ARTICOLE DE FOND

A REVIEW OF THE MAJOR PEST INSECTS OF TOMATO CROPS IN THE REPUBLIC OF MOLDOVA

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Rezumat

Prezenta lucrare este dedicată inventarierii entomologice a insectelor dăunătoare evidenţiate în cultura de tomate pe sectoare de teren protejat şi câmp deschis din Republica Moldova. Este prezentată lista celor mai semnificative specii de insecte dăunătoare, asociate cu plantele de tomate în diverse perioade de vegetaţie. De asemenea, sunt reflectate informaţii sintetizate în baza surselor bibliografice, ce ţin de răspândirea în plan mondial, aspecte ale gradului de dăunare şi infestare, plantele-gazdă şi specializarea trofică. Rezultatela cercetărilor sunt prioritare în vederea elaborării şi ajustării unor procedee eficiente de protecţie aplicate în sistemul de management sustenabil al dăunătorilor la tomate.

Cuvinte cheie: inventariere, insecte, dăunători, specii, tomate, Republica Moldova.
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Introduction

Tomatoes (*Lycopersicon esculentum* Mill.) are one of the most popular and widely cultivated vegetables in the world. Tomatoes have a high economic value in agricultural systems due to their relatively short crop cycle and the ability to grow as an uncovered field crop and in protected cultivation. Their rich content in minerals, vitamins, essential amino acids, sugars and dietary fiber define the beneficial effects on human health and, can help prevent major diseases.

Tomato is a vegetable crop of significant economic value in the Republic of Moldova. Introduced at the beginning of the 19th century, already as a crop, tomatoes due to its high adaptability and plasticity were extensively cultivated in all ecological regions. The total area cultivated with tomatoes in the Republic of Moldova ranged from 4 to 7 thousand hectares, the average tomato yield was between 9 and 25 tons per ha. Cultivation of vegetables in protected land has recently increased. Production of tomatoes from protected land was around 150 thousand tons annually, between 2013 and 2018, twice more compared to 2006-2012 years. From those around 70 thousand tons are processed, and more than 80 thousand tons are exported [64]. However, tomatoes yield per ha, in the Republic of Moldova, is about ten times lower compared to developed countries. Local production cannot cover the population demand, tomatoes productivity being affected by different factors among which pests and diseases are one of the most harmful.

Cultivation of tomatoes has always been a challenge for horticulture in the world, and in the Republic of Moldova as well. A significant aspect to mention, is the impact of pests, especially during the vegetation period. Tomatoes are attacked by over 100 species of pests worldwide, some of them can seriously damage the plants, considerably reducing the yield.

The key to any successful pest management program is to develop a regular survey plan to gain information on insect pest populations that may be used to determine if insecticide applications are needed. Thus, the aim of the study was to provide an extensive inventory of existing insect pests of tomatoes in protected-ground and in greenhouses across the territory of the Republic of Moldova.

Material and methods

Sampling events were conducted in tomato crops during 2017-2018 years in 12 localities from Republica moldova (Boscana, Corjova, Dubasarii-Vechi, Horasti, Ialoveni, Mereni, Onitcani, Pelivan, Puhaceni, Razeni, Slobozia-Dusca and Speia). Insects were collected using light traps, sweep netting and manually, at an interval of ten days through vegetation period [4]. Collected insects were individually placed in separate vials and stored for further investigations. Insects were identified using available literature [15, 35, 45, 46, 48, 55].

The reference list of the most significant pest insects of tomatoes in the Republic of Moldova was performed based on literature search and recent survey findings in the tomato crop. Also, additional information regarding their feeding preferences and distribution was provided.

Results and discussions

The fauna of tomatoes (*Lycopersicon esculentum* Mill.) in the Republic of Moldova is represented by 20 insect species from 10 families and 6 orders: Coleoptera (Scarabaeidae, Elateridae and Chrysomelidae), Lepidoptera (Noctuidae and Gelechiidae), Hemiptera (Aphididae and Aleyrodidae), Diptera (Agromyzidae), Orthoptera (Gryllotalpidae) and Thysanoptera (Thripidae).

