# Agro-morphological evaluation of four morphotypes of *Chrysanthellum americanum* L. VATKE in the Sudano-Sahelian zone of Burkina Faso


## ABSTRACT

**Aims:** *Chrysanthellumamericanum* L. VATKE is a herbaceous plant widely used in traditional medicine to treat a wide range of illnesses (kidney stones, anemia, malaria, etc.). Knowledge of the growth potential, vegetative development and phytochemical potential of a number of *Chrysanthellumamericanum* L. VATKE morphotypes could contribute to the development of the species. It is in this context that this study was initiated, with a view to gaining knowledge of the agro-morphological characteristics of *Chrysanthellumamericanum* L. VATKE.

**Methodology**: The study was carried out at the experimental station of the Institut de l'Environnement et de RecherchesAgricoles Saria (INERA/Saria). Four morphotypes (MT1, MT2, MT3 and MT4) from a mixture of *Chrysanthellemamericanum* seed collected from Bobo, Nandiala and Tema were grown in a Fisher design with three replications.

**Result:**A total of 27 agro-morphological parameters, including 8 qualitative and 19 quantitative, were observed and measured. Morphotypes showed variation in achene color and stem habit. Significant differences between morphotypes were observed for parameters linked to growth, the phenological cycle of plants and yield.The MT3 morphotype was the best performer, with a wide plant spread (22.34±1.02 cm), longer (10.78±0.57 cm) and wider (6.28±0.21 cm) leaves, a high number of secondary branches (10.78±0.52), better achene (1.44±0.12 t/ha) and fresh haulm (10.08±0.31 t/ha) yields. Morphotype MT4 achieved the highest thousand achene weight (0.70 g), and morphotypes MT1 and MT4 recorded the highest fertile achene/flower frequencies (73%).

**Conclusion**: For cycle length, morphotypes MT1 and MT2 were early with 71.33±2.40 JAS and 69.00±2.52 JAS.MT1 and MT2 could be domesticated in the Sudano-Sahelian zone due to their short cycle.



**Key words**:*Chrysanthellum americanum,* morphotypes, agro-morphological parameters.


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# 1. INTRODUCTION

Traditional medicine still remains the first resort for many Burkinabè due to the inaccessibility of conventional medicines[1]. In Burkina Faso, over 80% of the population regularly turn to traditional medicine and medicinal plants for their healthcare [2] These medicinal plants are therefore an integral part of Burkina Faso's cultural heritage. These plants include several woody and herbaceous species, such as A*cacia macrostachya* R, *Adansonia digitata* L, *Azadirachta indica* A. JUSS, *Chrysanthellum americanum* (L.) VATKE or *Chrysanthellum indicum* var *afroamericanum*B.L. TURNER. *Chrysanthellum americanum*is a plant with all its parts used in medical treatments. The leafy stems are used to treat yellow fever, hematuric icterus, dystonia, alcoholism, anuria, malaria, gallstones, salivary calculi, renal colic, urinary lithiasis, dyspepsia and intestinal fermentation[3]. However, in view of its medicinal use for human health, this species is under heavy anthropic pressure. Indeed, the population uses the whole plant (roots, stems and leaves). In order to meet local demand and contribute to the preservation of the plant in its natural habitat, one possibility would be to cultivate it. Consequently, knowledge of the agro-morphological and biochemical characteristics in terms of compounds and content, as well as antioxidant or biological activity, of a number of *Chrysanthellumamericanum (*L.) VATKE morphotypes under cultivation conditions would be a very important first step towards domesticating the species. It is within this framework that this study falls. The general objective of this study is to learn about the agro-morphological characteristics of *Chrysanthellum americanum* L. VATKE. Specifically, the aim is to: (i) Describe the qualitative characteristics of *Chrysanthellum americanum* L. VATKE; (ii) Characterize the agro-morphological performance of fourmorphotypes of *Chrysanthellum americanum* L. VATKE. (iii) Determine the Pearson correlations of agronomic parameters related to seedling growth, seedling phenological cycle and yield of *Chrysanthellum americanum* L. VATKE.

