Hop and Medicinal Plants, Year XXX, No. 1-2, 2022
ISSN 2360 – 0179 print, ISSN 2360 – 0187 electronic

Correlations between the Height of *Malva sylvestris* Plants and Some Growth and Development Elements with a Determining Role on Herb Production

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Abstract: The present work aims to improve the necessary knowledge for the introduction into cultivation of *Malva sylvestris* L. These studies were carried out at the National Research and Development Institute for Potato and Sugar Beet Brasov, within the Department of Technology and Good Agricultural Practices, Medicinal and Aromatic Plants Laboratory. *Malva sylvestris L.* (mallow) is an annual, biennial or perennial plant, common in areas with milder perennial climates. It is an herbaceous plant, has an erect stem, leaves, alternately arranged, long-petiolate, palmate-lobed with 5-7 lobes, with unevenly toothed edges. Mallow flowers are odourless, they have a mucilaginous taste. Petals vary from white - pink - emarginate ruffles. Concentric staminal filaments are arranged in a column surrounding the styles. It has been used for phytotherapeutic purposes since biblical times, in the treatment of internal and external inflammations, also in the form of poultices in the case of injuries. Literature has shown multiple biological effects in this species, from anti-inflammatory, healing, antibacterial and anticancer, antioxidant effects. During the experimental years, during the growing season, biometric determinations were carried out to highlight the phenological stages of vegetative and generative organ formation.

Keywords: biology, introduction into cultivation, *Malva sylvestris* L., observations, technology.

Introduction

Romania has a long tradition in the study of medicinal and aromatic plants. The introduction of wild flora species into organic cultivation is an alternative to harvesting these plants from the wild, thus ensuring the conservation of natural resources and biodiversity.

Thus, agriculture and food specialists have a very important role in public information, awareness, training and preparing all stakeholders in organic farming. Organic farming is also an economic segment in which much is written about development and added value production (Săvescu et al., 2016).

Malva sylvestris L. (*Malvaceae*), also known as common mallow, is native to Europe, North Africa and Asia and is present in all Italian regions. Its traditional use has long been documented, although little clinical evidence is available. Among the Romans, mallow was used for its emollient and laxative properties, and in folk medicine it is widely used for various inflammatory conditions in the form of infusions, decoctions, poultices, liniments, lotions, baths and gargles (Barros et al., 2010; Delfine et al., 2017).

In the Mediterranean region, this species has a long history of use as food, and due to its therapeutic properties, some parts of this plant have been used in traditional and ethnoveterinary medicine (Martins et al., 2017).

Hippocrates and Galen considered it a valuable medicinal plant. In European cuisine, it survived until the introduction of cabbage and spinach salad from Asia Minor (Bojor and Răducan, 2011).

Malva is frequently used as a vegetable but also as a medicinal plant in Iran, where it is called Panirak. Mallow flowers are used as a remedy for open wounds, eczema, infected dermal wounds, bronchitis, digestive problems and inflammation (Pirbalouti et al., 2009).

Malva sylvestris, can be considered a good source of phenolic compounds and antioxidants. Traditionally, medicinal applications for *Malva sylvestris* treat certain disorders of the body, such as the digestive system, respiratory, genitourinary, muscular and skeletal systems, as well as skin disorders and lesions. In addition to the most widespread anti-inflammatory properties, other pharmacological and clinical effects are also frequently mentioned. Mallow is considered to have diuretic, laxative, spasmolytic and choleretic effects. It is also used as a bronchodilator, expectorant, antitussive, anti-diarrhoeal, recommended for acne and skin care as an antiseptic and emollient (Carvalho, 2005; Quave et al., 2008; DellaGreca et al., 2009; Leporatti et al., 2009; Neves et al., 2009).

It is known that antioxidants are good fighters against diseases, protecting the body from the attacks of free radicals, which damage human cellular structures, improve the reaction mechanisms

of redox processes, capable of regulating the body's acid-base balance and improving metabolic processes (Săvescu, 2021).

Studies in the literature have reported different pharmacological properties for *M. sylvestris* and other Malva species. It is well known that *M. sylvestris* can be used as an anti-inflammatory substance for the respiratory tract, gastrointestinal tract and skin (Guarrera, 2005).