Considering the way of attack and feeding three main groups of pests were revealed: 1) pests of roots and underground rhizosphere (*Melolontha melolontha*, *Agriotes lineatus*, *Gryllotalpa gryllotalpa*, *Agrotis ipsilon*, *A. segetum*), 2) pests of leaves (*Leptinotarsa decemlineata, Liriomyza trifolii, Autographa gamma, Chrysodeixis chalcites, Helicoverpa armigera, Spodoptera exigua, Xestia c-nigrum, Phthorimaea operculella, Tuta absoluta, Aphis gossypii, Aphis fabae, Myzus persicae, Trialeurodes vaporariorum, Frankliniella occidentalis, Thrips tabaci*) and 3) pests of reproductive organs (*Helicoverpa armigera*, *Spodoptera exigua*, *Tuta absoluta*, *Chrysodeixis chalcites*). Most of the highlighted species are polyphagous, except *Leptinotarsa decemlineata, Phthorimaea operculella*, *Tuta absoluta* and oviparous form of *Myzus persicae*, which are oligophagous.

Order COLEOPTERA

Family Scarabaeidae

***Melolontha melolontha* (Linnaeus, 1758)** (European cockchafer), polyphagous species. Adults feed on leaves and flowers of fruit trees (plums, apple and cherry) and forest trees (oaks, beech and maple). The most dangerous are considered larvae, they feed on roots of different crops including tomatoes, causing severe damages.

The presence of larvae can be observed by reddening of aerial parts of the plant [47]. The species is widely distributed in Europe (Albania, Austria, Belgium, Bulgaria, Czech Republic, France, Germany, Greece, Sweden (south), Hungary, Macedonia, Republic of Moldova, Montenegro, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Spain, Italy, Switzerland and Ukraine) and Asia (China, India and Turkey) [63]. In the Republic of Moldova, the species was first time mentioned in 1913 by Vitkovskiy [51].

Family Elateridae

***Agriotes lineatus* (Linnaeus, 1767)** (Lined click beetle or Wireworm), a polyphagous species. *A. lineatus* is a common pest damaging almost all agricultural crops, such as wheat, rye, oats, barley, maize, potato, beet, carrot, onion, alfalfa, clover, tomato and fruit saplings. Larvae feed on roots of plants making holes and tunnels and providing access for soil organisms, especially bacterial rots [55, 56]. The species is distributed over Asia (Iran and Israel), North America (Canada and USA) and Europe (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Luxembourg, Netherlands, Portugal, Romania, Russian Federation, Spain, Sweden, Switzerland, United Kingdom and Ukraine) [63]. In the Republic of Moldova, the species was first time mentioned in 1917 by Miller and Zubowsky [58].

Family Chrysomelidae

***Leptinotarsa decemlineata* (Say, 1824)** (Colorado potato beetle) an oligophagous species. Both adults and larvae feed on leaves of Solanaceae plant species, causing severe damages. Colorado potato beetle is a primary pest of potatoes but can be harmful to eggplants and tomatoes [11, 21]. The species is widely distributed across Asia (Armenia, Azerbaijan, China, Republic of Georgia, Iran, Iraq, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan), North America (Canada, Mexico and USA), Central America and Caribbean (Cuba and Guatemala) and Europe (Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Republic of Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom) [63]. In the Republic of Moldova, the species was first time discovered in 1960 [52].

Order DIPTERA

Family Agromyzidae

***Liriomyza trifolii* (Burgess in Comstock, 1880)** (American serpentine leafminer), polyphagous species. Adult females damage the foliage, especially at the leaf tip and along the leaf margins, while feeding and oviposition [28]. However, the most harmful are mining larvae, their activity results in dangerous destruction of leaf mesophyll. The most important crops attacked are cucumber, lettuce, onion, potato and tomato [24, 34]. The species occurs in Asia (China, India, Indonesia, Iran, Israel, Japan, Jordan, Republic of Korea, Lebanon, Oman, Philippines, Saudi Arabia, Taiwan, Turkey, United Arab Emirates, Vietnam and Yemen), Africa (Benin, Côte d'Ivoire, Egypt, Ethiopia, Guinea, Kenya, Madagascar, Mauritius, Mayotte, Morocco, Nigeria, Réunion, Senegal, Sudan, Tanzania, Tunisia, Zambia and Zimbabwe), North America (Canada, Mexico and USA), Central America and Caribbean (Bahamas, Barbados, British Virgin

Islands, Costa Rica, Cuba, Dominican Republic, Guadeloupe, Guatemala, Martinique, Netherlands Antilles, Puerto Rico, Saint Kitts and Nevis, Trinidad and Tobago, and United States Virgin Islands), South America (Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Peru and Venezuela), Europe (Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Finland, France, Greece, Hungary, Ireland, Italy, Malta, Republic of Moldova, Montenegro, Netherlands, Norway, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom) and Oceania (Guam, Micronesia, Federated states of Northern Mariana Islands, Samoa and Tonga) [63]. In the Republic of Moldova was found since 1983 [36].

