
BIOMETRIC AND PRODUCTION CHARACTERIZATION OF SOME *LOTUS CORNICULATUS* L. GENOTYPES

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Abstract. The *Lotus corniculatus* L. species is important from the point of view of its nutritional quality, used as animal feed, contributing to increased lactation in ruminants. It is also used due to its high adaptation to harsh weather conditions and resistance to acidic and arid soils, in this sense it is introduced for soil remediation and cover crop in orchards due to its nitrogen-fixing capacity. The study was conducted in the research fields of ARDS Lovrin, Romania within the laboratory for the improvement of fodder and protein plants, during 2022-2023. The purpose of the study is represented by 10 Birdsfoot Trefoil genotypes harvested from the wild flora in the plain area of Banat, Romania, on which were made quantitative measurements and determinations, of production evaluating the following characters: plant size, number of flowers, number of pods, number of seeds/pods. The results obtained from these determinations have highlighted four valuable genotypes that can be introduced in the breeding process as potential genitors for the creation of new varieties. Analysis of the studied genotypes shows that the number of flowers varies between 200 and 580 from a surface of 1 square meter, and the number of pods per square meter is between 70 and 2900, according to the study, the length of the pods is between 18.75 and 30.66 mm, the average number of seeds/pods differs between 18.3 and 22.90, and the length of the plant varies between 20 and 45 cm. The statistical analysis and interpretation of the results highlights genotypes Lc119, Lc108, Lc73 and Lc62 in terms of analyzed productivity characteristics.

Keywords: *Lotus corniculatus* L., production, morphological characters, genotype.

INTRODUCTION

Birdsfoot Trefoil (*Lotus corniculatus* L.) is a species of perennial fodder legume, allogamous, generally tetraploid and self-compatible (Grant, 1991; Sindhu, 2004), known for its importance as animal feed, with a role in increasing lactation in ruminants (Grabber, 2014; Istrate, 2022), with a high nutritional value which does not cause bloating if grazed directly from the ground by animals.

It is characterized by high adaptation, withstands low-fertility, acidic and arid soils (Maroso, 2009; Drobná, 2010; Ayres, 2007) but also with a potential for soil remediation, being often recommended as a cover species due to the fact that it fixes nitrogen in the soil (Yerlikaya, 2019). Following certain studies, its use for medicinal purposes its anti-spasmodic and sedative role has been identified (Yerlikaya, 2019).

It is known that *Lotus corniculatus* L. species presents different problems in terms of seed production, in the sense that it produces a large amount of seeds, but there are different impediments characteristic of the genetics of the species that can lead to seed loss, aspects that are investigated in national and international breeding programs (Qingfeng, 1989; Wright, 1987). A first cause is that the pods are dehiscent (Repková, 2009; Grant, 1996) and they open very quickly in the phenophase of seed ripening, another aspect is represented by the flowering period that occurs in stages, so far it is difficult to identify the optimal harvesting time in order to achieve a minimum loss of seeds but also to ensure seed maturation for high germination (Anderson, 1955). An indicator constantly used to determine the optimal harvest time is the color of the pods, which at maturity has a tan, almost black hue. Harvesting is carried out when a percentage of 70-80% ripeness is reached, the color of the pod is darker and the pod texture and drying is observed (Winch, 1985, Churkova, 2011).

Other factors studied that influence seed production in this species are temperature and photoperiod. The study conducted by S.J. Long et al. In 1989 analyzed the influence of temperature and light regime (alternating cold temperature, constant cold, constant warm and alternating warm) on pod development and the number of seeds in pods. Following their experiments it was found that the number of seeds in the pod is not influenced by the thermal and light regime, but the size of the pods is strongly influenced, the ideal being reached at an alternating cooling regime (Long, 1989; Gatarić, 2013).

An important and constantly studied aspect from the point of view of seed production is the correlation between plant size, number of flowers, size of pods and number of seeds. Some research has shown that plants with a higher number of flowers produced more pods, but the size of the plants did not influence the size of the pods (Ollerton, 1998).

Another study indicates that the degree of dehiscence of the plant and the length of the pod do not show an important correlation in relation to seed production, high significance existing in the correlation between the amount of seeds, the number of inflorescences and the number of seeds in the pod (Dragomir, 2007).

MATERIAL AND METHODS

The study was conducted at ARDS Lovrin, Timis, Romania in the research fields of the laboratory for the improvement of fodder and protein plants (fig. 1). The soil on which the experience is located is a typical chernozem, weakly gleamed, blackish clay.

