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White Maize (*Zea Mays* L., 1753) six new lineages Agro-morphological performance In Cote D'Ivoire

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Abstract

Côte d'Ivoire produced 1,176,000 corn tons in 2020. In cereal harvest terms this represents 41%. Thus, for Ivorian populations food self-sufficiency, maize plays a crucial role. Due to that importance and in a national production dropping context, this study objective was to compare six new lines of white colored corn. For that, lineages L1D0, L4D200, L46D300, L72D300, L103D200 and L104D200 phylogenetic resources were used. Their agro-morphological and production characteristics have been evaluated. A significant diversity between studied lineages was highlighted. Ascending hierarchical classification (AHC) revealed that this variability is structured into 3 groups. Thus, group 1 (L46 and L104) characterized by lineages involving small plants with reduced insertion heights, leaf lengths and surface. Then Group 2 (L1(EV8728), L71, L103), not influenced by any factor. Group 3 (L4) contains plants with large diameters and lodging sensitivity high index. Regarding production parameters, 3 Sets were identified. Set 1 (L04, L72, L103 and L104), characterized by high values for variables linked to silk appearance, 50% of pollen released, spike and panicle appearance. Set 2 (L46) showed low spike weight. Set 3 included EV8728(L1), characterized by spike grain number high values. Within this study limits, these results can contribute to a maize productivity program improvement in Côte d'Ivoire.

Keywords: Corn; Food Self-sufficiency; Production; Trait

1. Introduction

Food security is a major concern in developing countries. However, potential exists considering food resources. A wide crop diversity is grown, and cereals occupy a prominent place[1] among which corn (*Zea Mays* L.) ranks in the leading group. It is an annual Poaceae (grass) family tropical plant. Corn is a monoecious grass with wide morphological diversity depending on varieties belonging to Zea genus which is a Myadaceae tribe representative[2]. In Ivory Coast, corn is the second most cultivated cereal after rice with a production estimated at 1,176,000 tones (t), on 558,406 ha total area[3]. The average yield is estimated at 2.11 t/ha. Some varieties have great sociocultural value[4]. However, despite local production millions of tons, several issues have been identified at different levels. These are rainy season shortening and rainfall reduction[5], as well as the soil fertility decline, many pests and diseases presence, leading to a yield drop[6]. All this under the effect of climate change. Indeed, increase by 2°C in average global surface temperature drives to 31% increase in yield losses linked to pest pressure for maize[7]. These different factors are therefore a major problem in large-scale corn production. It is important to emphasize that the general use of traditional varieties with low productivity by farmers in the corn sector considerably reduces yield. Thus, to improve national maize yield, it is essential to develop and promote the use of improved varieties with high production potential, using conventional breeding methods[8]. Thus, the application of the conventional method absolutely makes it possible to develop pure lines whose agronomic

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characteristics understanding is necessary for new and improved varieties creation which guarantee optimum production under conditions linked to climatic hazards. Furthermore, the mutation technique induced by gamma radiation to create high-performance varieties is of certain interest during the study. It is in this sense that this study general objective is to characterize white corn 6 new lineages induced by EV8728 variety seeds gamma irradiation.

2. Material and methods

This part consists in plot set up and study site agro-morphological parameters Presentation.

2.1. Study site

Study was carried out on Jean Lorougnon Guédé University (UJLoG) experimental site in Daloa, a Côte d'Ivoire town located in central-west region. Also, UJLoG Biology and Improvement laboratory in vitro unit was involved. Daloa, included in Haut-Sassandra region, is located between 6°53'38 north latitude and 6°27'0 west longitude. It's a tropical climate area with average temperature of 27.5 °C and annual rainfall between 1000 and 1500 mm. The experimental plot soil is ferralitic[9]. The first trials were carried out in the field, followed by the second stage in UJLoG plant physiology laboratory.

2.2. Vegetable material

The plant material used for this study consists of fifth corn generation, obtained from fourth generation seeds of the EV8728 variety. This was irradiated with gamma radiation at doses 200 and 300 grays in Austria (Seibers Dorf). A color change took place during the different successive self-fertilizations; it was white and red colored corn. These seeds were obtained after four cycles of self-fertilization. Pollen from non-irradiated EV8728 was also used. These lines studied are:

White: L1D0; L4D200; L46D300; L72D300; L103D200; L104D200.

