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Fungicides from the main diseases of pomegranate in the western zone of Azerbaijan

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ABSTRACT

Diseases of fruit crops cause great harm to horticulture - the yield is significantly reduced and its quality deteriorates, the plants weaken and become susceptible to various adverse conditions, which often leads to their death. Pomegranate scab (*Sphaceloma punicae* Bitank. Et Jenk.) sharply reduces the yield and quality of fruits, zithiasis fruit rot (*Zythia versioniana* Sacc.), which has spread widely in recent years, affects flowers, fruits, stalks, leaves, branches, trunk and root collar, which greatly weakens the tree, reduces its yield and resistance to frost. Damage to fruits by scab or anthracnose in some years reaches 40-50% or more.

A comparative analysis of the field assessment of the biological effectiveness of the applied fungicides in the fight against pomegranate scab in a fruit-bearing garden was carried out. The biological assessment of fungicides was carried out in 2019 and 2020 as already noted in the fruit garden. The study of the preparations was carried out in field conditions, optimal for growing a culture, against a natural infectious background. The plot is homogeneous in fertility, mechanical composition of the soil, relief, planting pattern, crown formation, with the same nutritional area, age and fruiting strength. Trees that were old and damaged by frost, cancers and rodents were excluded.

Keywords: Pomegranate, Main diseases of pomegranate, Phytopathogen, Susceptibility, Control measures, Fungicides.

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Introduction

Subtropical fruit growing is a large branch of agriculture in Azerbaijan, which is represented mainly by citrus fruits (*Citrus* L.), pomegranates (*Punica* L.), olives (*Olea* L.), figs (*Ficus* L.), hazelnuts (*Corylus* L.), nuts (*Juglans* L.), almonds (*Amygdalus* L.), feijoa (*Feijoa* Berg.), pistachios (*Pistacia* L.), etc. Increasing the production of subtropical crops is one of the ways to improve the well-being of the people, improve the supply of food to the population.

Among the subtropical crops, pomegranate is one of the most valuable. The pomegranate is of

exceptional interest for the development of fruit growing in Azerbaijan and Central Asia. However, in comparison with other subtropical crops, the technology of its cultivation, pests and diseases are still poorly understood.

The pomegranate belongs to the Punicaceae Horan. family, which has only one genus *Punica* L., Which includes two species: common pomegranate (*Punica granatum* L.) and Socotran pomegranate (*Punica protopunica* Belf.) [1-5].

Species *Punica protopunica* Belf. (Socotran pomegranate) is endemic to Socotra Island (Indian Ocean), the flora of which is characterized by an abundance of relict species. The Socotran pome-

granate is an evergreen tree and does not represent any economic value.

Species *Punica granatum* L. (common pomegranate) is represented by cultivated and wild-growing forms. Pomegranate in vivo is a small tree or a large bush up to 3-5 m in height, with a curved trunk and a highly branched crown [6].

On the territory of the former Soviet Union, the largest overgrown wild-growing pomegranates are located in the Eastern Transcaucasia. Clumps of wild-growing pomegranate are found in Azerbaijan.

Borders of the natural range of pomegranate: in the east, regions of North-West India and North-East Afghanistan; in the north-south regions of the Central Asian republics, the southern spurs of the Greater Caucasus Range; on the west coast of Asia Minor; on the south coast of the Indian Ocean and its bays [7-10].

Pomegranate (*Punica* L.) is cultivated mainly as a fruit crop, but can also be used for medicinal, technical and ornamental purposes. Its fruits have high taste and medicinal qualities, are distinguished by good keeping quality (up to 4-6 months).

Pomegranate diseases, both abroad and in our country, have not been sufficiently studied. Some diseases of this culture have been studied in Azerbaijan, Crimea, Turkmenistan, Uzbekistan, Turkey, Greece, Georgia, etc. Of the diseases of pomegranate (*Punica* L.), cancer or phomosis (*Phoma punicae* Tassi.), zithiasis fruit rot (*Zythia versioniana* Sacc.) and anthracnose or scab of pomegranate fruits (*Sphaceloma punicae* Bitank. Et Jenk.) are found everywhere.

The purpose and objectives of the research

Azerbaijan is one of the leading areas for subtropical plant growing.

The originality and specificity of the relief, climate, as well as a favorable combination provide the opportunity to grow here subtropical and dry subtropical crops rich in species composition.