The biological material evaluated in this study is represented by 10 genotypes harvested from the wild flora in the western Banat area belonging to the *Lotus corniculatus* L. species. The genotypes were collected in the form of clones, divided into several individuals and then transplanted into the breeding fields intended for the study of germplasm collection, under the same pedoclimatic conditions, with the average multiannual temperatures between 10-12°C and the multiannual amount of precipitation between 550-650 mm. The genotypes were planted in rows, in three repetitions, with distance between plants in a row and between rows of 1 m.

To perform the measurements and determinations there were 10 plants taken from each repetition.



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Figure 1 – Location of the field with the genotypes of *Lotus corniculatus* L.

The 10 genotypes were analyzed in 2 developmental phenophases according to BBCH code (Meier, 2018) full bloom phenophase-BBCH 69 and full ripeness phenophase-BBCH 89. In the phenophase of flowering, determinations were made on the number of flowers per square meter and the size of plants, and in the phenophase of full ripeness on the size of plants, the length of the pods (fig. 2) and the number of seeds in the pods. These activities were carried out in the experimental field (fig. 1) and in the research laboratory.

Statistical interpretation was performed using the correlation method in Excel.



Figure 2 – Biometric measurements on pods

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RESULTS AND DISCUSSIONS

The main productivity elements studied in *Lotus corniculatus* L. are: number of pods/plant and number of seeds/pods. From studies conducted over time, highlighted by various bibliographic resources, there are significant differences between genotypes regarding the viability of flowers at different temperature oscillations in terms of pollination and fecundation. Starting from this aspect we can evaluate the level of fruiting of the crop and its productivity. According to data from literature (Varga, 1998) The seeds need a period of about 25 days to ripen, at which point they become dehiscent. One factor that increases pod dehiscence is atmospheric humidity (about 35%).

In the present study, the importance of correlating these characters will be found in subsequent breeding programs within the research laboratory, in order to create new varieties adapted to current climate conditions, with high ecological plasticity and suitability to different technologies.

The parameters taken in the study (number of flowers and pods per sqm, plant size, pod length and number of seeds/pods) were correlated and presented in graphs fig. 3, fig. 4 and fig. 5.

The correlation between the number of flowers and the number of pods per square meter, in the 10 genotypes studied, is very significantly positive, with a correlation coefficient $r = 0.850^{***}$, which proves that with the increase in the number of flowers also the number of pods increase.

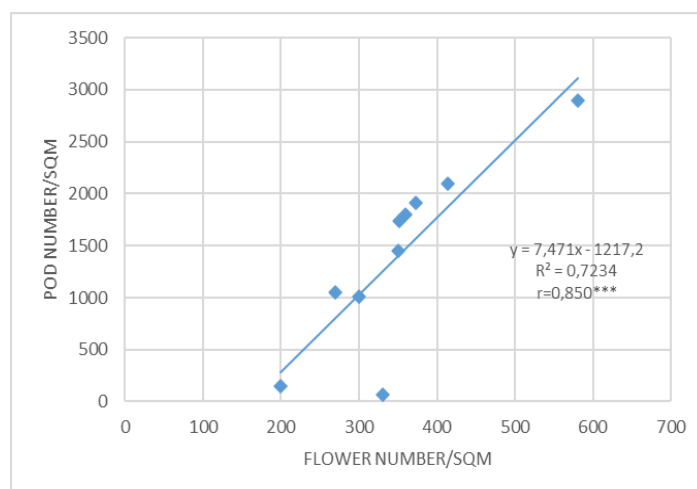


Figure 3 – Correlation between the number of flowers and the number of pods per square meter, in 10 genotypes of *Lotus corniculatus* L.

The number of flowers was determined in the phenophase of full flowering. The optimal period for determining this character is difficult, given the fact that flowering in this species is staggered, however, the most suitable optimal corresponds to the BBCH code 69. In the 10 genotypes studied, the number of flowers per square meter varies between 200 and 580. The statistical analysis and interpretation of the results highlights genotypes Lc108 and Lc73, with 414 respectively 580 flowers/sqm .

Given that on average, each flower (umbela) produces between 3 and 5 pods (Sindhu, 2004), the number of pods per square meter in the present study is between 70 and 2900. Also notable for this character are genotypes Lc73 and Lc108 with the highest number of pods 2100 for Lc 73 and 2900 for Lc 108. Analysis of the correlation between the two characters reveals a very significant positive difference, with a correlation coefficient $r=0.850^{***}$.