2.3. Technical equipment

Several technical materials were necessary. This consists of hoe and machete for weeding, then measuring tape for plant height, leaves width and length. Included also, a plots boundary stakes, a caliper for collar diameter, a permanent marker pen for leaves count. Post-harvest data collection involved a graduated ruler ears length measurement as well as a sensitive balance for different corncob weight.

2.4. Plot set up

An experimental plot of 194.56 m2 (12.8 m × 15.2 m) was used for trial implementation. Thus, a completely randomized Fisher block was designed with three repetitions. The area of each repetition is 56.32 m2 (12.8 m × 4.4 m) with 1 m distance between two repetitions. This entire system is completely randomized. Each repetition has 17 lines, each 0.8 m apart. Each line contains twelve pockets spaced 0.4 m apart due to two seeds per pocket. The distance between the three blocks is 1 meter. To carry out these tests, a hoe and a machete were necessary for manual weeding. Sowing was done on parallel sowing lines associated with a drip watering system. 14 days after the sowing, a young plant removal was done, which led to one plant per pocket.

2.4.1. Plot fertilization and maintenance

One week after the sowing, the plot was amended with urea, then with NPK two weeks later. Manual weeding of the plot is carried out twice until production. The plot is equipped with a drip irrigation system.

2.4.2. Obtaining seeds

The seeds used in this experiment were obtained after four plant self-fertilization cycles obtained from EV8728 variety seeds which were irradiated with gamma radiation. The different seeds generations were labelled as follows: M0 represents the initial EV8728 variety irradiated seeds, M1 is the first-generation seeds, M2 the second, M3 the third, M4 the fourth, and M5 the fifth generation of seeds.

2.4.3. Plot set up and sowing phase

Plots establishment began with site cleaning followed by splitting and measurement. The sowing was subsequently carried out by burying four (04) grains per pocket. Two (02) weeks later, weeding was finally done to leave only two (02) plants per pocket.

2.4.4. Plot Maintenance and fertilization

The trial site and its surroundings were regularly kept clean by manual weeding. It was fertilized with urea 46% two (2) weeks after sowing, then with NPK15-15-15 in a quantity of 7.5 g per plant two (2) weeks after urea application. Manual weeding of the plot was done twice.

2.4.5. Self-pollination

For the pollination, following operations were conducted

- Cover each plant ear by using a glassine paper envelope, before the silks appear
- Place a panicle bag (pollination bag) the day before pollination, to collect the pollen from the male flower (panicle).
- The next morning, bend over and lightly shake the plant to collect the pollen in the panicle bag.
- Remove the glassine paper protection wrapping female plant silks and pollinate the silks using pollen from panicle bag.
- Immediately cover silks using the glassine paper envelope; as well as panicles using panicle bag; this until harvest.
- Carry out pollination before the temperature reaches 36 °C.

2.4.6. Measured parameters

Different mutants' agro-morphological characterization was done using growth and production parameters. In fact, measurements were carried out on a sample of 45 plants selected randomly on each line, i.e. 15 plants per repetition. The sampling was done taking one plant on three for the entire plot. This allowed us to evaluate the emerging rate over a period of 10 days from the third day after sowing. It was determined by taking the ratio (raised seeds number per line divided by the total number of seeds sown on the line) and during the 10 days (Equation (EQ.) 1).

$$\text{TLJ (\%)} = \frac{NGGj}{NGS} X\ 100\ \ldots\ldots\ldots\ldots\ldots..(EQ.1)$$

TLJ: daily lifting rate
NGGj: daily germinated seeds number
NGS: number of sown seeds

2.5. Growth parameters

The growth parameters used to evaluate morphological characteristics were plant heights, collar diameters, ear insertion heights and lodging resistance index as well as leaves number, their lengths and widths. These measurements began 7 days after planting using a tape measure (height) and a caliper (diameter).

2.5.1. Plant height

Plant height (HP), expressed in centimeter (cm) was determined by measuring the distance from the stem base at the collar (at the soil line) to the spikelet insertion point at plant top.

2.5.2. Corncob (Ear) insertion height

Cob Insertion Height (HIE) was determined by measuring the distance between the crown and the Ear Insertion point on stem.