Dry subtropical crops are located in five out of ten natural and economic zones of the republic, and in three of them pomegranate (*Punica* L.) occupies an important place as a versatile culture for use.

However, for all the great value of this culture, the diseases that occur on the pomegranate have not been thoroughly studied in the republic until recently, or have been studied fragmentarily, they did not receive due attention. The protection of pomegranates from various diseases in Azerbaijan was carried

out by using multiple applications of various fungicides, which, naturally, contributed to environmental pollution.

In connection with the above, the task of our research was to clarify the species composition of fungi found on pomegranate, to study the biological characteristics of their causative agents of the most harmful diseases in order to develop scientifically based measures to combat the main diseases of pomegranate. In this regard, the following issues were studied:

1. Clarification of the pomegranate mycobiota;
2. Study of distribution, harmfulness, dynamics of development, pathogenicity of pathogens of the most harmful diseases;
3. Revealing the role of agrotechnical and sanitary-hygienic measures in the fight against pomegranate diseases;
4. testing various fungicides and establishing the timing and frequency of treatment and concentrations of fungicides;
5. Establishing the effectiveness of the developed measures.

Research results

Our research work on the study of pomegranate diseases was carried out in the farms of the Goranboy region (Western part of Azerbaijan).

In the western part of Azerbaijan (Ganja-Kazakh zone), the most common and harmful on pomegranate are zithiasis fruit rot (*Zythia versioniana* Sacc.), *Aspergillus* fruit rot (*Aspergillus niger* Van Tieghem.), anthracnose or pomegranate fruit scab (*Sphaceloma punicae* Bitank. Et Jenk.), botrytosis or gray rot (*Botrytis cinerea* Pers.), *Alternaria* or black rot (*Alternaria* sp.), cercosporosis (*Cercospora lythracearum* Heald. Wolf.), cancer or phomosis (*Phoma punicae* Tassi.), late blight or stem rot (*Phytophthora* sp.) macrofomosis (*Macrophoma granati* Berl. Et Vogl.), nematosporosis (*Nematospora coryli* Pegl.), etc [11-14].

Based on the results of 3-year surveys 2018-2020. of fruit-growing farms of the republic, it was found that in the structure of the dominance of phytopathogenic microorganisms in young intensive plantings of pomegranate in terms of frequency of occurrence, the dominant species are pathogens of pomegranate scab (*Sphaceloma punicae* Bitank. Et Jenk.), zithiosis (*Zythia versioniana* Sacc.). The aim of the research was to identify the most common diseases in young industrial plantings of pomegran-



Fig. 1. *Ovary anthracnose*



Fig. 2. *Anthracnose or pomegranate scab*

ate, to establish their species composition.

Anthracnose or pomegranate scab (*Sphaceloma punicae* Bitank. Et Jenk.) is the most harmful disease. Scab is found everywhere in the republic and cause great damage to farms cultivating the pomegranate culture. The disease is poorly understood.

In the conditions of Azerbaijan, the *Sphaceloma punicae* Bitank. Et Jenk. fungus infects the calyx of flowers and the skin of the fruit. A dark brown spot first appears on affected flowers, calyx and fruit. With the further development of the disease, the spots merge, take on various shapes and sizes. Affected flowers dry out (Pic. 1,2).

In places of spots, the development of tissue is suspended, and the surface of the skin is cracked. Cracks also capture healthy tissue, cracking of the entire fruit occurs, which reduces the market value of the fruit. Such fruits are susceptible to other diseases as well.

The source of infection is mummified fruits, fallen leaves and ovaries, as well as infected trees.

To establish the prevalence of scab in the regions of the republic, route surveys were carried out in Shamkir, Geranboy and Kazakh regions. As a result of surveys, it was revealed that pomegranate scab is found in all regions of the western part of Azerbaijan.

Table 1. *Distribution and development of anthracnose or pomegranate scab in the Ganja-Kazakh zone (2018)*

№	Districts	Posting date	Anthracnose or pomegranate scab	
			Spread, %	Intensity, %
1	Goranboy	7.IX	63,2	37,8
2	Shamkir	10.IX	57,2	32,1
3	Kazakh	11.IX	56,5	31,2
	Total	-	58,9	33,7

In addition to yield losses, scab also negatively affects the quality of the fruit. To clarify the effect of the disease on the quality of the fruit, we carried

out analyzes for the content of monosaccharides, disacchars, ascorbic acid and total acidity in sick and healthy pomegranate fruits.

