RESEARCH PROGRAMME

Population Dynamics Of Mustard Aphid (*Lipaphis erysimi)*And Its Management In Mustard Crop

DISSERTATION -1 REPORT

Submitted to

LOVELY PROFESSIONAL UNIVERSITY PHAGWARA PUNJAB INDIA

In partial fulfillment of the requirement for the award of degree of

MASTER OF SCIENCE
IN
(ENTOMOLOGY)

By
Salil Kumar Dwivedi 11610487

Under the supervision of
Dr. SUNIL DWIVEDI

LOVELY PROFESSIONAL UNIVERSITY

Transforming Education Transforming India

Department of entomology, school of agriculture,
Lovely Professional University, Phagwara, India
2017-18

CERTIFICATE

I here by declare that the synopsis entitled by "**Population dynamics of mustard aphid and its management in mustard crop "** it is a record of my work and carried out at Lovely Professional University as requirement of degree of master of science in the discipline of Entomology, under the guidance of Dr. Sunil Kumar Dwivedi Assistant Professor Department of Plant Protection with co-advisor Dr. Ankush Raut Assistant Professor Department of Plant Protection, school of Agriculture and this synopsis is not submitted for any other work, degree, or diploma.

Salil Kumar Dwivedi

Registration no: -11610487

M.Sc. Entomology (department of plant protection)
School of agriculture

CERTIFICATE

This is certified that synopsis entitled "**Population dynamics of mustard aphid and its management in mustard crop** " submitted in partial fulfillment of the the requirement for the award of degree of masters of Science in the discipline of Entomology, is a research work will be carried out by Salil Kumar Dwivedi (11610487) under my supervision and that no part of this synopsis has been submitted for any other degree of diploma

Field of Research problem**: - Population dynamics of mustard aphid (***Lipaphis erysimi* Kalt.)**.**

and its management in mustard

Different objectives under the title of the thesis are as follows: -

- To study the population dynamics of aphid in mustard crop.
- To find out the correlation between biotic and abiotic factor in mustered management
- Bioefficasy of new molecular insecticides and bio-pesticides against mustard aphid.

Introduction

Mustard plants are any of several plant species in the genera *Brassica* and *Sinapis* in the family Brassicaceae. Mustard seed is used as a spice. Grinding and mixing the seeds with water, vinegar, or other liquids, creates the yellow condiment known as prepared mustard. The seeds can also be pressed to make mustard oil, and the edible leaves can be eaten as mustard greens. In World it is cultivated in India, Canada, China, Pakistan, Poland, Bangladesh, Sweeden and France.33.8% area of the total cultivated area of world is in India (7.49 million hectare).16% of World total production is produced by India (5-6.7m.tons). According to area India stands first in World where as according to production it is on a second place after Canada. The average yield of Mustard and Toria in India is 7.5quintal per hectare. Other than Kerala it is grown in some areas of all the states. Uttar Pradesh is a leading mustard producing state of India 60% of total mustard production is from this state. Other than U.P it is grown on a large scale in Rajasthan, Madhya Pradesh, Haryana, Punjab, Assam, Bihar, Gujarat, West Bengal. Maximum yield of mustard (8.40 quintal / ha) is recorded in Jammu and Kashmir. Bihar hairy caterpillar, Mustard aphid, Painted bug, Mustard saw fly, Mustard leaf miner Diamondback moth, Cabbage head borer, Larger moth (leaf Webber) However, the relative importance of different species varies with location, season and time of flowering of different cultivars. The mustered aphid due to its extensive host range and destructiveness has become a serious pest of mustered in the tropics and sub-tropics. It is a serious pest of mustered in India. The nymph and adult has piercing and sucking type of mouthpart , plants shows sometime yellowing and leaf curling presence of ants is symbol of aphid infestation. And stunted growth and mould growth on plant also indicated the aphid infestation

*agriinfo and nutritional data

Aphid is a major pest of mustered. and it cause much more losses economically as well as on the health of the plants. Ecology of aphid shows that The nymph and adult feeds on mustered plants, which is considered as a major rice pest throughout India that devastate mustered harvest annually. They feed on folier part of plant and suck the cell sap.t. Full-grown adults are yellowish green or olive green in color and length of female ranges from 1.2-2.4 mmand males are 1.2-2.2mm. Aphids feed by sucking sap from their hosts. Large colonies can cause the plants to become deformed and the leaves curled, shriveled and yellowed (Metcalf, 1962). like other soft bodied insects such as leafhoppers, mealybugs and scales, aphids produce honeydew. This sweet and watery excrement is fed on by bees, wasps, ants and other insects. The honeydew serves as a medium on which a sooty fungus, called sooty mold, grows. Honeydew gives cabbage plants a dirty appearance that reduces their market value (Deshpande, 1937).

