

STRUCTURAL-FUNCTIONAL ORGANIZATION OF A LEAF OF KINDS OF KIWI IN THE CONDITIONS OF HUMID SUBTROPICS OF RUSSIA

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The content of green pigments in leaves of studied grades of a kiwi is defined. The greatest contents of a chlorophyll *a* and *b* in leaves of grades of Tomuri and Bruno are revealed. On the basis of it the grades which were potentially more adapted for conditions of the minimum lighting are established. The bigger accumulations of dry matters are happens in leaves of a grade of Tomuri. Dependence between the area of a sheet plate and specific density of sheet (UPPL) that is a diagnostic indicator at the ecological characteristic of a grade is revealed. The variation of biometric characteristics is connected with climatic factors of year. On the biological potential all studied grades of a kiwi are divided into three clusters.

Keywords: kiwi, chlorophyll, the leaf area, the specific density of the leaf, adaptation

As it is known [1, 5], studying of sheet parameters of culture allows to reveal mechanisms of adaptation of plants to action of abiotic factors of the environment, to use these indicators for identification of the anatomy-morphological indicators characterizing biological features of a grade, and, on the basis of it, to allocate the most perspective on efficiency and plasticity of a grade.

Materials and methods of research

The following grades of a kiwi participated in studying: the female grades – Bruno, Kivaldi, Monty, Hayward K-8, Hayward K-12, Hayward K-10, Hayward K-16, and man's grades of Matua and Tomuri; as control – the grade Hayward.

Laboratory researches are conducting on the basis of research and production department of subtropical and southern fruit crops and laboratory of biotechnology, physiology and biochemistry of plants at the All-Russian Scientific and Research Institute of Floriculture and Subtropical Crops.

For the purpose of identification of the perspective and adapted grades of a kiwi were defined: the area of a sheet plate (planimetric), the specific area density of a leaf (UPPL) [6], the content of a chlorophyll *a* and *b* at extract of green leaves [8].

Results of research and their discussion

One of the most important indicators of adaptive potential of plants in limiting conditions is the overall performance of the photosynthesis, including, and features of the pigments system. Only having studied pigment system of a kiwi it is possible to reveal completely biological and adaptive possibilities of culture. The chlorophyll *a* is a main photosynthesis pigment at the plant. The content of chlorophyll *b* testifies to level of fitness of plants to low illumination as it enters into a structural complex chloroplast, responsible for collecting quanta of light. In spite of the fact that the quantity of chlorophyll directly doesn't correlate with intensity of photosynthesis, their contents and a ratio are closely connected with a functional condition of plants [3, 4].

By us it is defined that the bigger content of a chlorophyll is revealed in leaves of man's grades, among female grades on limit of importance there is Bruno's grade; is noted excess respectively by 1,00–1,33 times at Hayward's (Table. 1).

Table 1
The content of green pigments and parameters of a leaf of studied grades of a kiwi

The grades	Chlorophyll «a», mg/g	Chlorophyll «b», mg/g	a/b	Area of a leaf plate, cm ²	UPPL mg/cm ²
Matua	1,35 ± 0,14	0,70 ± 0,05	1,93	430,3	3,93
Tomuri	1,44 ± 0,15	0,87 ± 0,10	1,67	215,4	17,27
Hayward	1,19 ± 0,17	0,73 ± 0,21	1,64	314,5	4,52
Hayward K-8	1,00 ± 0,11	0,58 ± 0,05	1,71	260,7	8,71
Hayward K-12	1,14 ± 0,13	0,55 ± 0,09	2,05	306,1	4,81
Bruno	1,33 ± 0,20	0,77 ± 0,19	1,73	249,0	7,26
Kivaldi	1,18 ± 0,14	0,69 ± 0,17	1,70	330,1	6,51
Monty	1,24 ± 0,09	0,72 ± 0,14	1,74	200,9	10,38
Hayward K-10	1,24 ± 0,18	0,70 ± 0,12	1,78	264,4	3,27
Hayward K-16	1,22 ± 0,23	0,68 ± 0,16	1,80	364,8	6,24
importance of distinctions ₀₅	0,15	0,13	–	57,5	–

The smallest quantity of green pigments is noted in leaves of grades Hayward K-8, grades Hayward and K-12 similar on content of chlorophyll of *b*. However grade Hayward K-12 surpasses other grades at the ratio of a chlorophyll *a* and *b*, including control Hayward. It is known that important is not only the content of pigment, but also their ratio, because on the ratio a/b it is possible to do the conclusion about prevalence in a plant of I or the II photosystems. At the same time, this indicator characterizes the structural organization chloroplasts and the adaptation of a plant to changes of environment [7].

