmers training on flowers cultivation (36.67%), lack of marketing facilities (28.33%), high price of pesticides (20.00%) and pest attack after harvesting (16.67%).

Table 4.26. Field level officials' opinion on the major problems faced by farmers for flowers cultivation

Major problems	Response	
	No. of respondent [N=60]	% Response
1. Insect pest attack	40	66.67
2. Weed infestation	46	76.67
3. Disease infection	56	93.33
4. Lack of propagating materials	38	63.33
5. Lack of irrigation facilities	26	43.33
6. Pest attack after harvesting	10	16.67
7. Lack of marketing facilities	17	28.33
8. Lack of farmers training facilities	22	36.67
9. High price of pesticides	12	20.00
Multiple response		

4.2.5. Occurrence of the insect pests of flowers in field condition

According to the opinion expressed by the field level officers, 100% FLO's reported that the flowers was infested in the field by both aphid and red mite, which was followed by thrips infestation as reported by 70.0% field level officers. Whereas, 15.0% FLO's reported that the flowers was attacked by leaf miner, followed by leaf eating bee and scale insect as reported by 11.67% field level officers, followed by Leaf eating beetle (10.0%) and whitefly (10.0%)

Table 4.27. Field level officials' response on the occurrence status of the insect and mite pests of flowers in field condition

Name of insect and mite pests	Response on the occurrence of pests [N=60]	
	Frequency	**% response**
Red mite	60	100.0
Aphid	60	100.0
Thrips	42	70.00
Leaf eating bee	7	11.67
Leaf miner	9	15.00
Leaf eating beetle	6	10.00
Whitefly	6	10.00
Scale insect	7	11.67
Multiple response		

4.2.6. Infestation status of the insect pests of flowers in field condition

According to the opinion expressed by the field level officers', out of 60 FLO's, the major insect pest of flowers in field condition was red mite stated by 87.80% FLO's. This was followed by aphid stated by 85% FLO's. On the other hand, the minor insect pests of flowers were leaf eating bee, leaf miner, whitefly and leaf eating beetle as stated by 74%, 94.30%, 90.40%, 88.33%, and 89.80% FLO's, respectively.

Table 4.28. Field level officials' response on the infestation status of the insect pests of flowers in field condition

Name of insect pests	Pest status(%response)	
	Major pest	**Minor pest**
Red mite	87.80	12.20
Aphid	85.00	15.00
Thrips	26.00	74.00
Leaf eating bee	5.70	94.30
Leaf miner	9.60	90.40
Leaf eating beetle	11.70	88.33
Whitefly	10.20	89.80
Multiple response		

4.2.7. Vulnerable stages of flowers plants to insect pests in field condition

According to the opinion expressed by the field level officers', vulnerable stages of flowers plants to insect pest in field condition. Among the insect pests, whitefly and scale insect attacked flowers at all stages of the flowers plants but mostly at seedling stages as reported by maximum 33.10% and 39.80% FLO's, respectively. Whereas aphid, leaf eating bee, leaf miner and leaf eating beetle mostly attacked as responded by 79.10% FLO's, respectively. On the other hand, thrips mostly attacked flowers at it flowering stage reported by 92.50% the FLO's.

Table 4.29. Response on vulnerable stages of flowers plants to insect pests

Sl. No.	Name of insects pest	Response on vulnerable stages (%)		
		Seedling	**Vegetative**	**Flowering**
1	Aphid	21.70	75.70	2.60
2	Red mite	54.30	31.0	14.70
3	Thrips	0.80	6.70	92.50
4	Leaf eating bee	17.70	78.70	3.60
6	Leaf miner	14.10	72.50	13.40
7	Leaf eating beetle	13.30	79.10	7.60
8	Whitefly	33.10	35.70	31.20
9	Scale insect	39.80	27.10	33.10
Multiple response				

4.2.8. Infestation severity of flowers plants by the insect pests in field condition

The field level officers, participated in the field survey, expressed their opinion about the severity of infestation caused by insect pests to flowers in the field condition. 89.00% farmers expressed that aphid caused damage flowers in the field with high infestation intensity. Whereas, red mite caused damage flowers plants with high infestation severity as reported by 84.20% FLO's. On the other hand, flowers thrips, leaf eating bee, leaf miner, leaf eating beetle and whitefly caused damage flowers plants with low infestation severity as reported by 51.8%, 59.7%, 60.0%, 46.7% and 60.0% FLO's, respectively.