Table 2. *The content of sugars, ascorbic acid and total acidity in healthy and scabbed pomegranate fruits (2020)*

№	Condition of the fruit	The amount of monosaccharides, %	The amount of disaccharides, %	Acidity, in %	Ascorbic acid, %
1	Healthy	5,2	6,4	3,3	7,4
2	Sick	4,6	6,2	9,2	3,5

The results of our analyzes show that in sick pomegranate fruits, the content of mono- and disaccharides decreases by 0.6-0.2%, ascorbic acid by 3.9%, and the total acidity, on the contrary, increases by 5.9%.

All this is evidence that anthracnose or pomegranate scab (*Sphaceloma punicae* Bitank. et Jenk.) significantly impairs the quality of the fruit.

The most effective, fastest, and most often the only method of preventing and protecting plants from scab (pathogen *Sphaceloma punicae* Bitank. Et Jenk.) is chemical protection.

The chemical method is currently one of the important measures in the fight against pests, diseases and weeds of fruit and berry crops, as it has some advantages over other methods. This method is especially effective when pests are spread over large areas and has a quick effect. However, it has a num-

ber of disadvantages: the danger of pollution of the environment and plant products. Therefore, chemical protection must be accompanied by strict sanitary and hygienic control. Treatment of plants with pesticides should be carried out in accordance with the regulations for their use, taking into account the phytosanitary state of fruit and berry crops [15-17].

The treated plants and the resulting products should not contain residual amounts of the active substance of pesticides above the maximum permissible levels. Therefore, the use of each drug is governed by a waiting period in days from the last treatment to harvest [18-20].

Obtaining high and stable yields in perennial agroecosis of fruit crops is impossible without the use of modern plant protection products, both biological and chemical in nature [21].

Table 3. *Influence of fungicides on the spread and development of anthracnose or pomegranate scab (2019)*

Preparations and their concentrations	First option			Second option		
	After the third spraying			After the third spraying		
	Disease spread, %	Development intensity, %	Technical efficiency in comparison with control, %	Disease spread, %	Development intensity, %	Technical efficiency in comparison with control, %
Azoxifen	34,5	21,1	43,5	38,1	20,9	36,6
Conazol	20,2	11,6	65,2	28,7	13,3	53,1
Selphat	19,0	10,2	68,6	20,1	12,4	66,3
P-oxyride	19,5	11,5	50,9	20,8	12,9	44,5
Control (without chemical treatment)	63,3	37,5	0	62,4	35,3	0

Spraying was carried out in 3 terms in two variants.

In the first variant, the first spraying was carried out 3-4 weeks after flowering before the disease appeared on the fruits.

The second spray, when the fruits reached 1/3 or half of their size, and the third spray 30 days before harvest.

In the second variant, the first spraying was carried out when the first signs of the disease appeared on the fruits; the second spraying at 30 day intervals, the third 30 days before harvest (Table 3).

As can be seen from the table 3, in 2019, in the first variant, the best result against anthracnose or pomegranate scab was obtained in the case of 0,4% Selphate. The spread of the disease was 20,2%, under control 63,3%, development 11,6%, under control 37,5%.

Good results were also obtained in the variant where spraying was carried out with 0,05% Conazol.

The rest of the fungicides tested by us lag behind the standard.

In the second option, the effectiveness of fungicides is the same as in the first option. Selfat turned out to be the best, followed by Conazol.

Conclusion

On the basis of our studies, it has been established that fungal diseases (especially anthracnose or pomegranate scab), common in Azerbaijan, cause great damage to pomegranate plantations.

In the fight against pomegranate diseases (including scab), both sanitary and hygienic, agrotechnical and chemical measures are significant. It has been established that the applied fungicides are effective against the complex phytopathogens of pomegranate (especially against *Sphaceloma punicae* Bitank. Et Jenk.). Spraying the pomegranate with 1% Bordeaux liquid and other preparations replacing it during the budding period, after the first petals fall and 15-20 days after the second. Four to five spraying of adult pomegranate plantations at the first signs of anthracnose or pomegranate scab 0.05% Azoxifen, 0.05% Conazol, 0.4% Selfat, 0.3% P-oxiride: first, before bud break (after trimming and cleaning the trunks and skeletal branches from peeled bark, mosses and lichens); the second, after the first petals have fallen; the third, 20 days after the second; fourth, when the fruits reach large sizes; fifth - (if necessary) - 15-20 days after the fourth.