Malva sylvestris L. (mallow) grows on sandy, salty lands, on the edge of flowing waters, it is an herbaceous plant, with a taproot, slightly branched fleshy (Ardelean and Mohan, 2008), straight stem, branched covered with bristles, growing up to a height of 1.5 m. The leaves, arranged alternately, are long petiolate, palmate-lobed with 5-7 lobes, with unevenly toothed edges (https://www1.agerpres.ro). Mallow flowers are almost odourless and have a mucilaginous taste when chewed. Petals vary from white to pink - emarginate ruffles. Staminal filaments are overgrown in a column surrounding the styles. The flattened schizocarp capsule fruits (hence the name *casul popii*) open at maturity (Muntean et al., 2007).

Materials and methods

The research was carried out at the National Research and Development Institute for Potato and Sugar Beet Brasov, within the Department of Technology and Good Agricultural Practices, the Laboratory of Medicinal and Aromatic Plants, during 2016-2019. The work presents partial results of the research.

In the experiment, different planting distances were tested, which would allowing the mechanization of maintenance works, correlated with the planting period and adapted to climatic conditions, as well as to establish the optimal nutritional requirement, the optimal the optimal spacing for growth, and profitable yields at Ha.

The experimental layout was bifactorial, according to the subdivided plots method, with two A X B factors, in three 3x3x3 repetitions, with the length of one variant being 2 m and the paths 1 m wide and 9 rows of plants per plot. To facilitate planting and maintenance work, the replicates were placed end to end.

Factor A is represented by the distance between rows, it had three graduations: 25 cm, 50 cm, and 70 cm. Factor B represents the distance between plants in a row with graduations: continuous row, 15 cm, and 25 cm.

Results and discussions

The dynamics of emergence and growth of the leaf apparatus were followed until flowering, when three plants were harvested from each experimental variant/repetition. For each harvested plant, the following determinations were made: plant height, number of branches, plant mass, stem mass, leaf mass, and flower mass. Average results are presented bellow (Table 1).

Table 1

The average results of the determinations in *Malva sylvestris*

Var.no.	Plt. no.	Average plant height (cm)	Average Ramifications no.	Plant's Average Weight (g)	Stem's Average Weight (g)	Average Leaves Weight (g)	Average Flowers Weight (g)
V_1	9	147	16	446	284	117	45
V_2	9	143	15	241	159	65	18
V_3	9	144	19	395	239	125	31
V_4	9	155	19	690	459	148	83
V_5	9	164	18	682	431	208	43
V_6	9	158	20	718	449	204	65
V_7	9	152	16	692	402	207	83
V_8	9	154	21	855	440	297	117
V_9	9	156	18	769	448	217	119

The Statistica program was used to calculate the correlation coefficient, which measures the degree of correlation between plant height and the other elements of growth and development, with a determining role on herb production. Both the X and Y axis values have been entered.

The value of the direct correlation between X and Y corresponds to the sum of squares and is the sum of the products, that is, the sum of all the products of the deviations of X in a pair of variants from the mean of X and the deviation of Y in the same pair of variants from the mean of Y.

The correlation coefficient is the ratio of the average product to the square root of the product of the two average squares. The correlation coefficient is an absolute value that is always a numerical value between 0 and 1. Its square is equal to the product of the regression coefficient of Y against X and the regression coefficient of X against Y.

Following the calculations of the correlation coefficient between the height of the plants and the number of branches, the

correlation value was obtained: r = 0.45569. As can be seen, the sum of products is positive, as it always will be if Y increases on average when X increases in turn.

The correlation coefficient value was compared with the 5% probability, 0.46<0.50; based on these comparisons, it can be stated that, between the height of the plants and the number of branches, the correlation coefficient is moderately positive. The degree of association of the points on the graph indicates a positive direction. The value of 0.46 signifies an average association between the two analysed factors, the linear form being directly proportional to the value of the correlation coefficient (Figure 1).

