THE EFFECT OF FUNGICIDES ON THE PHYSIOLOGICAL PROCESSES IN *SYRINGA VULGARIS* L. ATTACKED BY *ERISIPHE SYRINGAE* SCHWEIN.

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Abstract

Researches regarding the effect of some fungicides on the physiological processes were performed on Syringa vulgaris L. attacked by Erisiphe syringae Schwein., in Oltenia region. This causes powdery mildew, a common fungal disease on leaves, young branches, and occasionally on fruits, of various agricultural and ornamental plants. The physiological researches were carried out in the leaves of plants after treatments with fungicide and the leaves of plants attacked by the pathogen in which treatments with fungicide have not been performed. In the leaves of the plants attacked by the pathogen, in comparison with the leaves of plants after treatments with fungicide, it was observed that the physiological processes' intensity during the day has lower values as a result of the formation of a fine mycelium felt on the surface of the leaves, under which the tissues turn brown, the leaves distortion, wilting and drying out. In the leaves of the Syringa vulgaris L. attacked by the pathogen there were recorded lower values of chlorophyll content, fact which correlates with the intensity of photosynthesis.

Key words: attacked leaves, fungicide, pathogen, photosynthesis, transpiration.

INTRODUCTION

The lilac (*Syringa vulgaris L.*) is a very popular ornamental plant in gardens and parks. This is a deciduous, decorative, garden shrub with opposite, ovate leaves. It flowers in April and May, having mauve or rarely white, terminal, pyramidal, panicles.

Intensity of transpiration process proportionally increases with that of photosynthesis, both processes are dependent on solar radiation intensity (Bignami and Natali, 1992.) As the leaves on the plant are situated differently in relation to the sun, they are in most cases exposed to direct irradiation only for a certain time during the day. In the leaves of *Syringa vulgaris* situated on the side facing east attained higher intensity of photosynthesis (16 µmol CO_2 m^{-2} s^{-1}) than those situated on the sides facing south and west (12 µmol CO_2 m^{-2} s^{-1}) - Pilarski, 1999. The water content has a higher values and the dry substance content has a lower values in leaves of the plants after treatment with fungicide, compared with the leaves of the plants attacked by pathogen - not treated with fungicide (Nicolae and Buşe Dragomir, 2019).

Species of *Syringa vulgaris* are common host plants of powdery mildews. They are known for their beautiful and fragrant flowers and are widely cultivated as ornamentals worldwide. In late summer, lilacs can be attacked by powdery mildew, specifically *Erysiphe syringae* (syn. *Microsphaera syringae*).

Erysiphe syringae has its origin in North America and migrated to Europe at the end of the 19th Century or early 20th Century (Braun and Cook, 2012). Powdery mildews are a group of obligate biotrophic plant pathogenic fungi in *Erysiphaceae.* This group of fungi can affect around 10,000 species of angiosperms, including numerous

economically important plants, such as crops, cereals, vegetables, fruits, and ornamentals (Braun and Cook, 2012; Amano, 1986).

The symptoms of the disease appear as conspicuous white, powdery mycelial and spore masses on the above-ground parts of the plants, e.g., the leaves, buds, stems, flowers, and fruits. Severe infections can cause leaf drop, withering, reduction in growth, and even death of plants, resulting in substantial economic losses (Nasir et al., 2014; Mieslerová et al., 2020).

The geographic origin of E. syringae is North America, and chasmothecial formation is common there, whilst it is 45 rare in Europe (Seko et al., 2008, 2011; Takamatsu et al., 2016).

MATERIALS AND METHODS

The physiological researches were performed in the lilac (*Syringa vulgaris* L.), grown in the climatic conditions of the Oltenia region.

The treatments with fungicide were carried out starting on June 28th 2024 and consisted of the application of three treatments with *Topas* 100 EC at an interval of 14 days. The physiological analyses were carried out, according to the climatic conditions, on August 9th 2024, in the leaves of *Syringa vulgaris* L. after treatments with fungicide and in the attacked leaves by *Erisiphe syringae* Schwein. in which treatments with fungicide have not been performed.

Topas 100 EC fungicide is a systemic, local translaminar fungicide in leaves, which combats various species of powdery mildew. The product is rapidly absorbed by all active green parts of plants, especially leaves. It contains penconazole which acts against fungi at the moment of their penetration into the plant and during the period of haustoria formation. Topas 100 EC has preventive, curative and disease-blocking action.

