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Is it possible to develop dormancy groups for *Bituminaria bituminosa* L.?

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Abstract. This study was carried out with 86 *Bituminaria bituminosa* genotypes collected from Central Black Sea Region of Northern Anatolia in Samsun in 2012. After seed cleaning, germination tests and scarifying the seeds with sandpaper, seeds were sown in small pots. In November of 2012, the seedlings were transplanted to experimental field. No fertilizer and water applied throughout the study and spring and autumn elongation, hay yield and harvesting number in the second year of the plants (2014) were observed during the study. According to correlation analysis, there was a negative and statistically significant linear correlation between altitude and spring elongation, autumn elongation, harvest number. There was also a negative statistically insignificant correlation between altitude and hay yield. A positive and significant correlation was found between hay yield and spring and autumn elongations, harvest number; between spring and autumn elongations and number of harvest. Some genotypes taken from high altitudes stayed dormant in winter period, furthermore they started elongation later than the others and a slight growth was recorded in autumn. In the light of these results, it is possible to develop dormancy groups for *Bituminaria bituminosa* cultivars in future.

Keywords. *Bituminaria bituminosa* – Altitude - Spring and autumn elongation – Correlation – Dormancy groups.

Est-il possible de développer des groupes de dormance pour* Bituminaria bituminosa L.*, comme pour la luzerne ?

Résumé. *Cette étude a été menée sur 86 génotypes de* Bituminaria bituminosa *collectés dans la région centrale de la mer Noire au nord de l'Anatolie, à Samsun, en 2012. Après nettoyage et tests de germination, et abrasion au papier de verre, on fit germer les semences dans de petits pots. En novembre 2012 les plants furent transplantés aux champs. Pas de fertilisant ni d'eau ne furent appliqués durant l'étude, et on observa l'élongation de printemps et d'automne, le rendement en foin et le nombre de récoltes lors de la deuxième année des plantes (2014). Toutes les données obtenues pour les génotypes telles qu'altitude, élongation de printemps et d'automne, rendement en foin et nombre de récoltes, furent analysées ensemble. Les altitudes originelles de culture des génotypes se situaient entre 3 et 985 m. Le démarrage de l'élongation de printemps variait d'un génotype à l'autre. La hauteur des plantes selon les génotypes était mesurée vers la mi-avril pour le printemps et au début de novembre pour l'automne. En 2014 une récolte double fut effectuée pour 55 génotypes et une récolte simple pour 31. Selon l'analyse de corrélation, il y avait une corrélation linéaire négative et significative entre l'altitude et l'élongation de printemps, l'élongation d'automne, et le nombre de récoltes. Il y avait aussi une corrélation négative mais non significative entre l'altitude et le rendement en foin. Nous avons trouvé une corrélation positive et significative entre le rendement en foin et les élongations de printemps et d'automne, le nombre de récoltes; entre les élongations de printemps et d'automne et le nombre de récoltes. Certains génotypes prélevés à hautes altitudes sont restés dormants pendant la période d'hiver, en outre ils ont commencé l'élongation plus tard que les autres et ils avaient moins ou pas du tout de croissance en automne. À la lumière de ces résultats, nous pouvons dire qu'il est possible de développer des groupes de dormance pour des cultivars de* Bituminaria bituminosa *à l'avenir.*

Mots-clés. Bituminaria bituminosa – *Altitude - Élongation de printemps et d'automne – Corrélation – Groupes de dormance.*

I – Introduction

Bituminaria bituminosa (Bitbit) is a herbaceous deep rooted perennial legume that has been

used by farmers in the Canary Islands for hundreds of years where it is grazed in situ or is cut and fed green to dairy goats (Méndez, 2000). It is an extreme drought tolerant species, and produce good quality feed throughout the year. *Bitbit* remains green in summer and autumn in Mediterranean-type climates with minimal loss of leaves (Finlayson *et al*., 2012). The var. *bituminosa* has a wide adaptation across the Canary Islands (300-1000 mm) and is the only one present in the Mediterranean basin. In the Iberian Peninsula it is found in environments ranging from 250-1000 mm of rainfall and up to 1250-1500 m of altitude (Sternberg *et al*., 2006; Méndez *et al*., 2006). Natural distribution of *Bitbit* in Turkey is in coastal provinces, located in North, West and South of Anatolia (Davis, 1970; Kilinc *et al.,* 1998; Akcin *et al.,* 2010).