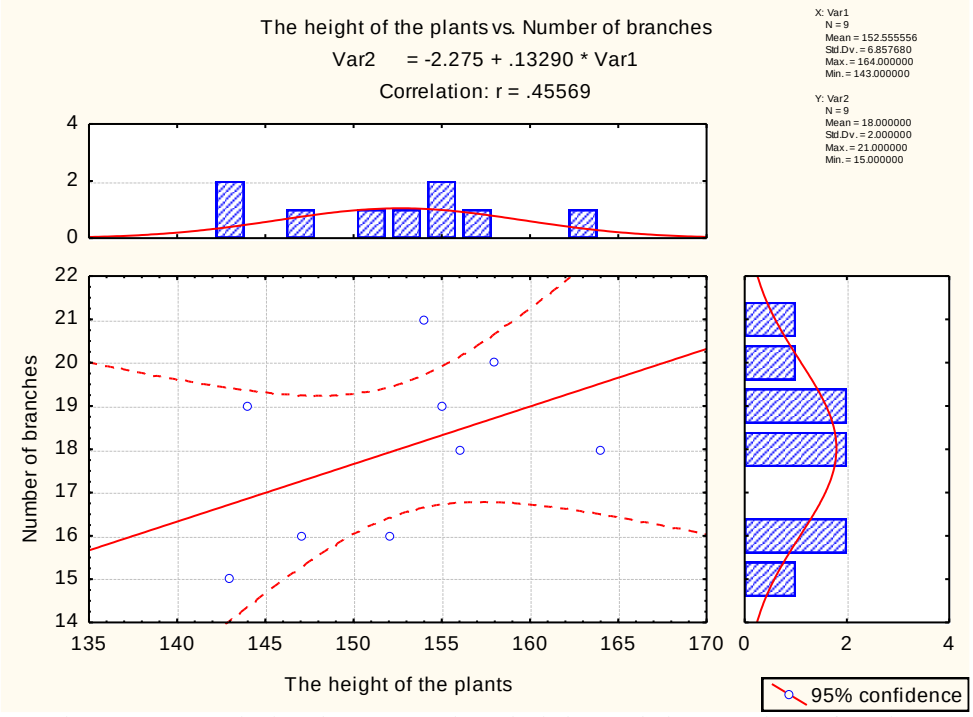

Figure 1. Correlation between plant height and the number of Malva branches

In the case of plant height, the median is equal to 152.56 cm. The standard deviation (the value by which the calculated mean deviates from the population mean) of 6.86 cm was calculated, with a minimum value on each variant of 143 cm and a maximum of 164 cm.

The average number of branches was 18.00 with a standard deviation of 2.00, the minimum and maximum being 15 and 21 branches, respectively.

The average mass of the plants is equal to 609.78 g, the standard deviation is 201.42 g, the value of the amplitude on each variant being the maximum of 855 g and the minimum of 241 g (Figure 2).

The correlation coefficient between plant height and plant mass in Malva species is r = 0.79095.

Comparing the value of the correlation coefficient with the probability of 5%, r = 0.79 > 0.70 it can be stated that between the height of the plants and the mass of the plants, the coefficient is very significantly positive. The degree of association of the points on the graph indicates a positive direction of correlation. The value of 0.79 signifies a very high association between the two analysed factors, the linear form being directly proportional to the value of the correlation coefficient.

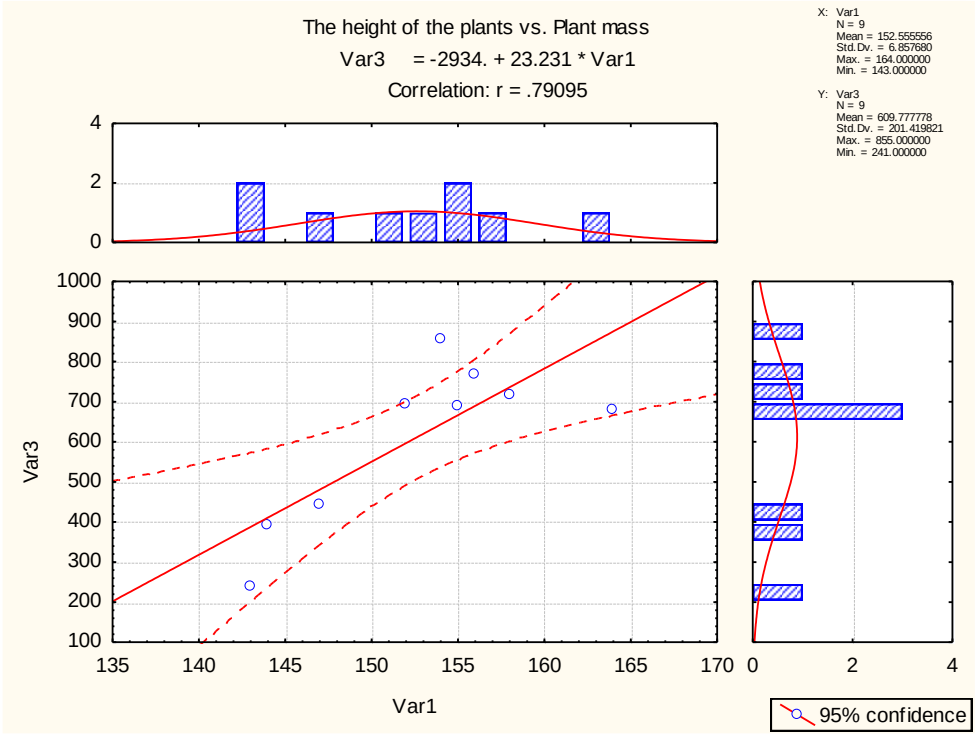

Figure 2. Correlation between plant height and mass (g) of Malva plants

Figure 3 shows a correlation coefficient r = 0.87080 between the height of the plants and the mass of Malva stems. Comparing the value of the correlation coefficient with the probability of 5%, r = 0.87 > 0.70 it can be stated that between the height of the plants and the

mass of the stems, the coefficient is very significantly positive. The degree of association of the points on the graph indicates a positive direction of correlation. The value of 0.87 means that there is a very high association relationship between the two analysed factors, the linear form being directly proportional to the value of the correlation coefficient.