The physiological processes (photosynthesis intensity and transpiration intensity) were established with the ultra compact photosynthesis measurement system (LCi) which enables recording and other parameters (photosynthetic active radiations, leaf temperature, stomatal conductance). The water content and the dry substance content were determined by the gravimetric method by drying the plant material using an oven. The chlorophyll content were determined with the Minolta SPAD 502 chlorophyllmeter and results obtained were expressed in SPAD units.

The attack produced by the pathogen was estimation with formulae elaborate by Săvescu and Rafailă (Săvescu and Rafailă, 1978).

RESULTS AND DISCUSSIONS

Erysiphe syringae Schwein is a specialized fungal pathogen that causes powdery mildew on various lilac species (*Syringa* spp.). The fungus overwinters as cleistothecia on fallen leaves or as mycelium on buds and young twigs. Infections typically start in spring and heavy infestations reduce the ornamental value of lilacs and may lead to premature leaf drop.

Symptoms produced by *Erisiphe syringae* Schwein appear first on the lower leaves and spread upward along the branch. The upper surface of infected leaves develops small white to gray, almost dusty-appearing, patches of the mycelium (Figure 1).

Figure 1. The leaves of *Syringa vulgaris L.* attacked by *Erisiphe syringae* Schwein. (Original).

Although the leaf surface appears powdery, the foliage itself may turn yellow or brown. The attacked leaves also become distorted and twisted and wilt. Generally the disease appear the latter part of the growing season and so does little damage.

The pathogen *Erisiphe syringae* Schwein. present mycelium external, whitish, conspicuous, initially in subcircular patches, later confluent and covering the entire leaf blade. Conidia are cylindrical, formed singly (Figure 2).

Figure 2. *Erisiphe syringae* Schwein. - conidia (Original).

When the pathogen is sufficiently advanced, the presence of small dark dots indicates the production of cleistothecium (chasmothecium), an important structure in the protection of potential inoculum (Agrios G. N., 2005).

The estimate of the attack produced by *Erisiphe syringae* is presented in Figure 3.

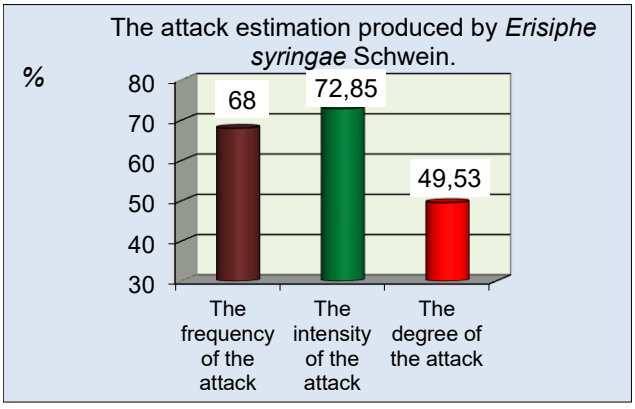

Figure 3. The attack estimation produced by *Erisiphe syringae* Schwein.

In the leaves of *Syringa vulgaris* L. the photosynthesis intensity and transpiration intensity, during the day, in the leaves of the plants attacked by the pathogen shows lower values, in comparison with leaves of the plants after treatment with fungicide, as a result of the formation of white to gray, dusty-looking mycelium spots on the leaf surface, the leaves yellowing, deforming and wilting as the disease evolution (Figure 4 and Figure 5).

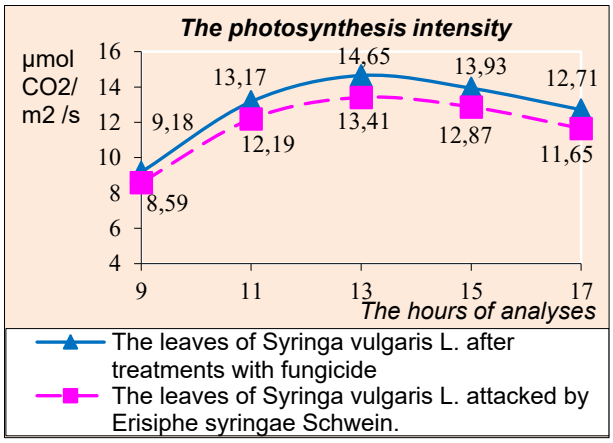

Figure 4. The photosynthesis intensity during the day in the leaves of *Syringa vulgaris* L.