Aphids vector many plant diseases that cause greater losses than caused by direct feeding injury. This is often the greatest impact of an aphid infestation. The turnip aphid is a vector of about 10 non-persistent plant viruses, including cabbage black ring spot and mosaic diseases of cauliflower, radish and turnip (Blackman and Eastop, 1984). In nonpersistent transmission the virus reproduces in the plant and aphids simply aid in dissemination of the virus and the infection process.

Management of Pests: -Here we will use many methods for the management of mustard aphid but our main focus will be to determine bio efficacy of new molecular insecticides and biopesticides experiment will be conducted at student's research farm at lovely professional university Jalandhar Punjab 144001 during *Rabi* season, 2017-18.

Observations:

populations of ***Lypaphis erisimi*** will recorded at weekly intervals on 5 randomly selected plants/ plot starting from vegetative stage till pod maturation. The apical portion of selected twigs 10 cm The spray of treatments will applied as and when ETL level will be crossed.

Review of literature:

Prasad, S.K.*(2003)r*eported that the population of *Lipaphis erysim*i in different years for 12 or more from 1989-90 to 2001 and conclude that it mainly depends on whether factors such as tempreture, relative humidity, light intensity etc. and said that in florescence shoot as early as in 51* week during 1996-97 and as late as in 5* week during 1998-99. At initial stage the aphid population were between 1 to 61. Then after, the number started increasing and reached to its highest level. at peak and the time of reaching peak there werea lot of difference in different year's population. The earliest peak reached was (6th standard week) in 1990-91 and in 9"1 standard week in 2000-2001. The highest population of aphid were 2350/plant in 1992-93 and minimum population were 60 aphids/plant during 1998-99 crop season. The aphids were on the plants for shortest period of 5 weeks during 1999-2000 and for longest period of 3 weeks during 1996-97.S

Muhmmad Saleem Wain et.al.(2010) Reported that the aphid population in wheat can be highly fluctuated by metrological factors such as temperature, humidity rainfall etc.main aim of this study was to investigate how meteorological factors play a role in the fluctuating aphid population and how different management practices could be effective in combating aphids. The results revealed that a peak aphid population was recorded during the beginning of the third week of March for both of the study year periods of 2007–2008 and 2008–2009. Aphid density was positively associated with maximum as well as minimum temperature while it showed a negative correlation with relative humidity. However aphid population was positively but not significantly affected by rainfall. Early sowing on 1st November produced the least aphid infestation hence early sowing was encouraged as a cultural practice for keeping aphids below damaging levels. The recently developed wheat varieties like: SHAFAQ-06, SEHER-06, FSD-08 and LASANI-08, revealed aphid resistance and performed better against aphids. On the other hand the genotypes V-05003, BARS-09 and 0BT006, revealed maximum vulnerability to aphids. Number of aphids per tiller was positive correlated with loss in grain yield. Application of insecticide significantly controlled the aphid population which suggested that a combination of host plant resistance with chemical control could restrain the aphid infestation in wheat.

