"DEVELOPMENT OF SEA BUCKTHORN AND OTHER HORTICULTURAL MARKETS IN THE ASIA REGION"

International Conference "ASIA BERRY-2024"

DISEASES OF CULTIVATED SEABUCKTHORN, DAMAGE AND OPTIMAL METHODS OF CONTROL

A.Uranchimeg, T.Batchimeg

Laboratory of Plant Pathology, Institute of Plant Protection Research,
Mongolian University of Life Science

31 October, 2024

Ulaanbaatar city

INTRODUCTION

Sea buckthorn (Hippophae rhamnoides L.) is a shrub in the Elaeagnaceae family, with six species and twelve subspecies growing wild across Europe and Asia. It is cultivated in several countries, including Mongolia, China, India, Nepal, Pakistan, Russia, the United Kingdom, France, Denmark, the Netherlands, Germany, Poland, Finland, Sweden, and Norway.

In recent years, as sea buckthorn cultivation has expanded domestically, the incidence of infectious diseases that severely impact its growth and yield has also risen, as research indicates.

This has underscored the need to study diseases affecting cultivated sea buckthorn, identify causative agents, assess disease spread, determine the causes and severity of damage, and develop effective control measures for practical application. This objective forms the foundation of our current research efforts.

MATERIALS AND METHODS.

- This article is based on findings from field research conducted from 2018 to 2024 across cultivated sea buckthorn fields in the provinces of Tuv, Selenge, Darkhan-Uul, Arkhangai, Bulgan, Uvs, and Zavkhan, as well as in sea buckthorn fields managed by district committees around Ulaanbaatar.

- The pathogens of sea buckthorn cultivation were determined based on the results of laboratory tests, and their external symptoms were shown by photographs taken during field research.

- The prevalence of sea buckthorn disease was assessed as a percentage by comparing the number of infected plants to the total plant population within the study area. Disease impact varies based on the distribution and severity of specific pathogens, with certain diseases capable of significantly reducing yields or even causing complete crop loss.

- In addition to studying measures to control methods of sea buckthorn diseases from the experience of foreign researchers, we recommend the most optimal methods based on the results of our own experimental research to farmers.

RESEARCH RESULTS.

- Our research identified six species of lower fungi, one species of mushroom, and one bacterial species impacting sea buckthorn cultivation in Mongolia.
- Among these, two types of wilting diseases are the most widespread and severe, with leaf and fruit diseases directly contributing to yield reduction.
- Although less common, diseases such as black rot, bacterial rot, and stem rot also pose serious threats, leading to the death of sea buckthorn plants.

Table 1. **Species composition of pathogens organisms of Cultivated seabuckthorn diseases.**

Name of diseases	Taxonomy of pathogens			
	Class	Order	Family	Species
Verticillium wilt	*Sordariomycetes*	*Glomerellales*	*Plectosphaerellaceae*	*Verticillium dahliae*
Fusarium dried-shrink	*Sordariomycetes*	*Hypocreales*	*Nectriaceae*	*Fusarium sporotrichoides*
Endomycosis	*Leotiomycetes*	*Helotiales*	*Sclerotiniaceae*	*Monilia altaica*
Scabies	*Dothideomycetes*	*Capnodiales*	*Mycosphaerellaceae*	*Stigmina hippophaes*
Brown spot	*Dothideomycetes*	*Pleosporales*	*Pleosporaceae*	*Alternaria alternata*
Black canker	*Dothideomycetes*	*Botryosphaeriales*	*Botryosphaeriaceae*	*Sphaeropsis malorum*
Main stem rot	*Agaricomycetes*	*Polyporales*	*Polyporaceae*	*Trametes versicolor*
Bacterial canker	*Gammaproteo-bacteria*	*Pseudomonadales*	*Pseudomonadaceae*	*Pseudomonas syringae*

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **FUSARIUM DRIED-SHRINK** is the most destructive and widespread disease affecting sea buckthorn, present in nearly all of our study sites. Our research identified the primary cause as ***Fusarium sporotrichoides***, a soil-borne fungus.
- This pathogen blocks the main stem veins, preventing the plant from absorbing water and nutrients, leading to dehydration and wilting.
- **Damage of disease:** This is the most damaging disease, as infected trees die completely and cannot regenerate.
- **Prevalence of disease**: According to 2018 research findings, Fusarium dried-shrink had a prevalence of 3.1–6.3% in sea buckthorn fields in Bayangol, Mandal, Tsagaannuur, and Shaamar sums of Selenge Province, resulting in a 2.5–5.8% yield loss. In 2022, the prevalence of sea buckthorn dried-shrink disease in Batsumber sum of Central Province reached 13.8%, resulting in an 8.3% loss in harvest. In 2024, the prevalence of tree rot disease in Uliastai sum, Zavkhan Province, escalated to 46%, leading to a 40.0% loss in orchard yield.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **VERTICILLIUM WILT** is one of the most common diseases affecting sea buckthorn, caused by the pathogenic fungus ***Verticillium dahliae.*** Infected trees display yellowing leaves that fall prematurely, beginning from the top of the crown. The fruit on these leafless branches ripens prematurely, leaving the tree bare. This pathogenic fungus is rooted in the soil and is transmitted through lesions on the stems and branches.
- **Damage of disease**: Cultivated sea buckthorn bushes affected by Verticillium Wilt may partially or completely dry out and die.
- **Prevalence of disease**: In 2018, the prevalence of sea buckthorn wilt disease ranged from 5.2% to 8.1% in Mandal and Tsagaanuur sums of Selenge Province. In 2020, the prevalence increased to 7.5% in Haliun sum of Gobi-Altai Province and ranged from 11.2% to 14.0% in Songino and Uliastai sums of Zavkhan Province. By 2024, the prevalence of sea buckthorn wilt disease was reported at 8.0% in Aldarkhaan sum and reached 28.6% in Uliastai sum of Zavkhan Province, resulting in fruit yield losses ranging from 6.0% to 20.0%.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