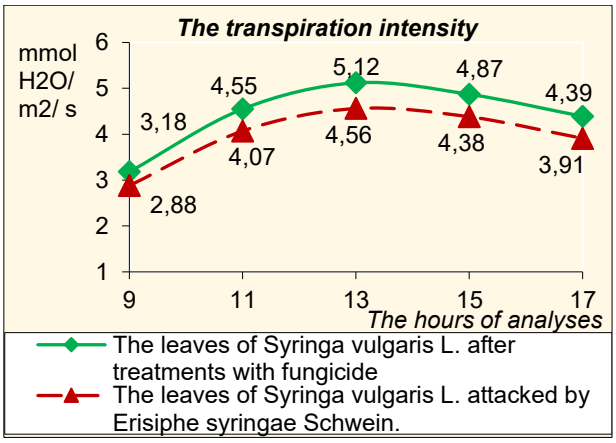

Figure 5. The transpiration intensity during the day in the leaves of *Syringa vulgaris* L.

The photosynthesis intensity and transpiration intensity depends on the photosynthetic active radiation, leaf temperature, stomatal conductance.

The photosynthetic active radiation in *Syringa vulgaris* L. in the morning (9 a.m.) has values of the 1182 µmol/m^2/s in the leaves of the plants after treatment with fungicide and 1134 µmol/m^2/s in the attacked leaves, these values increase in the middle of the day (1 p.m.) when it has

maximum values of the 1654 µmol/m^2/s in the leaves after treatment and 1592 µmol/m^2/s in the attacked leaves and decrease towards the evening (5 p.m.) when 1542 µmol/m^2/s are recorded in the leaves of the plants treated with fungicide and 1487 µmol/m^2/s in the leaves of the plants attacked by the pathogen. Linear regression made between the photosynthesis intensity and photosynthetic active radiations shows a positive correlation, the coefficient of determination (R^2) was 0.92 leaves of the plants after treatment and 0.89 the attacked leaves and linear regression made between the transpiration intensity and photosynthetic active radiations shows a positive correlation, the coefficient R^2 was 0.93 leaves of the plants after treatment with fungicide and 0.90 for the attacked leaves (Figure 6 and Figure 7).

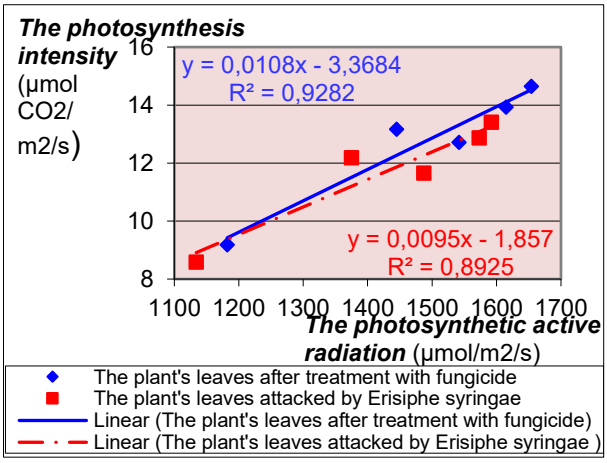

Figure 6. The correlation between the intensity of photosynthesis and the photosynthetic active radiation in *Syringa vulgaris* L.

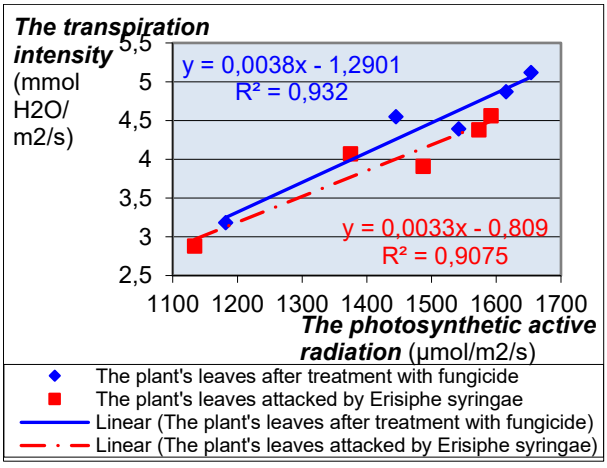

Figure 7. The correlation between the intensity of transpiration and the photosynthetic active radiation in in *Syringa vulgaris* L.

The leaf temperature in the morning (9 a.m.) has values of the 27.5 °C in the leaves of the plants after treatment with fungicide and 27.7 °C in the attacked leaves, the temperature increases until after noon (1 p.m.) when values are 38.7 °C in the treated plants and 38.8 °C in the attacked leaves and decrease towards the evening (5 p.m.) when values of 35.4 °C in the treated leaves and 35.6 °C in the attacked leaves. The regressions performed between the photosynthesis intensity and leaf temperature shows a positive correlation, the coefficient of determination (R^2) was 0.98 for the treated plants and 0.97 for the attacked leaves and regression performed between the transpiration intensity and leaf temperature the coefficient R^2 was 0.98 for the treated plants and 0.96 for the attacked leaves (Figure 8 and Figure 9).

