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Analysis of phenotypic and genotypic variability of 30 Moroccan genotypes of cactus pear *(Opuntia ficus indica Miller)*.

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OBJECTIVE

- The evaluation of the variability and the estimate of the genetic parameters of the agro morphological characters at 30 genotypes of cactus pear .

PLAN

- Introduction
- Materials and methods.
- Results
  - I. Analysis of phenotypic variation.
  - II. Heritability and genotypic gain
- conclusion

INTRODUCTION

Cactus pear has a very high economic importance in Morocco.

hence the need

The evaluation of variability and estimation of genetic parameters of agro morphological characters.

For select

Genotype suitable for:

- Forage & food production,
- Produce fruit and seeds
- Fight against erosion,

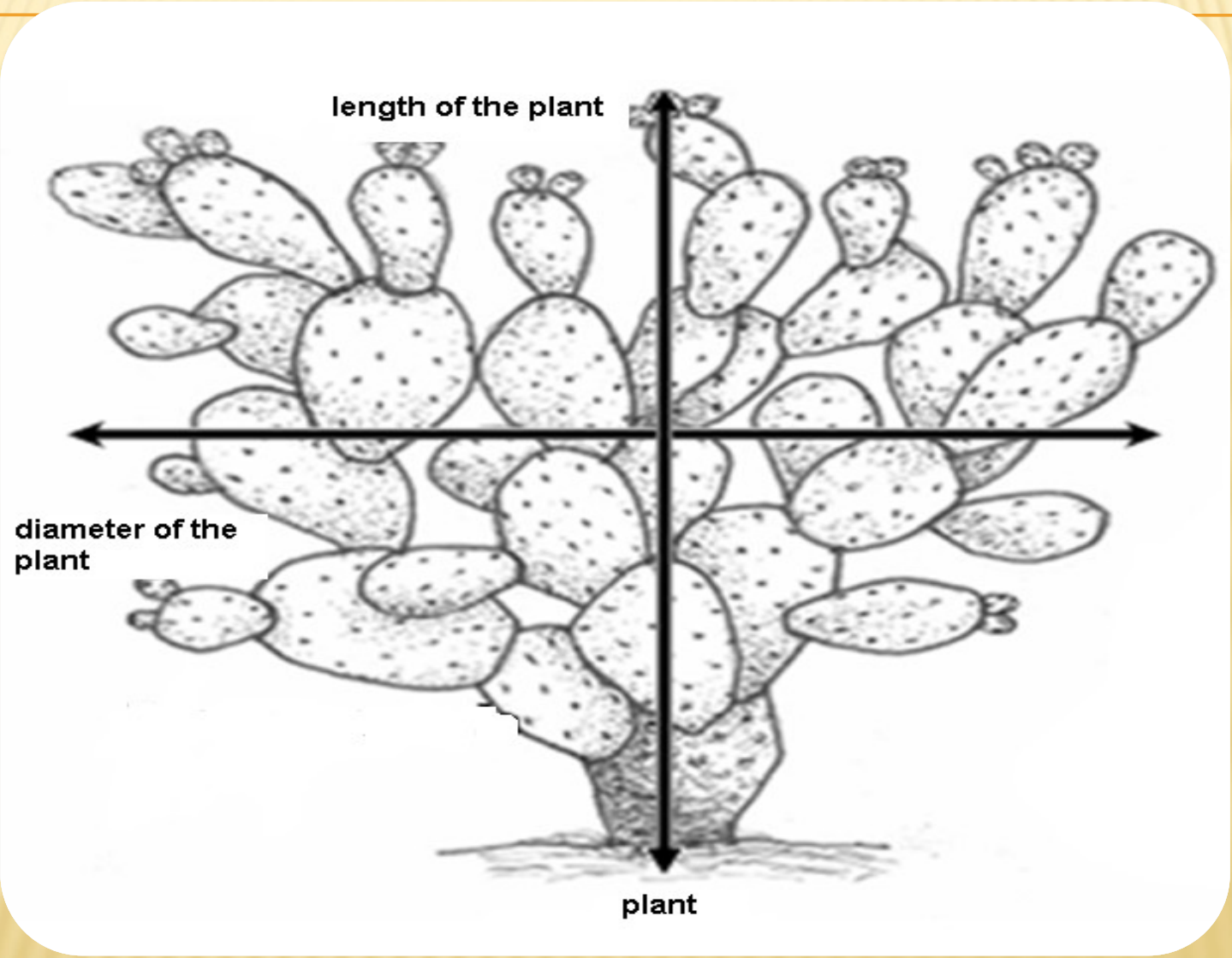
MATERIALS AND METHODS

- The material of this study comprised 30 genotypes of cactus pear
- Collected by Mr Boujghagh in different localities and planted in the experiment farm Melk Azhar of INRA in 2005.

