

## THE COMMON TOMATO INSECT PESTS IN GREENHOUSES

**Serhij Stankevych**  
State Biotechnological University  
(Kharkiv, Ukraine)

**Oleksij Horiainov**  
State Biotechnological University  
(Kharkiv, Ukraine)

**Viktoriia Horiainova**  
State Biotechnological University  
(Kharkiv, Ukraine)

**Abstract.** The purpose of the study is to study the harmfulness of tomato pests in greenhouses. Even if tomato insect damage is nominal, the pests themselves often are vectors for disease. So, it is imperative that you recognize tomato insect damage and learn about treating pests on tomatoes. Insect pests are very dangerous for greenhouse tomatoes. They not only cause damage to various parts of the plant, but are also carriers of various diseases. Getting rid of pests in a greenhouse is very difficult. The species composition of harmful organisms is represented by specific forms adapted to the subtropical conditions of closed soil. It is much easier to prevent their occurrence. For this, the plants, and the greenhouse itself are subjected to mandatory preventive treatments.

**Keywords:** tomatoes, greenhouse, insect pest, dangerous.

Indoor vegetable growing is one of the leading sub-sectors of the agro-industrial complex of Ukraine, which provides the population with vegetable products all year round and makes it possible to obtain the largest harvest from a unit of area. But for this, plants should be effectively protected from pests and diseases.

Closed ground today is different types of technologies and types of greenhouses when there is intensive restoration and increase of areas. Even in the private sector, technologies are being implemented that make it possible to collect about 45 kg of tomatoes from 1 m<sup>2</sup>.

At the same time, the limited species and variety set of crops, lack of crop rotation, and constant use of soil and crushed stone substrates, cultivation facilities, artificially created microclimate contribute to the massive development of harmful organisms in greenhouses.

It should be noted that the number of species of pests in greenhouses is much smaller than in open agrocenoses, the year-round use of such structures, constantly elevated air temperature and humidity, and the lack of natural regulatory factors contribute to the mass reproduction of phytophages and significantly increase their harmfulness.

Today, greenhouse farms show trends in the successful use of advanced technologies for growing vegetables. Undoubtedly, such products must be of high quality. The main criterion for the quality of vegetables is the absence of harmful residues of chemical compounds. Based on this, scientists and specialists develop and implement integrated systems of protection of vegetable crops, in which the main place belongs to biological and non-chemical techniques. In greenhouse farms, where there are qualified personnel and technological processes are organized at a high level, the use of chemicals during the growing season of plants is reduced to 70–80%. Pesticides are used to protect tomatoes from harmful organisms. This is due to the beginning of the mass appearance of several types of pests and the difficulties of creating conditions under which biological agents would be effective.

The species composition of harmful organisms is represented by specific forms adapted to the subtropical conditions of closed soil.

The most dangerous among all pests of tomatoes is the whitefly. A dangerous quarantine object, which, due to its great variability and wide distribution in the world, has been described under dozens of names – *Trialeurodes vaporariorum* Westwood, 1856 (Figure 1).



**Fig. 1. *Trialeurodes vaporariorum* (Westwood, 1856)**

Whiteflies are very small insects 1-3 mm long. Butterflies are yellow, sometimes have a slight reddish tint, there may be black spots on the wings. The body is covered with white waxy powdery pollen. At rest, butterflies fold their wings into a house.

Whiteflies settle on the underside of leaves, more often in the upper tier of plants. Females lay up to 130 eggs on the underside of leaves in clusters of 5–20. The eggs of these insects have a stalk, with which they are attached and kept on the leaves.

After 5-7 days, a larva emerges from the egg, which moves for several hours, choosing the juiciest place, and then proceeds to feed. In development, the larva goes through 4 stages, the first stage is mobile.

The larvae move over the leaves in search of the most succulent, on which they feed. They tuck their long legs under them and press against the leaf. A waxy sticky liquid stands out around them, which firmly adheres to the leaf blade and creates a greenish-brown fringe around the larva, which reliably protects it from adverse factors.

The next 3 stages are immobile – the larva is in a wax capsule and feeds continuously. Both larvae and butterflies suck the juice from the leaves, releasing a sweetish sticky liquid in the process. A new generation appears every 28 days.

It winters in the soil in a warm climate where there is no frost (Crimea, the Caucasus, the Black Sea coast of the Krasnodar Territory), in the northern regions it is preserved in greenhouses and on houseplants, it freezes completely in the ground even with warm and mild winters.

During the season, 4-5 generations of pests appear, and in the south up to 7-8 generations, so it is extremely difficult to completely get rid of the whitefly.