2.5.3. Collar Diameter

Collar diameter (DC) was measured at stem base, in the plant last internode (i.e. 1 to 2 cm above the ground).

2.5.4. Lodging sensitivity index

These parameters made it possible to determine the lodging sensitivity index (ISV) using equation 2[10]. When the results tend towards 1, the plant resists lodging.

$$\text{ISV} = \frac{HIE}{HP}\ldots\ldots\ldots\ldots..\text{(EQ. 2)}$$

ISV: Lodging sensitivity index
HIE: ear insertion height
HP: plant height

2.5.5. Leaf length

Plant Leaf length (LongF) was measured as follows. It starts with the leaf sheath wrapped on plant stem to leaves tips.

2.5.6. Leaf Width

Leaf Width (LargF) is a measurement determined at leaf median. These different parameters helped to measure the Leaf surface according to method described by equation 3 and noted in cm2. It was estimated by making the product of LongF and LargF, according to[11].

$$SF\ (cm2) = LongF \times LargF \times 0,75\ (\text{EQ.3})$$

SF: Leaf surface

2.5.7. Leaves Numbers

Leaves number was obtained by counting from germination until spikelet appearance, on a weekly basis.

2.5.8. Production parameters

Production parameters were used to evaluate lineages productivity.

They are among others

- Corn cob weight (me) determined using a precision weighing.
- Cob length (LE), obtained by measuring the ear from the base to the top.
- Cob diameter (DE) measured using a caliper placed at cob center.
- Line number per cob (NL), determined by counting
- Grains number per line (NGL), estimated by counting
- Seeds (grain) total number in a cob (NGE), obtained by multiplication between grain number per line and lines number (NGL x NL)
- 100 seeds weight of a cob (M100G), determined by weighing 100 seeds.
- Cob grain filling (RE), got from different cobs observation. Then a scale of 1 to 3 is assigned to the different filling levels, 1-Completely filled, 2-Moderately full; 3: Slightly filled cob.

3. Results and discussion

The results relate to the six (6) corn lineages agro-morphological characterization.

3.1. Seed germination rate

Seed germination rate curve, as a time function for the different lineages, shows a difference in their evolution (Figure 1). Rate curve, for all lineages, increased from 3 till six days. Then it stabilized over time from 7 to 10 days after seedling. Control L1(T0) germination rate was significantly higher than the five (5) other lines, with a maximum percentage of 85.41% after 10 days. Then came L46, followed by L104, L72, L103 and L4 with the lowest rate. Statistical analysis reveals clearly significant differences between corn lines. The difference expressed in seeds germination could reflect a heterogeneity in seeds quality which would mainly result from their health and physiological states given that they were irradiated at different doses. Grain emerging date is vegetative or growth phase start. Maize lines have the same coleoptile appearance dates ranging from 3 to 6 days. Similar results were found by[12] which indicate that the emergence date for corn is between 6 and 10 days. L04 line is the only one with the lowest germination rate. This may be due more to lineage than seed condition, given that all corn lines were grown under same conditions (sowing depth, soil condition and climatic constraints). Indeed, cultivation techniques and conditions influence germination and therefore the number of plants[12]. In Contrary to this observation, [13]reported the favorable effect of seed size on seedling emergence.

