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BIOLOGICAL CONTROLLING AND FIGHTING WITH THE WHITEFLY

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ABSTRACT

The necessity to control the pests in producing the agricultural products in order to reduce the population of the pests below the economic threshold level features the necessity to increase the information about the environmental pollutions of chemical pesticides more than ever. According to the available statistics, about one-third of the agricultural products in developing countries, is annihilated by the pests, illnesses and weeds in the processes of implant, grow and warehousing. In the recent years, in order to reduce the effects of abusing the pesticides, other alternatives for controlling the pesticides especially the biologic control is significantly considered. The biologic control may have a significant influence on maintaining the biodiversity and stability of the ecosystem and health of produced foods in the direction of the objectives of comprehensive management of pests. In this investigation, the efficiency of 8 biologic factors includes predators, parasitoid, funguses and card traps was investigated which finally the more influential efficiency of a factor was confirmed in comparison to other factors.

Keywords: Whitefly pest, greenhouse whitefly, silverleaf whitefly, biologic control

INTRODUCTION:

Global heating or warming of the earth as one of the most concerning problems of human's modern world is the name of a phenomenon resulting into increase of the average temperature of the surface of earth and oceans. This phenomenon has an abundant side effect on human's nature, economy and life. Based on experts' view, further heating of the earth planet causes more transmittal of living creatures including the insects on the earth surface and in a place except their natural ecosystem [1].

One of the major problems gripping the people with warming of the air is the development of whiteflies, i.e. small white-colored insects which are scattered in the air like the dust. Whitefly is a type of agricultural pests which causes creation of damage through both ways of direct feeding from the leaf of green plants and transfer of herbal illnesses. This insect is in the row of Hemiptera. Whiteflies have sucking mouthparts which become resistant to many of the chemical pesticides and this matter makes its chemical control more difficult. However, there are some solutions and techniques for encountering with the duplication of this insect and reduction of its damage [2].

During past 100 years, two types of whiteflies, i.e. greenhouse whitefly and silverleaf whitefly have been converted into economic pests in the world including Iran, so that today, the problem of greenhouse whiteflies and cotton has found more importance and it has caused disorder in cultivating the cotton and other agricultural plants and melon ground products especially cucumber and tomato [3].

Currently, greenhouse whitefly has more than 5000 herbal hosts. Female insects and immature stages of this pest creates damages through feeding from strainer vessel juices of host plants and honeydew secretion on a wide spectrum of agricultural, decorative and pasture plants and useful and non-productive trees. Controlling this pest has been always considered by the farmers due to high damages which it creates in greenhouses and also in open environments of tropical regions [4].

In modern agriculture, protection of plants using chemical pesticides is accounted as a substantial factor in increasing the production of agricultural products, although the dangers due to irregular usage of pesticides in the nature may not be denied. One of the methods of protecting the product from the damages of the pests is to use chemical pesticides due to practical control of population which have been achieved to the boundary of economic

loss and their rapid effect is to prevent from economic damages [1].

Application of different types of chemical materials during the past years results in resistance of pests, poisonousness for the environment, pollution of surface and underground waters, creation of problem in the fishery industry, indisposing the living conditions for rhizosphere micro-organisms and harmful effects in human's health. Biologic control is well recognized as an applicable science and it is accounted as an alternative for solving the problem of wide application of chemical pesticides [5].Hence, in this regard, the aim of the present investigation is biologic control and struggle with the whitefly pest. In the following, it is proceeded to investigate on the methods of biologic controlling with respect to the whitefly pest.

RESEARCH METHOD:

According to the objective considered in the investigation, the applied method is descriptive-analytical.

INVESTIGATION ON TYPES OF WHITEFLY PESTS:

During past 100 years, two types of whiteflies, i.e. greenhouse whitefly and silverleaf whitefly have been converted into economic pests in the world including Iran, so that today, the problem of greenhouse whiteflies and silverleaf whiteflies has found more importance and it has resulted in disorder of cultivating the cotton and other agricultural plants and melon ground products especially cucumber and tomato [6].