The whitefly is very active in hot and humid weather. In cold weather, it does not damage tomatoes as much. At temperatures below 10 °C insects stop flying, only larvae feed, at 0 °C the pest dies.

In a greenhouse, the insect spreads extremely quickly and is very difficult to get rid of. The pest is especially common in greenhouses with poor ventilation. During early summer frosts, the whitefly can survive, since the temperature in the greenhouse does not fall below 0 °C. But during prolonged cold weather in spring (the temperature in the greenhouse is 7-10 °C), insects die because they are not able to eat.

In closed ground, it damages all greenhouse crops (tomatoes, peppers, eggplants, cucumbers). On the street causes significant damage to potatoes, tomatoes, cabbage, strawberries, zucchini, garden flowers. The whitefly damages tomatoes and peppers especially strongly in the greenhouse. Favorable conditions for it are high temperature and humidity.

If you shake the infected bushes, then the butterflies immediately take off, but tend to return as quickly as possible. On the underside of the leaves there are small white dots – pest larvae. On the entire lower surface of the leaf there is a sticky mass – whitefly secretions.

In the place where the pest feeds, yellow or dirty brown small spots appear on the leaves, which increase in size over time. On the underside, the surface is rough with small gray-yellow dots. Gradually, the leaf fades and dries. The site of damage is inhabited by sooty fungi, which makes it grayish-green with small black dots.

With severe damage, leaf areas turn black. Sooty fungi disrupt the photosynthesis of the leaf, it dries up and falls off. The process occurs very quickly in 14-20 days, the whitefly and the fungus in the south can destroy all greenhouse tomatoes. On the street, the process is slower, the tomatoes die within a month. In the northern regions, damaged bushes are strongly oppressed, but do not die.

Mechanical measures: these include mechanical collection and the use of various traps. If the pest has just appeared, then it can be manually collected or suppressed on the leaves. It is easier to do this on tomatoes than on other plants, since with proper agricultural technology there are few leaves on the bushes.

Use glue traps. The whitefly loves yellow and flies to it en masse. Therefore, in the manufacture of traps, a yellow base is used. The results are visible within a few hours. Place 4-5 traps in the greenhouse. On the street they put one trap per 1-2 m<sup>2</sup>.

Agrotechnical measures: tobacco is planted along the perimeter of a plot with tomatoes or in a greenhouse. The whitefly prefers it to all other plants and gathers on it in huge quantities. At the same time, tomatoes and other crops are weakly populated with it. It remains only to destroy the tobacco along with the pest, while not forgetting to treat the tomatoes themselves and other plants with biological products.

If the nights are cold (below 10 °C), then leave the greenhouse open. Tomatoes will endure 3-4 cold nights without damage, and the whitefly at this temperature stops eating (both adult insects and larvae) and some individuals die of starvation. Cold nights often occur in the central black earth regions, where the pest spreads strongly in warm weather.

It is necessary to fight the whitefly throughout the season. Processing is carried out repeatedly with an interval of 5–7 days. For 3–5 treatments, it will not be possible to get rid of the whitefly on tomatoes. She very quickly gets used to insecticides, therefore, repeated treatment with the same drug is not carried out, with the exception of biological products.

The wax coating that covers the larvae makes it difficult to destroy pests. Not all substances are able to act on an insect through such a barrier.

Contact and systemic insecticides are used to kill whiteflies. The preparations are used during the period of flowering and filling of the first two brushes. Insecticides must not be used 14 days before harvest. And since tomatoes ripen unevenly, after pouring the first fruits, chemicals are not used.

The «Tanrek» systemic contact insecticide will help get rid of the whitefly. Spraying is carried out no more than 3 times per season. Carefully process the leaves from the top and bottom side. The drug is dangerous for bees, so spraying is carried out on the street in the evening, or at hours when the bees do not fly. The insecticide adheres well to the leaves and is not washed off by rain. The interval between treatments is 7 days.

Biological methods include the use of biological products and natural enemies of the whitefly. «Fitoverm» – the biological product does not penetrate plant tissues and does not accumulate in them, so it can be used at any stage of tomato development, including the day before harvest. When whiteflies appear, spraying is carried out on the upper and lower sides of the leaves. It can be used repeatedly during the entire period of pest control.

Encarsia is a whitefly parasite that will gladly help you get rid of harmful insects. Females lay eggs in larvae of 2-4 instars, but this does not interfere with their development. The death of the whitefly occurs when the larva turns into an adult insect.

