



## STUDY OF THE ANATOMO-MORPHOLOGICAL AND BIOCHEMICAL PARAMETERS OF STABILITY OF FORMS OF *CERASUS* MILL. TO *COCCOMYCES HIEMALIS* HIGGENS

**Shestakova Vera**  
**Kuznetsova Anna, Cand. Agr. Sci.**

Federal State Budget Scientific Institution North Caucasian Regional Research Institute of Horticulture and Viticulture, Krasnodar, Russia

**E-mail: kubansad@kubannet.ru**

### Abstract

Foliage research on forms of *Cerasus* Mill. for the anatomico-morphological and biochemical parameters was done in order to establish criteria for plant resistance to *Coccomyces hiemalis* Higgens. A statistically significant difference in the number of stomata in nonresistance, with a polygenic type of sustainability and resistance were installed.

The greatest difference in the content of chlorophyll (a and b) in leaves and carotenoids was found in May in the period of active growth of plants. The level of these substances was 1.3 times higher in the leaves of resistant forms and polygenes. The dynamics of change in the content of extract of the leaf calcium, coffee and succinic acids with using the methods of capillary electrophoresis are revealed.

**Key words:** forms of *Cerasus* Mill., *Coccomyces hiemalis* Higgens, stomatal apparatus, biochemical parameters.

### INTRODUCTION

Stone fruit crops occupy a leading position in the horticulture of south of Russian Federation. However, in recent years, the area occupied by a given culture (including cherries and cherry), are significantly reduced. More frequent epiphytotics of *Coccomyces* are the main reason of this, the exciter is a fungus *Coccomyces hiemalis* Higgens [1].

One of the major problems of selection is the elimination of breeding varieties more resistant to the disease. The most informative material for assessment the sustainability of the samples of cherries and cherry are perennial observation of the fungal infection of the trees in the garden, but the disadvantage of this method is a large field length and complexity of the process, as well as the inaccuracy of determining the degree of stability of shape due to the fact that the development of the disease and the susceptibility of the studied samples depends largely on the prevailing weather conditions, as well as on whether the immunologist populations of all eco-geographical zones.

Therefore, to speed up the breeding process requires rapid methods by which even in

the earliest stages of development of plants can be distinguished from the form of long-term stability to this harmful disease.

### MATERIALS AND METHODS

Hybrids and varieties of collection of NCZSRIH&V are taken in the study. Field assessment of the hybrid material for resistance to *Coccomyces* conducted in the 17th quarter of OPF ZAO "Central" (Krasnodar) and OPF "K.A. Timiryazev" (Ust-Labinsk area) during the growing season (from May to September) 2011-2014. Measurement of bio-chemical parameters of leaves of resistance and nonresistance forms of plants to *Coccomyces* was carried out according to the original techniques developed in FGBSO NCZSRIH&V [2].

Anatomico-morphological characteristics were studied by light microscope Olympus BX41 (investigated stomata on the lower epidermis of leaf of nonresistance to the disease forms of sort of cherry Lyubskaya, medium susceptible varieties of cherry Franz Iosiph and resistance forms: Immune 1, Immune 2, Immune 4, Immune 5 selection of NCZSRIH&V (derivatives of *Cerasus lannesiana* № 2.

**RESULTS AND DISCUSSION**

Plant resistance to disease is under the complex of genetic control and is made up of a variety of mechanisms that occur in different combinations in different species, providing effective protection against pathogens [4]. As for the detection of resistance of varieties and forms to biotic environmental factors of particular relevance is the ability to predict diagnosis and genetic variability, the contact continues to investigate the stability of the sort *Cerasus* Mill. to *Coccomicos*, as well as the identification of correlative links between biochemical, physiological, morphological characteristics and resistance (figure 1).

Shchekotov L.A., Turovsky I.I., Zhukov O.S. note that in the study of cross-sectional of leaves in much susceptible varieties of cherries Lyubskiy, the fungus is actively developing in the mesophyll, destroying the cells of the epidermis and parenchyma. The penetration of the hyphae of the fungus sprout causing *Coccomicos* carried out as surface tissue of leaf through the junction of cells and through stomata [5, 6].

