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BACTERIAL ROOT CANCER OF CHERRY IN THE CONDITIONS OF THE WESTERN PART OF AZERBAIJAN

Bacterial root cancer or goiter of the root system is a plant disease with symptoms of proliferation of plant stem or root tissues, caused by the transfer of Ti-plasmids from the virulent bacterium *Agrobacterium tumefaciens* Conn. into plant cells. The article presents the results of studies of bacterial root cancer of cherries in the conditions of the Ganja-Kazakh geographical zone during 2021—2023. In these years of research, it was found that the disease is widespread in cherry orchards in the western part of the country and severely damages trees. The causative agent of the disease from the soil through wounds and cracks in different parts of the root system penetrates into its cells and the incubation period of the disease begins. It lasts (depending on temperature) 4—7 weeks. The resulting cancer growths do not lead to the rapid death of cherry trees. However, the pathogen suppresses their overall growth, viability and reduces their resistance to fungal and other infections, which leads to a significant decrease in yield, and after a while the energy of the plants is depleted, they gradually dry out and eventually die. The bacterium *Agrobacterium tumefaciens* Conn. has been studied in detail in the laboratory over the years of research. We have developed a system of complex agrotechnical methods for combating bacterial root cancer.

cherry; bacterial root cancer; distribution; intensity of development; yield; harmfulness

Introduction. Cherry (*Cerasus* Juss.), a genus of trees and shrubs of the rosa family (*Rosaceae* Juss.), plum subfamily (*Prunoideae* Horan.), numbering more than 200 species, is found in the Former USSR about 60 [1,2,3,4]. Some species have been introduced into industrial culture and have become widespread throughout the world. Only 4—5 species are bred as fruit trees, and some as ornamental plants. Currently, there are a large

number of cherry varieties (more than 5000). Depending on the species and origin, the plants are represented by small shrubs (0.3—4.0 m) or trees, reaching 8—12 and even 20 m in height [5,6,7,8].

Cherry fruits are consumed fresh and processed (wine, marshmallow, canned food, jam, syrups, juices, marinades, etc.). Some types of wood provide good ornamental material, for example, for drawing supplies, chibouks, etc. [9,10].

Almost all cultivars of cherry (up to 270) are descended from the common cherry (*Cerasus vulgaris* Mill.) (Fig. 1,2).

Tumors or growths are the growth of the affected tissue under the influence of the pathogen. Tumors form on various plant organs: roots, tubers, root crops, etc. The appearance of growths occurs as a result of an increase in the size of the affected cells (hypertrophy) or an increase in their number (hyperplasia). Sometimes these two processes occur simultaneously. Violation of the nature of cell growth and acceleration of their division indicate that the substances secreted by the pathogen can disrupt the growth method inherent in the plant and lead to the growth of individual tissues unusual for the plant. The formation of outgrowths, tumors, and galls are characteristic signs of diseases caused by fungi, bacteria, and viruses [11].

Fig. 1,2. Ripe cherry fruits («Shchedraya» cultivar)

Bacterial root cancer (*Agrobacterium tumefaciens* Conn.) causes the greatest damage to young fruit plants in nurseries and young gardens. The pathogen is capable of infecting more than 1000 plant species in all areas of their cultivation. Most often, bacterial root cancer or goiter of the roots occurs: on fruit crops: apple, pear, cherry, peach, sweet cherry, plum; on forest species: willow, birch, poplar; in vineyards and berry fields (currant); on industrial crops: oleander, cotton; on legumes: fava beans; on flower-decorative crops: rose, chrysanthemum.

The harmfulness of the disease is especially enhanced in connection with the cultivation of planting material according to industrial technology based on the use of vegetatively propagated rootstocks. At the same time, the defeat of seedlings of stone fruit crops is 5—10%.

Purpose and task of research. The main goal of our research was to study bacterial root cancer in large industrially significant cherry orchards located in the Ganja-Kazakh geographical zone of Azerbaijan in 2021—2023. To achieve the goal set in the study, the following tasks were planned;

- Study of prevalence, intensity of development and harmfulness of bacterial root canker of cherry (*Agrobacterium tumefaciens* Conn.) in the conditions of the western part of Azerbaijan;
- Determination of environmental factors that stimulate growth, development of the pathogen;
- Study of biological characteristics of phytopathogenic bacteria;
- Development of agrotechnical methods of disease control.

