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Morphological characterization within some Algerian populations of *Trifolium striatum* L. (Fabaceae)

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Abstract. Within the framework of the evaluation and utilization of the plant genetic resources having a fodder and pastoral interest in Algeria, a morphological characterization was done on three Algerian populations *Trifolium Striatum* L. This species is regarded as quite scarce in Algeria. Several characteristics relating to plant vegetative and generative such as, fruiting heads, pods and seeds were studied. The ecological factors (rainfall, altitude) as well as geographical coordinates (latitude and longitude) of the population natural environment were taken into account during the statistical analysis. Preliminary results showed the existence of an intraspecific variation. Width of the fruiting heads characteristic was found to be particularly interesting for the taxonomic level and should deserve a special attention. The variation noticed in some characteristics of the plant, maximum height, maximum width, winter daily growth rate, length of the fruiting heads, would be linked to longitude and latitude parameters of the natural habitat of the populations. The conservation, the valorization and the development of this fodder legume, adapted to humid regions with a lot of rainfall in Algeria, could contribute towards the natural enrichment of soils with nitrogen fixation and the improvement of the living standards of the local communities through the expansion of livestock farming.

Keywords. Clovers – Ecology – Fodder legume – Morphology – Natural habitat.

Caractérisation morphologique chez quelques populations Algériennes de* Trifolium striatum *L. (Fabaceae)

Résumé. *Dans le cadre de l'évaluation et de la valorisation des ressources phytogénétiques d'intérêt fourrager et pastoral en Algérie, une caractérisation morphologique a porté sur trois (03) populations Algériennes appartenant à* Trifolium striatum *L. Cette espèce est considérée comme assez rare en Algérie. Plusieurs caractères relatifs à la plante, aux infrutescences, aux gousses et aux graines ont été étudiés. Les facteurs écologiques (pluviométrie, altitude) et les coordonnées géographiques (latitude et longitude) du milieu d'origine des populations ont également été pris en compte lors des traitements statistiques. Les résultats préliminaires obtenus, indiquent l'existence d'une variabilité intraspecifique. Le caractère "largeur des infrutescences" se révèle particulièrement intéressant sur le plan taxonomique et mérite une attention toute particulière. La variation observée chez certains caractères de la plante (hauteur maximale, largeur maximale, vitesse de croissance journalière hivernale, longueur des infrutescences), serait liée à deux paramètres (longitude et latitude) de l'habitat naturel des populations. La conservation, la valorisation et le développement de cette légumineuse fourragère, adaptée aux régions fortement arrosées et humides de l'Algérie, permettraient de contribuer à l'enrichissement naturel des sols en azote et à l'amélioration du niveau de vie des communautés locales, à travers le développement de l'élevage.*

Mots-clés. *Ecologie – Habitat naturel – Légumineuse fourragère – Morphologie – Trèfles.*

I – Introduction

In Algeria, the genus *Trifolium* L. comprises 37 species, amongst *Trifolium striatum* L. (Quézel and Santa, 1962). This fodder legume, quite scarce in Algeria (Abdelguerfi *et al*., 2006), is present in

pasture and scrub (Quézel and Santa, 1962). It is adapted to poor soils or containing little total limestone and bearing acid to neutral pH of the heavily watered and humid regions (Abdelguerfi *et al*., 2006). Coste (1983) reported its presence in lawns and sandy areas in almost all France and Corsica. *T. striatum* is an exceedingly polymorphic species (Zohary and Heller, 1984). Only a critical (experimental) study of the wealth of forms included in the discussed species will finally determine their constancy and taxonomic value (Zohary and Heller, 1984). The present study is in line with the evaluation and development of the plant genetic resources bearing a fodder and pastoral interest in Algeria and follows on the several studies carried out on spontaneous fodder legumes (Issolah, 2006; Issolah and Abdelguerfi, 2010; Issolah *et al*., 2011).

