

Physiological modifications in *Cerasus avium* (L.) Moench as a result of the attack produced by *Blumeriella jaapii* (Rehm) Arx.

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Abstract The research regarding physiological modifications produced by *Blumeriella jaapii* (Rehm) Arx. was made at *Cerasus avium* (L.) Moench cultivated in the climatic conditions in Oltenia region (Banu Mărăcine, Dolj).

In the attacked leaves one can also observe that the diurnal dynamics of the photosynthesis and of transpiration presents a minimum in the morning, a maximum at lunch and a minimum toward the evening, with specific variations in the attacked leaves by the pathogen. The diurnal dynamics of the photosynthesis and transpiration in the attacked leaves is similar to that in healthy leaves, but the recorded values are lower as a result of the reduction of the assimilation surface, but also by malfunctioning of stomata closing and opening mechanisms.

In the leaves attacked by the pathogen observe a decrease of chlorophyll content as a result of the blockage of its biosynthesis and the deterioration of the chlorophyll and the decrease of the total water content which is manifested by the withering and drying of the leaves.

Key words

attacked leaves, healthy leaves, pathogen, photosynthesis, transpiration

Cerasus avium (L.) Moench is native of southern Central Europe and western Asia. Cherry leaf spot is a common disease in different countries around the globe. This disease causes early defoliation of cherry groves, fruit buds differentiate incompletely and in the following spring, even if they bloom abundantly, little fruit is formed.

The net photosynthetic activity is subjected to seasonal changes and to diurnal changes which are mainly influenced by the stage of shoot development, the leaf ageing, the accumulation of hormones and of carbohydrates in the leaves, as well as the by the fluctuations of light, leaf temperature, air temperature and humidity [3].

The research regarding photosynthesis intensity in *Cerasus avium* (L.) Moench shows between values of 10.2 - 11.7 $\mu\text{mol CO}_2 / \text{m}^2 / \text{s}$ [2].

At the attacked plants, there is a decrease in the intensity of photosynthesis as a result of the occurrence of chlorate spots (chlorosis) in leaf and the degradation of chloroplast and the covering of stomata ostiola by fungus mycelium [4].

The diurnal dynamics of transpiration has a maximum at noon and a minimum during the night when cuticle transpiration occurs. Adjustment is made by changing transpiration openness of stomata, correlated with their resistance change [1].

Material and Method

The research on the physiological changes produced by *Blumeriella jaapii* (Rehm) Arx. was made in 2010 in mature leaves, fruit maturation stage, the species *Cerasus avium* (L.) Moench, cultivated in the climatic conditions in Oltenia region (Banu Mărăcine, Dolj).

Cerasus avium (L.) Moench is a tree about 10-15 m high, with thick dark ritidom. Crown oval, with long branches, the leaves are alternate, shiny green, simple ovoid-acute with a serrated margin.

The flowers are produced in early spring, they are hermaphroditic, borne in corymbs, each flower pendent on a peduncle, with five white petals, yellowish stamens, and a superior ovary. The fruit is a drupe, bright red to dark purple, variably sweet to somewhat astringent.

The intensity of the photosynthesis and transpiration was established with the analyzer LCI (Ultra Compact Photosynthesis Measurement System) which enables automatic recording and other parameters (photosynthetic active radiations, leaf temperature, stomatal conductance etc.). The results obtained were graphically represented and statistically interpreted.

The total water contents and the dry substance content were determined by the help of the gravimetric

method. The chlorophyll content were estimated with the help of the Minolta SPAD 502 chlorophyllmeter.

The estimation of the attack (the frequency, the intensity and the degree of the attack) was made using the calculation formulae elaborate by Săvescu & Rafailă [5].

Results

The disease commonly occurs on the leaves and rarely on the branches and fruit. The botom leaves in May, have small, circular, purple or red spots isolated with a more or less differentiated edge. The spots confluence, occupying in favourable conditions,

all the leaf blade and the central portion of the spots fades, becoming whitish gray (Fig. 1 and Fig. 2).

On the underside of the leaves are formed acervuli fungus, conidia and conidiophores camps.

