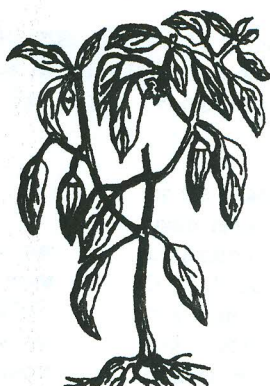


CAPSICUM & EGGPLANT NEWSLETTER



NUMBER 23

2004



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<http://www.capsicum.unito.it>**

CHARACTERIZATION OF LOCAL PEPPER LINES FROM NORTHWEST SPAIN

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SUMMARY:

Eighteen local pepper (*Capsicum annuum*) lines from Northwest Spain were evaluated at Mabegondo (A Coruña) on 2002. These lines showed a great variation in morphological traits. Principal component analysis was carried out to identify clusters of morphological and agronomical homogeneous behaviour. A hierarchical clustering method on the first three components was used to separate four different groups (72 % of variance explained). Each cluster was described by the means of the different traits and compared with other clusters. The great variation within lines was no obstacle for the distinction of the two types of pepper (Couto and Padrón). The higher variability in traits was observed within the “Couto” type lines. Fruit characters have a higher weight in the characterization than other morphological characters.

INTRODUCTION:

The “Padron” peppers are local hot pepper cultivars brought to the northwest of Spain on the XVII century, with short triangular fruits (Nuez *et al*, 1998; Estrada *et al*, 2000). This type of peppers is not only produced on the northwest of Spain and is very appreciated by the spanish consumers. The “Couto” pepper is a local ecotype cultivated on the province of A Coruña, very similar to the Padrón type with a longer non hot fruit (Carreiras, 1997).

Studies about *Capsicum* germplasm from the Northwest of Spain have only been reported by Nuez *et al* (1998), there are other authors that study some physiological aspects of “Padrón” type peppers (Estrada *et al*, 1998, 1999 and 2000). Local *Capsicum* collections are also being studied in other parts of Spain (Casquero & Guerra, 2000; Nuez *et al*, 1998).

The great variability between the local cultivars of *Capsicum annuum* in the Northwest of Spain, either within the “Couto” (Carreiras, 1997)

or the “Padrón” type (Estrada *et al*, 2000) is the main reason of the morphologic and agronomic evaluation of 18 local lines presented in this work. It would be interesting to complete the description of *Capsicum* local lines grown in Northwest Spain and to identify lines from this area with desirable characters useful for *Capsicum* improvement. The characterization presented here forms part of the Breeding Program of the Couto pepper, actually being carried out at the Centro de Investigaciones Agrarias of Mabegondo.

MATERIALS AND METHODS:

Eighteen local lines of *Capsicum annuum* were evaluated at the Northwestern Spain on 2002. The site was located at: (1) Mabegondo (43° 15'N, 8° 18'W) near the coast.

Thirteen of the eighteen lines belonged to the Couto type and were obtained at the Centro de Investigaciones Agrarias de Mabegondo during 1998 and 1999, the rest of the lines were Padrón type and selected at the Centro de Experimentación de Baixo Miño from 1995 to 1999.

All the lines were sown in february 2002 in greenhouse, the seedlings were then trasplanted to a plastic greenhouse. Plots (0,4m x 0,8 m) were laid out in a randomized block design with three replications and 12 plants per replication, and these were fertirrigated weekly by means of a drip irrigation system. The following measurements were recorded on every plant of each replication the sixth week after transplanting them: plant height, cross height, number of arms and stem diameter. At the stages of ripe fruits (red fruits) the following measurements were recorded on each of the 10 fruits randomly collected in each line at the two locations: weight, length, width, pedicel length, number of loculus, flesh thickness and placenta length.

Early plot yield (accumulated of the first four weeks of production) and total yield was also determined.

An analysis of variance of these traits was made using the following model for data from individual plants:

$$X_{ij} = M_u + b_i + g_j + (b \cdot g)_{ij} + E_{ijk}$$

Where: M_u is the overall average, b_i is the block effect, g_j is the line effect, $(b \cdot g)_{ij}$ is the block*line interaction and E_{ijk} is the residual (i.e. within plot) effect. The block effect was considered a random effect.

Data from fruits were analysed using the model: $X_{ij} = M_u + g_j + E_{ijk}$.