GREENHOUSE WHITEFLY:

Each year, in all over the world, a significant part of food sources is annihilated because of the damage due to the pests. The greenhouse whitefly is one of the important pests resulting in damage to greenhouse and decorative products. The body size of this pest is about 0.9 to 1.1 mm, and in the rest state, the wings cover the stomach region parallel to the leaf surface. Greenhouse whitefly has six stages of development, egg, and firststage, two static stages, pupae and mature insect. Eggs of this pest are usually oval-shaped. The end part of the egg is quite round and sharp and there’s a stalk with varying length in the wider part of egg base and the female insect attach the egg to plant host by this stalk.

Greenhouse whitefly with its expansive propagation in majority of greenhouses, land under cultivations and out of greenhouse on the different products is of high importance. 249 plant hosts botanical genus are reported. There is no accurate report for its damage arising from this pest.

This polyphagia pest attacks to more than 600 plant species around the world. This pest damages the host plant directly and

indirectly (Dehqani, 2011). Similarly due to aggregation of saprophyte fungi on the honeydew excreted from them result in decreasing the quality. Today chemical control of this pest due to environmental issues as well as rise of resistancetoward different chemical poisons makeresearcher to seek new alternative solution such as biologic control and hybrid management [8].

SILVERLEAF WHITEFLY:

Discovery of whiteflies dates back to 250 years ago. Near 1200 species belong to this family which most of them are monophagia, oligophagia and some of them are polyphagia. Meanwhile, Bemisia genus by having a lot of hosts and 37 identified species; in particular, Bemisiatabaci is the most important. This genus is known as silverleaf whitefly and can be found in most parts of the world as an economic pest. This pest has wide host realm and can live everywhere and is reported on many agricultural plans and is highly important as greenhouse productions pest in moderate and tropical regions around the world [9].

Silverleaf whitefly is one of the important pests of agricultural products, Silverleaf whitefly by sucking the plant sap and so, it gives rise to decreaseproduction by 50%. Fluid oozed by this insect provides the condition for growth of fungi which cause paleness of leaves. More than 60% of viral diseases contract by these insects [9].

Shortness of duration of a generation and large amount of eggs give rise to rapid population growth in this pest. From other side, nutrition, mating and laying of mature insects as well as growth of larva beneath leaves encumber chemical control of this insect. There are many factors affecting on the biology of silverleaf whitefly among which plant host is of high importance [10].

CONTROL METHODS AND BIOLOGICAL COMBAT WITH THE PEST:

Whiteflies are not eradicated simply and using insecticidesfailed in moderating their population and has triggered their rebellion. Ill-considered usage of insecticides sparks off the elimination of whitefly natural enemies and their rebellion [11]. These ineffective experiences suggest the role of natural enemy in adjusting its population.Today, biologic control is introduced as an effective strategy for managing different species of whitefly around the world [12].In the following some biologic methods regarding control and fighting crop pest are presented.

1- Amblyseius swirskii (predator mite)

Predator mite is a polyphagia from Phytoseiidae family which their moving types are beige color droplet-shaped with

short legs. Its eggs are spindle-shaped, transparent and to white color and all ages can be seen on the tip of main nervure, lateral nervure and in flowers. It feeds from thrips young larvae, greenhouse whitefly larva and egg (Trialeurodes vaporariorum). This predator controls greenhouse pests of cucumber, sweet pepper and a wide range of ornamental crops native of Egypt, Greece, Turkey and Middle East regions. Appropriate conditions for releasing this mite are temperature between 23 to 33^{o}C and relative humidity of 13 %. Predator mite seeks its prey or wait for the prey to pass and it sucks it and makes it dry [13].

In 2007, a test has been conducted by Meslink et al in examining the effect of two biologic agent A.Swiriskii and Euseius Ovalis in cucumber greenhouse with three treatments 1- presence of whitefly in greenhouse, 2- presence of only thrips, 3- presence of whitefly together with trips. Results showed that both predators have controlled trips successfully but the A.Swiriskii agent was more effective. In the treatment of presence of both whitefly and trips in greenhouse, population of whitefly by predator A.Swiriskii has reduced drastically. Observations showed that at the onset of releasing A. swiriskii predator, due to host diversity, the population growth of this predator continued until the end of cultivation period [14].

