ANNALS OF THE UNIVERSITY OF CRAIOVA

Series: ✓*Biology*
✓*Horticulture*
✓*Food products processing technology*
✓*Environmental engineering*

Vol. XXVII (LXIII) - 2022

VARIABILITY OF SOME MORPHOLOGICAL CHARACTERISTICS OF Lamium purpureum L. WEED

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Keywords*: Lamium purpureum, fruit formations, nuts, morphological characters, variability*

ABSTRACT

Among the species of weeds with early emergence in spring is Lamium purpureum L. The plant is observed by its appearance in the form of small hearths, with relatively high densities, in addition to and in the areas cultivated with wheat. On the one hand, there was an obvious spread in agricultural areas, and on the other hand, a certain culinary and medicinal interest increased. Its spread occurs through the relatively high number of seeds it produces and their persistence in the soil. Morphological characters have shown a continuous evolution, depending on the ecotype existing at a given time. Thus, the average plant measured 13 cm in height and weighed 0.12 g of dry matter. One plant had on average 35 top-like fruit formations, and the number of nuts on a plant was 28. The nuts were 1.8 mm long and 0.8 mm thick. and the mass of one thousand walnuts was at the level of the whole experiment of 0.57 g. Significant positive correlations were obtained between the height of the plants with their weight, with the number of fruit formations and with the number of seeds/ nuts. Negative correlations were between the length of the nuts and the other characters. The determinations performed showed that the weed also adapted to the current climatic conditions in the agricultural field, with the increase of the fruiting of the plants.

INTRODUCTION

The adaptation of weeds to the new current conditions (Abu-Ziada et al. 2014) can also be observed by studying the tendency of variability of specific morphological characters (Layka et al. 2011). It was found that a weed with the variability of morphological and reproductive characteristics as large as possible, managed to adapt much better to the ecology of a crop (Jones et al., 2012) or any other plant area. A known weed in agricultural fields is also *Lamium purpureum* L. (pro syn *L. rubrum* Landoz, red dead- nettle, purple dead- nettle, red henbit, purple archangel, velikdenche, LAMPU in Bayer code). The name *Lamium* was given to it by Carl Linnaeus. The plant is an annual herb of the *Lamiaceae* family. Unlike stinging nettle, the plant does not sting, thus being one of the dead nettle species. The plant is widespread throughout Eurasia and has even settled on the American continents, where it is considered invasive (Willson & Traveset 2000). In our territory, LAMPU grows all over the country and is found both in the spontaneous flora of the plains and hills, as well as on uncultivated lands, through orchards, vineyards and garden edges. It is often found among the furrows in the fields, at the beginning of spring, before sowing, but also in autumn cereals (wheat).

It prefers various soils, from weakly acid to neutral, low in humus, loose, mostly no calcium, as are those in the resort. The plant stands out with a small size, with a square stem in section, leaves with short petioles and serrated edges. The shape of the leaves is cordate-ovate to triangular, especially at the top. *Lamium amplexicaule* differs from *L purpureum* by its sessile, reniform leaves, crenate-lobed leaves. Instead, the zygomorphic flowers are similar, of an intense red-purple color, being visited by insects for the nectar available in early spring (Denisow & Wrzesień 2015). Apart from the fact that the plant is honey, its younger parts can be used for culinary purposes. From a medicinal point of view (Ito et al., 2006; Sen & Samanta, 2015: Waller et al. 2017), the plant contains an essential oil (Flamini et al., 2005) rich in *germacrene D*. The seed-nuts contain about 16% "*lamenallenic acid*" (*octadeca-5,6-trans-16-trienoic acid*) and unsaturated esters: *oleates, linolates* and *linolenates* (Bubueanu et al. 2013). The plant contains *phenylethanoid glycosides* called *lamamiides A, B, C, D* and *E*. They contain *3-O-glycosides-6"-O-malonyltransferase flavonol*. The number of chromosomes is n = 9, respectively 2n = 18 (Norihito et al., 2005; Bendiksby et al., 2011). The plant forms ovoid small- nuts, elongated, with 2 flat faces and a convex outer one and the truncated tip. The nuts are 2.0-2.7 mm long and are smaller than those of the *L. amplexicaule* species. To define some morphological characteristics, the following were measured: plant height and weight, number of bud type flowers per plant, number of nuts per plant and size of nuts: length and thickness (figure 1 and figure 2).