For the weight of the stems, the value by which the calculated average deviates from the population average (367.89 g) is 111.20 g, the maximum amplitude for each variant being 459 g and the minimum 159 g.

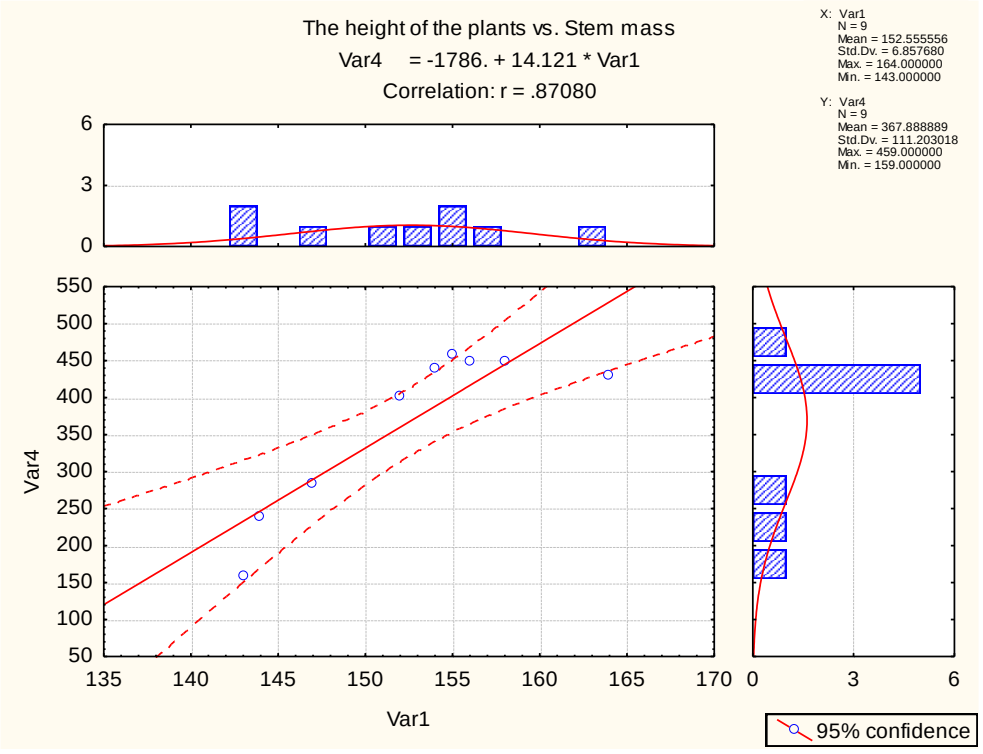

Figure 3. Correlation between plant height and mass (g) of Malva stems

Figure 4 shows a correlation coefficient r = 0.67824 between plant height and Malva leaf mass (weight). Comparing the value of the correlation coefficient with the probability of 5%, r = 0.68 > 0.50 it can be stated that between the height of the plants and the mass of the leaves, the coefficient is significantly positive. The degree of association of the points on the graph indicates a positive direction of correlation. The value of 0.68 means that there is a high association

relationship between the two analysed factors, the linear form being directly proportional to the value of the correlation coefficient.

For the weight of the leaves, the value by which the calculated average deviates from the population average (176.44 g) is 69.17 g, the maximum amplitude for each variant being 297 g and the minimum 65 g.