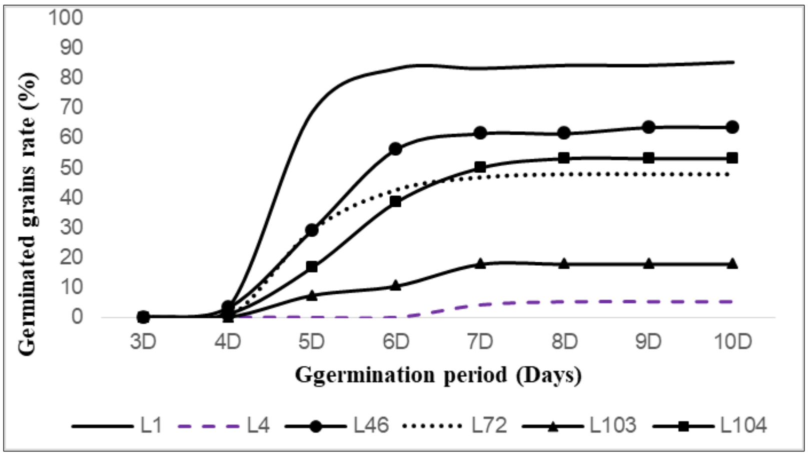


Figure 1 Corn seeds germination rate evolution

3.2. Lineages caulogenics parameters Comparison

Different lines cultivation in field (trial site) results are recorded in Table I. Statistical analysis showed that lineages growth and development relative caulogenic characters presented a very highly significant difference ($p < 0.01$). Differences are observed between corn lines quantitative variables mean values for studied characters, such as plant height (H), spike insertion height (HIE), lodging sensitivity index (ISV) and collar diameter (DC). Analysis was conducted with Tukey's HSD test at the 5% threshold.

3.2.1. Plant height

The average variation in height between corn lines is presented in Table I. The analysis classified corn lines into six groups with a highly significant difference ($p < 0.0001$). L1; L72; L4; L103; L46 and L104 lines respectively obtained H of 154.15 ± 14.3; 152.18 ± 18.3; 148.68 ± 22.2; 135.03 ± 16.9; 133.23 ± 15.3 and 129.21 ± 10.9 cm. Thus, all new lineages were found to be smaller compared to the control. Indeed, L1 produced the greatest height with an average of 154.15 ± 14.3 cm, compared to 129.21 ± 10.9 cm for L104, the line having provided the smallest average height. The control is 1.3% taller than L72 (152.18 ± 18.3 cm) and 19.3% larger than L104.

3.2.2. Cobs insertion height

In terms of spike insertion heights, Analysis grouped corn lines into five groups with a highly significant difference ($p < 0.001$) (Table 1). L4; L1; L72; L103; L46 and L104 lines respectively obtained HIEs of 85.13 ± 7.9; 72.92 ± 14.3; 71.42 ± 15.5; 65.1 ± 17.8; 62.85 ± 14.9 and 58.45 ± 13.5 cm. These results indicate that the insertion heights vary from 85.13 ± 7.9 cm (L4) to 58.45 ± 13.5 cm (L104) among lineages. Thus, L4 line presented the highest HIE and was therefore 16.7% higher than L1 control (72.92 ± 14.3 cm).

3.2.3. Collar Diameter

Regarding collar diameter, statistical analysis grouped corn lines into three groups with a highly significant difference ($p < 0.001$) (Table 1). L4; L1; L72; L46; L104 and L103 lines respectively obtained DC of 21.07 ± 3.7; 18.01 ± 3; 17.09 ± 3.1; 15.18 ± 2.6; 14.57 ± 2.8 and 14.4 ± 2.7 mm. The largest average diameter was obtained by the L4 line (21.07 ± 3.7 mm), while L104 had the smallest diameter (14.4 ± 2.7 mm). L4 is 16.9% greater in diameter than control L1 (18.01 mm).

3.2.4. Lodging sensitivity index

Regarding the lodging sensitivity index (ISV), analysis recorded a highly significant difference ($p < 0.0001$) between the lines. L4; L103; L1; L72; L46 and L104 lines respectively obtained ISVs of 0.58 ± 0.1; 0.47 ± 0.2; 0.47 ± 0.1; 0.46 ± 0.1; 0.46 ± 0.1 and 0.44 ± 0.1. Lineage L4 recorded the highest average ISV, compared to the lowest obtained by L104. L4 has on average an ISV 23.4% higher than the control L1. Means Comparison drove to identify three (3) different groups (Table 1).

Table 1 Maize lines caulogenic characters analysis results

Lineages	H(cm)	HIE (cm)	DC (mm)	ISV
$L4_{D200B}$	148,68 ± 22,2^{b}	85,13 ± 7,9^{a}	21,07 ± 3,7^{a}	0,58 ± 0,1^{a}
$L1_{D0B}$	154,15 ± 14,3^{a}	72,92 ± 14,3^{b}	18,01 ± 3^{b}	0,47 ± 0,1^{bc}
$L72_{D300B}$	152,18 ± 18,3^{ab}	71,42 ± 15,5^{b}	17,09 ± 3,1^{b}	0,46 ± 0,1^{bc}
$L103_{D200B}$	135,03 ± 16,9^{c}	65,1 ± 17,8^{c}	14,4 ± 2,7^{c}	0,47 ± 0,2^{b}
$L46_{D300B}$	133,23 ± 15,3^{cd}	62,85 ± 14,9^{cd}	15,18 ± 2,6^{c}	0,46 ± 0,1^{bc}
$L104_{D200B}$	129,21 ± 10,9^{d}	58,45 ± 13,5^{d}	14,57 ± 2,8^{c}	0,44 ± 0,1^{c}
F	34,48	36,98	62,60	29,34
P (< 0,05)	0,0001	0,0001	0,0001	0,0001