II – Materials and methods

A behavioral preliminary study was carried out about 13 species and 144 populations of the genus *Trifolium* in Algeria. The number of populations varies from 2 to 31 according to the frequency of the species (Issolah, 2006). Three populations belong to *Trifolium striatum* L.. The trial was conducted at the experimental station of Guelma (East of Algeria), located at 227 m above sea level. The zone of study is subhumid. The average yearly pluviometry is 678.6 mm. The temperature is 11°C (mean minimum temperatures) and 23.8°C (mean maximum temperatures). The soil texture was clayey. The pH was 7. The populations were sown (07/11/1990), in total randomization, on 1m long rows (Issolah *et al*., 1993). The phenological characteristics observed were: H1 (24/03/91) : maximum height at the row; W1 (05/05/91) : maximum width at the row; S1: winter daily growth rate (from 11/02 to 24/03/91) (cm/day) ; S2: spring daily growth rate (from 24/03 to 05/05/91) (cm/day) ; 1F: Appearance of the first inflorescence; BF: Beginning of the flowering (one inflorescence per plant).

This work was followed up by a biometrical study on the fruiting heads, the pods and the seeds of *T. striatum* (03 populations). For each population, 30 fruiting heads were chosen randomly. The studied characteristics were as follows: size of fruiting heads (cm) : length (LF) and width (WDF) ; number of pods per fruiting head (PF) ; number of seeds per pod (SP) ; number of seeds per fruiting head (SF) ; seed size (mm) : length (LS), width (WS) at the rate of 3 seeds per fruiting head (90 seeds per population) ; weight (g) of 30 fruiting heads (WF) ; the weight of a thousand seeds (WTS) ; ratio for weight of seeds / weight of fruiting heads (RW) (Issolah, 2006).

Following the analysis of the morphological variation, relations between the phenological and biometrical characteristics were studied by taken into account, some ecological factors (altitude (ALT), annual rainfall (R) according to Gaussen and Bagnouls (1947)) as well as the geographical coordinates (longitude, latitude) of the natural habitat of the populations.

III – Results and discussion

The variance analysis showed that the characteristics of number of pods per fruiting head and width of fruiting heads were those that varied most, compared to the whole characteristics, and respective variation coefficients of 7.6 % and 8.7 % (Table 1).

Concerning the number of seeds per pod, Zohary and Heller (1984) reported 1 seed per pod in *T. striatum*. 1 to 2 seeds per pod were found in this study. However, 2 seeds per pod were rarely encountered. Length of fruiting heads varied between 1.23 and 1.29 cm with average 1.25 cm. A previous study indicated that the size of heads varies between 0.6 and 1.5 cm (Zohary and Heller, 1984). Our results indicated that the width of fruiting heads varied between 1.16 and 1.36 cm, with an average of 1.29 cm. We note that the difference between the two extremes as far as “length of fruiting heads” is concerned, is very limited, insignificant, hence the lack of homogeneous groups, and this contrary to “the width of fruiting heads” which put forward a very highly significant difference between populations. This would probably be linked to the fruiting heads

Table 1. The fruiting heads, pods and seeds characteristics of some Algerian populations of *Trifolium striatum* L.

Characteristics	Min	Max	Mean	Standard deviation	Coefficient of variation (%)
LF (cm)	1.23	1.29	1.25	0.03	2.8
WDF (cm)	1.16	1.36	1.29	0.11	8.7
PF	22.53	26.23	24.39	1.85	7.6
SP	1	2	1-2	–	–
SF	21.37	24.5	22.98	1.57	6.8
LS (mm)	1.88	1.90	1.89	0.01	0.5
WS (mm)	1.28	1.37	1.32	0.05	3.4
WF (g)	2.81	3.14	3.01	0.18	5.8
WTS(g)	2.65	2.99	2.81	0.17	6.1
RW	0.61	0.66	0.63	0.02	4.0

Min: Mean of a population. Max: Mean of a population. Mean: Mean of the species.

morphology. Indeed, we note that, within the same population, the fruiting heads are either lone or in pairs made up of two fruiting heads firmly assembled, nearly mixed up. Zohary and Heller (1984) informed that the heads are solitary or in pairs due to spurious dichotomy whereas Coste (1983) speaks about usually lone inflorescences in *T. striatum*. Thus, the characteristic «width of the fruiting heads» proves to be particularly interesting on the taxonomic point of view and deserves a special attention.