The main aim of the study was to determine relationships amongst yield, harvest number, spring and autumn elongation, original altitudes of genotypes. Thus, we could be obtained some information about dormancy characteristics of *Bitbit.*

II – Materials and methods

Seed samples of 86 *Bitbit* genotypes were collected from Central Black Sea Region in 2012. Regarding the altitude, *Bitbit* plants naturally grow from just nearby the sea (3 m) to south-eastern skirts of Mount Dranaz (985 m). After seed cleaning and germination tests, seeds were scarified and sown in small pots. In November of 2012, the seedlings were transplanted to the experimental field with 70 cm*70 cm spaces as 20 plants for each genotype. Measurements were realised on 10 plant samples for all genotypes in 2014. Plant height in spring was measured on 15th of April. Last harvest was performed at the end of September and plant height data about autumn growing before winter were taken at the beginning of November. In 2014, 55 genotypes gave twice harvest but 31 genotypes only once. Linear correlation and regression analysis were performed amongst the traits with SPSS 17.0 program.

III – Results and discussion

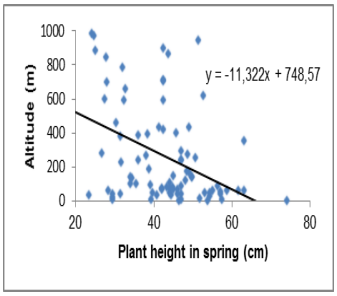
The altitude affected the measured traits negatively. As altitude increased, plant heights in autumn and spring, hay yield and harvest number decreased. While effect of altitude on elongation in autumn was statistically significant (r=-0.224*), elongation in spring and number of harvest were statistically significant affected by altitude at level of (P≤0.01). More hay yield was obtained from the genotypes when elongations in autumn and spring were high. The genotypes with elongation earlier in spring had higher hay yield and number of harvest (Table 1). Some other factors such as direction affect distribution of plant species. In south and south-eastern skirts and valleys of mountains, plants can survive up to 985 m altitude on the other hand cold winds come from Siberia and Balkans through north and north-western directions, limited the adaptation of *Bitbit* plants to 400-500 m altitudes.

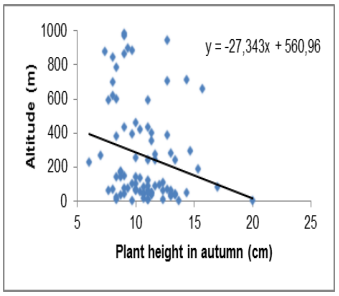
Table 1. Linear correlation values amongst the traits and their significance levels

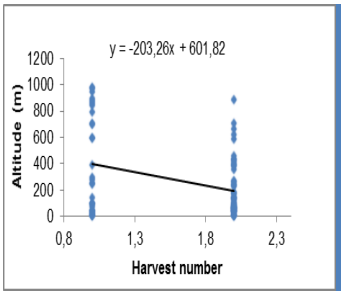
Traits	Altitude (m)	Plant height in autumn (cm)	Plant height in spring (cm)	Hay yield (g/plant)	Harvest number
Altitude	1				
Plant height in Autumn	-.224*	1			
Plant height in Spring	-.417**	.363**	1		
Hay yield	-.096	.278*	.433**	1	
Harvest number	-.337**	.064	.332**	.345**	1

*Indicated values at p ≤ 0.05; **indicated values at p ≤ 0.01 levels are significant.

The genotypes from high altitudes started elongation later than the others (Fig. 1). There was also slight elongation of those genotypes in autumn (Fig. 2). The plants adapted to high altitudes generally have dormancy characteristics and they stay dormant in autumn, winter and early spring period to survive in harsh conditions (Kilinc and Kutbay, 2004). *Bitbit* genotypes adapted to high altitudes had less elongation in autumn and also started to elongate late in spring.