Encarsia pupae are sold in packs of several thousand pieces. If there is a tense background for the pest, then in the greenhouse with tomatoes, and in the southern regions and on the street in the beds with tomatoes, cucumbers, zucchini, they put

cards with mummified insect pupae (sold in pet stores). After a few days, adults of encarisia appear.

Bug macrolofus – a predator that feeds on pests. This is one of the most effective, reliable, and safe ways to deal with whiteflies. One bug in its life (30-35 days) destroys about 2,5 thousand larvae. 1–2 individuals are usually enough for a greenhouse, 3–5 bugs in open ground. Many of them are not released, because with a lack of food they are able to survive by feeding themselves on the juices of plants, including tomatoes.

The fight against the whitefly is a very difficult task and is carried out with varying degrees of success. And if it is possible to get rid of a pest in a greenhouse, then it is almost impossible to do it on the street.

Dangerous pests are a large group of isopterous sucking insects, which includes about 800 species. A special group is formed by the family of Aphids – *Aphidoidea* (Figure 2).



**Fig. 2. *Aphis gossypii* (Glover, 1877):**  
1 – affected leaf; 2 –colony of the adult

Of 4400 aphid species, 250 are harmful to plants, which is why you may see white aphids, black aphids, red aphids, non-flying aphids along with winged aphids on tomato plants.

Aphids are a pest that affects many vegetable and flower crops, and every gardener knows about it. It can infect some plants completely along with the fruits, and in some, only the vegetative mass is affected, while the fruits do not suffer. This is exactly the case for tomatoes. Even though only tomato leaves are affected by aphids, this still affects the yield. The fact is that the plant is forced to fight the invasion of pests on its own, immunity decreases, and the ripening of the fruit goes into the background, unripe tomatoes in this case are deformed. In addition, aphids can provoke the development of fungal infections on tomatoes.

Both greenhouse and ground tomatoes are attacked by aphids. Seedlings may also be affected. Different types of aphids can parasitize on tomatoes: black, green, white, melon and peach. Regardless of which kind of tomato has settled, processing is done in the same way in all cases.

Aphids are small (2-4 mm), pear-shaped, soft-bodied insects. They can be green, gray, black, brown, yellow, or white – often mimicking the color of the plant they feast on. And these buggers just won't quit. Aphids are very prolific. Females can give birth to up to 80 offspring a week. That's a whole lot of aphid nymph mouths to feed, especially when you don't want your tomato plant to be part of the aphid nursery. And all those nymph babies can turn into adults in just 7 or 8 days. They don't limit themselves to tomatoes. You can find aphids on cucumbers, squash, melon, peppers, potato, and a host of other crops.

Aphids use their mouthparts to eat sap. They suck out juices and nutrients from tomato leaves, stems, and fruits. Their sap-sucking stunts plant growth, causes leaves to curl, and makes leaves turn to yellow. Plus, as aphids use their snouts to penetrate your tomato plants, they often transmit viruses like the tomato yellow leaf curl virus, the cucumber mosaic virus, the potato virus, and the tomato etch virus. And aphids keep on giving. They secrete a white sticky substance called honeydew. Left unchecked, honeydew attracts other pests like ants and leads to sooty mold and powdery mildew on your tomato plants.

Aphids attack tomato plantings when warm and dry weather is stable. The aphid does not touch the fruits of tomatoes, but the pests cause irreparable harm to the plant itself, with a massive invasion: the growth of tomatoes stops, flowering stops, and new tomatoes do not tie. As with any pest, the fight against aphids must begin as soon as they are noticed.

Aphids in greenhouses appear much earlier than on tomatoes in the open. Greenhouse conditions are more favorable for her – warm and dry. At the beginning of summer, you should carefully inspect the plants, looking under each leaf.

Control measures are the same, and on the open ground. When working in a greenhouse with pesticides, precautions should be strictly observed: be sure to protect exposed areas of the body, use a respirator and goggles.

In the spring, before planting seedlings, it is desirable to treat the entire structure of the greenhouse and the ground with karbofos. The greenhouse must be regularly ventilated. Sometimes it is useful to leave it open at night.

Prevention from aphids begins in the fall, immediately after harvest. Since eggs and some individuals hibernate on foliage or in the ground, all plant debris is removed and destroyed, and the earth is dug up by 10-15 cm. The earth is not leveled for the winter but left loosened. In the spring, a plot of the garden allotted for tomatoes is treated with karbofos. Observe the distance between plants when planting. Between the beds, you can plant herbs with a strong smell: dill, celery, marigolds. Watering is carried out only with warm water, between watering the soil should dry completely. Near plantations with tomatoes, all anthills must be destroyed. If you leave them unattended, then the ants will bring aphids to the tomatoes.