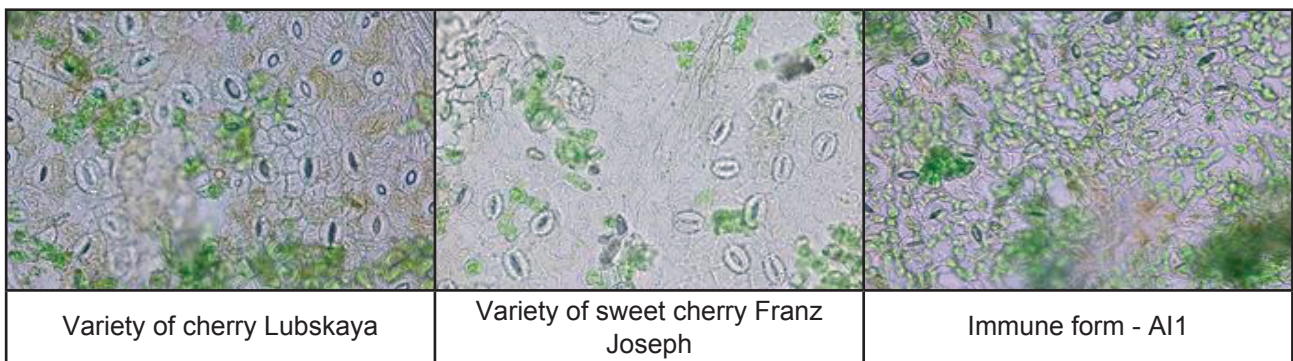
The study of stomata (the number of stomata per 1 mm<sup>2</sup>) established a statistically significant difference in the number of stomata on the leaves in resistant hybrids of breeding of NCZSRIH&V, nonresistant forms and medium resistant forms (table).

Nonresistant varieties have the average number of stomata per 1 mm<sup>2</sup> more than resistant forms.

These features of the structure of the leaf increases the degree of resistance of plants, as a morphological barrier to infection control (*Coccomicos* in the stone plants), reducing the penetration depth microscopic pathogen into the leaf as penetration hyphae comes through the stomata [6].

We have continued physiologo-biochemical study of leaf of varieties and forms of sort *Cerasus* Mill. to identify their relationship with resistance to *Coccomicos*. As resistance to the fungal diseases examined varieties were divided into two groups: nonresistant forms to *Coccomicos* (Lubskaya, Chernokorka, Nefris, Krasnodarskaya sladkaya) and resistant forms (Franz Joseph, VSL-2, Mac, AI1, AI4, AI5, AI90, AI92). The results of test were considered in the dynamics: the collection of data was carried out three times over the 4 years. The greatest difference in the content of summer of chlorophyll of a and b and carotenoids in leaves found in May in the period of active growth of plants.

In resistant forms and polygenic type of resistant forms of the sum of chlorophyll a and b are higher than the nonresistant in 1.3 times. Genetico-statistical analysis of four years of research for the entire growing season showed that the total content of chlorophyll a and b are significantly different from forms with varying degrees of destruction to *Coccomicos*.



**Fig. 1.** Stomata of the forms of sort *Cerasus* Mill. (an increase – 10 x 40)

**Table.** The relationship between resistance to *Coccomicos* and the number of stomata of forms of sort *Cerasus* Mill

Variety, form	Average lesion	The number of stomata per 1 mm <sup>2</sup> , 2011	The number of stomata per 1 mm <sup>2</sup> , 2012
Nonresistant	3,75	311,226±33,9*	317,97±14,34*
Resistant	1,17	181±44,2*	289,37±15,93*

\*Hereinafter: significant at  $P \geq 0,95$



Content of chlorophyll a and b at nonresistant forms is below (5.01 mg/g of dehydrated substance) than at forms of polygenic type resistance (7.15 mg/g of dehydrated substance) ( $t = 5,02$ , at  $p < 0.05$ ). Content of chlorophyll a and b at the resistant forms is higher (6.33 mg/g of dehydrated substance) than in nonresistant forms (5.01 mg/g of dehydrated substance) ( $t = 2,54$ , for  $p < 0.05$ ).