2- Phytoseiulus Persimilis predator mite

Phytoseiulus persimilis belongs to Phytoseiidae family and attack to all life stages of two pointed tick (often to younger ages) and only is able to keep living on these ticks. The mature and nymph predator seeks actively its preys and sucks and dries it. If the greenhouse humidity is low over day, the egg of this useful mite dries out and vanishes. Mature insect which have high activity is red and glossy. Spindle-shaped eggs are pink and transparent at the beginning and it becomes dark over time. Larva and nymph are light red [15].

3- Macrolophus Caliginosus predator mite

This predator mite attacks to all life age of greenhouse and silver leaf whitefly, however it rather damages egg and larva. Similarly it attacks to thrips and eggs of butterflies; however the rate of this mite population growth on the whitefly is higher. Mature mite by feeding from plant sap can survive for a while. Three days after mating, the female put its eggs in the leaves tissue by its ovipositor. If this mite feeds by whitefly comparing with feeding by aphid and spider mite, it lays more eggs. This mite can feed by 40 to 50 whitefly eggs per day. Sometimes it feeds by plant

sap too. In the conditions of shortage of prey it damages the host plant. For achieving appropriateefficiency, considering the properties of this predator, releasing it should take place by observation of first whiteflies in the greenhouse, so that this predator can develop an appropriate population in the greenhouse [16].

4- Encarsia Formosa (parasitoid wasp)

This wasp attacks to 3th and 4^{th} stages of greenhouse whitefly. This wasp lays its eggs in the larva body. Parasitoid wasp has high sensitivity to poisons. Appropriate temperature for the activity of this wasp is 25 degree centigrade; it has long life time and lays few eggs each day. 98 % of mature wasps are female and do not need mating. In the case of rise ofthe greenhouse temperatures, one should refrain to release it [17].In fact, the role of parasitoid wasp is inevitable, so that today, its mass proliferation is consideredas a biologic product in some countries. Application of biologic agent though had a satisfactory outcomes,but in some cases this approach resulted in failure too [18].

Appropriate efficiency of the parasitoid has resulted in its usage rise from 1968 to 1989 by 1000 times [8].Since successful release of Encarsia Formosa Jahan wasp against whiteflies in Netherland and Russia more attention is paid to using natural enemy against whiteflies [19].

5- Aphidius Colemani Parasitoid wasp

It is a wonderful parasitoid wasp with long antennas belong to Braconidae family and the mature insects are black with length of 2 to 3 mm. it directly lays egg in the body of pests. After few days the body of pest starts to inflate and turns into a leather mummy with brown or gray color. First mummified aphids can be observed nearly two weeks after first release. Immediately after wasp death, new parasitoid wasp appears with all the haste. The mature insect is black and other age stages take place within host body. This skillful predator identifies easily the colony of pests, when the pest population is small. In the study conducted by Stern et al in 2011 it has been revealed that aphids Colemani is highly sensitive to insecticides, however insecticides Methony fenozide and Indoncarb can be used due to low toxicity in IPM plan together with this parasitoid [20].

PEST HUNTING TRAPS:

One of the mechanical factors affecting in decreasing pests population within hybrid fighting is using cohesive paint traps. In general, insects react to colors whit wave length between 300 to 650 nanometers. Using cohesive traps is one of the most safe

and economic method for fighting pests. Yellow and blue cards and tapes can be used in a limited amount for detection and in larger amount for massive hunting of pests in particular in closed environments such as greenhouses [18].

USING PAINT FOR TRAPPING INSECTS:

Studies have shown that paint can be one of factors attracting B. tabaci to host plant. For example, Monde (1962) had reported that B. tabaci reacts to blue and yellow color from light spectrum and are attracted to it. Similarly other species of whiteflies are attracted to optimal spectrum yellow color. All of these researches finally concluded to using cohesive yellow cards as a trap for these insects [21].