Materials and research methods. To determine the spread and development of the causative agent of bacterial root cancer of cherries (*Agrobacterium tumefaciens* Conn.) in 2021—2023. carried out route inspections of industrial plantations of cherry located in the conditions of the western part (Ganja-Kazakh geographical zone) of Azerbaijan. The experiments were laid against the background of the agrotechnical cultivation of cherries recommended for this zone. Observations and records of the prevalence and development of bacterial root cancer (*Agrobacterium tumefaciens* Conn.) were carried out systematically throughout the entire growing season of plants, according to the methods generally accepted in phytopathology [12,13,14,15]. Route surveys for the purpose of selecting biological material were carried out in industrial cherry orchards located in the western part of the republic. The harmfulness of bacterial root cancer of cherries was studied on susceptible cultivars «Anadolu», «Shchedraya» and «Zhukovskaya».

Results and its discussion. Bacterial root cancer or root goiter (*Agrobacterium tumefaciens* Conn.) is one of the most common diseases of cherry orchards, found in almost all western regions of Azerbaijan. To this end, during 2021—2023, the distribution and intensity of development of bacterial root cancer (*Agrobacterium tumefaciens* Conn.) in different varieties of cherries in different western regions of the republic were determined (Table 1).

As can be seen from the table, the variety Zhukovskaya was most severely affected by this disease on the territory of all the western regions where the studies were carried out.

The disease manifests itself in the following. On the lateral and main roots or the root neck of the plant, outgrowths and influxes of various sizes and shapes of a woody consistency are formed (Fig. 3.4). On seedlings in the nursery, the size of the growths usually does not exceed the size of a chicken

1. Distribution and intensity of development of bacterial root cancer or goiter of cherry roots in the conditions of the western part of Azerbaijan (2021—2023)

Western regions of Azerbaijan	Cherry cultivars	2021 year		2022 year		2023 year	
		P, %	R, %	P, %	R, %	P, %	R, %
Shamkir	Anadolu	23.8	13.6	23.9	13.0	25.0	14.3
	Shchedraya	31.7	18.9	26.5	14.2	26.9	14.4
	Zhukovskaya	29.0	18.8	31.9	19.0	33.3	19.1
Tovuz	Anadolu	25.9	14.1	26.1	13.9	26.6	13.8
	Shchedraya	30.0	18.0	29.9	18.0	29.4	17.9
	Zhukovskaya	39.9	15.2	43.1	16.4	45.9	17.0
Kazakh	Anadolu	27.8	14.4	28.8	14.7	29.9	14.9
	Shchedraya	29.1	18.1	28.9	17.7	29.6	17.9
	Zhukovskaya	44.4	15.9	45.5	16.0	47.2	17.5
Note: P — prevalence, %; **R** — intensity of development, %							

egg, but in some cases it is the size of a fist. Growths are formed due to increased cell division, mainly parenchymal tissue of the secondary cortex.

Analysis of laboratory studies shows that the causative agent of bacterial root cancer, the rod-shaped bacterium *Agrobacterium tumefaciens* Conn. (section Gram-negative aerobic rods and cocci, family *Rhizobiaceae*, genus *Agrobacterium*) [16,17].

Analysis of laboratory studies indicates that the cells of *Agrobacterium tumefaciens* Conn. rods, usually 0.6—1.0 × 1.5—3.0 μm, motile by means of

Fig. 3,4. Bacterial cancer on the root collar and roots of cherries

1—3 peritrichous flagella. Bacteria Gram-negative, non-spore-bearing, aerobes. On potato agar, the colonies are raised, moist-shiny, light beige with a smooth translucent edge. The growth of the pathogen on media with carbohydrates is accompanied by abundant formation of extracellular polysaccharide mucus. Starch is not hydrolyzed. Milk is curdled, but not peptonized. Litmus milk is acidified. Nitrates are reduced. Gelatin is not liquefied or liquefied very slowly. The reaction to catalase, oxidase and urease is usually positive. Allocate indole, hydrogen sulfide and ammonia. They form acid on sucrose, dextrose, lactose, fructose, arabinose, galactose, mannitol.

Root cancer bacteria persist on plant debris, in the soil — throughout the year. Bacteria enter the plant from the soil through various lesions on the root system. Having penetrated the plant tissue, they begin to multiply. Bacteria are introduced into a plant of any age. Over time, the growths are destroyed, rot and, released from them, bacterial rods spread rapidly.