Blumeriella jaapii (Rehm) Arx. shows a mycelium that develops intercellularly in the leaf tissues and fructifies on the acervuli. The conidiophores are short, cylindrical, hyaline with hyaline cylindrical conidia which provide secondary infections throughout the growing season (Fig. 3).

The transmission from one period to another is realized by the mycelium of fallen leaves and also by the mycelium of resistance found in infected shoots of the previous year.



Fig. 1. *Cerasus avium* (L.) Moench - attacked plants by *Blumeriella jaapii* (Rehm) Arx. (Original).



Fig. 2. *Cerasus avium* (L.) Moench - attacked leaf by *Blumeriella jaapii* (Rehm) Arx. (Original).



Fig. 3. *Blumeriella jaapii* (Rehm) Arx. - conidia (oc. 10 x ob. 20) - Original.

The research regarding physiological modifications produced by *Blumeriella jaapii* (Rehm) Arx. was made, according to the climatic conditions (temperature, light intensity) on June 25th 2010.

The estimation of the attack produced by the *Blumeriella jaapii* (Rehm) Arx. at *Cerasus avium* (L.) Moench is presented in Fig. 4.

The intensity photosynthesis of the analyzed plants shows minimum values in the morning due to

low light intensity, low temperature and low opening degree of the stomata, maximum values at noon due to the increasing light intensity and temperature and to the opening degree of the stomata and minimum values towards the evening due to the decreasing light intensity and temperature and to the decreasing opening degree of the stomata.

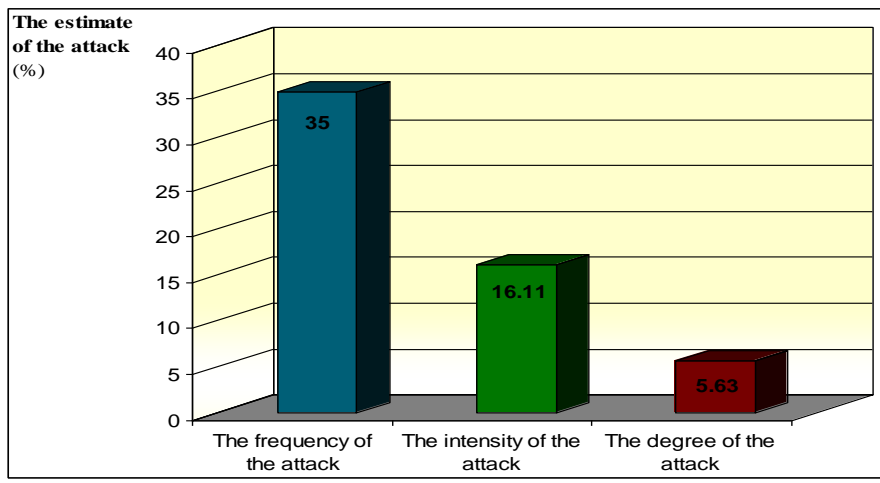


Fig. 4. The estimate of the attack produced by *Blumeriella jaapii* (Rehm) Arx. at the *Cerasus avium* (L.) Moench.

The intensity of transpiration of the analyzed plants shows minimum values in the morning due to the low opening degree of the stomata and to the low power of air dehydration, maximum values at noon due to the high opening degree of the stomata as a result of the increasing light intensity and temperature, and to the air dehydration power and minimum values in the

evening as a result of the decreasing light intensity and temperature.

The diurnal dynamics of photosynthesis and transpiration in the attacked leaves shows lower values as a result of the reduction of the assimilation surface through the deterioration of the chlorophyll, but also by malfunctioning of stomata closing and opening mechanisms (Fig. 5 and Fig. 6).