Order ORTHOPTERA

Family Gryllotalpidae

***Gryllotalpa gryllotalpa* (Linnaeus, 1758)** (European mole cricket), polyphagous species. European mole cricket has been reported as a serious pest of vegetable crops including tomatoes. Through feeding and tunneling, insects damage basal and underground parts of the plants. They cause the most severe damage to seedbeds and newly transplanted seedlings [32, 40]. The species is distributed across Asia (Armenia, Azerbaijan, Republic of Georgia, India, Iran, Kuwait, Turkey, Turkmenistan and Uzbekistan), Africa (Algeria and Egypt), North America (USA) and Europe (Albania, Austria, Belgium, Bulgaria, Croatia, Czech, Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Macedonia, Republic of Moldova, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom) [63]. In the Republic of Moldova us knowas a dangerous pest of cereales, potato and almost an vegetables [61].

Order LEPIDOPTERA

Family Noctuidae

***Agrotis ipsilon* (Hufnagel, 1766)** (Black cutworm), a polyphagous species. The black cutworm attacks the seedlings of many crops, such as broccoli, cabbage, carrot, eggplant, potato, tomato, turnip, as well as many other plants. *A. ipsilon* has a solitary habit, the larvae feed cutting off the stem and sometimes dragging the plants into their burrows. Because of their feeding nature on young plants, they are considered dangerous pests of newly planted fields [30]. This insect is nearly cosmopolitan and occurs in the Asia, Africa, North America, Central America and Caribbean, South, America, Europe and Oceania [63]. First time on the territory of the Republic of Moldova was mentioned in the work of Miller, Zubowsky and Ruscinschi [20].

***Agrotis segetum* (Denis & Schiffermüuler, 1775)** (Turnip moth), a polyphagous species. The larvae generally attack the roots and lower stems of plants, cutting down seedlings. Turnip moth is a serious pest of tomatoes, maize, grain, tobacco, sunflower, sugar beet and winter cereals during the first generation of pest development [27, 54]. The species is distributed across Asia (Afghanistan, Azerbaijan, Bangladesh, Bhutan, China, Republic of Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Korea, Kyrgyzstan, Lebanon, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Saudi Arabia, Sri Lanka, Syria, Taiwan, Tajikistan, Turkey, Turkmenistan, Uzbekistan, Vietnam and Yemen), Africa (Algeria, Angola, Benin,

Botswana, Cape Verde, Democratic Republic of Congo, Côte d'Ivoire, Egypt, Ethiopia, Kenya, Libya, Malawi, Mali, Morocco, Mozambique, Namibia, Saint Helena, Senegal, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe) and Europe (Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Macedonia, Malta, Republic of Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom) [63]. In the Republic of Moldova first time was mentioned by Rekalo in 1888 [60].

***Autographa gamma* (Linnaeus, 1758)** (Silver Y), polyphagous species. Silver Y moth damage to a wide variety of hosts which include vegetable, flower and greenhouse crops [41]. The young larvae feed on the foliage of their host plants and tend to occur singly rather than in groups. When larvae are young, they skeletonize the leaves, but older caterpillars eat the whole leaf [10]. The species occurs in Asia (Azerbaijan, China, India, Iran, Iraq, Israel, Japan, Kazakhstan, Korea, Saudi Arabia, Syria, Turkey and Uzbekistan), Africa (Algeria, Egypt, Libya and Morocco) and Europe (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Republic of Moldova, Netherlands, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom) [63]. In the Republic of Moldova first time was mentioned in 1910 by Miller and Zubowsky [57].