Singh et.al.(2012) reported that metasystox was highly effective against aphid control followed by neem product i.e., Neemazal, Nimbecidine and Econee, field studies were carried out for two consecutive *rabi* seasons (2005-06 and 2006-07) to screen certain rapeseed-mustard varieties for their resistance against mustard aphid, *Lipaphis erysimi* and to evaluate the bioefficacy of certain botanical and microbial insecticides. Their impact on predators, pollinators and crop yield were also evaluated. Among the sixteen varieties/genotypes tested, TH0101 and Potsangbam yella possessed high level resistance to mustard aphid. Whereas, microbial Vertical was least effective in controlling mustard aphid, but all the insecticidal treatments were superior to control. The population of predator, *Coccinella septempunctata* was found higher in plots treated with Vertical (2.01 beetles/plant), followed by Cal-MB(1.87 beetles/plant). Whereas, metasystox was found to be highly toxic to beetles (0.85 beetles/plant). The population of bees was higher in the plots treated with Cal-MB (2.53/10 plants/5 minutes) followed by Vertical (2.38/10 plants/5 minutes). The most toxic effect to bees was found in metasystox with minimum population (0.61 bees/10 plants/5 minutes). Highest seed yield (16.10q/ha) was recorded in the plots treated with metasystox, and it was found to be the most economic treatment with cost benefit ratio of 1:7.34.

SINGH et.al (2009)reported and studied about Biology and feeding potential of *Coccinella septempunctata* Linnaeus was studied in the laboratory at 27+- 2^0 C and 70 +- 5% RH on mustard aphid, *Lipaphis erysimi* Kaltenbach. The mean fecundity was 357.45 +- 22.41 eggs per female while ovipositional period, incubation period, larval period, pupal period, total developmental period (egg to adult) and adult longevity were 4.32 +- 0.26,4.40 0.22,10.95 +- 0.35,5.35 0.15,20.70 +- 0.72 and 122.90 3.12 days, respectively. The mean feeding potential of grub and adult was 50.38 1.56 and 83.54 1.15 aphids per day per individual, respectively.

BAPUJI RAO et.al.(2013) reported that Aphid incidence and population increment was found to be regulated by temperature and time to attain peak population was relatively short in warm humid climates than in cool climates. Aphids appeared generally when the accumulated thermal time ranged between 810-847 and diurnal temperature range had a key role on the pest build up. Functional relations developed from the present study between aphid incidence and peak population using previous weeks weather and pest data for majority of the locations could be used for taking of any prophylactic/control measures. Projections on aphid population in future climates using generated weather variables indicated that warming may not increase aphid population at all locations uniformly.

A. A. Khedkaret.al.(1998) A field experiment was conducted to see the relative susceptibility of different mustard genotypes/varieties against aphid under field condition during *Rabi*, 2009-10 at B. A. College of Agriculture, Anand Agricultural University Anand. Seventeen genotypes/varieties were grown in a plot 1.8 x 3.0 m with 45 x 15 cm spacing and replicated thrice in randomized block design. All the recommended agronomical practices were followed except use of any of the insecticides. The aphid, *L. erysimi* population was recorded regularly from its appearance at weekly interval on 5 randomly selected plants by following 0-5 index method as per the methodology described by Patel *et al.*, (1995). The weight of 1000 seeds was recorded to see the impact of aphid infestation on quality and boldness of seeds. Seed yield of mustard was also from the plot.aphid, *Lipaphis erysimi (Kaltenbach)* is known to be a key pest and caused 69.61 per cent loss in yield (Singh and Sachan, 1994). For the management of this key pest, growers generally reliance on the use of insecticides which creates undesirable problems

such as residues, development of resistance in pest to insecticides, resurgence, environmental pollution, toxic effects on natural enemies etc. To such as adverse effects, the identification and use of resistance/tolerant varieties is considered as best alternative for the management of the pest

Shankarganesh et.al.(2017)reported that Acetamiprid and thiamethoxam were found to be more toxic than other insecticides. After 24 h, the LC50 values for theBikaner population against different insecticides were 7.0, 6.0, 4.0, 3.0 and 2.0 ppm for carbosulfan, bifenthrin, imidacloprid, acetamiprid and thiamethoxam, respectively fro *Lipaphis erysimi* (Kalt.), using the leaf dip method, and against Coccinella septempunctata L. in semifield condition. Similarly, the descending order of toxicity for the Delhi population was acetamiprid (7.0 ppm), thiamethoxam (9.0ppm), imidacloprid (15.0 ppm),carbosulfan (32.0 ppm) and bifenthrin (36.0 ppm). The relative toxicity values suggest that in both populations, thiamethoxam and acetamiprid show the highest toxicity. Carbosulfan and bifenthrin were highly toxic to coccinellid grubs and resulted in 100% mortality in semifield conditions, whereas the neonicotinoids acetamiprid and thiamethoxam showed less mortality. It showed the tolerance of coccinellidae against neonicotinoids under semi-fieldconditions.