# 2.MATERIAL AND METHODS

## 2.1. PLANT MATERIAL

The plant material used consist of four of *Chrysanthellum americanum* morphotypes from a mixture of seeds collected in the localities of Tema, Nandiala and Bobo Dioulasso. *Chrysanthellum americanum* seeds were collected in the month of August 2021. This mixture of collected seeds was sown in bulk in a trial at Saria during September 2021 in order to observe the growth and development of the plants. The fourmorphotypes were selected on the basis of leaf size, plant height and stem habit within the plants obtained in this trial. Seed multiplication of these four morphotypes was carried out in June 2022, and the harvested seeds were used for this study.The trial was carried out in june 2022 at the INERA Saria site.

**2.2 METHODS**

**2.2.1. Experimental set-up**

A Fisher block design with three replicates was used. Pots with a depth of 0.215 m, a diameter of 0.2 m and a capacity of 9 L each were used to grow achenes (dry, indehiscent fruits of *C. americanum*). Each replication comprised 4 elementary plots, each with 6 pots in 2 rows, for a total of 24 pots. The spacing between successive pots in a row was 0.2 m, and the row spacing was 0.2 m. The distance between elementary plots was 0.5 m and the aisles between replicates were 1 m. Each pot was labelled with the repetition, pot and morphotype numbers. The surface area of each elementary plot was1.292 $m^2$ (1.9 m x 0.68 m). The surface area of the experimental set-up was 32.494 $m^2$ (7.7 m x 4.22 m).

**2.2.2. Data collection**

Data collected on the plants during the agro-morphological assessment covered eight qualitative and nineteen quantitative parameters.

- **Qualityparameters**

Eight quality parameter related to plant morphology were observed at flowering and maturity-harvest stages. All plants on both lines were collected for these parameters. Stem color and habit, leaf color and shape, and flower color were observed at the flowering stage. On the other hand, seed color, shape and texture were observed at the maturity-harvest stage.

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- ***Quantitative parameters***

***o Plant growthparameters.***

At the seedling stage, the number of plants lifted was obtained by counting all the plants lifted in all the pots in the elementary plot at 28 DAS. At the flowering stage, plant height and spread, leaf length and width, length of peduncles and primary flowers and length of peduncles and secondary flowers were determined by measuring three randomly selected plants per elementary plot, using a graduated ruler. Neck diameter was determined by measuring three randomly selected plants per plot, using a 150 mm caliper. At the maturity-harvest stage, the number of secondary branches was obtained by counting those directly connected to the main stem.

**o *Plant phenological cycle parameters***

Date of appearance of the first flower bud, date of appearance of the first flower and date of 95% maturity were recorded by counting the number of days from the sowing date to the date of their appearance. These dates are expressed in JAS.

***o Parameters related to yield and its components***

A total of eight parameters were determined at the maturity-harvest stage. The weight of achenes per pot, the total weight of achenes per elementary plot, the total weight of fresh haulm per elementary plot, the total weight of dry haulm per elementary plot and the weight of 1000 achenes per elementary plot was assessed by weighing using an electronic scale. The number of plants harvested per elementary plot was obtained by counting the plants after harvest.

From the three randomly selected plants per elementary plot, three flowers were randomly selected per plant and the ripe achenes per flower were harvested. These were counted to determine the number of fertile achenes per flower (NAFe/F) and the number of sterile achenes per flower (NASt/F) using a unocular magnifying glass. The total number of achenes per flower (NTA/F) was determined using the following formula:

$$\boldsymbol{NTA/F} = \sum \boldsymbol{NAFe/F + NASt/\ F}$$

The frequency of fertile achenes per flower (FqAFe/F) and the frequency of sterile achenes per flower (FqASt/F) were calculated using the following formulae[3].:

$$\boldsymbol{FqAFe/F}\ (\%) = \frac{\boldsymbol{NAFe/Fx100}}{\boldsymbol{NTA/F}}$$

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$$FqASt/F\ (\%) = \frac{NASt/F\ x\ 100}{NTA/F}$$

The average achene yield was obtained using the following formula:

$$Rdtaverageinachenes\ (t/ha) = \frac{Weightofachenes/potx10000m^2}{harvestedpotarea}$$

Fresh haulm yield (Rdt FF) and dry haulm yield (Rdt FS) were calculated using the following formulas[3].:

$$RdtFF(t/ha) = \frac{Weight\ of\ fresh\ tops/PEx10000m^2}{total\ area\ of\ pots\ harvested/PE}$$

$$Rdt\ FS\ (t/ha) = \frac{Dry\ leaf\ weight/PE\ x\ 10000\ m^2}{total\ area\ of\ pots\ harvested/PE}$$

*NB: 10.000 $m^2$ is equivalent to one hectare.*

## 3.RESULTS

### 3. 1. Variation in qualitative characteristics

In all morphotypes, no variation was observed in stem, leaf and flower colorations. Indeed, purple stems, green-dark leaves and yellow flowers were observed in all morphotypes. However, the achenes of the morphotypes were either pale black or dark black. Morphotypes MT1 and MT2 produced pale-black achenes, while morphotypes MT3 and MT4 produced dark-black achenes (Table 1).