P = Tests Approximate Probability; F = Ficher Constant Means followed by same letter are significantly identic at 5% threshold. H: Plant height; HIE: Cob insertion height; ISV: Lodging Susceptibility Index; DC: Collar Diameter.

3.2.5. lineages phylogenetic parameters Comparison

The results on corn lineages phylogenetic parameters are recorded in Table 2. It showed a highly significant difference ($p<0.01$) for growth and development characters. Were concerned, corn lines quantitative variables average values for different characters, such as leaves Number (NF), Leaf areas (SF), Leaf lengths (LonG) and Leaf widths (LarG).

3.2.6. leaves Number

In terms of leaves number, statistical analysis showed a highly significant difference ($p < 0.0001$) between lines. Values obtained by L4; L104; L46; L72; L1; L103; and lines are respectively 21.71 ± 1.3; 21.29 ± 1.1; 20.58 ± 1.3; 20.43 ± 1; 20.08 ± 1.2 and 19.06 ± 0.7 leaves. Tukey's HSD test at the 5% threshold classified the lines into six (6) groups (Table 2). The highest HSD was given by L4 while the lowest was from L103. It appeared that L4, L104, L46, L72 recorded greater H values than the control L1. Thus, L4 was 8.1% higher in H than L1.

3.2.7. Leaf surface

Concerning leaf surface, statistical analysis showed a highly significant difference ($p < 0.0001$) between corn lines. SF collected data for L4; L72; L1; L104; L103 and L46 are respectively 520.57 ± 104.7; 479.19 ± 86.3; 458.09 ± 71.8; 428.94 ± 78.9; 421.35 ± 59.3 and 418.1 ± 67.2 cm2. Corn lines were classified into three groups (Table 2). Variation in photosynthetic surface area showed values between 520.57 cm2 (L4), highest average, and 418.1 cm2 (L46), lowest average. L4 and L72 were found to be greater in SF than L1 (control), respectively at 13.6% and 4.6%, while L103 got a smaller 103 than L1. However, L46, L103 and L104 SFs were inferior to L1 one. L46, L103 and L104 obtained similar SFs.

3.2.8. Leaf lengths

Regarding leaf lengths, Tukey's HSD test at the 5% threshold showed a highly significant difference ($p < 0.0001$) between lineages. Average values obtained by L4; L103; L1; L72; L104 and L46 are respectively 85.16 ± 9.8; 84.06 ± 6.8; 83.13 ± 6; 80.92 ± 7.7; 77.536 ± 7.8 and 74.01 ± 7 cm. Corn lines were classified into four groups (Table 2). It appeared that L4 dominated the other lineages which was weakest, L46. L4 and L103 lines were found to be higher in LongF than L1, at 2.4% and 1.1% respectively. Furthermore, L46, L72 and L104 lines were found to be smaller in LongF than the control.

3.2.9. Leaf widths

In terms of leaf width, statistical analysis showed a highly significant difference ($p < 0.0001$) between corn lines. Values obtained by L4; L72; L46 L1; L104 and L103 are respectively 8.08 ± 0.7; 7.86 ± 0.8; 7.51 ± 0.7; 7.33 ± 0.8; 7.12 ± 1 and 6.66 ± 0.5 cm. Tukey's HSD test at the 5% threshold classified the lines into four (4) groups. Thus, the highest leaf width was obtained with plants from line L4, while L103 recorded the lowest. L4, L72 and L46 lines revealed a higher average LargF than L1, up to 10.2%, 7.2% and 2.4% respectively. Furthermore, L103 and L104 lines were found to be smaller than the control. Finally, L1 and L72 obtained similar results for LargF.