In this regard, grades with lower ratio of a chlorophyll and in, in our case is Hayward and man's grade Tomuri are potentially more adapted for conditions of the minimum lighting.

The area of a sheet surface is not less important diagnostic sign connected with photo-

synthetic activity of plants (Table. 1). By us it is revealed that the grade of Matua has the greatest area of a leaf and while significantly smaller area of a leaf surface – at grades Monty, Bruno and Tomuri (Table. 1). Besides the leaf area, a diagnostic indicator at the description of biological features of a grade is variability of a leaf depending on climatic conditions of vegetation that characterizes morphological variability. As a rule, plants with wide ecological plasticity (i.e. with high variability of the area of a leaf) have opportunity better to adapting in changing conditions and are more perspective at cultivation in limiting climatic conditions. Comparing the data within one year with average data, it is possible to conclude that the variation of biometric characteristics is connected with climatic factors of year. And, the bigger variation is noted at grade of Matua (Fig. 1).

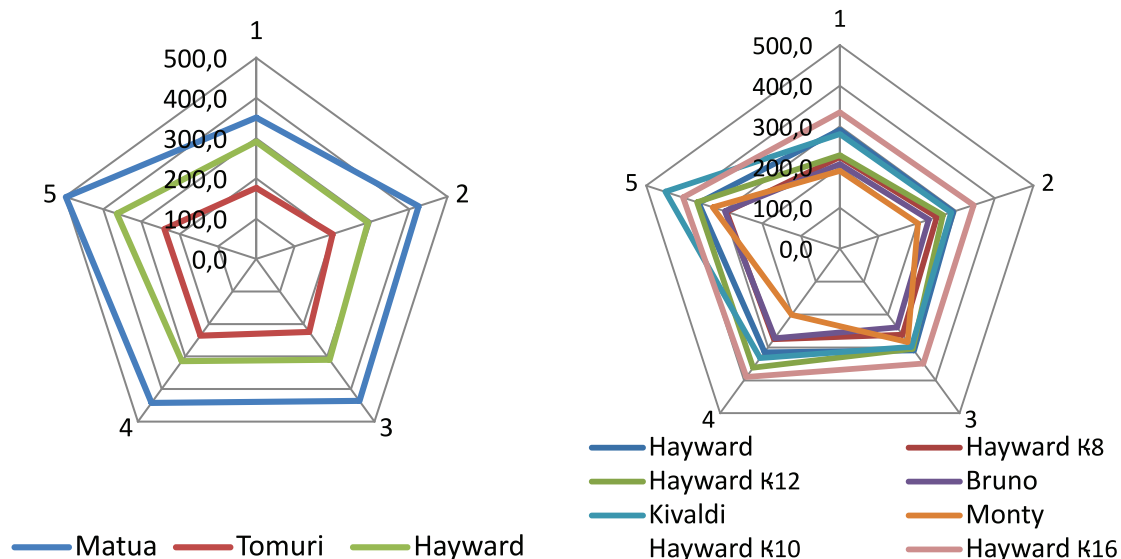


Fig. 1. Coefficient of variability of the leaf area of studied grades of a kiwi

The variation of a leaf at female grades differs not significantly, but on the general background are allocated Kivaldi and Hayward of K-16 (Fig. 1).

The individual variability expressed by coefficient of a variation, showed that variability of leaf grades fluctuates within 5,2–7,0% that below, than at listed above.

