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EVOLUTION OF THE MUSTARD WASP (Lipaphis erysimi (Kalt))

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Abstract- Mustard crop is more susceptible to various types of pests from sowing to harvesting as compared to other oilseed crops. Ketona invasion is one of the important factors responsible for the low yield; Mustardca aphid, L.; erysim(Kalt), Cabbageephid, B. Brassica (L.), Mustard sawdust, A. Proxima (Clug), Cabbage Butterfly, P.; Brassica (Lynn), Painted Bug, B.picta (K), Mustard Leaf Eater, S. litura (f), leaf minor, Ch. horticola (gauro) thrips, T.; Tabasi and Whitefly, B. Tabasi (Genadius). Among these, L. erysmicult enbach, (Aphididae: Homoptera) is the most destructive pest in India and distributed in many other countries, being the most preferred crop for the soccer complex and six varieties of mustard. Aphids are small, soft-bodied, pearl-like insects that have a fluid pair of cornicles (honey tubes) that exit the sixth abdominal segment. There are four nymphal stages (instar). Winged, female, adult aphids have a belly with dark green lateral stripes. Body segments and darker birds separate the nerves. Male aphids are olive-green to brown in color. Aphids usually attack during December and continue till March. The most favorable temperature is 200C or less. Cloudy and cool weather helps to accelerate insect development. About 45 generations are completed in a year.

Keywords: Mustard aphid, Lipaphis erysimi, life cycle, host crop and Management

Introduction- The mustard aphid Lipophis erisimi (Kultenbach) (Homoptera: Aphididae) is a major pest distributed in all agro-climatic zones of India. Adults and nymphs suck the sap from stems, leaves, inflorescences and pods, and the aerial parts of the plant are often covered with a large number of aphids (Srivastava, 2002) and have also been reported to infect mustard roots. Plant growth is adversely affected in the early stages. The buds do not produce flowers. Aphid colonization leads to partial or complete failure of silk production. The silk becomes thin and seedless. They also attack established pods, resulting in seed shrinkage (Zaman, 1990) and even plant death due to excessive sap-sucking (Aslam and Ahmed, 2001). The infected plant becomes weak and stunted. Excessive secretion of honeydew by aphids on the leaves results in the growth of black sooty mold, which disrupts the photosynthetic activity of the leaves. Controlling the pest with systemic insecticides is quite effective, but adversely affects the insect's predators and parasites. However, apart from the high cost of the pesticide, chemical control has several other disadvantages, i.e. development of resistance to commonly used insecticides, re-emergence of pests, secondary pest infestations, oil in excess of permissible limits and pesticide residues in cakes. Accumulation and environmental degradation (Singh and Sharma, 2009). Among all pests, the mustard aphid Lipophis erisimi (Kultenbach) (Homoptera: Aphididae) by sucking the sap from its host and causing 9 to 96% crop damage in various agro-climatic conditions of India is a major source of canola in India.It feeds has acquired pest status (Singh and Sharma, 2002; Bakhetia, 1984; Chorbandi and Bakhetia, 1987; Singh and Sachan, 1994; Singh and Sachan, 1995; , 2007). In some mustard crops, damage can reach 100% of the area (Singh and Sachan, 1999). Larger colonies of aphids can cause plant deformity due to curling and curling of leaves (Metcalf, 1962). In severe infestation, both sides of the leaves are attacked (Yadav et al., 1988). On mustard, Lipaphis erysimi prefers to feed on mustard flowers and leaves (Singh et al., 1965).