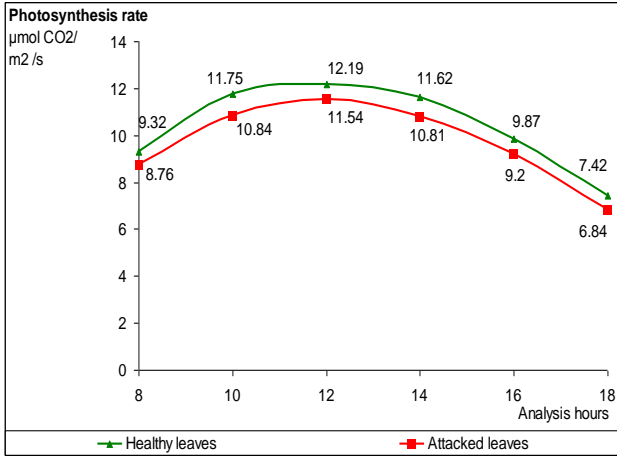


Fig. 5. The diurnal dynamics of photosynthesis at the *Cerasus avium* (L.) Moench.

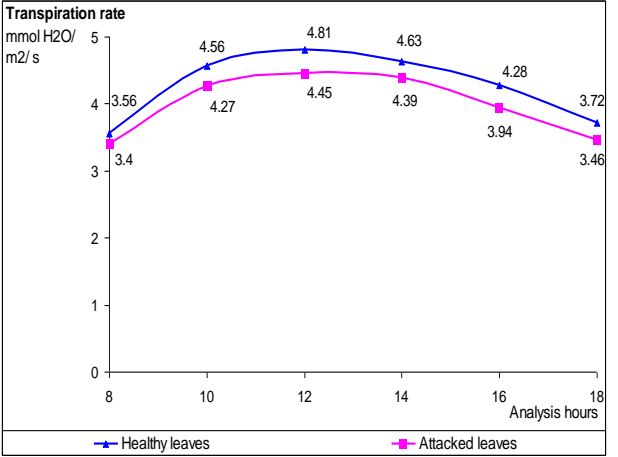


Fig. 6. The diurnal dynamics of transpiration at the *Cerasus avium* (L.) Moench.

The diurnal dynamics of photosynthesis and transpiration depend on the light radiation received by leaves, which are dependent on the position of the leaves on plants.

At the *Cerasus avium* (L.) Moench one can observe an increase of the photosynthetic active radiations presented on the surface of the leaves morning (8 a.m.) when one can record values of 1344 μmol / m² / s for the healthy leaves and of 1318 μmol / m² / s for the attacked leaves, their growth up until after lunch (2 p.m.) when one record 1580 μmol / m² /

s for the healthy leaves and 1556 μmol / m² / s for the attacked leaves, and towards evening (6 p.m.) one can notice a gradual decrease, recording values of 1374 μmol / m² / s for the healthy leaves and of 1360 μmol / m² / s for the attacked leaves.

Established a strong association between the physiological processes (photosynthesis rate and transpiration rate) and photosynthetic active radiations, leaf temperature and stomatal conductance.

Linear regression shows a positive correlation between the photosynthesis rate and photosynthetic

active radiations (the coefficient of determination R^2 was 0.83 for the healthy leaves and 0.78 for the attacked leaves) and between the transpiration rate and

photosynthetic active radiations (the coefficient of determination R^2 was 0.97 for the healthy leaves and 0.98 for the attacked leaves) - Fig. 7 and Fig. 8.

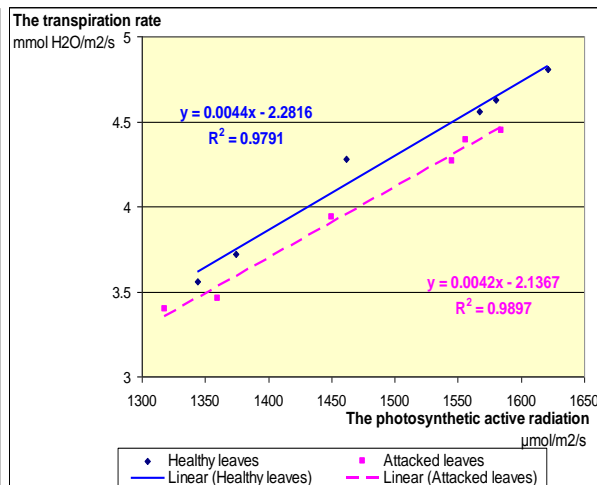
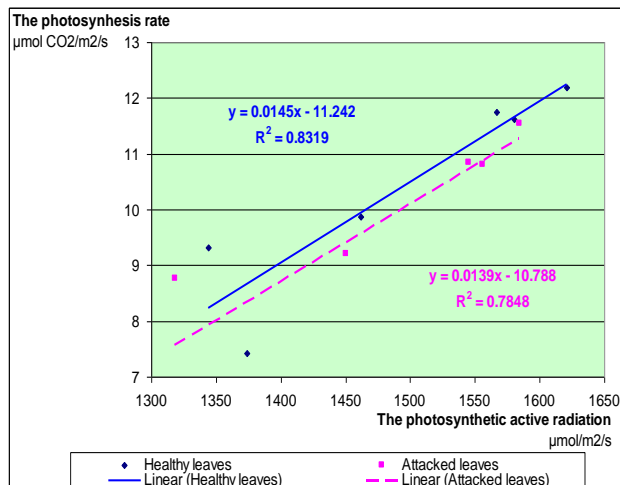


