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The morphological development in different phenological stages in *Raphanus sp.* L.

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Abstract Radish plants (*Raphanus sativus* L.) were grown in three varieties to establish the variability of characters with food importance. At 15 and 45 days after sunrise, observations were made, through biometric measurements of some characters in *Raphanus sp.* such as: plant height, number of leaves/plant, leaf width/length, length of main root (tuberous), diameter of main root/tuberous, number of secondary roots. The red summer radish variant shows the highest values for the observed characters, compared to the moon red radish and white summer radish variants.

Key words

Raphanus sativus L., height, length, diameter

Radishes are native to Asia and the Mediterranean Sea area and it is assumed that four species contributed to the formation of the cultivated species *R. sativus*, *R. raphanistrum* L., *R. maritime* Smith, *R. landra* Moretti, *R. rostratus* D.C. The radish was cultivated by the Egyptians approximately 3000 years BC. It was known by all the ancient peoples, but it entered China more recently (500 BC). Radishes are grown for the tuberous roots that are consumed fresh. Moon radish contains 5-8% dry matter, 3-3.5% carbohydrates, 0.6-1.2% proteins, vitamins B1, C (20-30 mg/100 g), mineral salts: calcium, phosphorus, magnesium and volatile substances. Summer-winter radishes contain 8-11% dry matter, 5-8% carbohydrates, 1-1.3% proteins. Due to the high content of volatile substances, radishes have a diuretic, bactericidal action. [1; 12]

The moon radish is an annual plant and the summer-winter radish behaves like a biennial species. In the soil, the tuberous portion represented by the hypocotyl axis develops, in the spherical varieties and in the elongated ones next to the hypocotyl, the upper part of the root also thickens. It is white, pink, red, black, and in some varieties, the tuberous portion is two-colored. The secondary roots are fibrous and penetrate the soil at 30-40 cm, for moon radishes and up to 60-80 cm for summer-winter ones. The cotyledon leaves are cordiform, pubescent. The leaf rosette includes 3-8 lirate or pinnate leaves, covered with hairs. The 50-100 cm tall floriferous stem is branched, the flowers are grouped in terminal raceme inflorescences, they are type 4, white or violet in color, with allogamous pollination, entomophilous. The fruit is an indehiscent silique, in which the ovoid, brown-colored seeds are formed, being larger, compared to those of other species from the *Brassicaceae* family. [6]

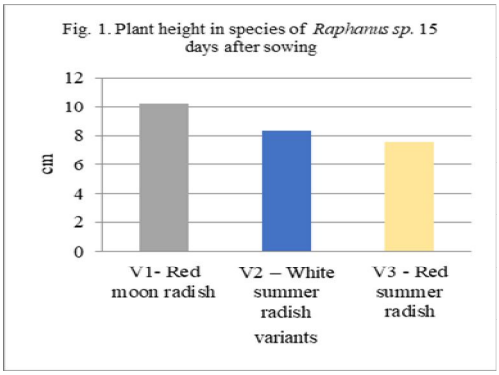
Material and Method

To carry out the study, three varieties of Raphanus sp. were chosen, establishing the variability of characters with food importance. The experimental variants were, variant V1 - Moon red radish, variant V2 - White summer radish and variant V3 - Red summer radish. During the experiment, at 15 and 45 days after sunrise, the establishment of quantitative characters *in Raphanus sp.* was followed by biometric measurements. (plant height, number of leaves/plant, width/length of leaves, length of main/tuberous root, diameter of main/tuberous root, number of secondary roots etc.) with economic importance.

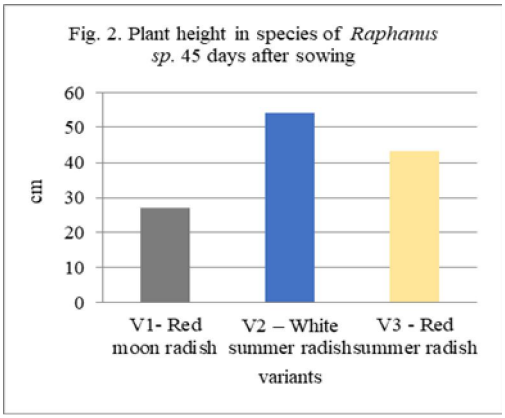
Results and Discussions

1. Plant height of *Raphanus sp.* L.

Plant height of *Raphanus sp.* after 15 days from emergence, it highlights the variant V1 - Moon red radish, with a higher average value of 10.22 cm (±0.38), compared to the variant V2 - White summer radish, which has an average value of 8, 35 cm (±0.26), and the V3 variant - Red summer radish with the lowest value of the average height of 7.58 cm (±0.13) (Fig. 1.).