Identification- Ericimi is a small, soft-bodied, light green, pear-shaped body consisting of a pair of small tubes called cornua on the 5'^-6"^ posteriodorsal region of the abdomen. Adults may be winged or wingless. Wingless mainly in the early stage of infection in the abdomen. The wings are long when present and are perpendicular to the body. The insect reproduces sexually and partly. A single female gives birth to 25–133 nymphs, which are 10 There are 7 adults in days. There are about 25 generations in a year.

symptom of Damage - Severe infestations cause yellowing, curling and subsequent drying of leaves, resulting in weak pods and small seed development in pods. This also excludes honeydew, which can cause sooty mold. It is responsible for growth and reduces the rate of photosynthesis Sekhon (1989). Therefore, it is imperative to regularly monitor the mustard crop during the favorable period of aphid breeding. In heavy infestations, mustard is necessary to combat aphid infestation. Chemical control is the only option. Therefore, this investigation was conducted to evaluate the biological effectiveness of certain insecticides against the mustard aphid, Lipophis ericimi cultivar.

Life cycle of Lipaphis erysimi- This aphid has two modes of young production: fertilization of females by males leading to egg production (sexual reproduction) and birth of live female nymphs by adult females without fertilization by males (parthenogenesis). Reproduction by parthenogenesis appears to be the norm. Because males are so rare and females are almost exclusively viviparous throughout the year (live young are produced) and males have been observed only in the colder months (Kawada and Murai, 1979).

Eggs- The eggs are laid along the veins of the leaves (Kawada and Murai, 1979). Eggs of this aphid have not been found in Hawaii.

Nymph- Apsaras have four nymph stages (instars). The general appearance of each instar is similar except for the increase in size during subsequent instars. The first, second, third and fourth nymphal stages last for 1-2 and 3 days, respectively (Sachan and Bansal, 1975), with days 8-9 Gives the total length of the nymphal stage. There is little variation in this duration between the winged and wingless forms when grown on cabbage, cauliflower, mustard and radish (Sachan and Bansal, 1975). For shaded drawing of first and fourth instars See Sidhu and Singh (1964).

Adult- Female wingless aphids (called Apterae) are pale green, grayish green or olive green in color, with white waxy blooms covering the body (Blackman and Eastop, 1984) The wax coating is thick in humid conditions. Feathered females and adult aphids (called alata) have a dark green abdomen with dark lateral stripes separating the body parts and dark wing veins (Blackman and Eastop, 1984). Antennae base (Deshpande, 2004). 1937). (Blackman and Eastop, 1984). See Sidhu and Singh (1964) for shaded drawings of apterous and late adults.