Fig. 7. The correlation between the photosynthesis rate and the photosynthetic active radiation at the *Cerasus avium* (L.) Moench.

Fig. 8. The correlation between the transpiration rate and the photosynthetic active radiation at the *Cerasus avium* (L.) Moench.

On during the day temperature of the leaves increase starting in the morning (8 a.m.) when value recorded is 27.5 °C in the healthy leaves and 27.7 °C in the attacked leaves, up until after lunch (2 p.m.) when value recorded is 30.3 °C in the healthy leaves and 30.5 °C in the attacked leaves and the evening (6 p.m.) temperature decrease when value recorded is 28.1 °C in the healthy leaves and 28.3 °C in the attacked leaves.

Linear regression shows a positive correlation between the photosynthesis rate and of the leaf temperature (the coefficient of determination R^2 was 0.73 for the healthy leaves and 0.71 for the attacked leaves) and between the transpiration rate and of the leaf temperature (the coefficient of determination R^2 was 0.92 for the healthy leaves and 0.91 for the attacked leaves) - Fig. 9 and Fig. 10.

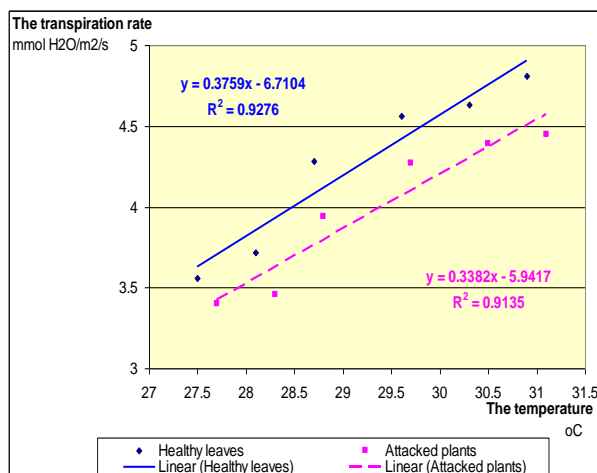
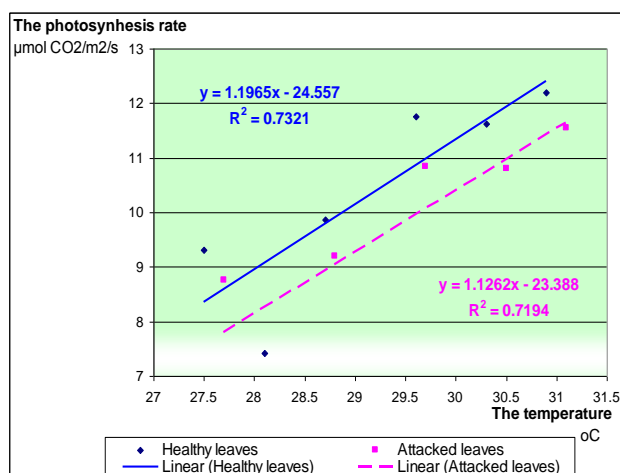


Fig. 9. The correlation between the photosynthesis rate and the leaf temperature at the *Cerasus avium* (L.) Moench.