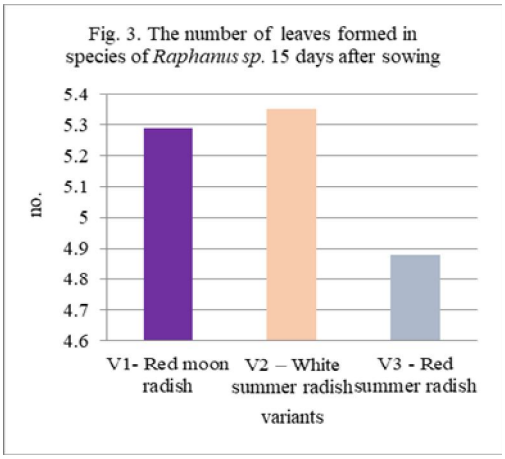


After 45 days from emergence, the V3 variant stands out – Red summer radish with an average height value of 43.12 cm (±1.23). V1 variant – Moon red radish has the lowest average height value of 27.14 cm (±1.83). Variant V2 – White summer radish having a higher average height value than the other variants of 54.18 cm (±1.89) (Fig. 2.).

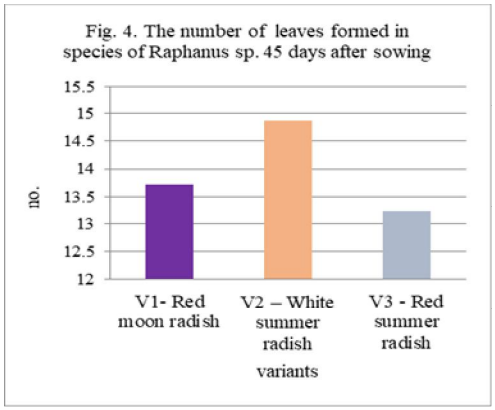


2. Number of leaves/plant in *Raphanus sp.* L.

The number of leaves/plant stands out as high after 15 days from emergence, in the variant V2 – White summer radish with a higher average value of the number of leaves of 5.35 (±0.13) and with a close value in the V1 variant – Moon red radish, which has an average value of 5.29 (±0.15). The variant with the lowest value of the average number of leaves/plant is presented by variant V3 – Summer red radish, with 4.88 (±0.11) (Fig. 3.).

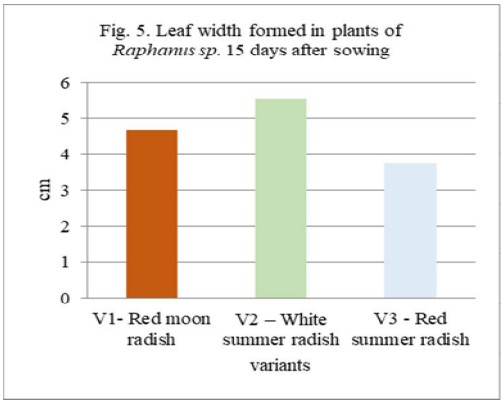


After 45 days from emergence, the V2 variant - White summer radish shows the highest average value of the number of leaves is 14.88 (±0.13). The average value of 13.72 (±0.11) is presented by the variant V1 – Moon red radish, and the lowest average height value is at the variant V3 – Red summer radish of 13.22 (±0.10) (Fig. 4.).