MATERIALS AND METHODS

- The experimental design is a randomised complete block with two replications.
- 24 agro-morphological characters were measured during two years (2008 and 2009)

MATERIALS AND METHODS



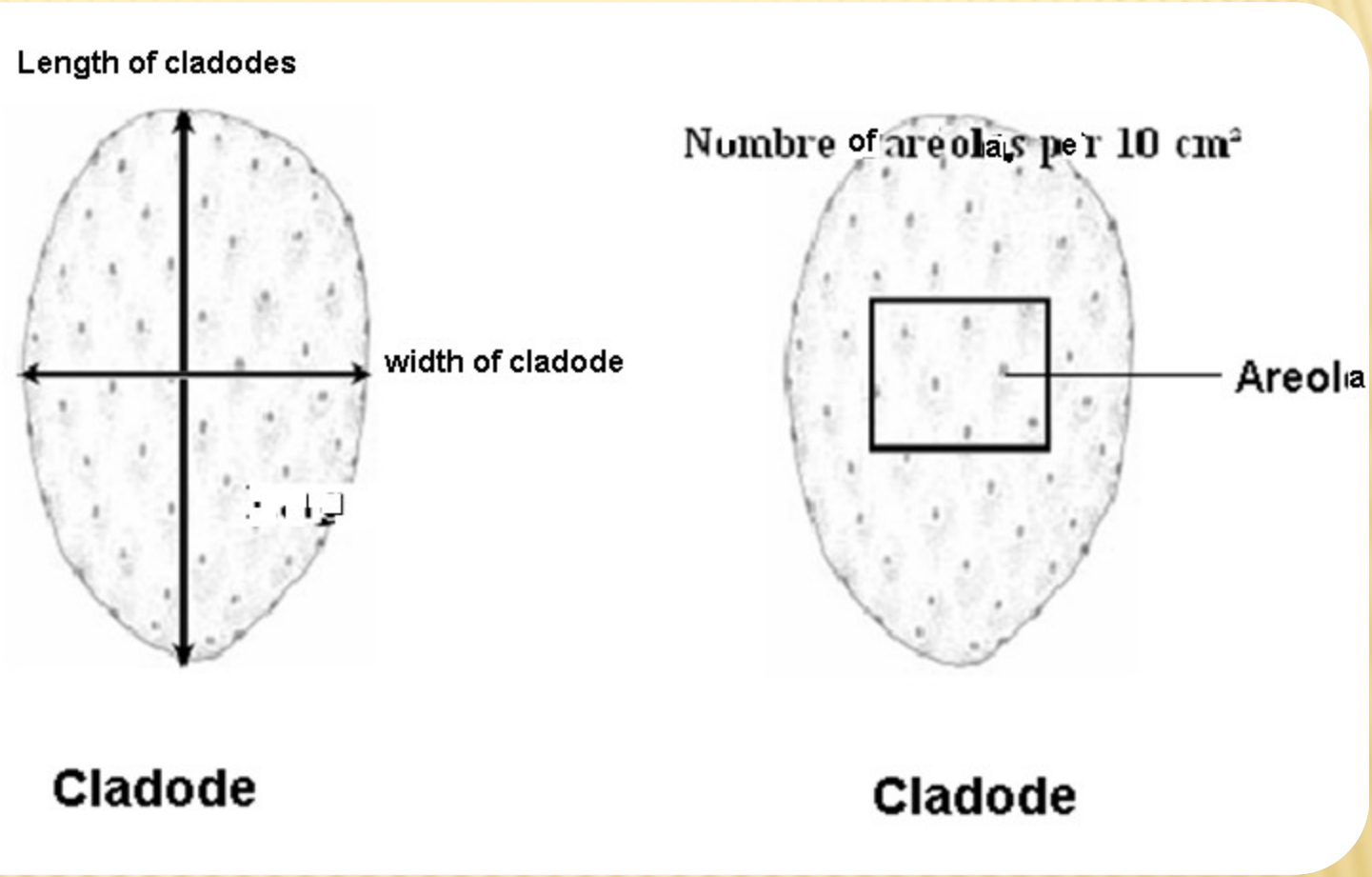
Characters measured at the plant

Newly formed cladodes of cactus

Fruits of cactus

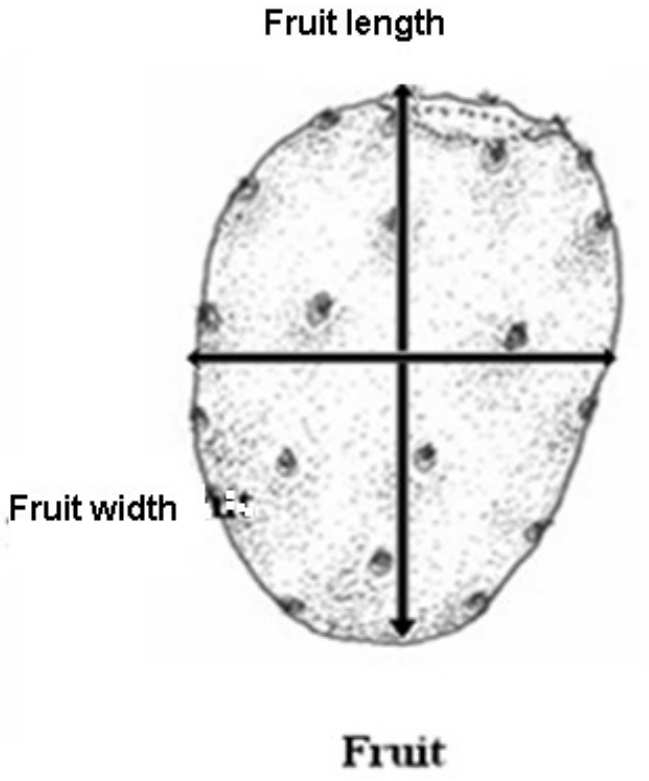
Characters measured at the plant

MATERIALS AND METHODS

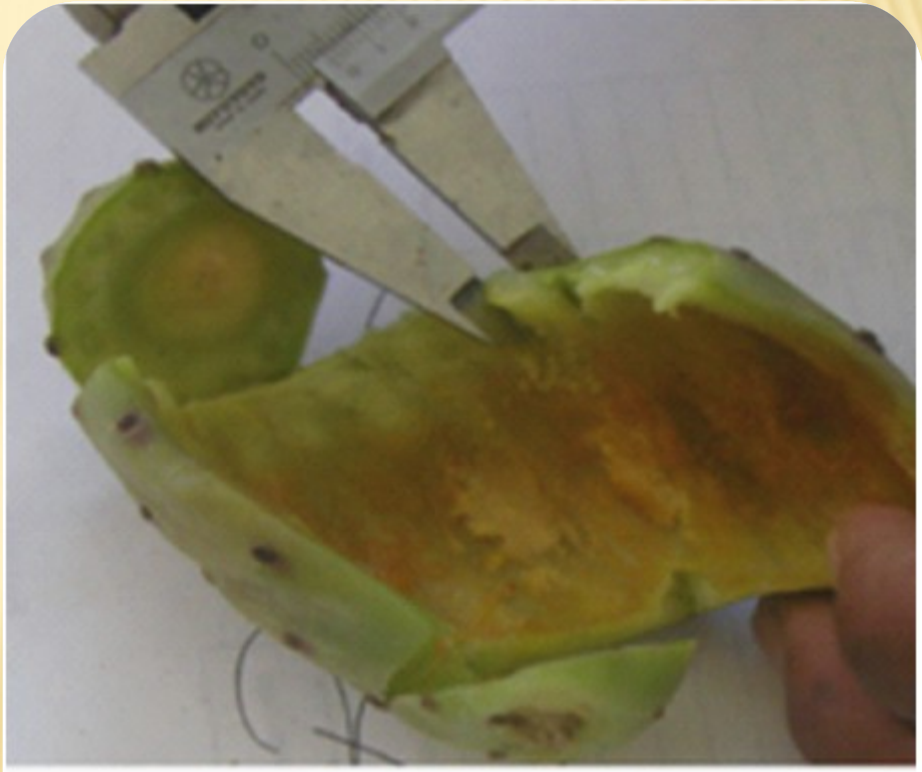


Characters measured at the cladodes

MATERIALS AND METHODS



Fruit



Peel thickness

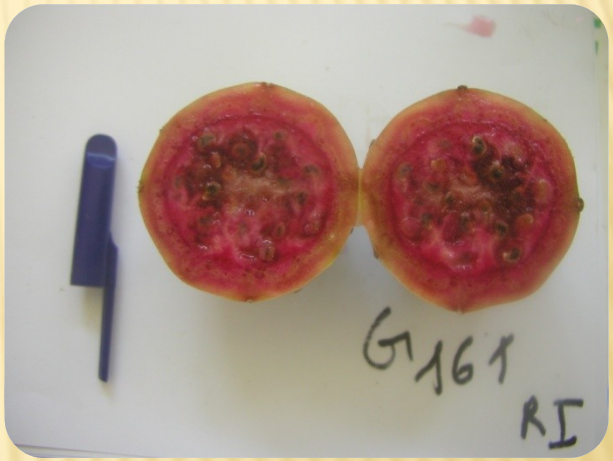
Characters measured at the fruits

MATERIALS AND METHODS