Yield data from plots were analysed using the following model: $X_{ij} = M_u + b_i + g_j + E_{ijk}$.

Multivariate relationships among lines were revealed with a principal component analysis (PCA) using a correlation matrix derived from the significant traits after the analysis of variance. The components with eigenvalues greater than one were used through hierarchical clustering analysis based on Euclidean distance computed between each population. The dendrogram formed by this method was cut at the four level cluster, each cluster being represented on the Principal Component Plan 1-2.

RESULTS AND DISCUSSION:

Means, range of variation and principal results of the ANOVA are in Table 1. Most of the characters presented a very significant line effect except stem diameter, early and total yields, fruit

flesh length as well as fruit number of loculi. Consequently, we will consider in this paper each line to be characterised by the eight significant characters: line means of these traits.

Table 2 .-Correlations between initial characters measured and the first two axes of a principal component analysis on a correlation matrix.

	Axis 1	Axis 2
P. height	0.3864	0.2277
Cross h.	0.3946	0.0713
N° arms	0.3074	- 0.0211
F. length	- 0.2656	0.5833
F.width	0.4338	0.0204
F. weight	0.3856	0.2009
Pedical length	0.4306	0.0539
Placenta length	- 0.086	0.7474
Eigenvalue	4.3865	1.3867
% Ac. Variance	54.83	72.17

Principal component analysis is used frequently to summarise large amounts of data. The first plan of the PCA explained the 72.17 of the total variance. The first axis can be interpreted as an axis related with plant characters (plant and cross height as well as number of arms). Axis 2 is explained by fruit characters like fruit width or pedical length. The projection of each line on the plan defined by Axis 1 and 2 are presented on Figure 1. Different lines are coded with numbers.

Table 1 – Mean, range of variation and main results of the ANOVA of morphologic and agronomic characters for 18 local pepper cultivars at Mabegondo

	Mean	Range	Block	Lines	Block*Line
Plants					
Height (cm)	108.4	87.5 – 126.3	***	***	***
Cross height (cm)	22.38	16.4 – 32.9	NS	***	NS
N° arms	2.55	2 – 3	NS	***	NS
Stem diameter (cm)	13.18	12.2 – 15.6	***	NS	***
Yields					
Early yield (g)	1771.38	1076.4 – 2348.6	NS	NS	
Total yield (g)	8162.3	5251 – 10074	NS	NS	
Fruits					
Length (cm)	8.211	6.75 – 9.63		***	
Width (cm)	2.588	2.02 – 3.25		***	
Weight (g.)	15.88	10.6 – 30.8		***	
Pedical length (cm)	2.429	1.95 – 3.23		***	
Flesh thickness (cm)	0.207	0.16 – 0.24		NS	
Placenta length (cm)	2.101	1.75 – 2.53		***	
N° loculus	2.72	2 – 3		**	

*, **, ***= significant at 0.05, 0.01 and 0.001 level respectively. NS – not significant.

Figure 1 .- Projection of 18 local lines of *Capsicum annuum* (1-18) on the plan 1-2 of a principal component analysis carried out on a correlation matrix on morphologic and agronomic traits. Accumulated variance = 72.17 %.