Fig. 10. The correlation between the transpiration rate and the leaf temperature at the *Cerasus avium* (L.) Moench.

The conductance of the stomatal increases until after lunch and then decreases as a result of the the influence of high temperature and low relative humidity of the air.

Starting in the morning (8 a.m.) one can observe an increase of the stomatal conductance, when the record values are $0.11 \mu\text{mol} / \text{m}^2 / \text{s}$ in the healthy leaves and $0.09 \mu\text{mol} / \text{m}^2 / \text{s}$ in the attacked leaves, the increase of the stomatal conductance up until after lunch (2 p.m.) when the record values are $0.17 \mu\text{mol} / \text{m}^2 / \text{s}$ in the healthy leaves and $0.16 \mu\text{mol} / \text{m}^2 / \text{s}$ in the attacked leaves and towards the evening (6 p.m.) the

gradual decrease of the stomatal conductance when the record values are $0.12 \mu\text{mol} / \text{m}^2 / \text{s}$ in the healthy leaves and $0.11 \mu\text{mol} / \text{m}^2 / \text{s}$ in the attacked leaves.

Linear regression shows a positive correlation between the photosynthesis rate and of the stomatal conductance (the coefficient of determination R^2 was 0.77 for the healthy leaves and 0.71 for the attacked leaves) and between the transpiration rate and of the stomatal conductance (the coefficient of determination R^2 was 0.95 for the healthy leaves and 0.93 for the attacked leaves) - Fig. 11 and Fig. 12.

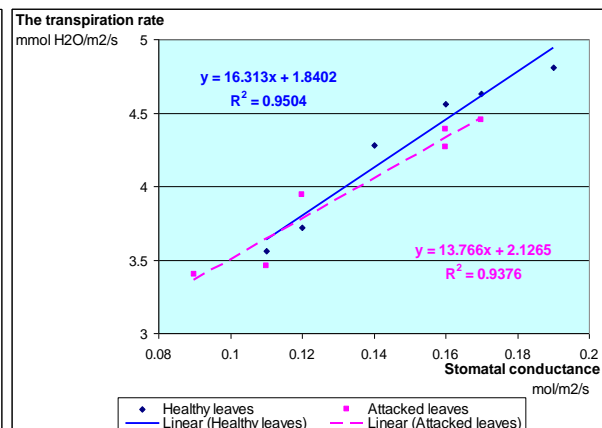
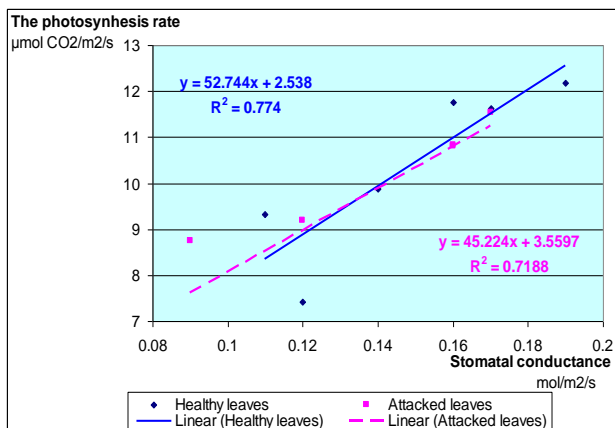


Fig. 11. The correlation between the photosynthesis rate and the conductance stomatal at the *Cerasus avium* (L.) Moench.

Fig. 12. The correlation between the transpiration rate and the conductance stomatal at the *Cerasus avium* (L.) Moench.

The attacked leaves by the *Blumeriella jaapii* (Rehm) Arx. present a decrease of the total water content by 1.56 %, which is manifested by the decrease of the cellular turgor, the withering and premature drying of the leaves (Fig. 13).

The dry substance content in the attacked leaves present a increase with 4.56 %, in comparison with healthy leaves (Fig. 14).