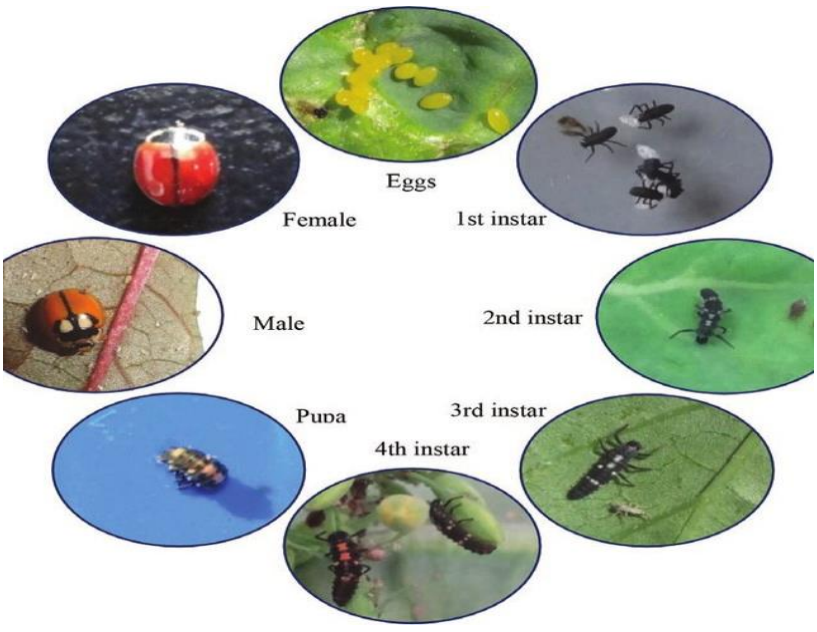

Fig. life cycle of mustard aphid

Population dynamics of Lipaphis erysimi- Viable temperature ranges, high temperatures shorten lifespan and low temperatures increase lifespan (Sidhu and Singh, 1964). A study by Sidhu and Singh (1964) reported longevity of turnip aphid on radishes at several temperatures throughout the year in India. Adults live 15 - 18 days in summer when temperatures are between 85 - 94 F. Lifespan was significantly longer, ranging from 31 to 61 days in winter temperatures (55 - 68 F). The number of nymphs produced also varies with temperature Each aphid produced 132 pups at an average temperature of 55.4 F (13.0 C), while 26 nymphs were born at 86.36 F (30.2 C) (Sidhu and Singh, 1964). In different species, the host is influenced by plant species and diversity (Singh, et al.1965).

Economic Threshold Level (ETL)- Rapeseed and mustard are one of the most important oil crops in India belonging to the genus Brassica of the Crucifera family. The oily brassica comprises four species: B. compestris (B. Rep), B. juncea (Indian mustard), B. napus (winter and spring rape) and B. carinata (Ethiopian mustard). Rapeseed or mustard oil is the most important edible oil of North India, which is difficult to replace with any other oil. The oil content of most types is between 30-48 percent; However, it is hardly 25–33 percent in white mustard. Compared to other edible oils, mustard oil has the lowest amount of harmful saturated fatty acids and contains significant amounts of two essential fatty acids, linoleic and linolenic. , which are not present in many other edible oils (Anon.., 2009). Mustard (Brassica compestris) is an important oilseed crop of Crucifera family grown in Rabi season (Bapuji et al., 2013). The green leaves and stems of mustard are a good source of green vegetables and the feed is rich in protein, minerals, vitamins A and C. The oil content of mustard seeds ranged from 32 to 42 percent, used for food purposes. Mustard seeds and oil have a special pungency, which is why they are suitable for seasoning and preparing pickles, curries and vegetables. The oil is also used to make soap, soften and lubricate leather After the oil is extracted from the seeds (Phadke Rai, 1986), the residue (cake) is used as fodder for mulching cattle. It is a very important and popular vegetable (Dubey et al. 2014), Which has considerable nutritional and economic value (Elumalai and Sujatha, 2011). It is grown almost all around the cities of India.It has an important place in kitchen garden. Mustard is used as salad, cooked vegetable, Cooked in curries, pickles and dry vegetables. Vitamin A, B and C are found in abundance in it. The crop covers about 270 thousand hectares in India with a production of 5700 thousand tons (Anonymous, 2004).

Host crop- Brassicas are members of the Crucifera family. In India, they are grown mainly in the Rabi season as oilseeds, spices and medicinal crops. In the world of agriculture, they hold a unique position as a source of vegetables, oilseeds, fodder and fodder, green manure and spices. Brassica seed oil is used in the food industry, in the lubricant and polymer industries, while its cake is used as an organic fertilizer and as a protein source in agriculture and animal feed. The seeds are good sources of oil and the oil content of the seeds varies from 32 to 42 percent. Its oil is used for food purposes. The green leaves and stems of mustard are a good source of oil (Jat et al.,2007)

Effect of abiotic factor on the population of Lipaphis erysimi- More than three dozen pests are known to be associated with different phenological stages of canola and mustard crops in India (Bakhetia et al., 1989). Among the pests that attack canola and mustard, the "mustard aphid", Lipaphis erisimi (Calt.), is a serious pest that attacks the crop from seedling to maturity, destroys the crop in the reproductive stage and acts as a limiting factor. . Production (Dixon, 1998). Yield loss due to mustard aphid at different locations in India ranged from 24% to 96% (Phadke, 1985), 35.40% to 72.30% (Bakhetia et al., 1986), 96% (Verma, 2000) . like Haryana, Delhi and Kanpur respectively. Insect infestation reduces not only seed yield but also oil content by 15% (Verma and Singh, 1987) and 66.87% (Singhvi et al., 1973).