The dynamics of change in the content of biochemical substances (chlorogenic, caffeic, succinic, malic, citric acids, cation  $Mg^+$ ,  $Ca^{++}$ ,  $K^+$ ,  $Na^+$ ) were studied during the growing period of 4 years (2009, 2010, 2011, 2012). Spending of patterns of caffeic and succinic acids, associated with resistance to *Coccinella* at different stages of the disease were found [1].

Quantitative of caffeic acid from forms does not strike until the defeat and it is an active flow with the development of infection. At nonresistant forms during epiphytosis is its accumulation, i.e. the content of acid increases, which apparently is a protective biochemical process aimed at preservation of the species (figures 2).

The concentration of succinic acid in the latency period (before the manifestation of the disease) was 1.8 times higher on average in the use of resistant forms. During epiphytotic of infection (the first decade of July) succinic acid was varied as well as caffeic, i.e. increase in the concentration of the substance are marked in the nonresistance and polygenic type of resistant forms, and in resistant forms are found its decrease for the entire period of vegetation (figure 3).

As a result of anatomico-morphological studies, we found that the leaves of nonresistant varieties have the average number of stomata per  $1\text{ mm}^2$  more than the resistant forms of 1.2 times.

Study of biochemical parameters revealed that the greatest differences in content of chlorophyll and carotenoids in the leaves found in May in the period of active growth of plants. The level of these substances was on average higher in the leaves of highly resistant to *Coccinella* varieties and forms in 1.3 times. Patterns in the dynamics of the content of the caffeic and succinic acids with the development of infection are found.