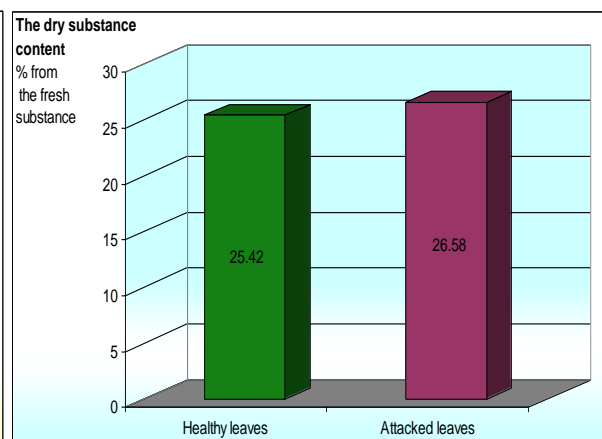
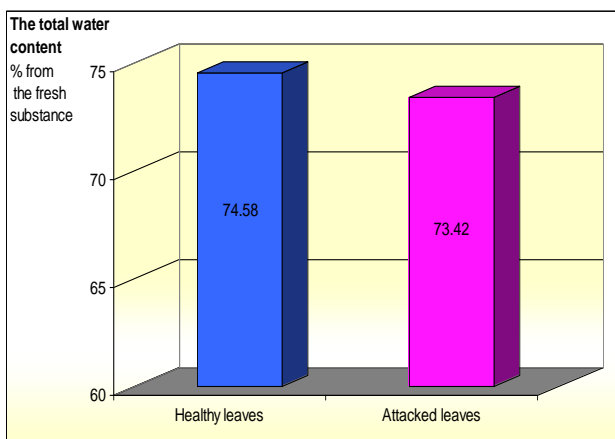


Fig. 13. The water content at the *Cerasus avium* (L.) Moench.

Fig. 14. The dry substance content at the *Cerasus avium* (L.) Moench.

The attacked leaves present a decrease of the chlorophyll content by 12.42 % in the young leaves and by 11.17 % in the mature leaves as a result of the

blockage of its biosynthesis and the deterioration of the chlorophyll (Fig. 15).

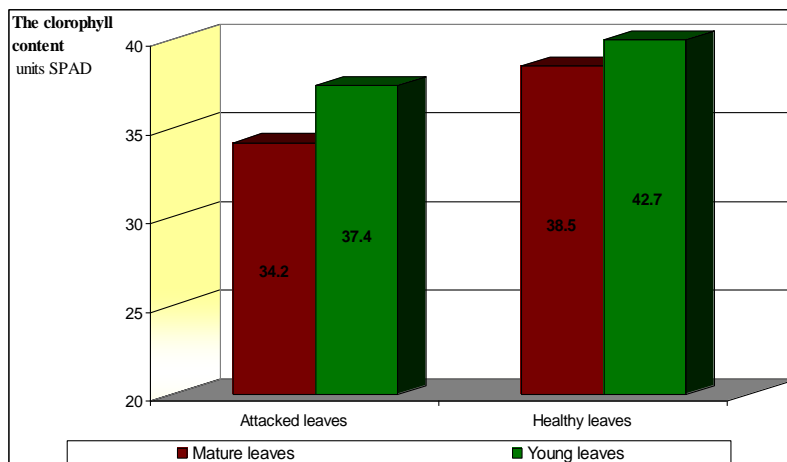


Fig. 15. The chlorophyll content at the *Cerasus avium* (L.) Moench.

Conclusions

The intensity of the physiological processes in *Cerasus avium* (L.) Moench varies according to the frequency, the intensity and the degree of attack, but also by the climatic conditions. At the analyzed attacked leaves by *Blumeriella jaapii* (Rehm) Arx. one can observe that intensity of the photosynthesis and of transpiration presents a minimum in the morning, a maximum at lunch and a minimum toward the evening, but the recorded values are small in comparison with healthy leaves.

The increase of the photosynthetic active radiations, temperature leaf and conductance stomatal is positive correlate with the increase of the photosynthesis and of the transpiration, but shows variations in the attacked leaves as a result of several structural modifications produced by pathogen.

As a result of the action pathogen on the attacked leaves one can observe a decrease of the chlorophyll content because of the blockage of its biosynthesis and the deterioration of the chlorophyll,

and the decrease of the total water content which determines of the withering and drying of the leaves.

References

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