Growth and development variables statistical analysis showed that corn lines differ from each other by plant height, cob insertion height, lodging sensitivity index, collar diameter, leaves number and leaf surface. The morphological diversity thus expressed shows that among cultivated corn varieties, morphological differentiation is often based on agronomic traits. Indeed, according to[14], this morphological diversity structuration shows that in cultivated corn, morphological differentiation is often based on agronomic traits. Following, it was observed a difference in size with control for maize lines. That could express specificities due to grain color and even nutritional specificities. This agrees with the work of[15] who showed that there would be variability between morphotypes for size, leaves number, leaf area for different colors seeds.

Table 2 Growth and development of relative phylogenetic characters analysis results

Lineages	NF	SF (cm^2)	LongF (cm)	LargF (cm)
$L4_{D200}$	21,71 ± 1,3^a	520,57 ± 104,7^a	85,16 ± 9,8^a	8,08 ± 0,7^a
$L1_{D0}$	20,08 ± 1,2^d	458,09 ± 71,8^b	83,13 ± 6b^c	7,33 ± 0,8^b
$L72_{D300}$	20,43 ± 1^{cd}	479,19 ± 86,3^b	80,92 ± 7,7^a	7,86 ± 0,8^b
$L103_{D200}$	19,06 ± 0,7^e	421,35 ± 59,3^c	84,06 ± 6,8^d	6,66 ± 0,5^d
$L46_{D300}$	20,58 ± 1,3^c	418,1 ± 67,2^c	74,01 ± 7^b	7,51 ± 0.7^b
$L104_{D200}$	21,29 ± 1,1^b	428,94 ± 78,9^c	77,536 ± 7,8^c	7,12 ± 1^c
F	53,93	22,38	27,58	32,26
P (< 0,05)	0,0001	0,0001	0,0001	0,0001

P = Approximate Probability of Tests F = File Constant Average values followed by the same letter are significantly identic at the 5% threshold. NF: Number of sheets; SF: Leaf area of the Plant; LongF: Leaf Length; LargF: Leaf width

3.3. lineages diversity structure

3.3.1. Correlation between characters

Matrix analysis (Table 3) revealed significant correlations (≥ 0.50) between certain pairs of characters. Thus, positive and highly significant correlations were established between:

- Corncob insertion height (HIE) and collar diameter (DC) (0.64).
- Lodging sensitivity index (ISV) and DC (0.51).
- HIE and plant final height (0.66).
- ISV and HIE (0.81).
- SF and LargF (0.61).
- SF and LongF (0.57).

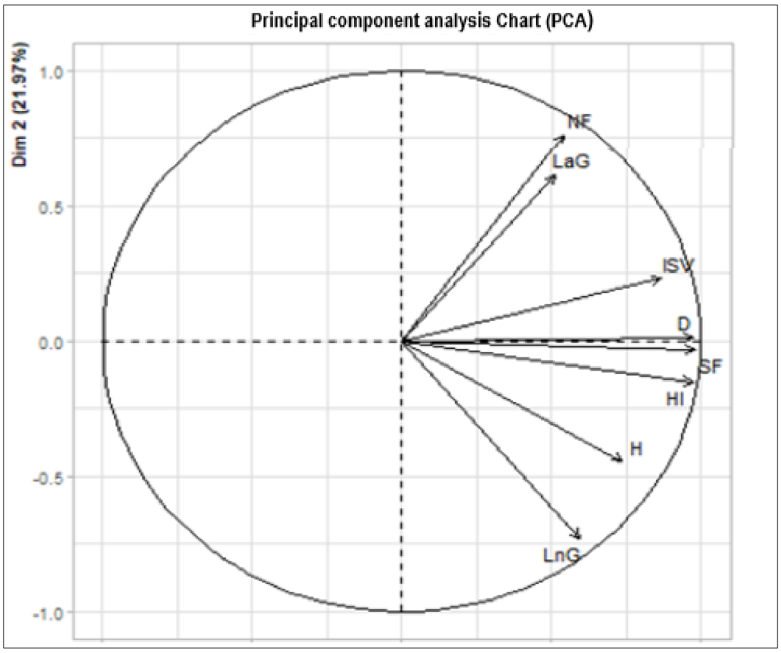
3.3.2. Diversity Structuration by principal component analysis (PCA) and agro-morphological performance