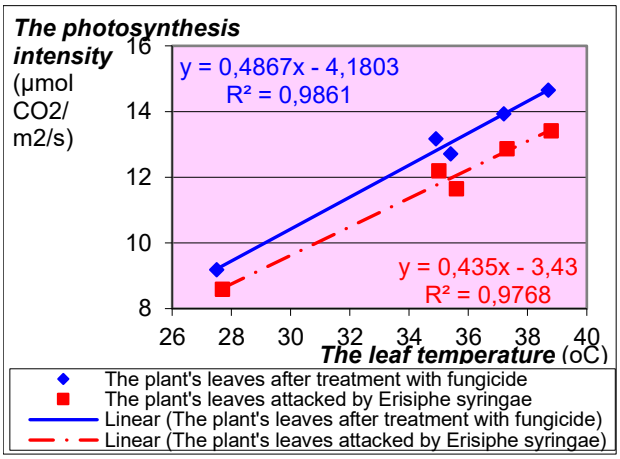

Figure 8. The correlation between the intensity of photosynthesis and the leaf temperature in *Syringa vulgaris* L.

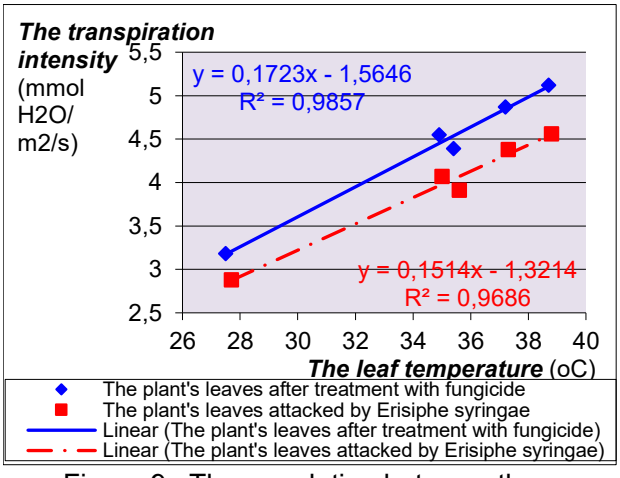

Figure 9. The correlation between the intensity of transpiration and the leaf temperature in *Syringa vulgaris* L.

The stomatal conductance in the morning (9 a.m.) has values of 0.07 mol/m^2/s in the leaves of the plants after treatment with fungicide and 0.06 mol/m^2/s in the leaves attacked by the pathogen, this increases until afternoon (3 p.m.) when has values of 0.16 mol/m^2/s in the treated plants and 0.14 mol/m^2/s in the attacked leaves and decreases towards evening (5 p.m.) when has values of 0.12 mol/m^2/s in the leaves of the plants after treatment with fungicide and 0.11 mol/m^2/s in the attacked leaves by the pathogen. The regressions performed between the photosynthesis intensity and stomatal conductance show a positive correlation with the coefficient of determination (R^2) of 0.98 in the leaves of the plants after treatment with fungicide and 0.96 in the attacked leaves by the pathogen, and the transpiration intensity and stomatal conductance shows a positive correlation with the coefficient R^2 of 0.98 in the plant's leaves after treatment with fungicide and 0.97 in the plant's leaves attacked by pathogen (Figure 10 and Figure 11).

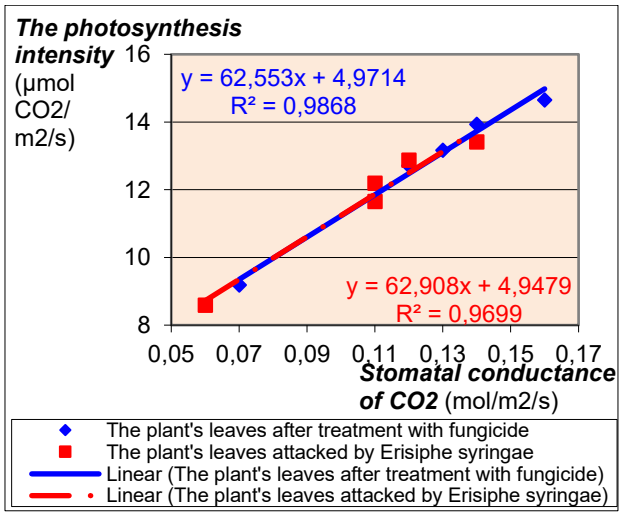

Figure 10. The correlation between the intensity of photosynthesis and the stomatal conductance in *Syringa vulgaris* L.