Seed of cactus

Characters measured at the fruits

MATERIALS AND METHODS



Genotype 161

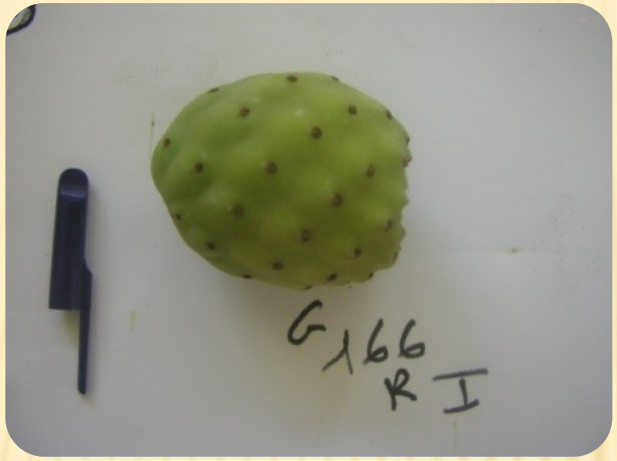
Genotype 163

MATERIALS AND METHODS

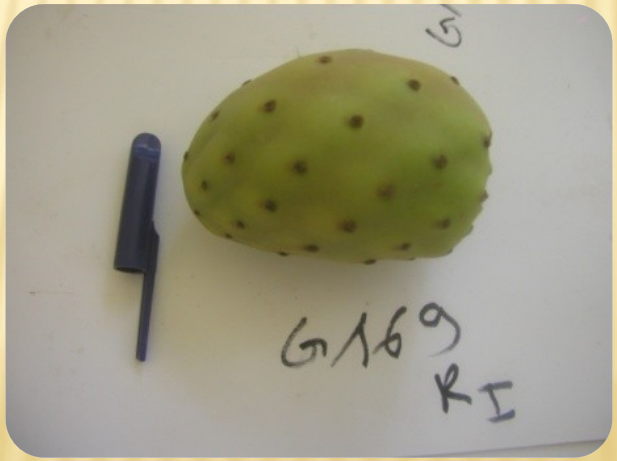
Genotype 164

Genotype 165

MATERIALS AND METHODS



Genotype 166



Genotype 169

MATERIALS AND METHODS

- Data were collected from each plant with five replicates per plant and year
- Statistical analysis: mean, minimum, maximum, standard deviation, coefficient of phenotypic variation and analysis of variance were performed using the software Statistica

MATERIALS AND METHODS

- The coefficient of phenotypic variation :

$$CV_P) = \frac{\hat{\sigma}_P}{m} \times 100$$

- Broad sens heritability : $\hat{H}^2_{Bs} = \frac{\hat{\sigma}^2_G}{\hat{\sigma}^2_P}$

- Based in partitioning the $\hat{\sigma}^2_P$ in $\hat{\sigma}^2_G$ and $\hat{\sigma}^2_E$ (between and within genotypes variances)

MATERIALS AND METHODS

If we select the best genotypes the expected pecentage relative of genotypic gain:

- Genotypic gain (ΔG): $\Delta G = \mathbf{i}\hat{H}^2\hat{\sigma}_P$
- Relative genotypic gain (ΔG_r): $\Delta G_r = \frac{\Delta G}{m} \text{x } 100$

i : standardized selection differential = 1 (p = 0.38)

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	22	73	126	21.78	35.64
2009	15	78	230	37.17	47.71