***Chrysodeixis chalcites* (Esper, 1789)** (Golden twin-spot moth), polyphagous species. The moth is a general feeder on crops including vegetable, fruit and ornamental hosts. Larvae feed on leaves and fruit of their host plants. The most dangerous and voracious are the last two larval instars. In tomato, larvae damage both the leaves and fruits of tomatoes, leading to reduce the yield [6, 26]. The species is distributed across Africa (Algeria, Angola, Cameroon, Cape Verde, Comoros, Congo, Cote d'Ivoire, Egypt, Gambia, Guinea, Kenya, Libya, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Nigeria, Reunion, Saint Helena, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Tunisia, Uganda, Zambia, and Zimbabwe), Europe (Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, France, Germany, Gibraltar, Greece, Hungary, Italy, Macedonia, Malta, Republic of Moldova, Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom), Middle East (Iran, Iraq, Israel, Jordan, Lebanon, Syria, Turkey and Turkmenistan) and North America (Canada) [6, 63]. Species occurrence in the Republic of Moldova was mentioned in the work of Tugulea and Derjanschi [39].

***Helicoverpa armigera* (Hübner, 1808)** (Cotton bollworm), polyphagous species. Cotton bollworm can damage different economically significant crops such as tomato, leguminous plants, sorghum, maize, potatoes, ornamental plants and fruit trees. Their larvae feed on leaves, stems, buds, inflorescences, fruits and pods [29, 42], damaging the vegetative and reproductive plant stages. On tomatoes, young fruits are invaded and fall, larger larvae may bore into older fruits. This species is widespread in central and southern Europe, temperate Asia, Africa, Australia, and Oceania, recently has been revealed from Brazil. It is a migrant species, able to reach Scandinavia and

other northern territories [63]. In the Republic of Moldova first time was mentioned in 1977 by Tkach [60].

***Spodoptera exigua* (Hübner, 1808)** (Beet armyworm), polyphagous species. The beet armyworm is a serious pest of vegetable, field, and flower crops. The most susceptible vegetable crops are beans, beet, cabbage, celery, corn, eggplant, lettuce, onion, pea, pepper, potato, radish and tomato. Among field crops are alfalfa, corn, cotton, safflower, sorghum, soybean and sugar beet [8]. Larvae consume both the foliage and fruit and cause contamination of the crop. The holes that larvae drill in tomatoes can lead to rotting. They also may leave feces in crops, remain in the crop, or cause significant scarring, all of which negatively influence crop yields [43]. The species originated in southeast Asia, it has expanded its geographic range extensively outside of Asia, becoming an invasive species. It is found in temperate and subtropical regions around the globe, including China, Japan, the United Kingdom, Scandinavia, the United States, South America, Africa, and New Zealand [44]. In the Republic of Moldova reported by Miller, Zubovschi and Ruscinschi in 1929 [20].

***Xestia c-nigrum* (Linnaeus, 1758)** (spotted cutworm), polyphagous species. Spotted cutworm is considered to be a minor agricultural pest in most of its range but can develop into a major local infestation on a wide variety of crops. *X. c-nigrum* is an ubiquist species that occurs particularly abundant in open areas such as on extensive meadows, ruderal terrain or nutrient-poor grasslands [13]. The species occurs across Asia (Afghanistan, China, Republic of Georgia, India, Japan, Kazakhstan, Korea, Republic of Kyrgyzstan, Pakistan, Turkey, Uzbekistan and Vietnam), Africa (Morocco), North America (Canada, Mexico and USA), Central America and Caribbean (El Salvador) and Europe (Albania, Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Republic of Moldova, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom) [63]. In the Republic of Moldova reported by Miller, Zubovschi and Ruscinschi in 1929 [20].

Family Gelechiidae

***Phthorimaea operculella* (Zeller, 1873)** (Potato tuber moth), an oligophagous insect. Potato tuber moth is associated mainly with potatoes, but they have been observed feeding on tomatoes, eggplants and peppers [1]. Larvae feed on leaves, stems and petioles, on potatoes, they damage the tubers. The larvae prefer to feed on young foliage, creating mines on leaf and leaving intact the upper and lower epidermis of the leaf. In tubers larvae bore tunnels, they leave their excreta inside making the tubers unfit for consumption [18, 31, 38]. *P. operculella* is a cosmopolitan pest, especially in warm temperate and tropical regions where host plants are grown. It has become a global pest with distribution reported in more than 90 countries [63]. In the Republic of Moldova, the species was reported in 2017, the most abundant being in Slobozia and Stefan-Voda [12].