When dealing with aphids, chemicals should be used with caution. Do not forget that the active ingredients are removed from tomatoes no earlier than 25 to 30



days after treatment. If it became necessary to treat the tomatoes with insecticides, then the fruits, painted in pinkish or brown color, are removed in advance and placed for ripening in a dark place.

Insecticides to control aphids:

«Biotlin» – destroys not only adults, but also prevents the development of the young generation of aphids. Not addictive. Recommended for use in greenhouses. Dilute 5 ml per 10 liters of water, this solution is enough to process 30 sq.m. planting areas;

«Akarin» is an insecticide of intestinal-contact action. 8 ml mixed with 1 liter of water. One liter of solution is enough to spray 10 sq.m. tomato plantation;

«Spark» – the drug has a wide spectrum of action, is used to combat other pests. 1 tablet is diluted in 10 liters of water, used to kill aphids per 50 sq.m. landings.

The preparations «Aktara», «Fufanon», «Commander» are also recommended. Use them according to the directions on the package.

The drug «Fitoverm», or its analogue «Aktofit», can be used 2 days before picking the fruit from the bush. Tomatoes are processed at a temperature not lower than 16 °. At lower temperatures, the drug will not work. If the air temperature is close to 30 °, which often happens in greenhouses, then the dose of the drug is reduced by 1 liter.

Thrips are another important pest of tomatoes. Thrips have been known for a long time, they are broad polyphages, damaging a wide range of cultivated and wild plants (from 100 to 400 species). For example, the most common of them is *Heliothrips haemorrhoidalis* (Bouché, 1833) (Figure 3).



**Fig. 3. *Heliothrips haemorrhoidalis* (Bouché, 1833)**

1 – adult of thrips; 2 – symptoms of damage to tomatoes by thrips

This is the most common and dangerous polyphage, which has inhabited almost all greenhouses due to its close relationship with plants, where its entire life cycle develops – from eggs to adults. In the natural conditions of the southern region of Ukraine, the tobacco thrips were found on large areas of vegetable crops with the

seedling method of their cultivation, mainly cucumbers, tomatoes, onions, cabbage, watermelons, and the like. It harms bulbs in vegetable stores, which leads to a deterioration in the quality of garden plants and gardening material. The reaction of the plant to the damage by the trips is desensitization, which is manifested in growth retardation, distortion, and loss of turgor of damaged leaves, which later become yellow and dries.

This pest is a small insect whose body size does not exceed 3 mm. Thrips have an elongated body and a cone-shaped head. The pest has three pairs of legs, which are equipped with special teeth and suckers. This allows the insect to move easily from the underside of the leaves and lead a hidden lifestyle.

The oral apparatus of the pest is of a sucking type. Thrips feed on tomato cell sap, which disrupts metabolic processes in tissues and slows down the development of seedlings.

The main reasons for the appearance: temperature within + 25–30 °C; low air humidity; contaminated soil; density of landings; lack of timely feeding.

In closed ground conditions, thrips can remain viable and reproduce year-round.

Adult females overwinter in greenhouses – in various openings, and in open ground – in the upper layer of the soil at a depth of 7–10 cm, under plant remains or in the rootstock of perennial plants or weeds. Insects die at temperatures below 0°C and in the absence of snow cover.

The pest spreads at all stages of development – eggs, larvae, adults – with planting material of vegetable crops (with plants or in the soil), transport, containers, workers' tools, their clothes, or shoes. It happens during the collection, packaging, and sale of contaminated products.

Tobacco thrips can develop in open soil at temperatures above 10 °C during the growing season from the second decade of May to the end of September in the conditions of the steppe and forest-steppe zones of Ukraine, causing significant damage to vegetable crops. Depending on the weather conditions, the pest can produce from 3-4 to 5-6 generations.

Thrips larvae initially live on the above-ground part of the plant, and then go into the substrate for ten days, where they continue their development. Currently, they affect the root system of tomatoes, which leads to the appearance of constrictions on them, which interfere with metabolic processes in the tissues.

When characteristic signs of thrips damage appear on tomato seedlings, as in the Figure 2, complex control measures are necessary. However, you should be prepared for the fact that not one, but several treatments will be required, depending on the number of pests. At the same time, you need to know exactly after what period they are carried out so that this procedure is as effective as possible. The drugs and agents used can have a detrimental effect on adults and larvae, but they cannot penetrate the outer shell of the eggs.

With the mass reproduction of pests, it is necessary to use chemicals. After their application, insects initially lose their ability to eat, and after a day they die. However, thrips are characterized by increased survivability and quickly get used to



the action of chemicals. Therefore, when using them, it is recommended to alternate them periodically.