TABLE 1: NC / Plant: number of cladodes per plant

	Min	Mean	Max	SD	CV_P (%)
2008	0	19	69	17.23	89.27
2009	0	8	25	7.28	91.60

TABLE 2: NNC / Plant: number of newly formed cladodes per plant

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	1	108	345	82.91	76.25
2009	0	42	290	55.10	130.81

TABLE 3: NF / Plant: number of fruit per plant

RESULTS

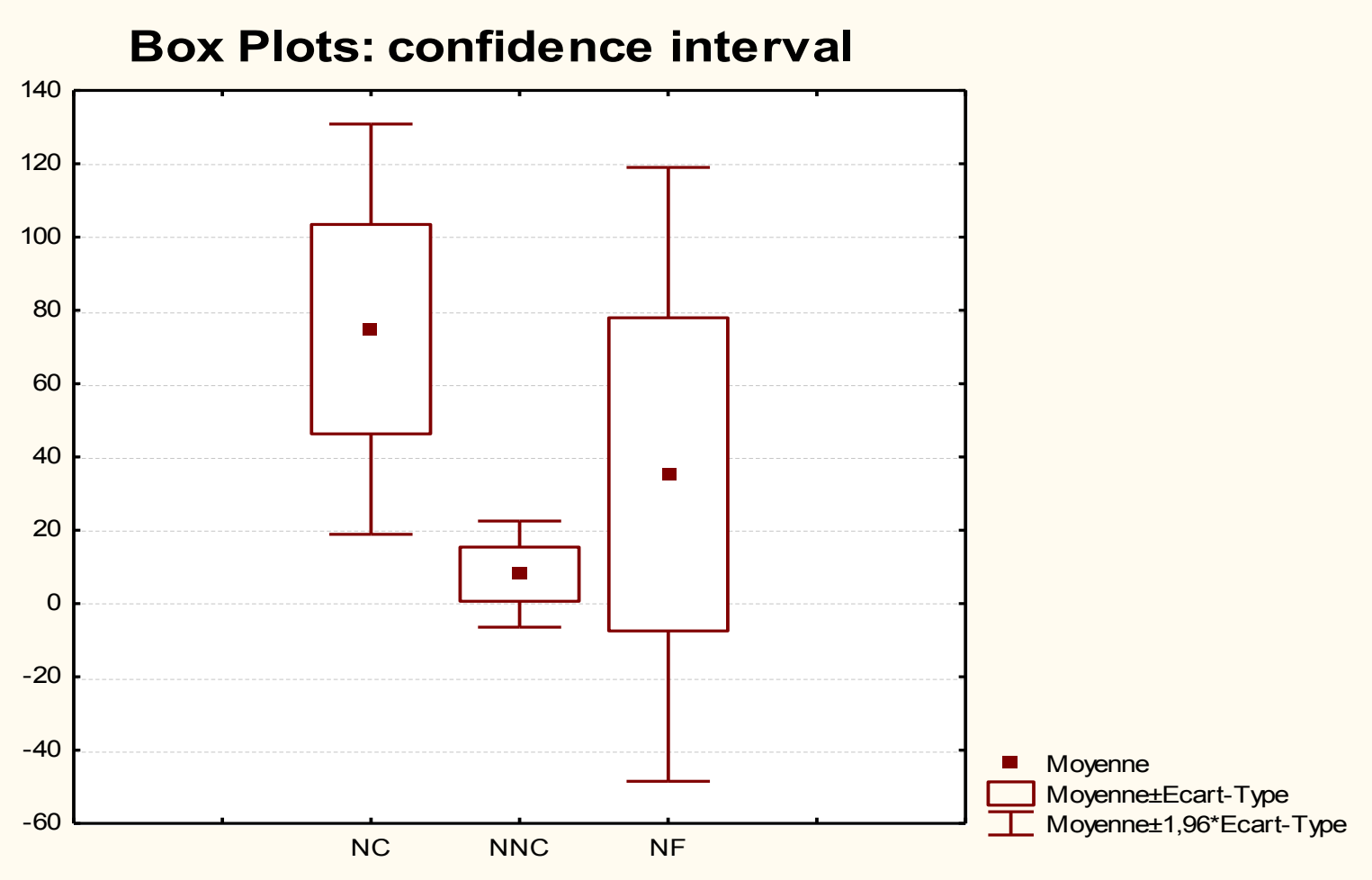


Figure 1: NC: **Number of Cladodes, NNC: Number of Newly Cladodes NF: Number of Fruits**