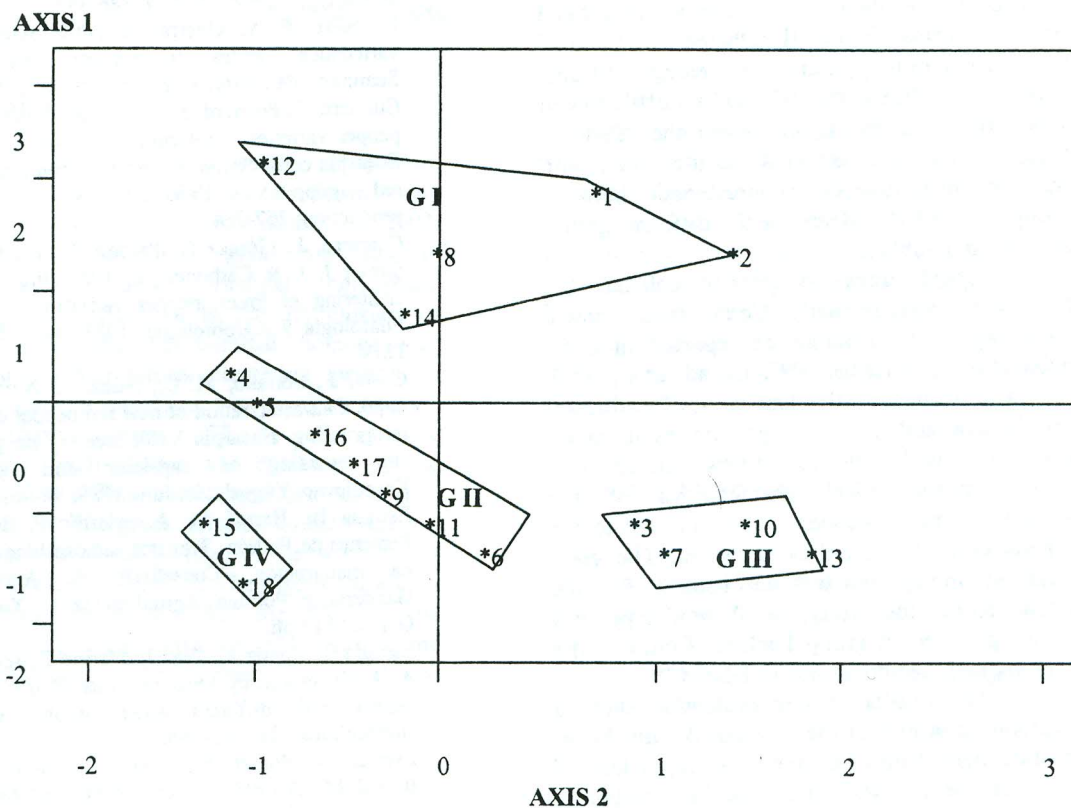


Table 3 . Means of the different groups obtained from the ascendent hierarchical classification. Means in the same line following the same letter are not significantly different from each other based on Duncan's multiple range test at P=0,05.

Groups	I	II	III	IV
Plants				
Height (cm)	128.82 a	106.40 b	96.92 c	99.36 c
Cross height (cm.)	30.88 a	18.48 b	19.39 b	18.93 b
N° arms	2.74 a	2.52 b	2.41 b	2.44 b
Fruits				
Length (cm.)	7.39 c	8.14 b	9.47 a	7.95 b
Width (cm.)	3.12 a	2.48 b	2.39 b	2.04 c
Weight (g.)	19.30 a	14.91 b	15.94 b	10.66 c
Pedicel length (cm.)	2.91 a	2.27 b	2.32 b	2.02 c
Placenta length (cm.)	2.01 b	2.09 b	2.39 a	1.77 c

An ascendent hierarchical classification carried out on the base of Euclidean distances obtained from the coordinates of the first three axes of the PCA allowed the lines to be regrouped in classes of a similar behaviour. A partition was chosen in four groups and 72 % of total variance was explained. The projection of the group number on the plan 1-2 showed that group I included all the "Padron" type lines with short and triangular fruits. Group III gathered the "Couto" type lines with long, pointed and elongated fruits. Group IV included the "Couto" type lines with short triangular fruits, similar to the "Padrón" type, and group II gathered "Couto" lines with fruits that had intermediate characteristics between groups III and IV. Means of the different groups are shown in table 3.

Local lines of pepper collected in Northwest Spain, specially "Couto" type, show a wide range of variation, as reported in other publications (Carreiras, 1997; Estrada *et al*, 2000; Rivera & Andrés, 2001). This work of evaluation and the availability of these genetic resources are going to allow the selection of new cultivars, with typical morphological characteristics of the respective type of pepper and adapted to the conditions of the Northwest Spain. The great variation among lines was no obstacle for the distinction of the two types: "Padrón" type lines are all gathered in group I while "Couto" type lines are included on groups II, III and IV.

The results of this evaluation show a great variation in 8 of the 12 studied traits, being most of them fruit characters. The importance of fruit characters – flesh thickness, fruit weight or fruit width - on pepper evaluations has been reported previously by other authors (Cuartero and Pochard, 1977; Costa *et al*, 1989; Cuartero *et al*, 1983; Berchez & Dumitrescu, 1995).

It is also important to mention the great variation recorded in characters non related with the fruit such as plant height, cross height and number of arms which may be successfully used for the distinction of the two types of peppers.

The reduced variation in yield is also an important character for the respective breeding programs. The small variation on the early yield among the "Couto" type lines differs from previous reports (Rivera *et al*, 2001) and is also a very important character for breeding as pepper prices have important oscillations along the production period.

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