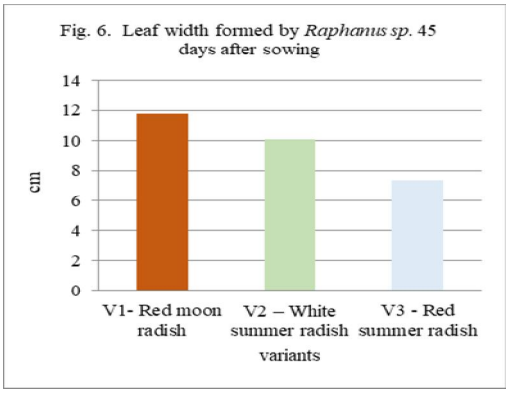


3. Leaf width of *Raphanus sp.* L.

The highest average value of the leaf width 15 days after emergence is 5.55 cm (±0.14) for the V2 variant – White summer radish. Variant V1 – Red moon radish has an average value of 4.68 cm (±0.10) %, and the lowest value of the average leaf width is in variant V3 – Red summer radish of 3.75 cm (±0,12) (Fig. 5.).

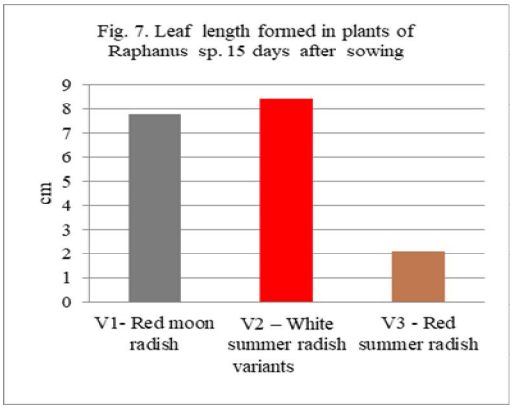


In the variant V1 – Moon red radish, the highest average value of the leaf width is 11.82 cm (±0.14) 45 days after emergence, and the variant V2 – White summer radish shows an average value close to 10.10 cm (±0.10). The variant with the lowest value of the average leaf width is the variant V3 – Red summer radish, of 7.33 cm (±0.15) (Fig. 6).

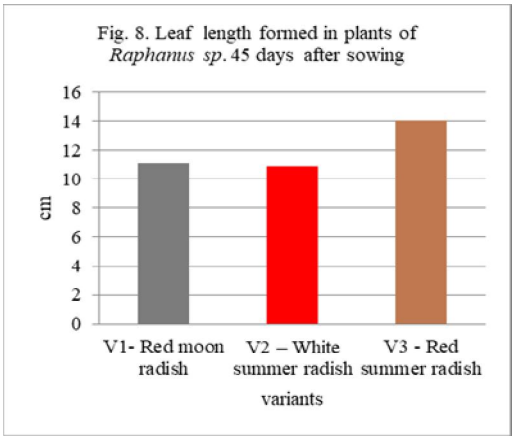


4. Leaf length in *Raphanus sp.* L.

After 15 days from emergence, in the V2 variant – White summer radish, the highest average value of the leaf length is 8.44 cm (±0.23). In the variant V1 – Red radish of the moon, the leaf length shows an average of 7.77 cm (±0.19), and the lowest value of the average length of the leaf among the analyzed variants is presented by the variant V3 – Red radish of the summer with 2.13 cm (±0.15) (Fig. 7.).