Table 4.30. FLO's response on the infestation severity of flowers crops by the insect pests in field condition

Name of insects pest	Severity of infestation (% response)		
	High	Moderate	Low
Aphid	89.00	5.30	5.7
Red mite	84.20	5.10	10.7
Thrips	21.20	27.00	51.8
Leaf eating bee	6.20	34.10	59.7
Leaf miner	7.90	32.10	60.0
Leaf eating beetle	12.4	40.90	46.7
Whitefly	11.30	28.70	60.0
Multiple response			

4.2.9. Relationship among insect pest, disease and weed infestation in cutflowers field

Out of 60 field level officials of DAE participate in the survey study, 97% of the them expressed their positive opinion about relationship of insect pest infestation with disease and weed infestation in the cutflowers field, whereas only (3%) respondents expressed their negative opinion.

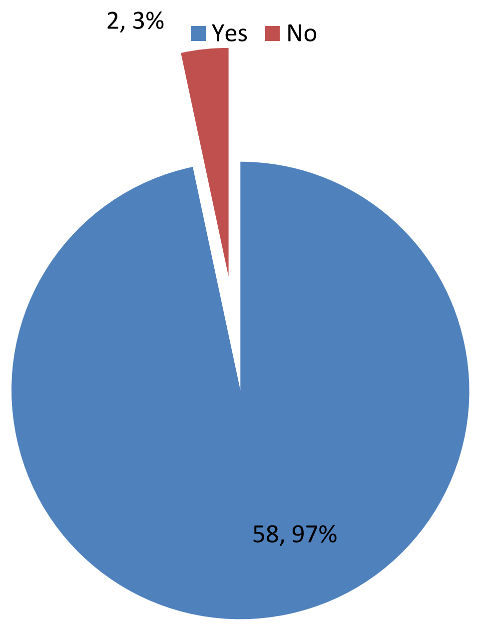

Figure 3. Field level officials response on the relationship of insect infestation with disease and weed infestation in cutflower field

4.2.10. Currently occurrence of more damaging insect and mite pests of flower and ornamental plants

According to the field level officers opinion, out of 60, majority (78%) of the FLO's reported that red mite was more damaging insect pest of flowers in field condition than previous infestation, which was followed by aphid infestation (70%) and thrips as reported by 50% FLO's. On the other hand, 20% field level officers did not provide any response about this issue.

Table 4.31. More damaging insect and mite pests currently occurred in the field of flowers and ornamental plants

Insect and mite pests	Number of respondents [N=60]	% response
Red mite	47	78.33
Aphid	42	70.00
Thrips	30	50.00
Leaf eating bee	13	21.67
Don't know	12	20.00
Multiple response		

4.2.11. Options for controlling insect and mite pests of flowers

Out of 60 field level officers, participated in the field survey, most (80%) of them reported that farmers applied insecticides in flowers fields to control insect pests of flowers. This control option was followed by irrigation(45%). Whereas 30% farmers collected insect pests by hand picking method. Other methods used by the farmers to control insect pests of flowers were application of insecticide with irrigation, seed treatment and used of balanced fertilizer.