The mustard aphid Lipophis erisimi (Kaltenbach) (Homoptera: Aphididae) is a major pest distributed in all agro-climatic zones of India. Adults and nymphs suck sap from stems, leaves, inflorescences and pods, and the aerial parts of the plant are often covered with large numbers of aphids (Srivastava, 2002) and have also been reported to infect the roots of mustard plants (Singh and Singh). give. 1987). Plant growth is adversely affected in the early stages of infection. Flowers do not bloom from buds. Aphid colonization leads to partial or complete failure of silk production. The silk becomes thin and seedless. They also attack established pods, resulting in seed shriveling (Zaman, 1990) and even plant death due to excessive sap-sucking (Aslam and Ahmed, 2001).

Screening of mustard variety against mustard aphid- RLM-514, Vardan, RH-819, RH-7859, Vaibhav, B-85 and RH-8113 as less susceptible to aphids. Bhadauria et al. (1991) reported cultivars RKV-24 and RKV-47 as less susceptible to mustard aphid based on aphid count and multiplication index. Lal (2009) Rai Laha 101 and B. juncea 6105 were probably the most resistant, probably due to the cumulative effect of preference, antibiosis and

tolerance. Rai culture 294. R.T. 11 B. juncea 5976 and B. juncea B.R. 13 are also quite durable, mainly due to their tolerance. Rana (2005) [24] revealed that canola (B. campestris var. BSH-1, B. campestris var. YSPB-9) and mustard (B. juncea RH-30) were better hosts for this aphid than other Brassica species (B. napus, B. nigra, Eruca sativa, B. carinata). Chaudhary and Patel (2017) The variety Vardan (1.42) also showed lower aphid index and grouped into resistant (R), while the varieties GM-2 (1.78), HYOLA-401 (1.69), GM-3 (1.83) and GM-1 (1.80) were categorized as sensitive and highly sensitive, respectively.

Natural enemies of mustard-Tajwar, et al., (2016) The results showed that the weekly average population per leaf of thrips, whitefly and their predator Geocoris varied with different dates and phenology of mustard sites. predator Geocoris remained maximum (15.33+0.31) in 3rd week of February and minimum (4.50+0.25) in 1st week of January at Tando Allahyar

Damage caused by Lipaphis erysimi- Aphids feed by sucking sap from their hosts. Large colonies can cause plant deformation and curling, shriveling and yellowing of leaves (Metcalf, 1962). The turnip aphid can sometimes be found in large numbers on the undersides of the outer open leaves or in the inflorescences (flowers) (Blackman and Eastop, 1984). In severe infestation, both sides of the leaves are attacked (Yadav et. al., 1988). In cabbage, large populations can affect leaf size (Deshpande, 1937) and yield (Jagan Mohan et al., 1981). On mustard, these aphids prefer flowers to leaves (Singh, et al., 1965). Like other soft-bodied insects such as leafhoppers, mealybugs and scales, aphids produce honeydew. Bees, wasps, ants and other insects feed on this sweet and watery excrement. Honeydew serves as a medium on which a sooty fungus, called mold, grows. Honeydew imparts a dirty appearance to cabbages which reduces their market value (Deshpande, 1937). Aphids transmit many plant diseases that cause greater losses than are caused by direct feeding injury. This is often the biggest impact of an aphid infestation. The turnip aphid is a vector of about 10 non-persistent plant viruses, including cabbage black spot and mosaic diseases of cauliflower, radish and turnip (Blackman and Eastop, 1984). With continuous transmission, the virus multiplies in the plant and the aphids simply aid in the spread of the virus and the infection process.

Management of Lipaphis erysimi

Cross-cultural operation- Optimal plant population was maintained by thinnings that maintained healthy seedlings in both years. Manual weeding was done one month after sowing. After manual weeding, the field remained free and clear of weeds throughout the season.