***Tuta absoluta* (Meyrick, 1917)** (Tomato leafminer), oligophagous insect. The tomato leaf miner is one of the most serious pests of tomato but is also known to attack cultivated solanaceous plants such as eggplant, potato, pepper, tobacco and solanaceous weeds [5]. The larva feeds on stalks and leaves producing galleries, it

also consumes apical buds, green and ripe fruits. *T. absoluta* is capable to cause a yield loss of 100% [3]. *T. absoluta* is a native pest to South America but has spread to Asia (Bangladesh, Republic of Georgia, India, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Nepal, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates and Yemen), Africa (Algeria, Botswana, Egypt, Ethiopia, Ghana, Kenya, Lesotho, Libya, Mayotte, Morocco, Mozambique, Niger, Nigeria, Senegal, Sudan, Tanzania, Tunisia, Uganda and Zambia), Central America and Caribbean (Costa Rica and Panama), South America (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela) and Europe (Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, France, Guernsey, Hungary, Italy, Lithuania, Malta, Montenegro, Republic of Moldova, Netherlands, Portugal, Romania, Russian Federation, Serbia, Slovenia, Spain, Switzerland, Ukraine and the United Kingdom) [63]. Since 2013 the species was recorded in the Republic of Moldova [62].

Order HEMIPTERA

Family Aphididae

***Aphis gossypii* (Glover, 1877)** (Melon aphid), is a polyphagous species in a family where most are host specialists [16]. Melon aphid is a serious pest of cucurbit vegetables, among other vegetable crops affected, can also be carrot, celery, parsley, parsnip, pea, pepper, radish, tomato, and eggplant. The melon aphids feed through sucking the nutrients from the underside of plant leaves, or on growing tip of vines. Their activity cause distortion and curling of leaf, hindering photosynthetic capacity of the plant, as a result, the foliage dies premature affected by chlorosis [7]. Also, melon aphids produce honeydew which provides a substrate for growth of sooty mold. Moreover, the melon aphids are vectors of several dangerous plant viruses [19]. *A. gossypii* has a cosmopolitan distribution. It prefers warm climates; in colder areas, it is often a pest in greenhouses. The species is known on the territory of the Republic of Moldova since 1980 as a dangerous pest of different crops [14].

***Aphis fabae* (Scopoli, 1763)** (Black bean aphid), polyphagous species. Black bean aphid is a serious pest of sugar beet, beans, haricot beans, potatoes, sunflower and tomato. They feed through sucking the sap from stems and leaves and causing distortion of the shoots. *A. fabae* acts also as a vector for viruses that cause plant disease. Moreover, they produce honeydew that encourages the growth of sooty mold. All this together reduce considerably the yield [53]. *A. fabae* occurs across Asia (Afghanistan, Ceylon, China, Cyprus, Formosa, India, Iraq, Israel, Japan, Jordan, Lebanon, Nepal, Pakistan, Persia, Philippine Islands and Turkey), Africa (Cameroun, Canary Islands, Belgian Congo, Egypt, Eritrea, Kenya, Libya, Madeira, Morocco, Nigeria, Republic of South Africa, Southern Rhodesia, Sudan and Tanganyika), Australasia and Pacific Islands, Hawaii, North America (Canada and USA), Central America and West Indies, South America (Argentina and Brazil) and Europe (Austria, Belgium, Britain, Bulgaria, Channel Islands, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Republic of Moldova, Poland, Portugal, Romania, Sardinia, Spain, Sweden and Switzerland) [63]. In the Republic of Moldova is known as a dangerous [50].

***Myzus persicae* (Sulzer, 1778)** (Green peach aphid), the viviparous forms are polyphagous, while the oviparous are oligophagous. Oviparous females being much more restrictive in diet choice prefers as hosts trees of the genus *Prunus*, especially peach, including peach crosses, and also apricot and plum. The viviparous stage feeds on an assortment of plants including crops in the families Solanaceae, Chenopodiaceae, Compositae, Brassicaceae and Cucurbitaceae. Vegetables that are reported to be the most affected by *M. persicae* are beets, broccoli, cabbage, carrot, cauliflower, corn, cucumber, eggplant, pea, pepper, potato, radish, spinach, tomato and watermelon [2, 9]. Green peach aphid usually feeds on the underside of the oldest leaves. It is common on seedlings, young plants and lower leaves of older plants. Throughout the world *M. persicae* is causing serious damage to the crops, being considered the most important vector of plant viruses. Both nymphs and adults are equally capable of virus transmission [25]. *M. persicae* like its primary host plant *Prunus persica* originate from Asia, now it occurs everywhere in the world except the areas with extreme temperature or humidity. In the Republic of Moldova is known as a dangerous pest [50].