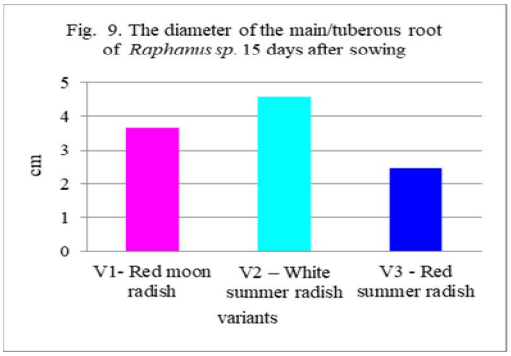


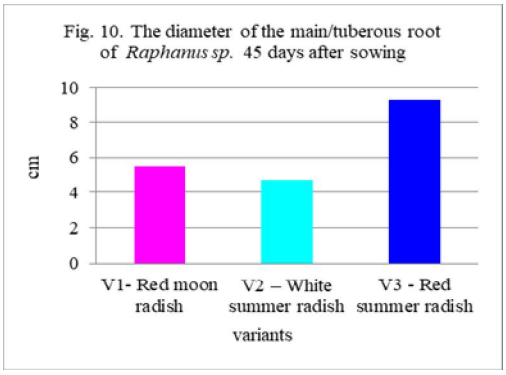
After 45 days from emergence, in the V3 variant – Red summer radish, the highest average value of the leaf length is 14.05 cm (±0.11). Variant V1 – Moon red radish has an average value of 11.13 cm (±1.12), and the variant with the lowest average value of leaf length is variant V2 – White summer radish, with 10.89 cm (± 1.23) (Fig. 8.).



5. The diameter of the main/tuberous root in *Raphanus sp.* L.

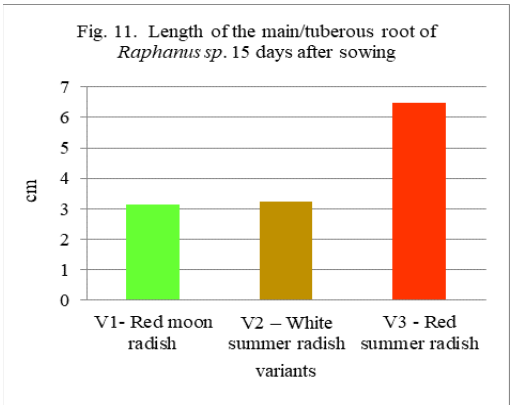
The root diameter of the variant V1 - Red radish of the moon has an average value of 3.66 cm (±0.21), after 15 days from emergence, and the variant V3 - Red summer radish has the highest value of the average diameter of the main roots by 4.58 cm (±0.28). The smallest root diameter is recorded in the V2 variant – White summer radish of 2.45 cm (±0.19) (Fig. 9.). 45 days after emergence, the V3 variant – Red summer radish, the largest value of the root diameter is 9.28 cm (±1.11). An average value of the root diameter of 5.48 cm (±1.32) shows the variant V1 - Moon red radish. The smallest diameter is recorded for the V2 variant - White summer radish of 4.73 cm (±1.16) (Fig. 10).



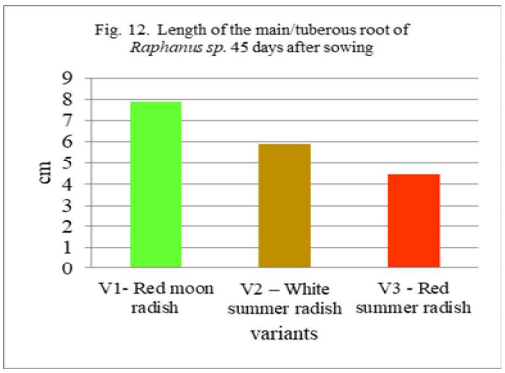


6. The length of the main /tuberous root in *Raphanus sp.* L.

After 15 days from emergence, the V3 variant - Red summer radish shows the highest value of the average length of the main roots, of 6.48 cm (±0.18). Variant V2 - White summer radish shows an average value of 3.23 cm (±0.21), compared to this variant V1 - Moon red radish, the smallest length of 3.13 cm (±0.24) (Fig. 11).



In figure 12. it is highlighted that after 45 days from emergence, in variant V1 - Moon red radish, the highest value of the average length of the main roots is 7.88 cm (±1.25). The smallest length is recorded in the V3 variant - Red summer radish of 4.45 cm (±0.24), compared to the V2 variant - White summer radish, which has an average value of 5.88 cm (±1.35).