Figure 1. *L. purpureum* flowering plant


Figure 2. The small-nuts of the species

MATERIALS AND METHODS

The determinations were performed during March on the mature plants of *Lamium purpureum*, in the last two years. Plants were chosen from the field of autumn wheat cultivated within the resort. Thus, 100 plants of *L. purpureum* were harvested, by cutting from the ground, from several hearths, by crossing in the zig-zag system. The plants were brought to the laboratory, kept for a period to dry, after which each one was analyzed. The measurements and determinations were as follows: plant height and weight, number of bud type-flowers on a plant, number of nuts formed on a plant, length and thickness of nuts. Due to the very small mass of walnuts on a plant, the weight of a thousand walnuts was made at the level of 100 plants. The study of morphological characters in the species *Lamium purpureum* was done in three directions. Thus, on the one hand, analyzes were made on the data sets obtained, by the method of frequency polygons (histograms). Class intervals were used in the method. The histograms present, on the one hand, the mod values (highest frequencies), then the limits of the variability intervals of the studied

characters, as well as the specifics of each character of the plant ecotype in the analyzed area. On the other hand, simple correlations were established between the analyzed characters, with the help of which their tendencies within the studied ecotype could be observed. Excel was used to express values. The data obtained were compared with the theoretical values of transgression probabilities for 5%, 1% and 0.1%. Thirdly, for the statistical calculation of all the determined characters, the analysis of variance (anova test) was used, namely on the variation strings. Statistical parameters were calculated using the formulas: $\bar{a} = \Sigma x/n$, where $\bar{a}$ = average of the determinations, and x = determined values, S^2 (variance) = $1/(n-1)$. $[\Sigma x^2 - (\Sigma x)^2/n]$, S (standard error) = $\sqrt{(S^2)}$, S% (coefficient of variation) = $S/\bar{a}.100$.

RESULTS AND DISCUSSIONS

Variability of plants and fruits. There is a competition between wheat and weed seedlings. In this interaction the weed forms plants with specific morphological characters. Thus, the height or plant was between 9 and 21 cm (figure 1). Of these, those with 13 cm (26%) dominated. Close to them were the plants that measured 11 cm (20%), 15 cm (23%) and 17 cm (14%), respectively. From these data it results that within the hearth the species has a relatively small size (figure 2), but in this early phase, the high density of the plants was dominant in the wheat field.

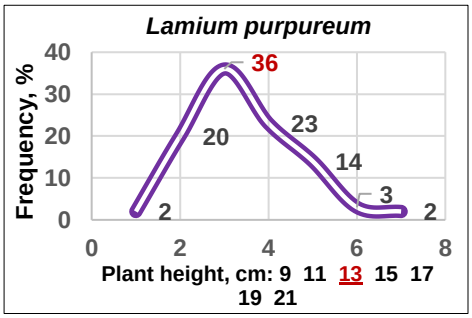

Figure 1. Frequencies of plant height

Figure 2. *L. purpureum* flowering plants

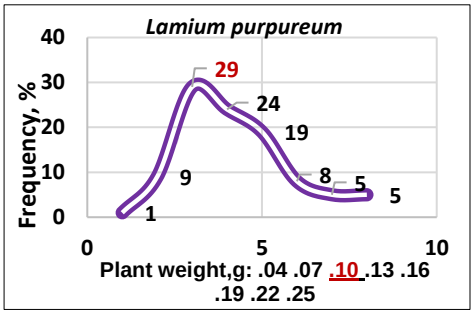

Figure 3. Frequencies of plant weight

Figure 4. *L. purpureum* mature plant

The biomass of a plant was between 0.04 g and 0.25 g. (figure 3). Dominant were plants weighing 0.10 g (36%). Those with 0.13 and 0.16 g accounted for 23% and 19%, respectively. Plants with 0.22 g and 0.25 g accounted for 5% of the total.

A mature plant of *L. purpureum* is shown in figure 4. The image shows the characteristics of leaves and bud type-flowers formations.

The floral arrangement consists in joining 2-3 bud-like formations, compressed, in the form of vertices, at the underside of the leaves. The calyx is globose, bell-shaped, with lanceolate, subulate and long teeth. The number of these formations was different. Determinations resulted in between 20 and 70 bud-type on a plant (Figure 5). The dominant number on a plant of *L. purpureum* was 30 bud-type (32%), followed by those with 40 buds (26%) and those with 50 buds (15%). Plants with 20 bud-type accounted for 13%, and those with 70 buds, 2%. Nuts like seeds are formed in these bud-type (figure 6).