Intensity of the main process of assimilation-photosynthesis – depends on the area of a sheet plate which directly influences efficiency of cultures (Briggs, 1999; Ahmad, 1999; Lin, 2000). Indirect indicator of efficiency is UPPL. It is known that specific area density of a leaf connects growth and photosynthesis processes because reflects solid accumulation by sur-

face unit. If the UPPL is higher, the processes of photosynthesis which are counting on unit of a surface of a leaf are synthesizing the big biomass more effectively (Kuzmin, Kuzmin, 2001). The studied grades of a kiwi significantly differed on this indicator (Fig. 2).

So, grade Tomuri have the highest UPPL (17,27 mg/cm²), K-8 (8,71 mg/cm²) Monty (10,38 mg/cm²) and Bruno (7,26 mg/cm²) are exceeding a control grade on this indicator in 2,3, 1,9 and 1,6 times. The established fact testifies that grades are characterized by high photosynthetic potential. There are opinions that between the area of a leaf and UPPL have an inverse relationship [7]. Our researches confirm it, as it is visible from Fig. 2 data, and, the

coefficient of correlation is higher than an average ($r = -0,79$).

It was noted above that the specific area density of a leaf characterizes accumula-

tion of dry matter and in this connection; we carried out the analysis of data on amount of dry matter in leaves of studied grades of a kiwi (Fig. 3).

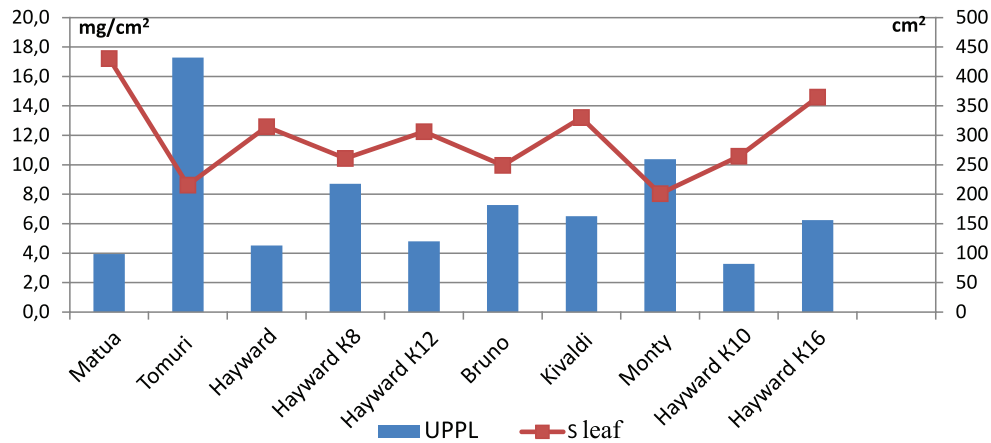


Fig. 2. Interrelation of the area of a leaf surface and specific area density of a leaf of studied grades of a kiwi

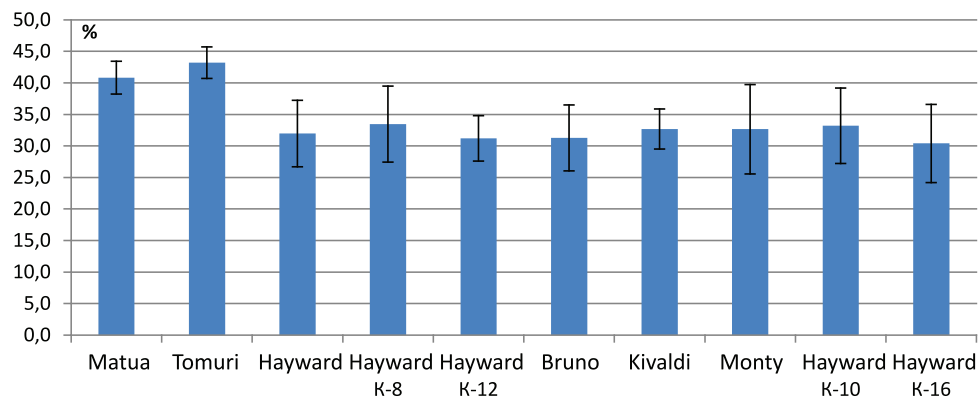


Fig. 3. The content of dry matter in leaves of studied grades of a kiwi

Was revealed that bigger accumulation of dry matter happens in man's grades and that is quite expected as there is no expenditure of assimilation substances on the processes connected with formation of fruits. Female grades differ on this indicator slightly, at the same time, can note a little bigger excess of control at grades Hayward

