ABSTRACT

Key words: sunflower, *Sclerotinia*, resistance

Sunflower (*Helianthus annuus* L.) is one of the most important oil crops, being cultivated worldwide.

The particularly higher danger of plant diseases currently exists due to the large number of pathogens and their unexpected virulence. The plant-pathogen reaction requires a permanent competition between breeders, in order to create new resistant genotypes, so it is necessary to establish some priorities in the sense of choosing the pathogens that cause the highest damage in those areas (Leonte, 2011).

The doctoral thesis entitled „*Use of morpho-physiological and biochemical markers to identify germplasm sources in sunflower with genetic resistance to Sclerotinia Sclerotiorum (Lib.) de Bary"* is divided in two parts and comprises seven chapters.

The first part contains the documentary study and describes the *Helianthus annuus* L. and the *Sclerotinia sclerotiorum* (Lib.) de Bary species, and also general date regarding the oxireductases involved in the metabolism of the pathogen.

The second part describes the biological material, research method and results.

Chapter I contains a synthesis of the origin, importance, biological traits and cultivation technology of sunflower.

Chapter II – Characterization of the pathogen *Sclerotinia sclerotiorum* (Lib.) de Bary – gathers teh data regarding the importance of the pathogen, life cycle and symptoms.

Chapter III – State of researches regarding the sunflower resistance to the attack of *Sclerotinia sclerotiorum* (Lib.) de Bary - contains a wide documentation on the actual issues regarding the sunflower resistance to the pathogen.

Until now, there is no total resistance in any sunflower cultivar to the disease caused by this pathogen

Chapter IV – Researches regarding the oxireductases involved in the metabolism of the *Sclerotinia sclerotiorum* (Lib.) de Bary species gathers a classification and characterization of these enzymes.

The enzymes from the oxireductases class represents around 25% from the total number

of enzymes known so far, being involved, mainly, in the biological oxidation processes, where they catalyse biomolecular reactions, such as:

$$A_{red} + B_{ox} \leftrightarrow A_{ox} + B_{red}$$

This class contains dehydrogenase, catalase and peroxidase etc.

Chapter V presents the natural environment of the reasearches and the climatic data from the experimentation period.

In **Chapter VI** there are described the objectives, research material and method.

The researches from the doctoral thesis aimed the identification of germplasm sources in sunflower (*Helianthus annuus* L.*)* with genetic resistance to the attack of *Sclerotinia sclerotiorum (Lib.)* de Bary pathogen.

The main objectives were:

- The evaluation of some morphological traits in sunflower (flowering head diameter, thousand grains mass, plant height, number of leaves, leaves length and width);
- Identification of the resistant or tolerant cultivars to the attack of the *Sclerotinia sclerotiorum* (Lib) de Bary pathogen;
- Determination of the activity of some biochemical markers (isocitrat – dehydrogenase, malate dehyidrogenase, catalase), from the infected leaves;
- Establishing the correlations between the phenotypic expression and the attack degree of the pathogen;
- Determination the photosynthetic pigments content (chlorophylls a and b) and flavonoids, due to the attack of white rot.

In this chapter there are presented the protocols used in the techniques based on morphological, physiological and biochemical markers and also the artificial infection methods with the *Sclerotinia sclerotiorum (*Lib.*)* de Bary pathogen in sunflower.

Chapter VII – Results regarding the identification of germplasm sources in sunflower with genetic resistance to *Sclerotinia sclerotiorum* – presents the results obtained at the phenotypic evaluation of the biological material, for the main morphological traits, the use of physiological and biochemical methods, the artificial inoculation with the *Sclerotinia sclerotiorum* (Lib.) de Bary pathogen, the correlations between the phenotypic data and the attack degree.

Following the measurements and observations, there were made correlations between:

- ❖ Number of seeds on the flowering head and the flowering head diameter;
- ❖ Flowering head diameter and the seeds weight;
- ❖ Thousand grains mass and the flowering head diameter.

The number of seeds on the flowering head and the flowering head diameter had a positive correlation, with r = 0,40 in year 2011 and r=0,36 in 2012.

The temepratures and rainfall in the years of experimentation influenced the attack of the pathogen.

Even if 2011 was a dry year, the rainfall from June and July have foster the attack of the pathogen.

Due to the higher temperatures in 2012, the attack of *Sclerotinia* sp. had a lower rate, being influenced by the enviroment conditions.

Following the artificial infection, five of the 19 hybrids had a better tolerance: *PR63A86*, *PR64F50*, *PR64A83*, *PR64A89* and *LG58.63CL*.

At the artificial infection on the flowering head, the *Giessen* isolate presented a higher virulence than *Iaşi*, with a dimension of the lesion of 5,09 cm.

Regarding the morphological traits:

- ❖ The plant height ranged between 167,2 cm for the *PR63A86* hybrid and 191,5 cm for *PR64J80*.
- ❖ The highest value of the thousand grain mass (75,3 g) was recorded for the *LG56.58CL* and the lowest (64,3 g) for *PR63A86* and *PR64A71*.
- ❖ Regarding the diameter of the flowering head, it ranged between 18,5 cm (*Favorit*) and 28,4 cm (*PR64A83*).
- ❖ The number of leaves also ranged. The highest number (28,7) was recorded for *LG.56.58.CL* and *LG.58.63.CL* and the lowest for ***P****R64J80, PR64G46* (24,0).
- ❖ The leaf lenght had values between 16,6 cm for the *PR63A86* hybrid and 20,5 cm for *PR64A89*.
- ❖ The leaf width had the highest value for the *PR64A15* hybrid - 18,8 cm, and the lowest for *PR64J80* - 15,2 cm.
- ❖ In 2012, the plant height ranged between 163,5 cm and 191,1 cm.
- ❖ The highest thousand grains mass was recorded for the *PR64A89* hybrid (72,7 g), and the lowest for *PR63A86* (63 g).

- ❖ The highest value for the flowering head diameter was recorded for *PR63A71* (27,3 cm), and the lowest for *PR63A62* - 18,2 cm.

Following the spectophotometric tests, that have evaluated the absorbance of the acetonic extract of pigments, the highest photosyntetic activity was recorded in the absorbance center, for the sensitive hybrids (*PR64A15* - 1,7 absorbance units, *Favorit* - 1,6 a.u. and *PR64H45* - *S* - 1,5 a.u.). The lowest activity was recorded for the tolerant hybrids: *PR64A83* - 1,1a.u., *PR63A86* and *PR64A89* - 1,0 a.u., *PR63A50* and *PR63A90* - *TS* - 1,0 a.u.

The data obtained due to the evaluation of the biochemical parameters (catalase, peroxidase, malate-dehydrogenase, izocitrat-dehydrogense, alfa-cetoglutarate) in all the phases, have shown that in the healthy leaves the enzymatic value is lower than the one from infected leaves.

Also, between the peroxidase and catalase activity there is a compensation ratio: when the catalase is lower, the peroxidase is higher and vice versa, showing that during the netire life cycle of the plants, the cells develop protection mechanisms against the accumulation of hidrogen peroxide, which is extremely toxic, but also a good enzymatic equipment.

In the end of the doctoral thesis there are the general conclusions and references.