Table 3 Correlation between quantitative variables

	D	H	HIE	ISV	LargF	LongF	NF	SF
D								
H	0.4875							
HIE	0.6418	0.6634						
ISV	0.5065	0.1258	0.8192					
LargF	0.3613	0.1251	0.2131	0.1988				
LongF	0.1894	0.1882	0.2283	0.1569	0.3783			
NF	0.2925	0.0324	0.1740	0.2260	0.2057	- 0.0738		
SF	0.3647	0.2104	0.2865	0.2179	0.6147	0.5787	0.1115	

H : plant height ; **HIE :** cob insertion height ; **ISV** : lodging sensitivity index; **DC :** collar diameter, **NF** : leaves number ; **SF** : leave surface; **LongF** : leaf length ; **LargF** : leaf width

Variables projection in the factorial plan revealed that they are well represented (figure 2). Indeed, a variable has a representative quality if it's located on the circle or close to the circle. Furthermore, connections level between different variables is represented by the geometric angles between the arrows. Variables projection in the factorial plan showed that all of them participated in targeted characteristics discrimination. Thus, the morphotypes performance allowed lineages classification. This confirms the correlations revealed by the correlation matrix.



(**H:** plant height ; **HI=HIE :** cob insertion height ; **ISV** : lodging sensitivity index; **D=DC :** collar diameter, **NF** : leaves number ; **SF** : leave surface; **LnG**=**LongF** : leaf length ; **LaG**=**LargF** : leaf width)

Figure 2 Correlation circle between variables

3.3.3. Individual lineages' projection in factorial plan

Lineage projection is shown on plane formed by axes 1 and 2 according to their contribution (Figure 3). This figure presents lineages agro-morphological characters projection on the factorial plan formed by axes 1 and 2 which, together, explain 85.05% of the variability. Examination makes it possible to distinguish 3 groups of statistically distinct individuals whose relative contribution to axes formation is the most important. Group 1 (G1) includes L46 and L104 lines, group 2 (G2) made of L1(EV8728), L71 and L103 while group 3 (G3) component is L4 line. Thus, group 1 was characterized by lines presenting small size with reduced insertion heights, leaf lengths and leaf areas. Group 2 was not influenced by any factor while Group 3 contains large collar diameters plants and a high lodging sensitivity index. Results regarding leaves number and surface highlighted significant diversity. Furthermore, the variability observed during this study can be attributed to irradiation applied to EV8728 variety seeds, used as control. This gamma irradiation caused significant alterations in seed genome, which are responsible for various observed traits. [16]demonstrated that this practice induces random modifications at genome different levels, thus leading to distinct lineages creation which present varied characteristics.

In fact, [17]showed that certain gamma radiation doses have an inhibitory impact on plant development, thus leading to photosynthetic surface shape and leaves number modifications. Similar results were reported by[18] on *Lepidium sativum*. Indeed, leaves and nodes number as well as plant height decrease with the increase in gamma irradiation dose[18]. This ionizing radiation would cause biological effects, mainly DNA and RNA modifications shown by changes such as chain breaks or hydrogen bonds, leading to DNA replication blocking[18]. However, [19]specified that gamma radiation low dose (50 and 100 grays) induces an increase in *Canscora decurrens* growth and a nodes number.