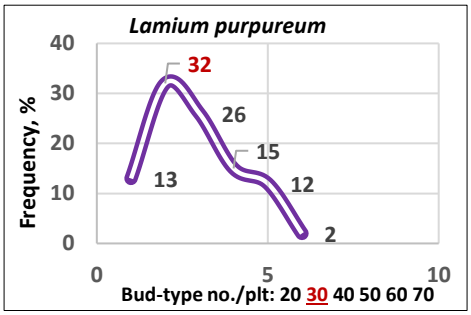

Figure 5. Frequencies of bud-type/plant

Figure 6. Bud-type position

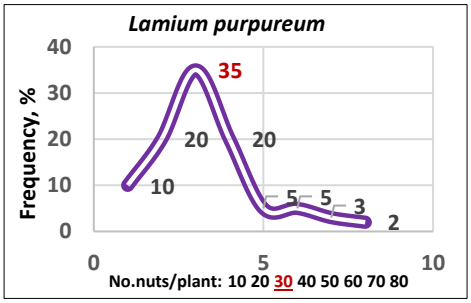

Figure 7. Frequencies of nuts no./plant

Figure 8. Nuts, buds and leaf of LAMPU

The seeds/ nuts have an elongated shape, with two flat faces and a convex outer face, brown- gray in color. The surface of the nut has whitish dots. The number of nuts on a plant was also variable. The determinations showed values between 10 and 80 nuts (figure 7). Of these, plants with 30 nuts (35%) dominated, followed by those with 20 nuts (20%) and those with 40 nuts (20%). Plants with 80 nuts accounted for only 2% of the total. The positioning of the tops at the base of the leaf and the tops containing nuts is shown in Figure 8.

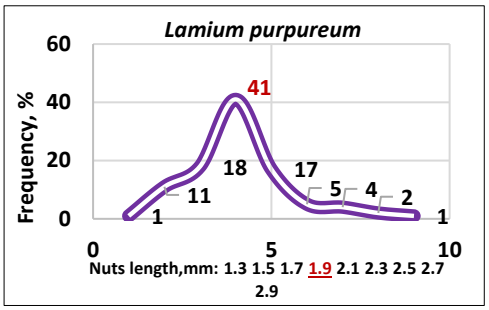

Figure 9. Frequencies of nuts length

Figure 10. Nuts length aspect

The nuts are generally 2.0-2.5 mm long and 1.0-1.2 mm thick (Willson & Traveset, 2000). The determinations showed that the length of the nuts was between 1.3 mm and 2.9 mm (figure 9). The dominant length was 1.9 mm, in proportion of 41%. This was followed by 1.7 mm (18%) and 2.1 mm (17%) long walnuts. 2.9 mm walnuts accounted for only 1%. During the maturation of the tops, the nuts are disseminated in nature (figure 10).

The thickness of the nuts was between 0.5 mm and 1.2 mm (figure 11). The nuts of 1.0 mm thickness (29%) dominated. Nuts with a thickness of 0.9 mm (21%) and those with 0.7-0.8 (both by 16%) followed in descending order. Walnuts with a thickness of 0.5 mm accounted for 1%, and those with 1.2 mm accounted for 3%. The appearance of mature walnuts during dissemination is shown in Figure 12.

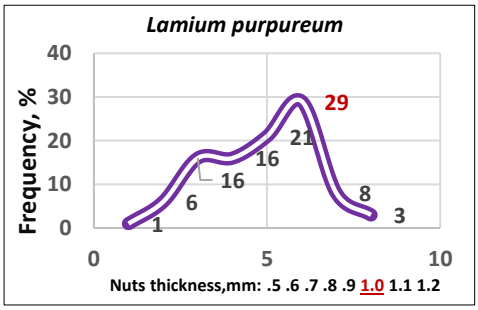

Figure 11. Frequencies of nuts thickness

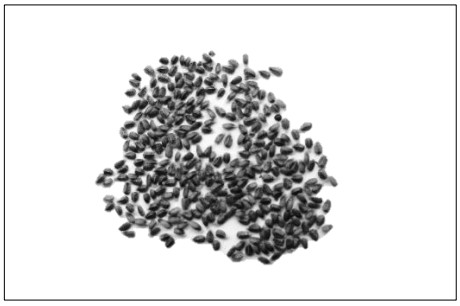

Figure 12. The specific nuts of the species

Correlations between main characters. Simple correlations have been established between the morphological characters of the weed. The aim was to observe the tendencies of their manifestation in the researched area. Among the significant links, a positive and a negative one will be analyzed. Thus, the correlation between plant size and the total number of nuts on a plant was distinctly significant positive (r = 0.270 **). From the distribution of values in the graph there is a larger grouping of the number of nuts, ie up to 40 on plants with heights between 10 and 18 cm (figure 13). At the same time, more than 40 walnuts were formed on other plants in approximately the same register of plant heights. This means that some plants have found more favorable conditions offered by the young wheat field.