Table 4.32. Options for controlling insect pests of flowers

Control options	Number [N=60]	% response
Spraying of insecticides on the flower plants	48	80.00
Collect harmful insect pest by hand picking	18	30.00
IPM	9	15.00
Application of insecticide with irrigation	15	25.00
Seed treatment	12	20.00
Irrigation	**27**	45.00
Used of balanced fertilizer	12	20.00
Application of granular insecticide	10	16.67
Multiple response		

Plate 1: The flower of rose affected by aphid

Plate 2: The flower of marigold affected by mite

Plate 3: The gerbera plant with flower

Plate 4: The Chrysanthemum plants with flowers

Plate 5: The leaves rose affected by leaf eating beetle

Plate 6: The gladiolus cultivated field

Plate 7: The gladiolus field affected by diseases

Plate 8: The rose field

Plate 9: The leaves of dahlia plant affected by insects

Plate 10: The flower of rose affected by thrips

CHAPTER V

SUMMARY AND CONCLUSION

The study was conducted in the 20 upazilla of 10 selected major flowers growing districts of Bangladesh during the period from December 2016 to February 2017 to find out the present status and diversity of insect pests of flowers, their risks and management options. The data were collected through interview of 500 cutflower farmers considering 25 cutflower farmers from each upazilla and 60 field level officers of DAE considering one UAO, one AEO and one SAAO of DAE.

SUMMARY

Majority (69.97%) farmers used rose for cultivation in their field, whereas 63.07% farmers reported that they cultivated marigold. Most (71.20%) of the farmers (356) used their own grafted seedling followed by from seed retailer. Other sources of flowers seed were local nursery, company and seedlings importer from neighboring countries etc.

Most (90.20%) of the flowers farmers faced problems with disease infection of the produced flowers followed by damage caused by insect pest attack in field and weed infestation and lack of propagating materials in the field during flowers cultivation. Other major problems were lack of irrigation facilities, lack of marketing facilities, lack of farmers training facilities and high price of pesticides.

Rose and marigold were the most susceptible flowers to insect pests and diseases. Most (31.80%) of the farmers reported that the orchid was infested in the field by aphid, followed by whitefly and scale insect. In rose cultivation, most (62.80%) of the farmers reported that the rose was infested in field by aphid, followed by thrips and red mite. In tuberose cultivation, most (49.20%) of the farmers reported that the tuberose was infested in the field by thrips, which was followed by aphid and red mite. According to the opinion expressed by the flowers farmers, mostly 73.20% farmers reported that the gladiolus was infested in the field by thrips, followed by leaf miner. Besides carnation cultivation, most (25.00%) of the farmer reported that the carnation was infected by aphid and thrips. On the other hands, most (28.80%) of the farmers reported that the lily was infested in the field by aphid, followed by thrips. Mostly 43.80% farmers reported that the chrysanthemum was infested in the field by aphid, followed by thrips. According to the opinion expressed by farmers, most (42.80%) of the farmers reported that the marigold was infested in the field by leaf miner. On the other hand in aster cultivation most (48.00%) of the farmers reported that the aster was infested in the field by aphid, followed by thrips. According to the opinion expressed by the flowers farmers, most (51.00%) of the farmers (255) reported that the dalhia was infested in the field by aphid, followed by flower beetle and thrips. Most (26.00%) of the farmers (130) reported that the jesmine was infested in the field by aphid, followed by flower beetle and leaf eating beetle

Among the insect pests, aphid and thrips attacked cutflowers at all stages of the cutflowers plants, whereas aphid, leafhopper, leaf miner and whitefly mostly attacked potato plants at vegetative stages. On the other hand, aphid and thrips mostly attacked cutflowers at inflorescences stage of cutflowers. The vegetative stage of cutflowers plants were most vulnerable for aphid, red mite, thrips leaf miner and whitefly.

Most (99.80%) of the farmers applied insecticides in cutflowers fields to control insect pests of cutflowers followed by application of irrigation and hand picking followed by IPM and perching. Most (95%) of the farmers received assistance and advices for controlling insect pests of potato from pesticide dealers. Other sources of services were DAE officials, neighboring farmers and NGO officials.