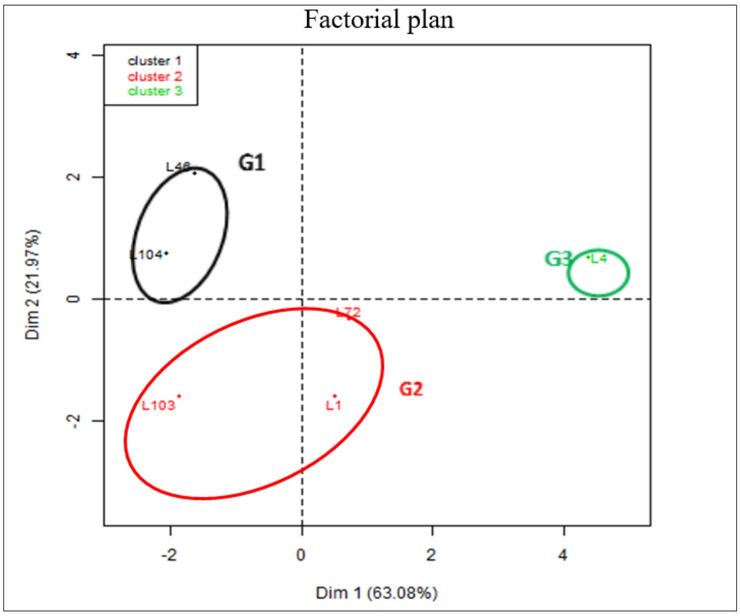


Figure 3 Projection of variables in the factorial design

3.4. Lineages ascending hierarchical classification

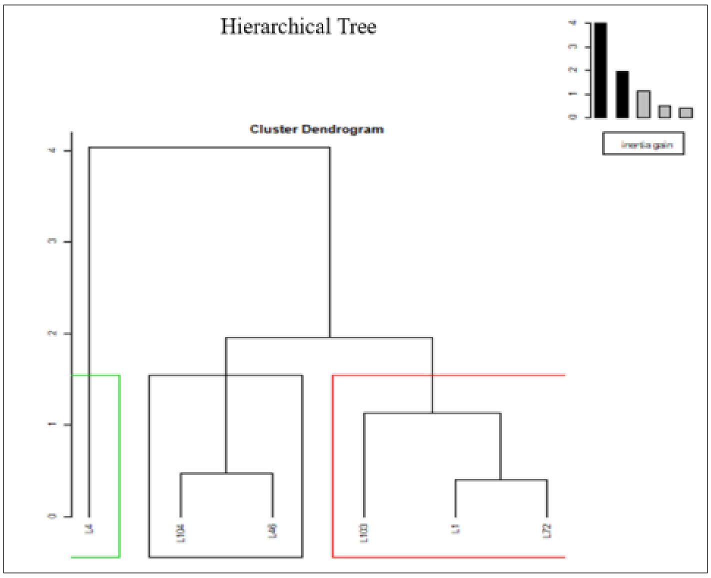


Figure 4 Dendrogram from ascending hierarchical classification

Lineages ascending hierarchical classification (CHA) resulting from principal component analysis was carried out. This CHA aimed to make interpretation completely objective, and to attest a well-defined and homogeneous group existence, at truncation level 1.5 point (figure 4). This confirmed structuration into three statistically distinct lines diversity groups, previously revealed by the PCA. These are G1 (L46 and L104), G2 (L1 (EV8728), L71 and L103) and G3 (L4). This morphological diversity has been structured into several groups which are differentiated by the emergence rate and agro-morphology. Morphological characterization is one of the important steps in cultivated plants description and classification[20]. Indeed, any program to improve agricultural resources necessarily relies on phenotypic variability[21]. In addition, analysis showed very significant differences between average values for all the characters analyzed not only between the new maize lines but also especially between those lineages and the control for all the parameters considered. These different variations made it possible to highlight corn lines' hetero diversity. This morphological diversity would be linked to each lineage's genetic resources' variability. Similar results were obtained by[22] in evaluating agro-morphological diversity of maize accessions collected in Côte d'Ivoire. Furthermore, observed diversity in corn lines growth characteristics also seems to result from their ability to adjust to the growing environment. Thus, for[23], this strong morphological diversity would result from peasant seed management practices. Indeed, particularly the exchange of varieties between farmers, are the source of significant diversity between populations of cultivated plants[23].

4. Conclusion

The present study evaluated the agro-morphological parameters of 6 corn lines (L1D0 as control and L4D200; L46D300; L72D300; L103D200; L104D200 irradiated from white corn L1D0 (EV8728)). An interline comparison was carried out then these maize lines were compared to the control through morphological parameters. The results obtained highlighted considerable morphological and agronomic variability among the different maize lines. This variability made it possible to structure corn lines into 3 homogeneous groups. Thus, group 1 composed of lines L46 and L104 is characterized by lines with plants presenting small size with reduced insertion heights, leaf lengths and leaf areas. Group 2, L1(EV8728), L71, L103 is not influenced by any factor. Group 3, L4 contains plants with large diameters and a high index of sensitivity to lodging. In terms of recommendations, it should be noted that this variability can be an asset in integrated crop management programs. Indeed, their alternation in cultivation could offer a possibility of fighting against certain corn enemies. In addition, a study on grain yield performance should make it possible to consider new crosses aimed at improving the control variety with, given morphotype L4 specifics caulogenic performances, superior the control one.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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