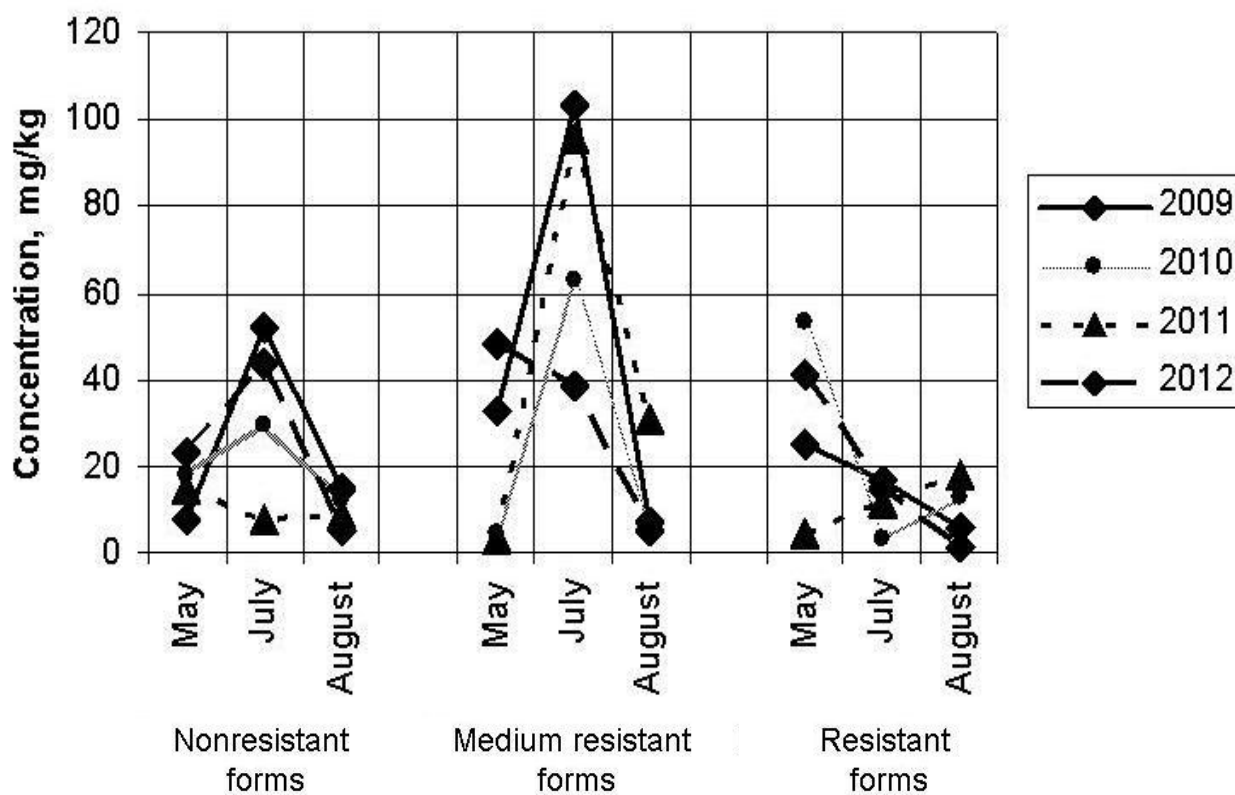


Fig. 2. Changes in the content of caffeic acid in forms of sort *Cerasus Mill*

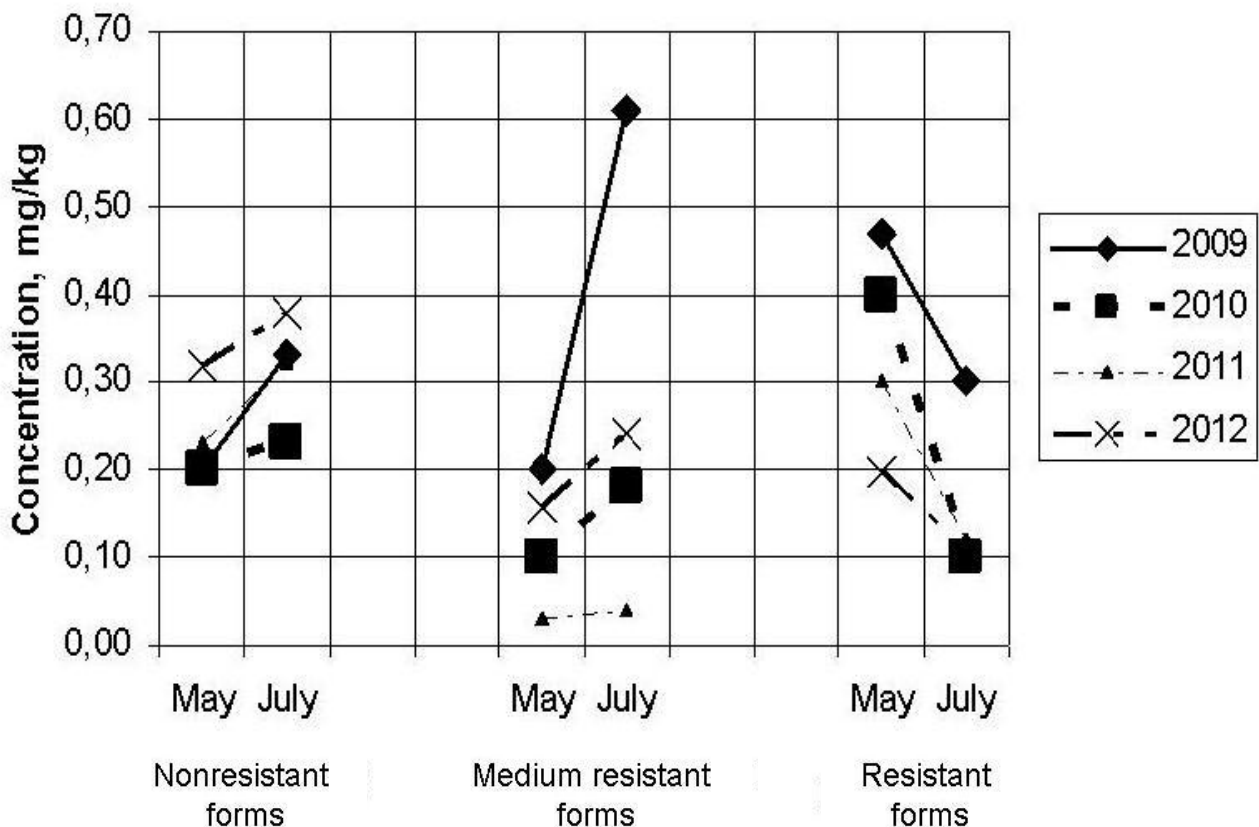


Fig. 3. Changes in the content of succinic acid in forms of sort *Cerasus Mill*

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