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# Variability of Quantitative Morphological Characters of *Momordica Charantia l.* Samples of Different Geographical Origin

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**ABSTRACT**

The Authors study the variability of quantitative morphological characters of M. charantia samples of different geographical origin. The results suggest that environmental conditions affect the size of the leaf, the mass and size of the fruit, and also indicate significant differences between the majority of the features of the studied plant, such as the size of pedicel and bracts. We found that location of bract in the female flowers is always located closer to the base of pedicel than in the male ones.

**Keywords.** *Momordica charantia*, variability, morphological features, Russia, Vietnam, Germany.

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## INTRODUCTION

Study and an introduction to the culture of the new, innovative perspective to use plant species is comparable in significance to the crucial events of the technological revolution, as it allows to get innovative and practical results new of the new level. One of such plants is M. charantia L. (Cucurbitaceae). Interest to its study emerged first of all due to the fact that the plant is one of the most promising for a obtaining of lycopene and other carotenoids [1, 2]. Wild plant M. charantia is found mainly in South Asia and sub-Saharan Africa [3-5]. Therefore the development and study of the features of its cultivation in other climatic conditions becomes important. Study of variability of quantitative morphological features in experimental conditions is one of the main methods for assessing and analyzing the similarities and differences of plant samples of different geographical origin [6-8]. Since the nature of variation of features depends on the interaction of environmental factors and plant genotype, by culturing of samples in the same environments in the areas of the Botanical Garden in fact we can assess the variability to a greater extent genetic rather than modification features of the plants. This approach not only allows a comparative analysis of samples of different geographical origin, but also helps to identify the most promising forms for use in regions of introductions. Identification of variability of morphological features with the introduction to the culture of plants is the basis for developing high-productive introduction populations. From this perspective a substantial interest is paid to the study of morphological variability of M. charantia plants grown in the conditions of the Belgorod region (Belgorod).

## METHODS

The study of morphological variability on samples of M. charantia of different geographical origin was conducted on the experimental site of Belgorod State University Botanical Garden. We studied three samples of M. charantia obtained from Vietnam ("Vietnam"), Russia ("Belgorod") and Germany ("Germany"). Each plant was analyzed according to nineteen morphometric features [9]. All data were analyzed using Statistica 8.0 (STATSOFT). For each morphological feature were calculated average values and standard deviations of their values [10]. Univariate analysis of variance (ANOVA) was performed to compare the features of samples with different geographical origin [11]. For comparison of characteristic values of male and female flowers we performed a paired t-test. Independent t-test was used to compare two independent groups of data [12].

## MAIN PART

Average values and ranges of variation of morphological features of fruits and seeds of plants of the studied samples of different geographical origin are presented in Table 1. Average weight per fruit of M. charantia is 102.24 g ± 72.44 g (average value ± standard deviation). We noted significant differences between plants of different geographical origin of the samples at $p < 0.001$. The length of the fruit averaged 11.5 mm ± 7.1, and diameter - 5.8 mm ± 1.4. From these two features, only the length of the fruit varies depending on the geographic origin of the sample in accordance with the results obtained using the one-dimensional analysis of variance ($p < 0.001$) (Fig. 1).

**Table 1.Average values of features of fruit and seed in *Momordica charantia* L plants.**

| | Vietnam<br>n = 15 | Russia<br>n = 10 | Germany<br>n = 10 |
|---|---|---|---|
| **Weight of the fruit (g)** | 189.28 ± 74.15<br>(100.3-253.1) | 62.68 ± 12.79<br>(49.87-86.78) | 66.22 ± 15.41<br>(52.92-86.6) |
| **Length of the fruit (cm)** | 20.32 ± 2.17<br>(16-23) | 7.93 ± 1.18<br>(6.5-9.5) | 5.36 ± 0.79<br>(4.3-6.5) |
| **Fruit diameter (cm)** | 6.59 ±1.21<br>(4.3-7.6) | 5.71 ±1.08<br>(4.0-7.7) | 5.04 ±1.05<br>(4.8-6.9) |
| **Seed number per fruit** | 36.6 ± 7.4<br>(31-49) | 25.25 ± 6.01<br>(18-34) | 12.62 ± 1.59<br>(10-15) |
| **Length of the seed (mm)** | 14.00 ± 0.79<br>(11.5-15) | 12.51 ± 0.55<br>(11.3-13.5) | 12.49 ± 0.88<br>(10.8-14.1) |
| **Width of the seed (mm)** | 7.77 ± 0.47<br>(7.1-8.8) | 7.28 ± 0.41<br>(6.5-8.3) | 6.93 ± 0.43<br>(6-7.9) |
| **Thickness of the seed (mm)** | 4.00 ± 0.47<br>(3-4.8) | 3.84 ± 0.3<br>(3.3-4.4) | 3.85 ± 0.45<br>(2.8-4.5) |

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Studying M. charantia plants showed that their fruit contains in average 24 seeds. The number of seeds in a single fruit varies depending on the geographical origin of the studied samples with significant difference (p = 0.05) (Fig. 2). The thickness of the plants seed averaged 3.78 mm ± 0.45. It is characterized, in general, by similar values in all studied samples (p = 0.14). On the other hand the length and width of the seed is more in "Vietnam" samples, (p <0.001). However the value of such variability is insignificant.