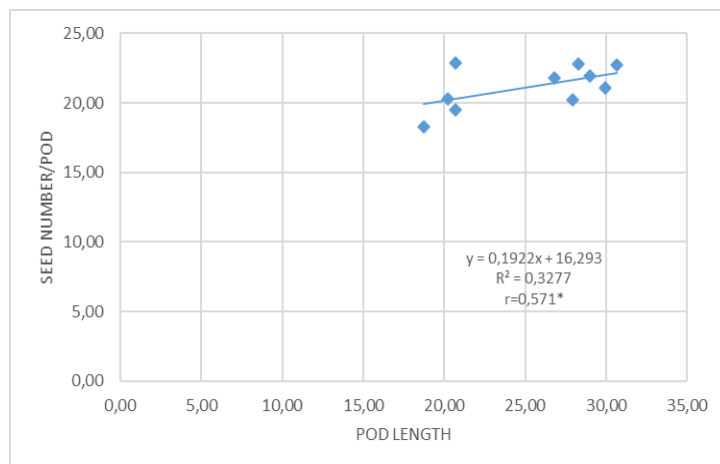


Figure 4 – Correlation between pod length and number of seeds/pods, in 10 genotypes of *Lotus corniculatus* L.

In the climatic conditions of the analyzed period 2022-2023, between the characters length of the pod and the number of seeds / pods (fig. 4) there is a significant positive correlation, highlighted by the value of the correlation coefficient $r = 0.571^*$ and the slightly upward trend of the correlation line. At an average pod length, varying according to genotype from 18.75 to 30.66 cm, the average number of seeds/pods varies between 18.3 and 22.90, with the best result obtained by genotype Lc62, 8% more compared to the average of the experience – 21.16 seeds.

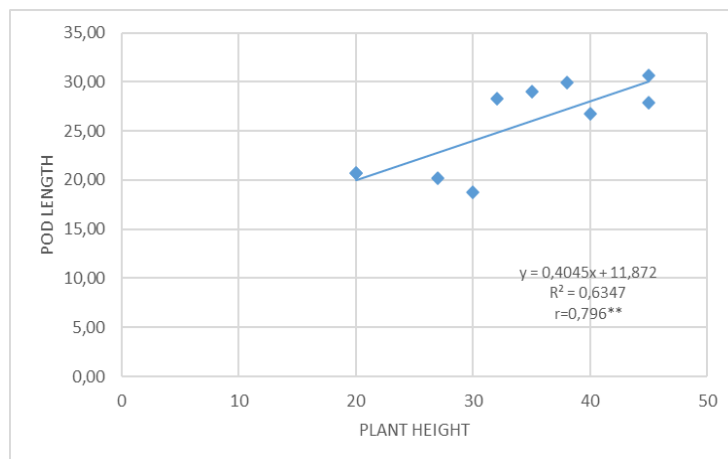


Figure 5 – Correlation between pod length and plant height

The correlation between the characters of the plant height and the length of the pods shown in figure 5 reveals a distinctly significant relationship between the two characters (correlation coefficient $r = 0.796^{**}$). The values, depending on the analyzed genotype, vary between 20 and 45 cm (plant size), respectively 18.75 and 30.66 (pod length). The genotypes that recorded the best result are Lc119 and Lc1312 in terms of plant height, and Lc119 and Lc1414 in terms of pod length.

Similar studies conducted by Rechițean et al. (2020) on some local populations of Birdsfoot Trefoil, highlight a population (Lv8) that has proven a good genotype for its characters: number of generative shoots/plant,

number of umbels/plant, number of pods/plant, number of seeds per plant and weight of seeds per plant, and which can be included in breeding programs for the creation of new varieties of Birdsfoot Trefoil.

CONCLUSIONS

Following the studies carried out on the main productivity characteristics of the 10 genotypes of *Lotus corniculatus* L. analyzed, the following conclusions are drawn:

- Between the number of pods and the number of flowers per square meter there is a very significant positive correlation;
- Between the length of the pod and the number of seeds/pods there is a positive significant correlation,
- Between the height of plants and the length of the pods there is a distinctly significant relationship, The results obtained demonstrate that there is a positive correlation between the main productivity characters, the higher the number of flowers, the higher the number of pods, and the longer the length of the pod results in an increase in the number of seeds in the pod.

The study highlights genotypes Lc119, Lc108, Lc73 and Lc62 with important productivity characteristics for the breeding process and with high potential in their use as resources for creating synthetic varieties of high productivity, nutritional and aesthetic value, suitable for different uses and adapted to current climatic changes.

The use of local, autochthonous populations of fodder plants, in this case Birdsfoot Trefoil, in breeding techniques is the guarantee of obtaining improved varieties that will be better adapted to the challenges posed by current and future climate change and to those of ensuring food security.

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