Control methods of Dried-shrink and Wilt diseases:

- To manage dried-shrink and wilt diseases, it is essential to remove diseased and dried branches, as well as uproot dead trees. Disinfecting the holes in infected trees with specialized treatments, such as copper sulfate, is also recommended.
- Preventive measures include proper care for sea buckthorn trees, which involves spring and autumn pruning and applying a 3% Bordeaux liquid in the spring.
- Additionally, providing adequate irrigation during drought conditions, applying biological preparations containing *Bacillus subtilis* bacteria three to four times during the growing season, controlling weeds, and ensuring proper fertilization can help prevent dried-shrink and wilt diseases in sea buckthorn.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **ENDOMYCOSIS** is caused by the pathogenic fungus ***Monilia altaica***. The first symptoms typically appear in mid-August, coinciding with fruit ripening, when the fruit begins to pale and soften. The internal soft tissue of the fruit transforms into a light, slimy liquid, eventually causing the skin to rupture and juice to leak out, which can then infect healthy fruit. Endomycosis is often triggered by soft tissue damage due to sudden temperature fluctuations. The pathogen can be spread through frost, raindrops, and insects.
- **Damage of disease**: Infection from endomycosis affects the quality of sea buckthorn fruits, leading to direct yield losses.
- **Prevalence of disease:** Disease Prevalence: The prevalence of endomycosis in sea buckthorn fruits has been documented at various rates over the years. In 2018, it was recorded at 3.8% in Uvs Province. By 2020, the prevalence decreased to 1.5% in Haliun sum of Gobi-Altai Province. However, in 2021, it increased to 6.9% in Selenge sum and 5.3% in Orkhon sum of Bulgan Province. In 2022, the prevalence reached 8.5% in Batsumber sum of Central Province.

Control methods:

-In early spring, prior to bud break, a 3% solution of copper sulfate or iron sulfate can be applied to disinfect sea buckthorn trees and branches.

-During the fruit development phase, it is advisable to administer three applications of biological preparations containing Bacillus subtilis, spaced 10 to 14 days apart.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **SCABIES DISEASE:** is caused by the pathogenic fungus ***Stigmina hippophaes***. Initial symptoms manifest on the branches of sea buckthorn as splitting and cracking of the bark, which can subsequently lead to infection of the fruit. Infected sea buckthorn fruits exhibit pitting and the formation of dark ulcers due to the pathogenic fungus. Furthermore, fruits that are infected during the growing period often turn black after harvesting and during storage, significantly impacting their quality and marketability.
- **Damage of disease**: Infected sea buckthorn fruit tends to yellow prematurely, with the affected areas eventually turning black. The flavor and overall quality of the diseased fruit deteriorate significantly. Scabies disease has spread to Mongolian sea buckthorn plantations, resulting in a reduction in fruit yield by 5% to 20%.
- **Prevalence of disease**: Research conducted in 2018 indicated that the prevalence of sea buckthorn scabies disease was 15.8% in Batsumber sum of Central Province. In 2021, prevalence rates were recorded at 7.3% in Erdenebulgan sum of Arkhangai Province, 7.6% in Bayan-Agt sum, and 4.7% in Selenge sum of Bulgan Province. By 2024, the prevalence of sea buckthorn scabies disease had decreased to 3.2% in Baruunturuun sum of Uvs Province.

Control methods:

Fallen fruit and leaves from infected trees should be thoroughly removed and incinerated to prevent further spread. In spring, a 3% solution of copper sulfate and a 3% Bordeaux liquid should be applied to the sea buckthorn trees to disinfect them. In the second half of summer, it is recommended to conduct two applications of a 1% Bordeaux liquid at 10-day intervals.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **BROWN SPOT** disease in sea buckthorn is caused by the pathogenic fungus ***Alternaria alternata***. Symptoms typically manifest in the second half of summer as round brown spots on the leaves. Heavily infected trees exhibit yellowing leaves that dry out prematurely. The disease can also infect the fruit, leading to the development of a black mold that causes the fruit to turn black. The pathogenic fungus can persist in plant debris and fallen leaves, expanding its range year after year.
- **Damage of desease**: The premature yellowing of sea buckthorn leaves, characterized by numerous brown spots, adversely affects fruit development. As the disease progresses, it spreads to the fruit, resulting in a loss of flavor in the affected berries.
- **Prevalence of disease**: Brown spot disease in sea buckthorn was recorded with a prevalence of 1.5% in Batsumber sum of Central Province in 2018. This increased to 6.8% in Tsagaannuur sum of Selenge Province in 2020, and further rose to 10.2% in Buregkhangai sum of Bulgan Province in 2021.