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	19.5	37.86	53	4.89	12.89
2009	14	37.15	51	5.65	15.23

TABLE 4 : LC: Length of cladodes (cm)

	Min	Mean	Max	SD	CV_P (%)
2008	11	23.51	45	5.26	22.38
2009	10.5	25.84	41	6.49	25.14

TABLE 5 TC: Thickness of cladodes (mm)

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	16.08	106.87	220.13	34.77	32.53
2009	13.6	98.05	137.88	32.54	33.19

TABLE 6 FW: Fruit Weight (g)

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	3	7.38	11	1.21	16.47
2009	2.5	7.51	11.14	1.51	20.11

TABLE 7 : FL: Fruit length (cm)

	Min	Mean	Max	SD	CV_P (%)
2008	2.8	5.02	7.20	0.67	13.31
2009	2.7	4.93	6.6	0.68	13.79

TABLE 8: FWd: Fruit width (cm)

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CVP (%)
2008	10	47	90	13	27.3
2009	1.3	6.7	11.5	17	25.3

TABLE 9: PT: Peel thickness (mm)

	Min	Mean	Max	SD	CVP (%)
2008	11.02	52.70	110.6	17	32.26
2009	8.42	55.98	95.23	17.54	31.30

TABLE 10 PW: Peel weight (g)