There are yellow cards in different dimensions and are installed at the plant crown or a place in which the insects have highest activity. Once using yellow cards for controlling leafminer flies, it is better to install them horizontally [4].

Considering conducted tests the cohesive yellow card has reduced the whiteflies population with respect to control group. Using these cards in open space has some problems such replacing cards due to glues dry out by wind or air particles. In a test using 16 yellow plastic panel with dimension of 0.4x1 m sprayed by resin, it has been shown that whiteflies has been properly controlled so that the tomato greenhouse was without pest for next 4 months while adjacent greenhouse required 14 times insecticide poisoning over this time [22].

In another study, 10 days after installing cohesive yellow traps, whiteflies attracted to it drastically and the greenhouse was devoid from the pest attack over one year (Nosifora et al , 1983).

7-Trichoderma:

Among factors of biologic control, Trichoderma fungi are able to be established around the seed and root of a lot of plants and by excreting hormones, enzymes, antibiotics, growth and antifungal compounds prevent pathogenic fungi entering to areas in which seed and roots are active. As a result, the agent increasing the speed of seed sprouting, accelerating plant growth and protection of underground parts against pathogenic fungi attract can prevent soil disease such as Phytophthora drechsleri, death of seedling, decay of seed and root as well as sapling and trees withering. Among other advantages of these fungi, one can point out to Mycoparasite property. Trichoderma increases the resistance of plant to inappropriateenvironmental conditions through increase of root length, dissolving and solvability of nutria elements, disabling

pathogenic animal enzymes (Malekiziarati et al, 2009).

8- Lecanicillium muscarium strain Ve6 entomopathogenic fungus

This substance affects on spore of fungus, is an entomophatogenic fungus for insects such as thrips and whitefly larva. This substance is consumed together with edit oil. The amount of using this substance is 100 g in 100 liter water together with 250 cc Edit oil. This product is a contact type and the best environmentally time in relative humidity of 75% is within 10 to 12 hours after spraying so that its spore on the insect body can sprout and its mycelium enters the insect body. After entering mycelium in the inset body, after some days the spore sprouts again on the insects body which it gives rise to contamination of other insects too [23].

RESEARCH FINDINGS:

Namur et al (2011) examined the efficiency of yellow flat sticky trap for monitoring the legume leaf miner in greenhouses. Findings indicated traps placed at 50 cm height could absorb the highest numbers of insects, as well as a significant difference was observed between statistical group of traps at 120 cm height and 170 cm treatment. In the second step, where experiment was conducted at maximum pest population and shrubs were at their final height, the existing traps that were placed at 170 cm height could absorb the highest numbers of adult leaf miner. Findings indicate that 1 meter distance treatment had the greatest efficiency and there is significant difference between 2 meters distance treatment and other treatments.

Idris et al (2012) studied the effect of design and color of sticky traps for controlling whitefly. In the research, he studied the effect of traps design including cylinder, horizontal and vertical design as well as color type on controlling whitefly population. He found that yellow color had the highest influence on controlling whitefly population. In addition, vertical traps had the highest impact on attracting insects. In general, regarding conducted studies among biological control techniques of whiteflies, sticky traps method has better efficiency and performance to control such pest.

CONCLUSION:

Whitefly is the main crop pest. As environmental contamination is caused by the use of chemical toxins, so it seems that we have to consider biological strategies by correctly studying factors and pests. One of these strategies is to use sticky traps. This technique helps us to fight whitefly pest and also have sustainable agriculture which is based on non-use of chemical pests. To biologically fight a pest, the initial steps of

pest formation through damage should be studied and the highest damage to insects must also be examined to have effective biological control.

RESEARCH RECOMMENDATIONS:

1. competiveness production and even import of biological control factors
2. contiguous training of private and state experts
3. research on organic agricultural products are feasible by employing biological method, so attention to pest biological control will provide a basis for increase level and organic production volume.
4. Attention to the discussion of making cultural bed and raising awareness and doing suitable developmental activity fitted with condition of local societies among greenhouse holder and also raising the exciting technical knowledge.
5. Making domestic the production of needed factors in biological control.

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