References

- [1] Huseinova L.A., The main diseases of pomegranate and measures to combat them, ANAS Ganja branch, Collection of news, № 3 (2018) 118-122 (in Azeri).
- [2] Kahramanogly I., Usanmaz S. Growing pomegranate, Cyprus, 2005 (in Turkish).
- [3] Metin A., Shahin A., Dzhanykhosh E., Oztyurk N., Growing pomegranate, Ankara, 2012 (in Turkish).
- [4] Ozguven A., Yilmaz J., Yilmaz M., Imrak B., Growing pomegranate, Cyprus, 2015 (in Turkish).
- [5] Mkervali V.G., Research on the protection of subtropical plants from diseases, Subtropical cultures, 5 (169) (1980) 37-42 (in Russian).
- [6] Jalagoniya K.T., To the study of premature drying out of citrus and some other subtropical fruit crops, Subtropical cultures, 4 (1971) 22-28 (in Russian).
- [7] Kalyuzhny Yu.V. Diseases of subtropical and tropical fruit crops and their control. Kiev: Ukrainian Agricultural Academy, 1987 (in Russian).
- [8] Ganiev M.M., Nedorezkov V.D., Garden protection in private subsidiary plots, Kolos, Moscow, 2005 (in Russian).
- [9] Grekov S.P. Subtropical in mid-latitudes, Agropromizdat, Moscow, 1985 (in Russian).
- [10] Vorontsov V.V., Shteiman U.G., Cultivation of subtropical crops, Kolos, Moscow, 1982 (in Russian).
- [11] Karasharly A.S., Pomegranate and its uses, AzerGosizdat, Baku, 1979 (in Russian).
- [12] Kulkov O.P., Pomegranate culture in Uzbekistan, Fon, Tashkent, 1983 (in Russian).
- [13] Fedorenko V.S., Subtropical and tropical fruit crops, Vishchaia Skola, Kiev, 1990 (in Russian).
- [14] Guliev F.A., Huseinova L.A. The species composition of causative agents of pomegranate diseases in the Ganja-Kazakh geographic zone and the improvement of measures to combat the main ones, Perm Agrarian Bulletin №3 (31) (2020) 39-51 (in Russian).
- [15] Guliev F.A., Huseinova L.A., Phytopathological examination of pomegranate orchards in the western part of Azerbaijan / Materials VII of the International Scientific and Practical Conference Science and Education in the Modern World: Challenges of the XXI Century,

- Kazakhstan, 2020, pp. 60-68 (in Russian).
- [16] Guliev F.A., Huseinova L.A., The main pests of pomegranate bushes in the western part of Azerbaijan and measures to combat them, International scientific and practical J. Global Science and Innovation 2020: Central Asia, Kazakhstan, 2020, pp. 10-15 (in Russian).
- [17] Guliev F.A., Huseinova L.A., Parasitic fungi of pomegranate bushes in the western part of Azerbaijan, Scientific collection of the Institute of Viticulture and Winemaking, issue 57, Odessa, 2020, pp. 35-46 (in Russian).
- [18] Guliev F.A., Gurbanov M.M., Huseinova L.A. Zithia fruit rot of pomegranate bushes in the western part of Azerbaijan, Bulletin of the Izhevsk State Agricultural Academy №4 (64) (2020), 19-30 (in Russian).
- [19] Guliev F.A., Huseinova L.A., Influence of individual agrotechnical measures on the infection of pomegranate plants with phomosis or branch cancer in the conditions of the Ganja-Kazakh geographical zone, International scientific and practical J. Global Science and Innovation 2021: Central Asia", Kazakhstan, 2021, pp. 15-20 (in Russian).
- [20] Guliev F.A., Huseinova L.A. The main diseases *Punica granatum* L. in the conditions of the western part of Azerbaijan, Agroecological J., Kiev, (4) (2020) 76-83 (in Russian).
- [21] Guliyev F.A., Huseinova L.A. The main disease of pomegranate in chestnut (gray-brown) of Azerbaijan/Kherson State Agrarian University, The impact of climate change on spatial development of Earth,s territories: implications and solutions, 2020, pp. 89-94.