RESULTS

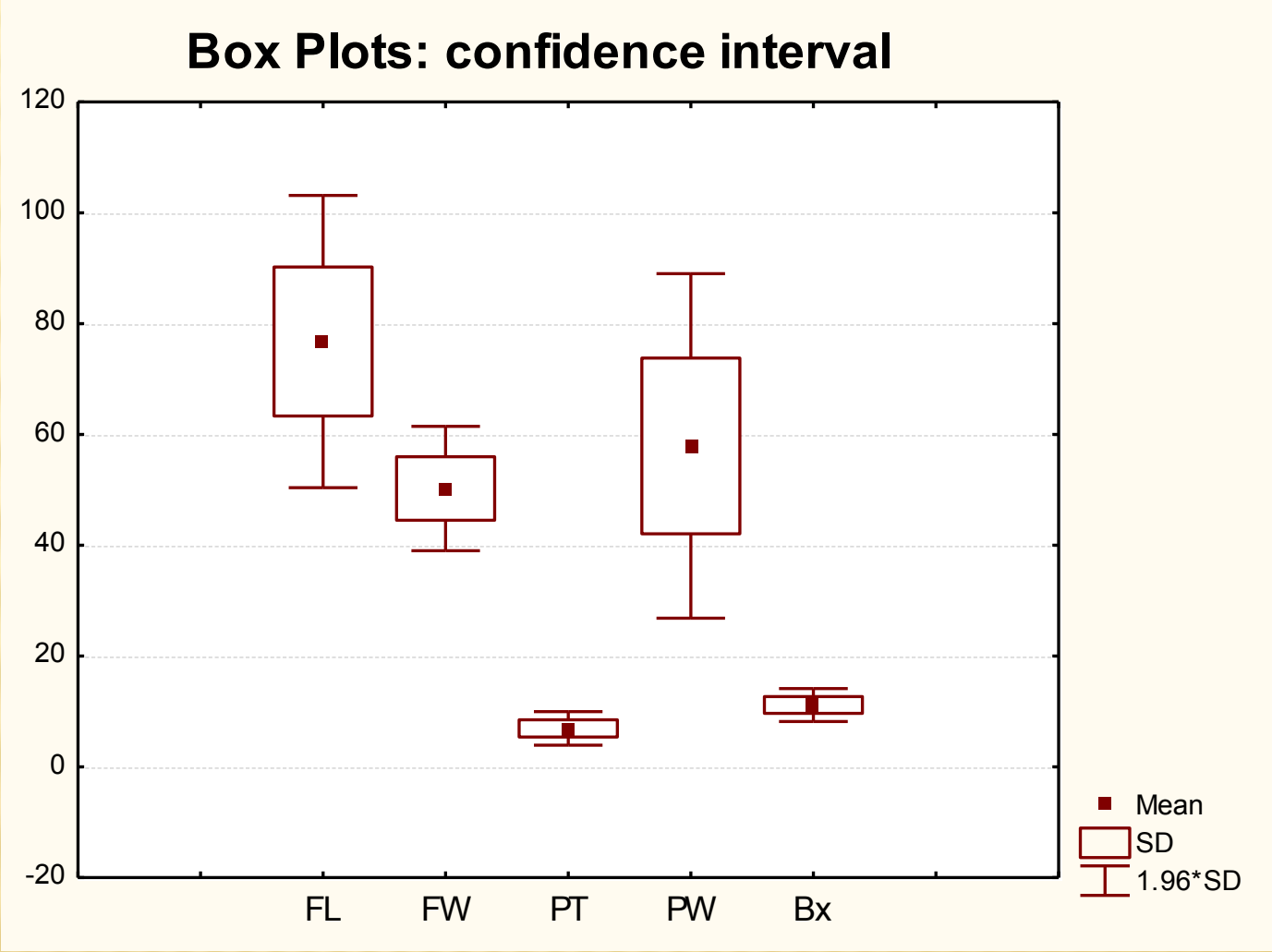


Figure 2:FL: **Fruit Lenght**, FW: **Fruit Width**, PT: **Peel Thickness**, PW: **Peel Weight**

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	0.22	3.76	7.77	1.49	39.50
2009	0.34	3.44	6.22	1.22	35.42

TABLE 11 : SW: Seed weight (g)

	Min	Mean	Max	SD	CV_P (%)
2008	21	274	496	96.60	35.21
2009	68	268	407	79.24	29.52

TABLE 12: NS: Number of Seed

RESULTS

I. Analysis of phenotypic variation:

	Min	Mean	Max	SD	CV_P (%)
2008	6	11.60	15	1.55	13.36
2009	7	11.17	15	1.54	13.79

TABLE 13: Brix : Sugar content

RESULTS

II. Heritability and genotypic gain

NC / Plant	2008	2009	Mean
H^2	0.19	0.35	
ΔG_r (%)	6.86	13.48	10.17

NNC / Plant	2008	2009	Mean
H^2	0.20	0.09	
ΔG_r (%)	15.78	8.30	12.04

RESULTS

II. Heritability and genotypic gain

NF / Plant	2008	2009	Mean
H^2	**0.33**	**0.24**	
ΔG_r **(%)**	**24.14**	**29.15**	**26.64**

RESULTS

II. Heritability and genotypic gain

Fruit Weight	2008	2009	Mean
H^2	**0.20**	**0.42**	
ΔG_r (%)	**5.30**	**13.78**	**9.54**

Fruit width	2008	2009	Mean
H^2	**0.24**	**0.31**	
ΔG_r (%)	**1.78**	**4.25**	**3.01**

RESULTS

II. Heritability and genotypic gain

Seed weight	2008	2009	Mean
H^2	0.56	0.45	
ΔG_r (%)	21.82	15.71	18.76

Seed Number	2008	2009	Mean
H^2	0.46	0.38	
ΔG_r (%)	13.07	10.95	12.01

RESULTS

II. Heritability and genotypic gain

Brix	2008	2009	Mean
H^2	**0.38**	**0.18**	
ΔG_r **(%)**	**3.87**	**2.49**	**3.18**

CONCLUSION

- For some characters, there is a large phenotypic and genotypic variability within and among the genotypes analysed.
- The results show differences in the amount of variability between characters and years

CONCLUSION

High to moderate CV_P (coefficient of phenotypic variation) are observed for :

- NF/plant : number of fruit per plant
- NNC / plant : number of newly formed cladodes per plant
- NC / plant : number of cladodes per plant
- FW : Fruit width
- SW: Seed weight
- NS : Number of seed

CONCLUSION

Low values of CV_P (coefficient of phenotypic variation) are observed for :

- Brix : Sugar content.
- LC : Length of cladodes.
- TC : Thickness of cladodes.

CONCLUSION

The lowest values of the relative genotypic gain(ΔG_r):

- LC : Length of cladodes.
- TC : Thickness of cladodes
- Fw : Fruit width
- Brix : Sugar content.

CONCLUSION

The larger values of the relative genotypic gain (ΔG_r) :

- NF / plant : Number of fruit per plant.
- SW: Seed weight.
- NS: Number of seed.

CONCLUSION

There is a need:

- To screen a large number of genotypes to identify genotypes with a high yield per plant for fruits, cladodes and seeds production for use in breeding programmes aimed at developing high yielding varieties.
- To estimate genetic parameters for productive traits: heritabilty , genetic correlations and genotype x environment interaction.


Thank you
for your
attention