CONCLUSIONS

- The rose and marigold were most susceptible flowers species to insect pests and diseases. The major sources of flowers seeds used by the farmers for cultivation were the own produced seeds, BADC seeds, seed traders/dealers and neighboring farmers.
- Mostly (90.20%) flowers farmers faced problems with diseases infection of the produced flowers. Other major problems faced during flowers cultivation were lack of irrigation facilities, lack of marketing facilities, lack of farmers training facilities and high price of pesticides.
- Most (31.80%) of the farmers reported that the orchid was infested in the field by aphid, followed by whitefly and scale insect. In rose cultivation, most (62.80%) of the farmers reported that the rose was infested in field by aphid, followed by thrips and red mite. In tuberose cultivation, most (49.20%) of the farmers reported that the tuberose was infested in the field by thrips, which was followed by aphid

and red mite. According to the opinion expressed by the flowers farmers, mostly 73.20% farmers reported that the gladiolus was infested in the field by thrips, followed by leaf miner. Mostly 43.80% farmers reported that the chrysanthemum was infested in the field by aphid, followed by thrips. According to the opinion expressed by farmers, most (42.80%) of the farmers reported that the marigold was infested in the field by leaf miner.

- Currently aphid and thrips were more damaging insect pest of flowers in field condition than previous infestation. Mostly (99.80%) flowers farmers applied insecticides in cutflowers fields to control insect pests of flowers. Other important control options were application of irrigation, hand picking, and IPM.
- Most (95%) of the farmers received assistance and advices for controlling insect pests of cutflowers from pesticide dealers. Other sources of services were DAE officials, neighboring farmers and NGO officials.

CHAPTER VI

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APPENDICES

Appendix 1: Questionnaire for cutflower farmers

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INSECT PEST RISK OF CUTFLOWERS IN BANGLADESH

সেট-১: ফুল চাষীদের জন্যে জরিপ প্রশ্নাবলী

কোডঃ				

মোবাইল ফোন											

A.0 ফুলচাষীর ব্যক্তিগত তথ্যাদিঃ

A.1 উত্তর দাতার নাম: --

A.2 গ্রাম -- **A.3** কৃষি ব্লক: ---

A.4 উপজেলা: -- **A.5** জেলা: --

A.6 শিক্ষাগত যোগ্যতাঃ -------------------------------------- **A.7** বয়সঃ --- ।

A.8 পেশাগত:[কোডঃ ১=ক্ষুদ্র ফুলচাষী, ২=মধ্যম ফুলচাষী, ৩=বড় ফুলচাষী, ৪=ফুল ব্যবসায়ী] **A.9** লিঙ্গঃ (কোডঃ ১=পুরুষ, ২=মহিলা)

B.0 ফুলের আবাদ ও পি.আর.এ সংক্রান্ত তথ্যাবলিঃ

B.1 উত্তরদাতার ব্যবহৃত জমির ধরণ/ প্রকৃতিঃ

ফুল চাষে ব্যবহৃত জমির ধরণ	জমির পরিমাণ (শতাংশ)
১. এ বছর ফুল চাষ করেছেন এমন জমির পরিমান বলুন?	
২. অন্য ফসলের তুলনায় এবছর ফুল চাষে নিয়োজিত জমির আনুমানিক শতকরা পরিমান (%) বলুন	
৩. কত বৎসর যাবৎ ফুল চাষ করেন?	

B.2 আপনি এবছর কোন কোন ফুল চাষ করেছেন, দয়া করে বলবেন কি?

চাষকৃত/ব্যবহৃত ফুলের প্রকার/নাম (নীচে উল্লেখিত ফুলের কোড ব্যবহার করুন]	বিভিন্ন প্রকার ফুলের চাষকৃত জমির পরিমাণ (শতাংশ)	অর্জিত আয় (হাজারটাকা/একর*)
১.		
২.		
৩.		
৪.		
৫.		
৬.		
৭.		