Family Aleyrodidae

***Trialeurodes vaporariorum* (Westwood, 1856)** (Greenhouse whitefly) is a polyphagous species. Greenhouse whiteflies attack many host plants, including economically important vegetable crops such as cucumber, eggplant, green beans, green pepper, potato, strawberry, tomato and watermelon [22]. Adults and nymphs feed through sucking sap from leaves, caused damages usually are not visible. Large populations of greenhouse whiteflies reduce quickly the potency of plants. Adult insects produce honeydew, which serves as a substrate for the growth of sooty mold and is affecting the fruit quality. Also, the species is a vector of dangerous plant viruses. *T. vaporariorum* has its origin in tropical or subtropical America, now it is distributed on all continents except Antarctica [23]. It is distributed widely throughout the tropics and subtropics and occur in greenhouses in temperate zones. In the Republic of Moldova is known since 1983 [36].

Order THYSANOPTERA

Family Thripidae

***Frankliniella occidentalis* (Pergande, 1895)** (Western flower thrips), a polyphagous species. Crops attacked by this pest include beans, cucumber, eggplant, onion, tomatoes and watermelon. *F. occidentalis* feed by sucking up the cell contents. They perforate the leaves, flowers, or stems with mouth causing a characteristic silvery appearance, eventually browning and dying. Leaf tips wither, curl and die (Metcalf 1962). In addition to direct damage, this pest also is a vector of several species of destructive plant viruses, including Tomato Spotted Wilt Virus (TSWV) and Impatiens Necrotic Spot Virus (INSV), of which it is the most important vector worldwide (Bautista 1993). The species occurs across Asia (China, Iran, Japan, Republic of Korea, Kuwait, Malaysia, and Sri Lanka), Africa (Algeria, Kenya, Morocco, Reunion, Swaziland, Tunisia, Uganda and Zimbabwe), North America (Canada, Mexico, and the USA), Central America (Costa Rica and Guatemala), South America and the Caribbean (Dominican Republic, Martinique, Puerto Rico, Argentina, Brazil, Ecuador, Chile, Colombia, Guyana, Peru, Uruguay and Venezuela), Europe (Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic,

Denmark, Estonia, Finland, France, Germany, Greece, Guernsey, Hungary, Ireland, Israel, Italy, Latvia, Malta, Republic of Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Ukraine and the United Kingdom) and Oceania (Australia and New Zealand) [63]. First time in the Republic of Moldova was mentioned by Verderevskaya, Tertyak and Voinyak [49].

***Thrips tabaci* (Lindeman, 1889)** (Onion thrips), polyphagous species. Preferred hosts are onions and garlic but can also seriously damage other crops such as cabbage, cotton, celery, tomatoes, beans and cucumber. *T. tabaci* feed by sucking the fluids from cells, they usually rasp and pierce the surface of the plant leaf with their mouthparts. Damaged areas turn silvery and are losing the ability to perform photosynthesis. They can also serve as vectors of some viruses and other plant diseases [33]. Onion thrips is a global pest of onion grown between sea level and 2000 m [17]. Onion thrips is a native to the Mediterranean region but has become a major pest of agricultural crops throughout most of the world. Severe damage to various crops has been reported in Africa, Asia, Europe, North and South America, and Australasia [23]. In the Republic of Moldova is known as a dangerous pets [37].

Conclusions

Due to its demand, tomatoes are one of the most cultivated horticultural crops. Tomato plantations are considerably enlarged every year, thus increasing their vulnerability to a variety of insect pests. No matter where the plants are grown, in greenhouses or in open field, insect pests can harm the roots, leaves or fruits and thereby decrease the yield. Thus, knowledge of pest insect fauna and species occurrence can enhance the results of pest management practices.

Obtained results regarding the study of the major pest insects of tomato crop in the Republic of Moldova may serve as a base in developing recommendations for sustainable management of tomatoes pests. Also, recent discovering of some dangerous pests on the investigated territory, suggests the importance and critical need for permanent monitoring of insect pests and inventory of their fauna. With the intensification of trade, the potential for new pests to spread over larger territories is increased particularly for those that are now near the border. Thus, future studies may enlarge the list of tomatoes pests in the Republic of Moldova.

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