The water content in the plant's leaves attacked by pathogen, in comparison with the plant's leaves after treatment with fungicide, has a lower values and dry substance content has a higher values, fact which causes hidric imbalances (Figure 12).

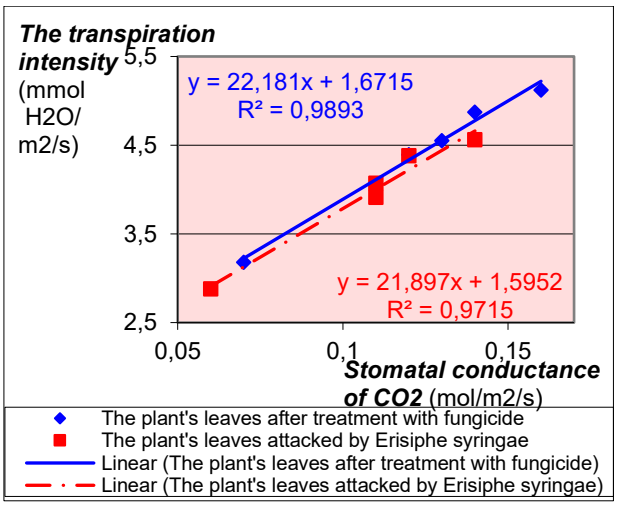

Figure 11. The correlation between the intensity of transpiration and the stomatal conductance in *Syringa vulgaris* L.

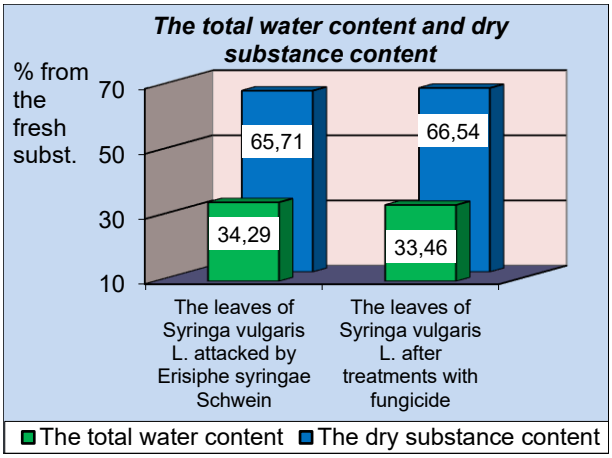

Figure 12. The water content and the dry substance content in the leaves of *Syringa vulgaris* L.

The chlorophyll content has lower values in the plant's leaves attacked by pathogen, as a result of damage to chloroplasts with consequences on the photosynthesis process (Figure 13).

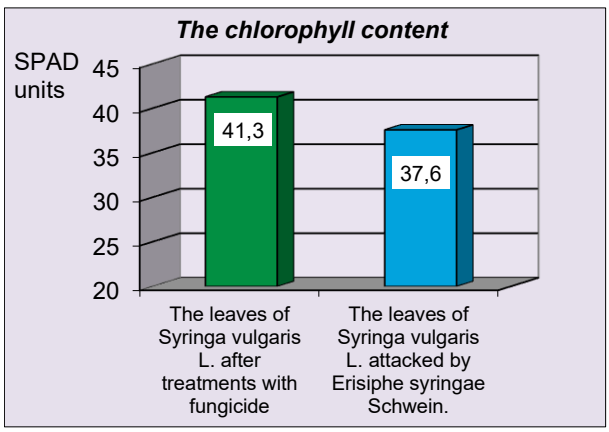

Figure 13. The chlorophyll content in the leaves of *Syringa vulgaris* L.

CONCLUSIONS

In *Syringa vulgaris* L., during the day, one can observe that the physiological processes' intensity (photosynthesis and transpiration intensity) has a lower value in the attacked plants as a result of the harmful action of the pathogen manifested by formation of white to gray, dusty-looking mycelium spots on the leaf surface, the leaves yellowing, deforming and wilting of leaves. The physiological processes' intensity are positively correlated with the photosynthetic active radiation, leaf temperature and stomatal conductance.

In the plant's leaves attacked by pathogen there are lower values of the water content and chlorophyll content, in comparison with plant's leaves after treatment with fungicide, fact which causes hidric and metabolic imbalances with consequences on plants growth and development.

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