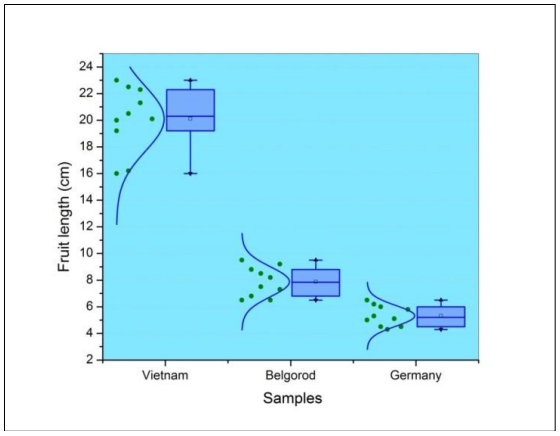


**Figure 1: Variability length of the fruit samples studied M. charantia plants (p <0.001)**

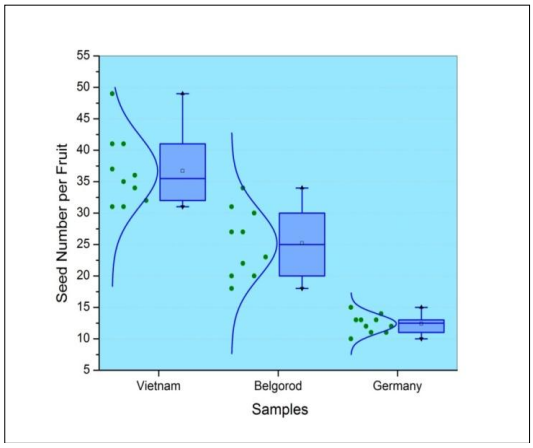


**Figure 2: Variability the number of seeds per fruit in the studied of M. charantia samples (p = 0.05)**

Study of characteristic values of leaves and flowers shows their considerable variability. The length of the leaf blade in some cases was up to 140 mm, but the average has lower values (84.11 ± 17.13 mm). Results obtained using the one-dimensional analysis of variance indicate that this feature varies between samples (p <0.01). Average values of leaves samples from "Vietnam" were (102.14 mm ± 18.84), more than the same of other plants. The average value of the width of the leaf blade in all studied plants was 61.97 mm. Its value in all studied samples is different at p <0.01. The smallest width of the leaf blade was observed in samples "Belgorod" (51.23 mm ± 10.68) (Fig. 3).

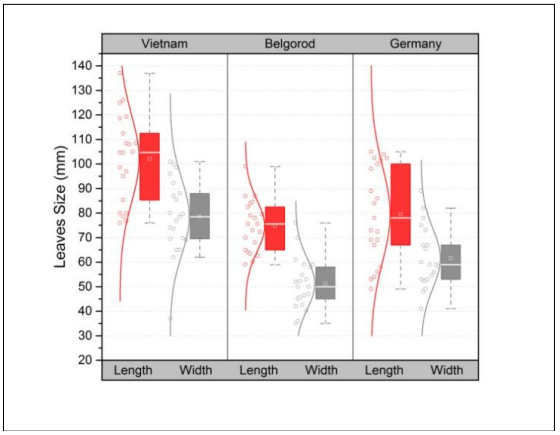


**Figure 3: Variability of leaves characteristic features in the studied samples of M. charantia plants (p <0.01)**

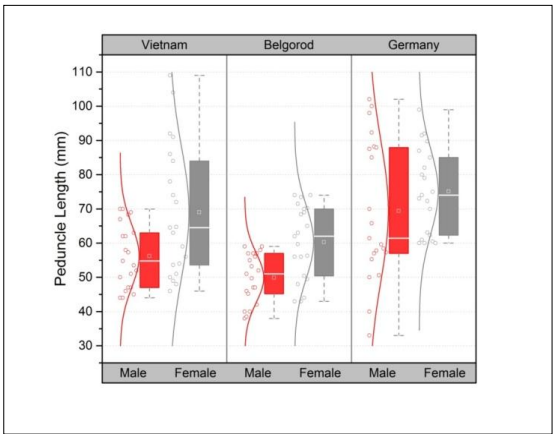


**Figure 4: Variability of pedicel length features in the studied samples of M. charantia plants (p = 0.02).**

Study of plant features showed that the average length of the peduncle of male flower is 65.9 mm ± 23.96, but for some plants belonging to the samples from Germany, this length was higher than 100 mm (p = 0.02). Peduncle length of female plants pedicel varies significantly between samples of different geographical origin (p = 0.02). Small value of the length of female pedicels was observed in plants from Belgorod (60.57 mm ± 11.6), and the highest value was found in plants from Germany (75.86 mm ± 14.24). We conducted a paired T-test that showed that there is no significant variability between the values of the length of the male and female peduncles (p = 0.36) (Fig. 4).

Position of bract of M. charantia plants is determined by the distance from it to the base of the peduncle. Value of the average length of the male plant was 21.17 mm, female - 10.96 mm. This feature was

not significantly different in samples (at p = 0.59 for male and p = 0.35 for the female plants). However our paired T-test (p <0.01) indicates that the distance from the male bract to the base of peduncle is almost always greater than the corresponding distance from the female bracts the base of peduncle.

## SUMMARY

Thus, the results of the study indicate that the samples of different geographical origin of plants grown under the same environmental conditions at experimental sites of Belgorod State University botanical garden are characterized by different values of morphological features: leaf size, weight and size of the fruit. Significant differences were found for the size of the peduncle and bracts.

## CONCLUSION

Dimensions and weight of the fruits of the studied samples M. charantia plants of different geographical origin vary significantly (p <0.001). No correlation between fruit weight and number of seeds was found in the studied samples . Fruit weight in plant samples from Vietnam was more than three times the mass of fruits of other samples studied, but the number of seeds in a single fruit was only 1,5 times. Our study revealed the accuracy of changes in the values of leaf sizes (at p <0.01) and the length of the peduncle (at p = 0.02), which is due to differences between plants samples of different geographical origin. Location of bract was the same for all samples. However, the female flowers bract is always located closer to the base of pedicel.

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