[কোডঃ ১= অর্কিড, ২=গোলাপ, ৩=জারবেরা, ৪=রজনীগন্ধা, ৫=গ্ল্যাডিওলাস, ৬=কার্নেশান, ৭=লিলি, ৮=চন্দ্রমল্লিকা, ৯=গাঁদা, ১০=এ্যাস্টার, ১১=ডালিয়া, ১৩=বেলী, ১৪=অন্যান্য -------------------- (যদি থাকে)]

* ১ একর = ১০০ শতক

B.3 নিম্নলিখিত ফুলের প্রতি পোকামাকড়/রোগ/আগাছার প্রতি সংবেদনশীলতা ও কোন পোকার আক্রমন বেশী হয় উল্লেখ করুনঃ

ক্রঃ নং	ফুলের নাম	যার প্রতি সংবেদনশীল (কোডঃ ১=পোকামাকড়, ২=রোগ, ৩=আগাছা, ৪=কোনটাইনা)।	ডানপাশের তালিকা হতে কোন কোন পোকা-মাকড় বামপাশের ফুলে আক্রমন কওে তার কোড উল্লেখ করুন	পোকা-মাকড়ের তালিকা (কোডসহ)
১.	অর্কিড			১=জাব পোকা, ২=ফুলের বিটল, ৩=সাদা মাছি (হোয়াইট ফ্লাই), ৪=জুন বিটল, ৫=মেটালিক ফ্লি বিটল, ৬=স্ব-ফ্লাই, ৭=পাতা সুরঙ্গকারী পোকা, ৮=পাতা খেকো মৌমাছি, ৯=থ্রিপ্স, ১০=স্কেল ইনসেক্ট, ১১=লাল মাকড়, ১২=অন্যান্য ---------]
২.	গোলাপ			
৩.	জারবেরা			
৪.	রজনীগন্ধা			
৫.	গ্ল্যাডিওলাস			
৬.	কার্নেশান			
৭.	লিলি			
৮.	চন্দ্রমল্লিকা			
৯.	গাঁদা			
১০	এ্যাস্টার			
১১	ডালিয়া			
১২	বেলী			
১৩	অন্যান্য ----------			

B.4 ফুল চাষের জন্যে সাধারণতঃ কোন কোন উৎস থেকে বীজ/চারা ক্রয়/সংগ্রহ করেন?

উৎসসমূহ	উত্তরেরধরণ (কোডঃ হ্যাঁ=১, না=২)।
১। নিজের তৈরী বীজ/চারা	
২। প্রতিবেশী কৃষকের কাছ থেকে সংগৃহীত	
৩। অন্য কোন কোম্পানীর বীজ/চারা/কন্দ	
৪। স্থানীয়বীজ/চারাউ ৎপাদনকারী নার্সারী থেকে	
৫। আমদানীকারকের নিকট থেকে সংগৃহীত	
৬। গবেষনাপ্রতিষ্ঠান থেকে সংগৃহীত	
৭। এনজিও হতে	
৮। ফুলবীজ/চারাব্যবসায়ীর নিকট হতে সংগৃহীত	
৯। অন্যান্য (যদি থাকে)-----------	

B.5 ফুলের ক্ষতিকর পোকামাকড়ের আক্রমনের অবস্থা, গাছের ঝুঁকিপূর্ণ ধাপসমূহ, পোকাক্রান্ত গাছের অংশ এবং আক্রমনের তীব্রতা কেমন?