Atri et.al.(2012) Concluded that B.juncea-fruticulos a introgression set may prove to be a very powerful breeding tool for aphid resistance related QTL/gene discovery and fine mapping of the desired genes/QTLs to facilitate marker assisted transfer of identified gene(s) for mustard aphid resistance in the background of commercial mustard genotypes Majority of introgression lines had expected euploid chromosome number (2n= 36), showed normal meiosis and high pollen grain fertility. Well-distributed and transferable simple-sequence repeats (SSR) markers for all the 18 B. juncea chromosomes helped to characterize introgression events. Average proportions of recipient and donor genome in the substitution lines were 49.72 and 35.06%, respectively. Minimum alien parent genome presence (27.29%) was observed in the introgression line, Ad3K-280 . Introgressed genotypes also varied for their resistance responses to mustard aphid infestations under artificial release conditions for two continuous seasons. Some of the test genotypes showed consistent resistant reaction.

HANSRAJ MEENA et.al. (2013) reported that the use of Microbial agents such as (Verticillium lecanii, Beauveria bassiana and Metarhizium anisopliae @ 5 g per litre of water),plant products (Tobacco, onion and neem seed kernel extract @ 5%), cow urine @ 50 litre/ha and dimethoate30EC @ 300 g a.i/ha were evaluated against mustard aphid, Lipaphis erysimi (Kalt.) and their safety to natural enemies and pollinators. Significantly higher aphid reduction these treatments over the control without any phytotoxic effect and found safe to natural enemies of mustard aphid and honeybee. Mostfavourable cost-benefit ratio was obtained under the treatment i.e. dimethoate 30 EC @ 300 g a.i/ha (1:38) followed by neem seed kernel extract @ 5% (1:18), onion extract @ 5% (1:17), cow urine @ 50 litre/ha (1:11), Beauveria bassiana @ 5 g per litre of water (1:10), Verticillium lecanii @ 5 g per litre of water (1:10), Metarhizium anisopliae @ 5 g per litre of water (1:8), tobacco extract @ 5% (1:6) and water spray (1:2).

Surender Kumar and rajdeep kudesia (2014) During present investigation nine yield contributing characters of four species/ varieties of oleiferous *Brassicas were* studied. Germplasm belonged to three species i.e. *Brassica campestris, B.juncea* (brown variety and yellow variety) and *B.carinata*. Nine yielding contributing characters were plant height, number of primary branches, number of leaves per plant, number of flower per plant on main branch, number of siliquae per plant, number of seed per siliqua, weight of hundred seed, total seed weight per plant and harvest Index . The seeds of total four species/varieties were sown in 'Split Plot Design'. The Harvest index of *B. juncea* (Brown) was maximum which was due to lesser dry weight of the plant but the maximum hundred seed weight per plant and total seed weight per plant. The present investigation with four species/varieties of oleiferous *Brassica*s reveals that *Brassica juncea* (brown) is the highest yielding species. It is adaptive to Bundelkhand's environmental conditions.

Khan et.al.(2015) In the present study aphids density and yield components of 12 genetically diversified *Brassica* genotypes were determined under field conditions during 2006-08. The genotypes tested were *Brassica napus* (Westar), *B. napus* (Ganyou-5), *B. napus (*Rainbow), *B. napus* (Oscar), *B. napus* (Vanguard), *B. napus* (Crusher), *B. napus* (Torch), *B. napus* (Legend), *B. napus* (Altex), *B. juncea* (Raya Anmol), *B. carinata* (Peela Raya) and *B. campestris* (T-16-401). The results showed that mean aphids density was significantly higher (37.94 aphids plant-1) on Legend and lower (12.84 aphids plant-1) on Vanguard. With respect to yield and its components, highest values for seed yield (2386 kg/ha), plant height (214.3cm) and number of branches/plant (19.20) were recorded in Peela Raya, whereas maximum 1000 grain weight (4.80g), siliqua length (8.31cm) and seed/siliqua (23.57 seed) were found in Westar, Ganyou-5, and Oscar, respectively. Overall, among the 12 genotypes Vanguard, Crusher and Legend
were the best. Based on comparatively better performance against aphids attack and giving better yieldcomponents, Vanguard, Crusher and Legend were found best among the *Brassica* genotypes.