Systematic treatment of plants with the following insecticides gives satisfactory results in the fight against tobacco thrips: Akketlik, Aktara, Phytoverm, Karate Zeon, Confidor Maxi (with irrigation water) and others. It is obligatory to change preparations during the growing season. On the onion fields thrips is successfully reduced with insecticide of natural origin Spintor when using periodic spraying of plants.

An effective method of combating thrips on tomatoes is the use of biological products, such as Fitoverm. This tool is safe for humans, as it is based on the waste products of soil microorganisms. Its use is justified not only against thrips, but also ticks, whiteflies, aphids.

To prepare an effective remedy for pests on tomato seedlings, it is necessary to dilute 5 ml of the drug in 500 ml of water. After processing, Fitoverm begins to act after 3-4 hours, and the death of pests occurs after 3-4 days.

Since thrips are very persistent pests in addition to insecticides, predatory mites, *Acari barken*, *Acari derenerans*, as well as predators *Orius laevigatus*, *Orius magusaculus*, should be used.

Today, the protection of vegetable crops takes the direction of the use of biological agents against pests – polyphages, special attention should be paid to the use of natural enemies of tobacco thrips.

The cotton bollworm (*Helicoverpa armigera* Hübner, 1808, Lepidoptera, Noctuidae) (Figure 4) is widespread in the southern and central regions of Ukraine. It tends to populate even part of the northern regions.



**Fig. 4. Larvae of the *Helicoverpa armigera* Hübner, 1808**

The pest damages corn, cotton, tomatoes, tobacco, chickpeas, sorghum, pumpkin, etc. The wingspan of a butterfly is 30-40 mm. The front wings are grayish-yellow with a red, pink or greenish tint, males are lighter than females. The spots are rounded and kidney-shaped dark gray, indistinct, longitudinal stripes are also indistinct. The hind wings are lighter, with a brown stripe near the outer edge and a dark echo-shaped spot in the middle. The egg is 0,5-0,6 mm in diameter, 0,4-0,5 mm high, initially light yellow, later greenish in color, with 26-28 radial ribs. The larvae is 35-40 mm long, varying in color from light green and yellow to red-brown and even black. The head is yellow, with spots, the chest shield with a dark marble pattern, along the body – three wide dark stripes. There is a yellow stripe above the spiracles, the ventral side of the body is light. Light-colored caterpillars are almost without a pattern. The body, except for the thoracic shield, is covered with small spines. The pupa is 15-22 mm long, reddish brown; the cremaster is small, smooth, with two spines curved like a hook at the top.

First instar caterpillars damage the leaves of corn, tomatoes, and alfalfa; from the second age, they switch to nutrition by generative organs: they damage the threads of cobs, corn grains, buds, flowers, ovaries and fruits of tomatoes, tobacco, beans and chickpea seeds, etc.

Humidity and temperature are important for the survival of pupae in the winter-spring period. The death of pupae that enter diapause is caused by sharp temperature fluctuations and freezing of the soil at high humidity. The development of flowering nectarines is influenced by a warm spring with a sufficient amount of precipitation, which contributes to the nutrition of females, which in such years lay many eggs, and later to the nutrition of caterpillars. A dry and hot spring or a sharp cold snap limit the reproduction of the pest.

Protection measures: agrotechnical: deep plowing, inter-row cultivation of row and vegetable crops during the period of mass pupation of caterpillars, destruction of weeds in the spring, in order to worsen the feeding conditions of butterflies and caterpillars, destruction of plant residues after harvesting.

Biological: during the egg-laying period, release 50-100 thousand *Trichogramma* egg-eaters/ha in two periods: at the beginning and during the period of mass egg-laying.

Chemical: during the revival of caterpillars, insecticides approved for use in Ukraine are used. On corn, it is primarily Ampligo (0,2-0,3 l/ha) and tank mixtures of Aktellic and Karate Zeon (0,8 l/ha + 0,2 l/ha).

Insect pests are very dangerous for greenhouse tomatoes. They not only cause damage to various parts of the plant, but are also carriers of various diseases.

Therefore, to prevent the emergence and reproduction of insect pests, preventive measures should be applied: compliance with the temperature regime and optimal humidity; application of fertilizers according to the recommended

agrotechnical norms; enrichment of the soil with organic matter; soil loosening; timely destruction of weeds; compliance with crop rotation; joint landings.

Getting rid of pests in a greenhouse is very difficult. It is much easier to prevent their occurrence. For this, the plants, and the greenhouse itself are subjected to mandatory preventive treatments.

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