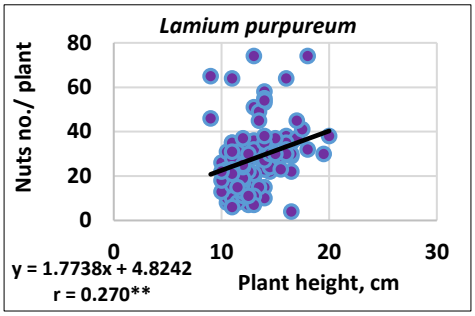

Figure 13. Correlation between plant height and no. of nuts/ plant

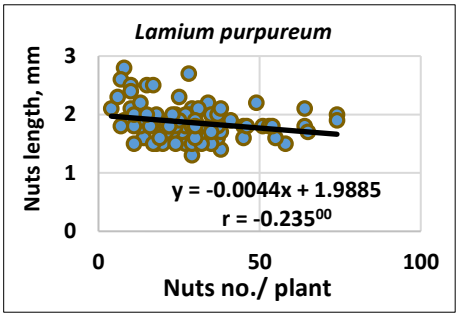

Figure 14. Correlation between nuts no./ plant and nuts length

The correlation between the number of nuts on a plant and the length of the nuts was negative, with statistical assurance (r = -0.235^{000}). The graph shows the great diversity of the number of nuts below 2 mm in length. At the same time, nuts with longer lengths, ie between 2.5 mm and 2.9 mm, formed in fewer nuts on a plant of *L. purpureum*. In general, the correlation confirms that plants with fewer nuts favor their size.

The morphological characteristics of *L. purpureum* plants showed quite different causal links - table 1. Among these are the positive correlations of plant size and the number of nuts on a plant. This shows that when weeds find better conditions in the wheat crop, the plants will form a larger number of seeds / nuts.

Similarly, plant biomass correlated very significantly with the number of bud-type and the number of nuts. And in this case the conditions in the culture environment can favor the plants of *L. purpureum*. At the same time, the better the weed plants find conditions in the wheat ecosystem, the more nuts they will produce (r = 0.4956 ***).

At the same time the length of the nut was negatively correlated with all the other characters and especially with their number (r = -0.2353^{00}), which shows that by forming more seeds/ nuts on a plant, they will have shorter lengths. The thickness of the walnut was negatively correlated only with the height of the plants, which shows that those taller plants will form more walnuts, but with smaller thicknesses.

Table 1

Correlations between the main characters of *Lamium purpureum* weed

Characters	Plant height	Plant weight	No. bud-type	Nuts no.	Nuts length	Nuts thickness
Plant height, cm	1	0,0141	0,1664	**0,2700**	-0,1697	-0,0547
Plant weight, g		1	**0,6397**	**0,4792**	-0,0830	0,1452
No. buds/ plant			1	**0,4956**	-0,1860	0,1039
No. nuts/ plant				1	**-0,2353**	0,0173
Nuts length, mm					1	0,0173
Nuts thickness, mm						1
LSD 5%=0,19 LSD 1%=0,25 LSD 0,1%=0,32						

Statistical analysis of the variability of morphological characters. Calculated for each character analyzed: mean (ā), variance (s2), standard error of mean (s) and

coefficient of variation (CV, %). The statistical estimates performed revealed characteristic values of the Lamium purpureum ecotype from the wheat crop. The values obtained were characteristic. Thus, the plant measured 13.1 cm and weighed 0.12 g. The plant formed 34.6 tops and 28.2 walnuts. The length of the walnut measured 1.8 mm and was 0.8 mm thick (Table 2).

The average variability had the size of the plants and the size of the nuts. The weight of the plant, the number of tops and especially the number of nuts on a plant had great variability.

CONCLUSIONS

a) A common species present in early spring in wheat cultivation is *Lamium purpureum* L. The weed is widespread in our country and in the south of the territory. The existing eco-type is very well adapted by specific biology.

b) In order to control it through one's own management, it is good to know as many morphological characters as possible. From the observations it was found that a weed species, which expresses a wide variability of morphological characters, demonstrates higher degrees of adaptability, and complex control measures will be more extensive. The morphological variability, on the whole plant, as well as for the reproductive one, being less known in the wheat culture, could bring some new information within the existing eco-type in these conditions.

c) Average variability was found in plant height (17%) and nut size (14-18%). High variability was found for all other characters analyzed. They actually express degrees of adaptability of the weed species among winter wheat plants.

Table 2

Statistical indices of *Lamium purpureum* morphological characters

Indices	The main characteristics					
	Plant height, cm	Plant weight, g	Bud-type no./ plt.	Nuts no./ plt.	Nuts length, mm	Nuts thickness, mm
Mean	**13,1**	**0,12**	**34,6**	**28,2**	**1,8**	**0,8**
Variance, s^2	5,13	0,002	163,0	221,4	0,07	0,02
Standard error, s	2,26	0,04	12,7	14,88	0,26	0,14
Var.Coeff.%	**17,25**	**33,33**	**36,70**	**52,76**	**14,44**	**17,50**

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