Material methods: -

The **e**xperiment will be conducted during *rabi season* 2017-18 to full fill the different objectives of research topic in lovely professional university student research farm.

- **Population dynamics of aphid in mustard aphid in mustard crop: -**
  population will be recorded at weekly interval on randomly selected 5 plants/plot from each treatment during different growth stages of plant. Population will be collected from 3 days interval from yellow sticky trap for monitoring from field.
- **Correlation studies:**
  Correlation between population of aphid with abiotic factors i.e. minimum temperature, maximum temperature, relative humidity and rainfall will be worked out.at the experimental location
- **Bio agents and natural enemies**: - The population of different natural enemies will be recorded and observe their efficacy
- **Management of mustard aphid by new molecular insecticides and bio pesticides: -**
  To promote the mustard variety will be grown into 5x3 M^2 plot size with nine treatments and three replications in RBD (all the recommended agronomic practices will be followed to raise the crop of good stand) the pest population will be regularly mention and schedule of respective insecticides spraying will be initiated with ETL that is (25-150 aphids/plant) the level of aphid activity. For recording aphid incidence randomly selected five plants/plot, the pretreatment count will be taken before one day of each spraying for taking decision to initiate the imposition of treatment and subsequently post treatment will be counted or recorded after first third seven and fifteen days after each spraying.

Location	**Student research farm** **lovely professional university Jalandhar Punjab**
Plot size	**5x3 M^2**
Treatment	**9**
Replication	**3**
Design	**RBD**
Key pest	*Lipaphis erysimi*
Variety	**T-6**

Spacing	**45x10 cm**

Damage Assessment:

Damage due to mustard aphid will be assessed in terms of yellowing plant stunted plant growth by counting total number of damaged plants in each selected treatment utilize when population of aphid cross the ETL then spraying of treatment takes place and after that population will be recorded 1st DAS, 3RD DAS, 7th DAS and 15th DAS at reproductive stage and pod formation stage..

Yield Assessment:.

Yield loss should be worked by from 2 plots - One with full chemical protection and another with no protection. (rabi season 2017-18)

Statistical analysis:

Analysis of variance of the data was done for each trial was done by considering each trial under randomized block design. Critical and difference values will be computed. Pest infestation data will subject to angular transformation prior to analysis As said earlier percent of damaged plants at vegetative and reproductive stage each transect of particular treatment formed one replication and each crop cut made from each triangular area of the treatment plot formed a replication. The Damage data will collect weekly basis after seedling stage at vegetative and reproductive stage. The damage data was transformed into angular transformation for normalized data. The population data collected from field was transformed in square-root for normalized data. And the collected data will be analyzed by using two way analysis of variance (ANOVA) It will be performed in SPASS (version 16)

The reduction % age over control is calculated by using following formula : -

$$ROC = \frac{UTP-TP}{UTP} \times 100$$

UTP= untreated plot, TP=treated plot

Layout:

Design - RBD

Variety - T-6

Treatment - nine

Replications - Three

Plot size - 5x5m

T1	**T9**	**T7**
T2	**T8**	**T6**
T3	**T7**	**T2**
T4	**T6**	**T3**
T5	**T4**	**T1**
T6	**T5**	**T4**
T7	**T3**	**T5**
T8	**T2**	**T6**
T9	**T1**	**T8**

TREATMENT : -9

SPACING;- 45X10 CM^2

REPLICATION : 3

PLOT SIZE:-5x3 M^2

AREA: 680 M^2 (including all spacing and extra peace od land)

Details of treatments:

T1	Imidachloprid	150ml/ha
T2	Thiamethoxam	100g/ha
T3	Monocrotophos	200ml/ha
T4	Malathian	180ml/ha
T5	Fipronil	50-70g/hac,
T6	Acetamiprid	120g/ha
T7	*B. Bassiana*	5g/lit of water
T8	*Metarhizium anosopolae*	5g/lit of water
T9	Control	

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