K-8 and Monty. We carried out the correlation analysis which has shown existence of direct dependence of accumulation of dry matter not only with an area of a leaf, but also with UPPL (Table. 2). Besides, we revealed direct correlation between morphological parameters of a leaf and the contents in them green pigments.

Table 2

Coefficients of correlation (r) between studied indicators

Parameters	Dry matter, g	Sum of chlorophylls, mg/g
Area of a leaf, cm ²	0,66	0,63
UPPL, mg/cm ²	0,75	–
Sum of chlorophylls, mg/g	0,46	–

The cluster analysis which carried out of the results of three years of researches, gave the chance to distribute grades on the groups. The groups are different such physiology-morphological parameters, as the area of a leaf, UPPL, quantity of green pigments and accumulation of dry matter (Fig. 4). As a result, it is possible to see that all grades were divided into three clusters: separately are standing Matua and Tomuri, which are different the studied indicators and this is justified as it is man's grades. But the grade Matua on biological potential is closer to other grades, because it is a uniform subcluster.

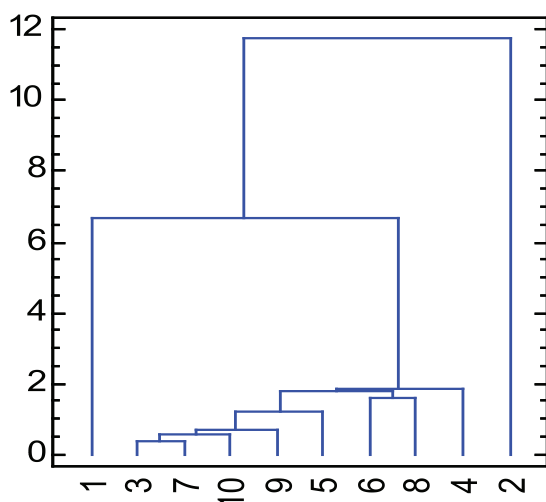


Fig. 4. Dendrogramm of the physiology-morphological parameters of leaves of a kiwi[^] where 1 – Matua; 2 – Tomuri; 3 – Hayward; 4 – Hayward K-8; 5 – Hayward K-12; 6 – Bruno; 7 – Kivaldi; 8 – Monty; 9 – Hayward K-10; 10 – Hayward K-16

There are in closer group such grades, as Hayward, Kivaldi, Hayward K-16, Hayward K-10 and Hayward K-12; and a separate sub-cluster are including the grades Hayward K-8, Bruno and Monty.

Conclusion

As a result of the conducted researches by us is established that the greatest contents of a chlorophyll *a* and *b* in leaves of grade of Tomuri and Bruno's grade. Grades with lower ratio of a chlorophyll *a* and *b* (Hayward and Tomuri) are more adapted for conditions of the minimum lighting. The biggest area of a leaf is noted on the grade of Matua and Hayward K-16, and grade of Matua have a big variation of a leaf in reply to change of climatic conditions. The variation of leaves at the grades are

differs not significantly, but grades Kivaldi and Hayward are differ from other grades. The plants which possess a big variation of metric indicators, are characterized by wide ecological plasticity, these grades have opportunity better to adapt in changing conditions.

The grades of Tomuri, Monty, Hayward K-8, Bruno have a highest UPPL; that grades are possesses the high photosynthetic potential. Man's grades have a bigger accumulation of dry matter (they not are spending the plastic substances on development of fruits) and grades Hayward of K-8 and Monty have a bigger accumulation of dry matter too. All studied grades were divided into three clusters, are relatives of the biological potential by results of the obtained data and the cluster analysis.

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