Conclusions

The lowest height of the plants is recorded in the V3 variant - Red summer radish after 15 days from sunrise. After 45 days of vegetation, the variant V2 - White summer radish recorded the highest growth, while the variant V1 - Red moon radish was found to have the lowest height. The highest number of leaves in all measurement periods was recorded for the variant V2 - White summer radish, and the lowest number of leaves was recorded for the variant V3 - Red summer radish. Leaf width shows average measured values that differ according to the development stage. If after 15 days the highest average value was at V2 - White summer radish, and the lowest at V3 - Red summer radish, after 45 days of vegetation the highest average value of leaf width was at V1 - Moon red radish, and the smallest at V3 - Summer red radish. After the first 15 days of vegetation, the variant V2 - White summer radish registers the highest value of leaf length, and the variant V3 - Red summer radish, shows the lowest average value, following that after 45 days of vegetation the most high value of the length of the leaves to be recorded in the variant at V3 - Red summer radish, and the smallest at V2 - White summer radish. During the entire determination period, the highest average values of the diameter of the main root were determined for the variant V3 - Red summer radish, and the lowest for the variant V2 - White summer radish. The highest values of the length of the main root in the first 15 days of vegetation were recorded for the variant V3 - Red summer radish, and the smallest ones at V2 - White summer radish, and after 45 days the longest length was recorded for the variant V2 - White summer radish, and the smallest at V3 - Red summer radish.

References

[1] Petrescu Irina, Sarac I. and colab, 2015, Morphological aspect for the grain pollen of Alopecurus pratensis and Dactylis glomerata, Volume 19(4):89-92, JOURNAL of Horticulture, Forestry and Biotechnology.

[2] Morgan, A.P. argyle: An R Package for Analysis of Illumina Genotyping Arrays. G3: Genes Genomes Genet. 2016, 6, 281–286.

[3] Steel, R.C.D.; Torrie, J.H., 1981, Principles and Procedures of Statistics; McGraw-Hill Book Company, Inc.: New York, NY, USA, pp. 34–74.

[4] Ismail, B.P.; Senaratne-Lenagala, L.; Stube, A.; Brackenridge, A., 2020, Protein demand: Review of plant and animal proteins used in alternative protein product development and production. Anim. Front., 10, 53–63.

[5] Tan, M.; Koc, A.; Dumlu Gul, Z., 2012, Morphological characteristics and seed yield of east Anatolian local forage pea (Pisum sativum ssp. arvense L.) ecotypes. Turk. J. Field Crops, 17, 24–30.

[6] Tuver, G.Y., Ekinci, M. & Yildirim, E., 2022, Morphological, physiological and biochemical responses to combined cadmium and drought stress in radish (Raphanus sativus L.). Rend. Fis. Acc. Lincei 33, 419–429.

[7] Federer, W.T.; Crossa, J., 2012, Screening experimental designs for quantitative trait loci, association mapping, genotype-by environment interaction, and other investigations. Front. Physiol., 3, 1–8.

[8] Reckling, M.; Döring, F.T.; Bergkvist, G.; Stoddard, L.F.; Watson, A.C.; Seddig, S.; Chmielewski, M.F.; Bachinger, J., 2018, Grain legume yields are as stable as other spring crops in long-term experiments across northern Europe. Agron. Sustain. Dev., 38, 191.

[9] Aboagye, L.M., 2007, Strategies for sustainable conservation and use of legume genetic resources in Ghana. Ghana J. Sci., 47, 59–67.

[10] Naeem, M.; Awais Ghani, M.; Muhammad Atif, R.; Amjad, M.; Ahmad, T.; Batool, A.; Muzammil Jahangir, M.; Ali, B.; Mehran Abbas, M.; Nadeem Akram, M., 2020, Estimation of correlation and path coefficient for morphological and quality related traits in pea (Pisum sativum L.). Bangladesh J. Bot., 49, 549–555.

[11] Gallia Butnaru, Ioachim Căpălnăşan, Ioan Sărac, 2006, Cromosomii: particularitati morfo-functionale la plante si animale.

[12] Ciofu Ruxandra şi colab, 2004 - Tratat de legumicultura. Editura Ceres, București.

[13] Gherghi, A. şi colab., 2001, Biochimia şi fiziologia legumelor şi fructelor, Ed. Academiei Române, Bucureşti.

[14] Maximilian, C., Ioan, D.N., 1984. Dicţionar enciclopedic de genetică, Editura Ştiinţifică şi Enciclopedică.

[15] Caroline E. R., Norman C. E., 2009, Rapid evolution of morphology and adaptive life history in the invasive California wild radish (Raphanus sativus) and the implications for management.