ক্রঃ নং	পোকার নাম	আক্রমনের অবস্থাঃ (১=মূখ্য, ২=গৌণ, ৩=আক্রমন হয় না)।	ফুল গাছের ঝুঁকিপূর্ণ ধাপসমূহ [১=চারা, ২=বাড়ন্তগাছ, ৩=ফুল ফোঁটা/বৃদ্ধি পর্যায়]।	পোকাক্রান্ত গাছের অংশ (কোডঃ ১=পাতা, ২=কান্ড, ৩=ফুল, ৪=শিকড়/কন্দ)।	আক্রমনের তীব্রতা (১=বেশী, ২=মধ্যম, ৪=কম)
১	জাব পোকা				
২	ফুলের বিটল				
৩	সাদা মাছি (হোয়াইট ফ্লাই)				
৪	জুন বিটল				
৫	মেটালিক ফ্লি বিটল				
৬	স্ব-ফ্লাই				
৭	লিফ মাইনার				
৮	পাতা খেকো পোকা				
৯	থ্রিপ্স				
১০	স্কেল ইনসেক্ট				
১১	লাল মাকড়				
১২	অন্যান্য----------				

B.6 ক. আপনার এলাকায় ফুল ক্ষেতের বাগানে বর্তমানে এমন নতুন কোন পোকা দেখা যাচ্ছে কি, যা পূর্ববর্তীসময়ে ছিল না? (কোডঃ হ্যাঁ=১, না=২)। ☐

খ. যদি উত্তর হ্যাঁ হয়, তাহলে পোকা-মাকড়গুলো কি কি? নাম উল্লেখ করুনঃ

১. -------------------------, ২. ------------------------, ৩. ------------------------, ৪. ------------------------

B.7 আপনার এলাকায় ফুল ক্ষেতের বাগানে আগের তুলনায় বর্তমানে অধিক ক্ষতি কওে এমন কতগুলো অনিষ্টকারী পোকা-মাকড়রের নাম বলুন?

১. -------------------------, ২. ------------------------, ৩. ------------------------, ৪. ------------------------

B.8 আপনি সাধারণত কিভাবে ফুলের ক্ষতিকর পোকামাকড়ের আক্রমণ দমন করেন? নিচের খালিঘরে কোড নাম্বার লিখুনঃ

(কোডঃ ১= ফুলগাছে কীটনাশক স্প্রে করে, ২= ফুলের চারা/কন্দ রোপন করার সময় নালাতে দানাদার কীটনাশক প্রয়োগ, ৩=সেচের সাথে কীটনাশক প্রয়োগ করে, ৪=চারা/বীজ কীটনাশক দিয়ে শোধন, ৫= সেচ প্রদান, ৬= ক্ষতিকর পোকা সমূহ হাত দিয়ে সংগ্রহ করে মেরে ফেলা, ৭= পাখি বসার জন্য জমিতে খুঁটিপুঁতে দেয়া, ৮= সমন্বিত বালাই পদ্ধতি (আই.পি.এম.), ৯= সুষম সার ব্যবহার, ১০= অন্যান্য ---------------------(দয়া কওে উল্লেখ করুন)]

Appendix 2: Questionnaire for Field Level Officers of DAE

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INSECT PEST RISK OF CUTFLOWERS IN BANGLADESH

Set-A: KII Checklists for Field Level DAE Officials

কোড:				

Name of Key Informant…….. ………………………………. Designation……………………

Organization:………………………..…………… Working area…………………..

Mobile:………..…………..……………..…………

1.0 INFORMATION ABOUT INSECT PESTS OF CUT FLOWERS AND FOLIAGE

1.1 What are the major insect pests that cause potential damage to flowers and foliage in your area?

1.2 What are the minor insect pests that may harm to cut flowers and foliage, if not to be controlled?

1.3 What are the insect pests of cut flowers and foliage, which incidences are being seen in recent years, but not seen earlier in your area?

1.4 What is the damage potential of mealy bug on flowers in your area? Are there any various species of mealy bug present in flowers, if yes please mention those species along with kinds of flowers.

1.5 Is there any incidence of Japanese beetle on flowers in your area? If yes, please mention the host flowers along with damage severity.

1.6 What are the effective options to control the quarantine insect pests that are found in the cut flowers and foliage field or storage in your area?

1.7 Give your suggestions for the better management of the insect pests of flowers in Bangladesh.