A biomerical study conducted on 139 algerian populations of 12 species of the genus *Trifolium* L. indicated that *T. spumosum*, *T. repens*, *T. bocconei, T. fragiferum* and *T. resupinatum* presented a large size (lenght) of fruiting heads (Issolah, 2006). This also study signalized that *T. repens, T. spumosum, T. bocconei, T. glomeratum* were characterized, by a high number of seeds per fruiting head (Issolah, 2006). The discriminant factorial analysis, applied on seven species of *Trifolium* (*T. campestre*, *T. scabrum*, *T. tomentosum*, *T. glomeratum*, *T. fragiferum, T. resupinatum, T. striatum*), revealed that the biometical characteristics (width of fruiting heads, weight of a thousand seeds, weight of fruiting heads, number of pods per fruiting heads and the number of seeds per fruiting head) were the most discriminant, comparing to the bloom and particularly to the vegetative growth ones (Issolah, 2006).

Concerning the matrix of correlations (Table 2), certain characteristics (H1, W1, S1) relating to the vegetative growth of the plants were noticed to be positively correlated to the longitude and negatively to the latitude of the natural habitat of the populations. Concerning the fruiting heads, only the characteristic “length of fruiting heads” proved to be positively correlated with the longitude of the natural habitat of the populations. Thus, the efficient populations, for some characteristics, come from the eastern regions located inland. There were found not to be relations either between the phenological and biometrical characteristics on the altitude and/or rainfall of the natural habitat of the populations (Table 2).

Previous studies conducted on several species of clovers in Algeria indicated that the altitude was the factor that had affect on the size of fruiting heads (lenght), specially in *T. scabrum* and *T. campestre* (Issolah, 2006). The number of pods per fruiting heads was negatively linked to the altitude in these two species (*T. scabrum* and *T. campestre*). Within *T. campestre*, the vegetative growth (width), was positively linked to the altitude (Issolah, 2006). This factor (altitude) also had affect on the bloom within *T. tomentosum* and *T. glomeratum* (Issolah, 2006). In *T. bocconei,* the number of pods per fruiting head was positively linked to the latitude of the natural habitat of the populations (Issolah and Abdelguerfi, 2010).

Table 2. Relations between the morphological characteristics and the ecological factors within some Algerian populations of *Trifolium striatum* L.

	Morphological characteristics								
Ecological factors	**H1**	**W1**	**S1**	**S2**	**1F**	**BF**	**LF**	**PF**	**SF**
Altitude	NS	NS	NS	NS	NS	NS	NS	NS	NS
Rainfall	NS	NS	NS	NS	NS	NS	NS	NS	NS
Longitude	**1*** **	**1*** **	**0.998***	NS	NS	NS	**0.997***	NS	NS
Latitude	**-0.999***	**-1*** **	**-0.999***	NS	NS	NS	NS	NS	NS

Characteristics : see Materials and methods for details.

*P<0.05, **P<0.01, ***P<0.001, NS: no significant.

IV – Conclusions

The obtained results showed the existence of a certain variation within *T. striatum*. The characteristic of the fruiting heads width have been found to be particularly interesting for the taxonomic point of view and deserves a special attention. For some characteristics, the observed variation would be related to the longitude and the latitude parameters of the natural habitat of the populations. Taking into account the number of populations being restricted, a larger number of individuals and populations could reveal more information on the behaviour and morphological characteristics of *Trifolium striatum* L.

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