Biological- Mari, et al., (2016) revealed that both adults and spines of C. undecimpunctata (L) had significant feeding potential for all aphid species, but the highest feeding potential was recorded for alfalfa aphids than mustard and corn aphids . in the observed period because it survives compared to other species of aphids. Hakim, et al, (2016) predator activities were recorded in varieties with maximum pest activity. The overall data indicate that the population of insect pests and predators remained constant for all varieties. Sajid et al., (2017) Among entomopathogenic biopesticides, M. anisopliae (83.23%) was the most effective against mustard aphid, followed by B. bassiana (78.33%) and B. thuringiensis (73%). Biopesticides can be used as a potential candidate for integrated management against mustard aphid after field efficacy. Liz, et al., (2017) Biological control of crop pests and diseases has been found to play a significant role in reducing over-reliance on chemical pesticides.

Botanical- Kumar and Patel. (2017) Crude aqueous extracts of Ageratum conyzoides (L.), Parthenium hysterophorus (L.), Lantana camera (L.), Solanum nigrum (L.), Cannabis sativa (L.), Calotropis gigantean (L.), Livistona chinensis (Jacq.), Cassia angustifolia (Mill.) were tested for their insecticidal and repellent activity against Myzus persicae (Sulzer) and Brevicoryne brassicae (Linnaeus). The repellent activity was inversely proportional to the concentration of the plant extract. Inayat, et al., (2017). Antioxidant activities of different fractions of methanolic extracts were indicated in the range of 69.08-84.89%. From the current study, it can be concluded that the selected plants have the potential of antimicrobial and antioxidant properties, which play a key role in controlling a number of diseases caused by various bacterial pathogens and free radical oxidation in the body.

Chamical Effective control of the mustard aphid-Lipaphis erysimi (Kalt) is possible with a systemic insecticide, but this cannot be a permanent solution, as its population returns to the same level within a fortnight after spraying the chemical (Singh et al., 1984). Effective control of the mustard aphid Lipaphis erysimi (Kalt) is possible with a systemic insecticide, but this cannot be a permanent solution as its population returns to the same level within a fortnight after spraying the chemical (Singh et al., 1984). Among the various insecticides evaluated against the mustard aphid, Lipaphis erysimi Kalt, imidacloprid 17.8 SL @ 0.2 g/litre showed the highest reduction. Imidacloprid 17.8 SL @ 0.2 g/litre reduced 87.53% incidence of mustard aphid followed by Fipronil 5 SC @ 1.0 ml/litre 83.56% reduction in 7 days after 1st spray. Similarly, the same trend was recorded after 15 days of spraying when both chemicals recorded 83.86% and 78.90% respectively. The trial was repeated after 15 days to control the aphid population and it was observed that imidacloprid 17.8 SL @ 0.2 g/litre followed by fipronil 5 SC @ 1.0 ml/litre and neem oil 2% @ 2.0 ml/liter when data were recorded after 7 and 15 DAS. Dotasara, et al., (2017) [10] Among the various insecticides evaluated against the mustard aphid, Lipaphis erysimi Kalt, imidacloprid 17.8 SL @ 0.2 g/litre showed the highest reduction. Imidacloprid 17.8 SL @ 0.2 g/litre reduced 87.53% incidence of mustard aphid followed by Fipronil 5 SC @ 1.0 ml/litre 83.56% reduction in 7 days after 1st spray.

Conclusion-A major problem in chemical control is the development of insecticide resistance, recovery, outbreaks, etc., against most commonly used broad-spectrum insecticides in the field. This has necessitated the use of alternative ecological insecticides to maintain protection against insect pests, and the development of resistance against these traditional insecticides can be easily broken down by the use of a newer group of molecules. Replacing older recommendations or other conventional insecticides with newer, safer insecticidal molecules has reduced the impact of hazards on natural enemies. In this context, this study was conducted considering the effectiveness of several newer insecticides under field conditions for their comparative effectiveness against mustard aphid. On the other hand, plants are a rich source of natural substances and have great potential to be formulated as botanical pesticides that can be used in the development of environmentally safe alternative methods for insect control instead of synthetic insecticides Kumar and Patel (2017). Plants contain secondary metabolites that are harmful to insects and other herbivores in various ways; through acute toxicity, enzyme inhibition, and interference with food consumption and/or utilization. Therefore, this study was conducted to evaluate the insecticidal and repellent activity

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