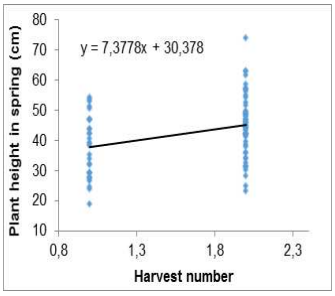


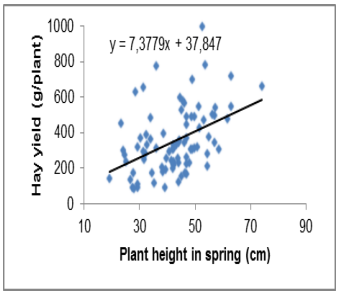


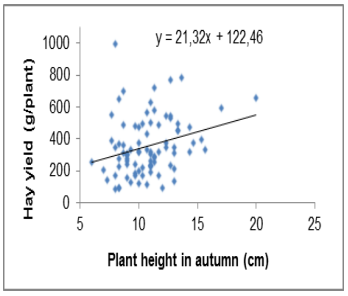


Figs. 1, 2 and 3. Relations between altitude and plant height in (1) spring and (2)autumn; relations between altitude and harvest number (3).

Regarding the altitude, as adaptation limits increased, the number of harvest was decreased (Fig. 3). Unlike Fig. 3, in Fig. 4, the genotypes started elongation earlier in spring had more number of harvests. The genotypes stayed dormant in winter, they started elongation late and natural consequence of this situation, number of harvest decreased. Some researchers determined clear differences amongst *Bitbit* genotypes in terms of cold tolerance, harvest number and hay yield (Correal, 2012; Real *et al*., 2014).





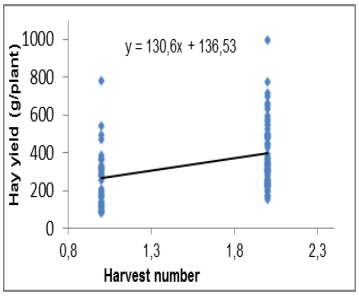


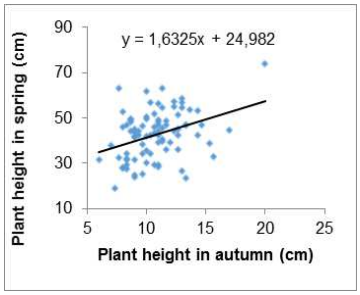
Figs. 4, 5 and 6. Relations between (4) plant height in spring and harvest number; hay yield and plant height in (5) spring and (6) autumn.

There were statistically significant correlation between hay yield and plant height in spring (r= 0.433**) and in autumn (r=0.278*) (Table 1 and Figs 5 and 6). The genotypes started elongation early in spring and continue their growth until autumn with higher hay yield than the others. Probably those genotypes have better regeneration ability of than the others. Furthermore, if a genotype started elongation early it has more time and natural resources for growing. Even if the plants keep growing and greenery in summer period, there are the best environmental conditions in spring, thus earlier genotypes have more advantage compare to the others.

It is not surprised that increasing number of harvest causes increasing hay yield (Fig. 7). Despite the decreasing hay yields through to sequencing harvests, the genotypes had higher number of harvest gave higher hay yield. There was a strong correlation between plant heights

in spring and autumn (r= 0.363**) (Table 1 and Fig. 8). The genotypes had more growth in autumn; they also started elongation earlier in spring due to no dormancy period.





Figs 7 and 8. Relations between hay yield and harvest number (7) and relations between plant heights in spring and autumn (8).

IV – Conclusions

There was a strong relation among the altitude, *Bitbit* genotypes, and growing characteristics. The genotypes adapted to high altitudes had a slight growth in autumn and they also started elongation later than the others in spring. They survived in cold period owing to dormancy or semi-dormancy. This behaviour of *Bitbit* plants is similar to alfalfa. In the light of these results, it is possible to develop dormancy groups for *Bitbit* cultivars in future.

Acknowledgment

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