Without plant protection, it is impossible to consider issues of increasing the efficiency of agricultural production. The most effective and acceptable from the point of view of environmental protection is the agrotechnical method of struggle.

The agrotechnical method of pest and disease control is a set of agricultural techniques that create unfavorable conditions for the development of pests and pathogens, as well as favorable conditions for increasing the protective properties of the plants themselves [18,19].

All agrotechnical methods can be characterized as various techniques for creating optimal conditions for the development of cultivated plants and the suppression of harmful organisms. How this or that agricultural technique will affect the biocenosis varies greatly depending on local climatic conditions; when planning field work, one should always remember local features [20].

It should be noted that the high efficiency of any method of protecting plants from diseases can only be ensured with a deep knowledge of the processes that determine the nature of the development of the disease.

To this end, studies conducted in 2021—2023 studied the impact of agrotechnical measures on the spread and development of bacterial root canker of cherries (*Agrobacterium tumefaciens* Conn.) (Table 2).

As can be seen from the table, the activities carried out gave positive results against bacterial root cancer (*Agrobacterium tumefaciens* Conn.). In 2023, the spread of the disease decreased by 46%, and the intensity of the development of the disease by 25.7%.

CONCLUSION

Measures to combat this disease mainly include a wide range of agricultural practices, since there are no permitted chemical and biological preparations to suppress it in Azerbaijan.

2. The influence of individual agrotechnical measures on the infection of cherry plants with bacterial root cancer (2022—2023)

Experience Options	2022 year			2023 year		
	P, %	R, %	BE, %	P, %	R, %	BE, %
Cleaning up fallen leaves and dry branches, mummified fruits, cleaning up cancerous wounds, tilling the soil around trees, fertilizing, moderate irrigation, spraying with 1% DNOC, etc.	40.6	23.7	44.0	33.9	18.1	59.0
Control	78.0	42.2	—	79.9	43.8	—
Note: P — prevalence, %; **R** — intensity of development, %; **BE** — biological or technical efficiency, %						

From the work carried out by us, it turned out that agrotechnical and sanitary-hygienic measures give a good result in the fight against bacterial root cancer of cherries (*Agrobacterium tumefaciens* Conn.). Therefore, these measures can be carried out as mandatory in the fight against bacterial root cancer of cherries (*Agrobacterium tumefaciens* Conn.) in the western part of Azerbaijan. These include:

- Establishment of new plantings in appropriate soil and climatic conditions;
- Cultivation of phytopathogen resistant and tolerant varieties adapted to local conditions;
- Timely and plentiful watering is of great importance, preventing the soil from drying out;
- Prevention of any kind of mechanical and thermal damage to the bark, root system;
- Fighting weeds in the garden as possible reservoirs of infection;
- Cleaning boles, root collar from lagging bark, moss, lichens.

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Бактеріальний кореневий рак вишні в умовах західної частини Азербайджану

Бактеріальний кореневий рак або зобуватість коренів — хвороба рослин із симптомами проліферації тканин стебла або кореня, спричинена перенесенням Ті-плазмід від вірулентної бактерії *Agrobacterium tumefaciens* Conn. у клітини рослин. У статті наведено результати досліджень бактеріального кореневого раку вишні в умовах Гянджа-Ка-

захської географічної зони протягом 2021—2023 рр. За роки досліджень встановлено, що хвороба широко поширена у вишневих садах західної частини країни і сильно пошкоджує дерева. Збудник хвороби з ґрунту через рани і тріщини в різних частинах кореневої системи проникає в її клітини і починається інкубаційний період хвороби. Він триває (залежно від температури) 4—7 тижнів. Утворені ракові розростання не призводять до швидкої загибелі вишні. Однак збудник пригнічує загальний ріст дерев, життєздатність і знижує стійкість проти грибкових та інших інфекцій, що призводить до значного зниження врожаю, а через деякий час рослини виснажується, поступово всихають і зрештою гинуть. Бактерія *Agrobacterium tumefaciens* Conn. була детально вивчена в лабораторії за роки досліджень. Нами розроблено систему комплексних агротехнічних методів захисту від бактеріального кореневого раку.

вишня; бактеріальний кореневий рак; поширення; інтенсивність розвитку; урожайність; шкідливість

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