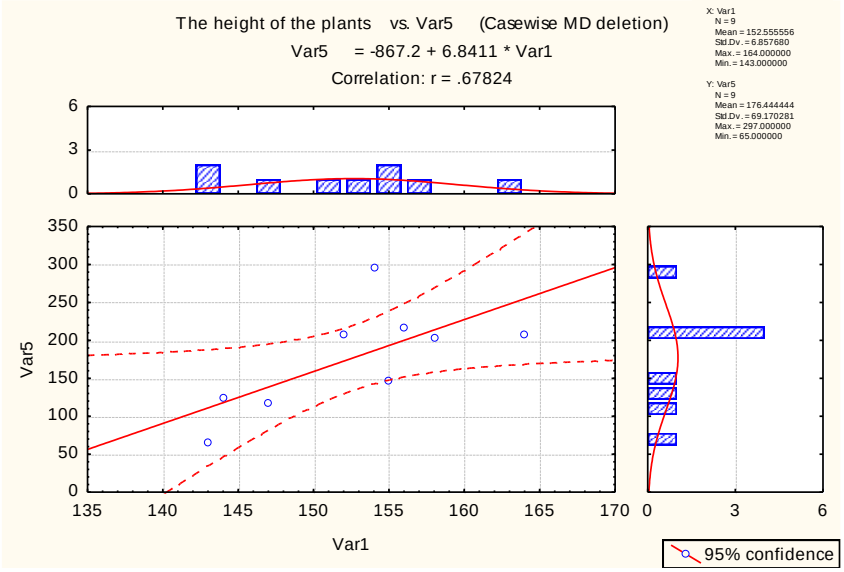

Figure 4. Correlation between plant height and Malva leaf mass (g)

Figure 5 shows a correlation coefficient r = 0.45052 between plant height and Malva flower mass. Comparing the value of the correlation coefficient with the 5% probability, r = 0.45 < 0.50, it can be stated that between plant height and flower mass, the coefficient is moderately positive. The degree of association of the points on the graph indicates a positive direction of correlation. The value of 0.45 means that there is a moderate association relationship between the two analysed factors, the linear form being directly proportional to the value of the correlation coefficient.

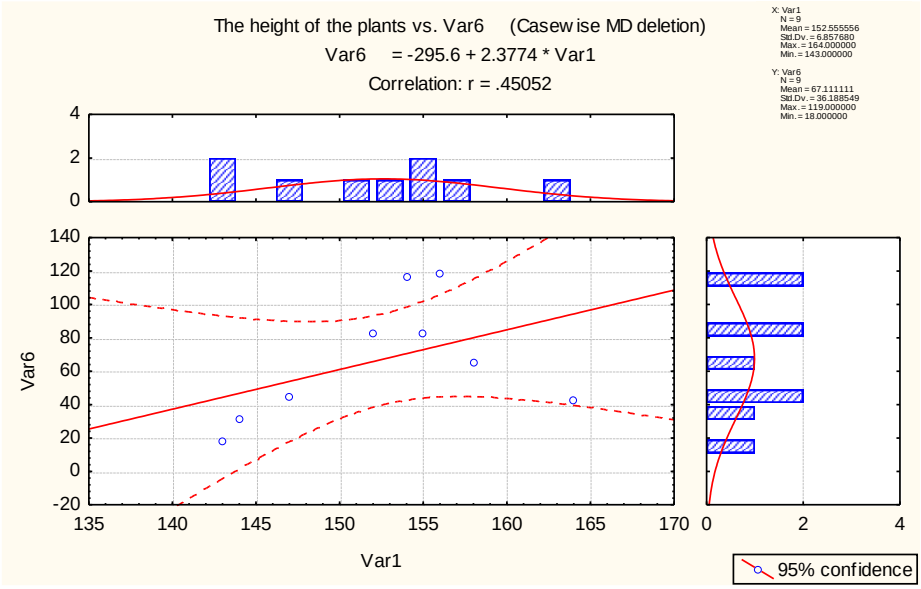

Figure 5. Correlation between plant height and Malva flower mass (weight) (g)

Conclusions

Following the analysis of the final results of the correlation between plant height and other elements of growth and development, with a determining role on herb production, the following conclusions can be formulated:

- The analysis of the obtained results and their processing through correlations on the regression line highlighted the connection between the analyzed factors.
- The correlation coefficient between the height of the plants and the mass of the stems in the Malva species is r = 0.87080, which shows a great connection between the factors, this correlation being the strongest among the analysed situations.
- The correlation coefficient between the height of the plants and their mass is r = 0.79095, indicating a very high correlation between the two analysed factors.
- The correlation coefficient between plant height and flower mass in the Malva species is r = 0.45052; the correlation is moderate, among the analysed situations, having the lowest value.

- The positive value of the correlation coefficients between the height of the plants and the other analysed elements, indicates a directly proportional association of the studied factors.

Acknowledgements: This work was supported by the project ADER 2.4.1. "Maintaining the biodiversity of medicinal and aromatic plants by conserving and enriching the collection of genetic resources and producing seeds from the higher biological categories for species representative of the hill and mountain area".

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