Control methods: Thoroughly clean the fallen leaves in the sea buckthorn garden. Weeds are removed from the field during the growing season. To prevent brown spot disease, spray with fungicides and biological agents that act on *Alternaria* fungi when the disease is not detected and to limit the spread of the disease. Repeat the spraying of fungicides and biological preparations 2 to 3 times with an interval of 10 days.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **SEABUCKTHORN BACTERIAL CANKER** disease is caused by the bacteria *Pseudomonas syringae pv.syringae*. The leaves of trees infected with the bacterial canker disease suddenly wither and fall, and wedge-shaped cracks form in the bark of the main stem and branches, separating diseased tissue from healthy tissue. Bacterial exudate is released from infected tree branch wounds. Diseased trees stop growing, and in winter, the lateral shoots freeze. Frozen branches and trees die without regrowth. Bacterial canker diseases of Sea buckthorn trees are manifested in two forms: slow and chronic disease. In young trees, branch buds become partially diseased and gradually wither, while in chronically infected trees, the entire tree withers and dies. The disease-causing bacteria hibernates in sores on the bark of infected trees, and the infection spreads through rain and wind. In winter and spring, the damaged bark can become infected with bacteria and make the tree sick.
- **Damage of disease**: Sea buckthorn trees infected with the bacterial canker disease slowly wither and die.

Prevalence of disease: In 2021, Sea buckthorn bacterial canker disease was registered with a prevalence of 1.0% in Erdenebulgan sum of Arkhangai province.

Control methods : Painted with lime solution the main stem of the seabuckthorn trees to prevent the bark from cracking in the winter. Remove diseased trees by Bacterial canker and dead branches from orchards and burn them.

The predominant diseases affecting cultivated sea buckthorn in Mongolia.

- **MAIN STEM ROT** is caused by the mushroom ***Trametes versicolor***. This mushrooms infects old, diseased and weakened sea buckthorn trees, penetrates through cracks in the bark of its stems and branches, and parasitizes from the veins of the main stem. As the fungus grows, it will cause the main stem rot of Sea buckthorn.
- **Damage of disease**. Sea buckthorn trees die from main stem and branch rot.
- **Prevalence of disease**: Sea buckthorn main stem rot disease has a prevalence of 2.5 to 4.3% in Batsumber sum of Central province in 2018 to 2019, 3.0% in Selenge sum of Bulgan province in 2021, and in 2022 year in the 21st khoroo of Songinokhairkhan district of Ulaanbaatar city was found in Arghunt with a prevalence of 5.2%.

Control methods: To prevent this disease, make healthy and rejuvenating pruning of the buckthorn tree every year. Grown tree trunks are painted with lime solution and paint of garden trees to protect them from cracking and fungal infections. When wood mushrooms start to grow, cut the mushrooms with a sharp knife, disinfect the rest by applying a 3% solution of copper sulfate, and seal open wounds and cracks in the tree bark with a special putty.

CONCLUSION

In Mongolia, cultivated sea buckthorn trees are affected by seven species of microorganisms and one species of fungus. The absence of effective disease prevention measures in sea buckthorn cultivation has led to escalating crop losses.

For instance, in Uliastai sum of Zavkhan Province, the prevalence of sea buckthorn dried-shrink disease surged from 14.5% in 2020 to 46.0% in 2024, resulting in a 30% loss of fruit yield. Similarly, the prevalence of sea buckthorn wilt disease increased from 14.0% in 2020 to 28.6% in 2024, causing a yield reduction of 20.0%. Over the past four years, more than 50% of the 10 hectares of sea buckthorn fruit trees have succumbed to disease and desiccation, underscoring the consequences of neglecting crop health.

While plant diseases may be less prevalent during certain years due to climatic conditions, outbreaks can occur when conditions become favorable. Therefore, it is imperative to implement proactive measures for disease management during the growing season of sea buckthorn in Mongolia.

Thank you all for your attention!

Address of our organization :

Institute of Plant Protection Research

Ulaanbaatar city, Bayanzurkh district. 13-st khoroo, 14th microdistrict /13330/, Peace avenue-123/6. (In front of the Officers' palace)

Contact address :

A.Uranchimeg, researcher, plant pathologist, consultant agronomist

Email: alturanchimeg71@gmail.com
Fb: Urnaa Altangerel
Tel: 976-99814294, 976-88814294