**Table 1: Color of morphotype parts**

| Morphotypes | Col T | Col Feuil | Col Fl | Col A |
|---|---|---|---|---|
| **MT1** | Violet | Dark green | Yellow | Pale Black |
| **MT2** | Violet | Dark green | Yellow | Pale Black |
| **MT3** | Violet | Dark green | Yellow | Dark black |
| **MT4** | Violet | Dark green | Yellow | Dark black |

***Legend: Col T: stem color; Col Feuil: leaf color; Col Fl: flower color; Col A: achene color.***

For all morphotypes, no variation was observed in achene texture and shape, nor in leaf shape. In fact, all morphotypes developed hairy-textured, ovoid achenes and triangular-shaped leaves. However, a variation was observed between morphotypes for

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stem habit. Thus, morphotypes MT1 and MT2 developed creeping stems, morphotype MT3 semi-ramping stems and morphotype MT4 erect stems (Table 2).

**Table 2: morphology of morphotype plants**

| Morphotypes | Text A | Fr A | Fr Feuil | Pt Tig |
|---|---|---|---|---|
| **MT1** | Hairy | Ovoid | Triangular | Rampant |
| **MT2** | Hairy | Ovoid | Triangular | Rampant |
| **MT3** | Hairy | Ovoid | Triangular | Semi-creeper |
| **MT4** | Hairy | Ovoid | Triangular | Erected |

Legend: Text A: Achene texture; Fr A: Achene shape; Fr Feuil: Leaf shape; Pt Tig: Stem habit.

### 3.2. Variation in quantitative characteristics

#### 3. 2.1. Variation in plant growth parameters

For parameters related to plant growth, analysis of variance showed no significant difference (P>0.05) between morphotypes for the variables number of plants lifted, length of peduncles and primary flowers and length of peduncles and secondary flowers (Table 3). On the other hand, within morphotypes, a highly significant difference (P=0.000) was recorded for the variables plant height and spread, collar diameter, leaf length and width, and number of secondary branches. Thus, the MT3 morphotype obtained plants with larger wingspans (22.34±1.02 cm), longer leaves (10.78±0.57 cm), wider leaves (6.28±0.21 cm) and a higher number of secondary branches (10.78±0.52). Also, morphotypes MT2, MT3 and MT4 all produced plants with a large crown diameter (0.37±0.02 cm; 0.40±0.02 cm and 0.34±0.02 cm).

In addition, the MT4 morphotype was the one whose plants were the tallest (22.58±0.88 cm) with a moderately high number of secondary branches (7.11±0.20). In contrast, morphotypes MT1 and MT2 had the lowest values for plant height (10.58±0.29 cm and 10.87±0.81 cm), plant spread (11.56±0.28 cm and 12.07±0.55 cm), leaf length (5.00±0.12 cm and 5.25±0.25 cm) and leaf width (3.42±0.11 cm and 3.54±0.17 cm). The MT1 morphotype was the only one to have plants with a low crown diameter (0.26±0.02 cm) and a moderately low number of secondary branches (6.67±0.24). The MT2 morphotype had the lowest number of secondary branches (5.78±0.15). On the other hand, the MT4 morphotype recorded intermediate values for plant span (17.33±0.85

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cm), leaf length (8.19±0.37 cm) and leaf width (4.89±0.21 cm). The MT3 morphotype also recorded an intermediate value for plant height (15.24±1.08 cm).

Table 3: ANOVA results for plant emergence and growth parameters

| **Morphotypes** | **NPL** | **Haut Pl (cm)** | **Env Pl (cm)** | **Diam Col (cm)** | **Long Feuil (cm)** | **Larg Feuil (cm)** | **Long PF I$^{re}$ (cm)** | **Long PF 2$^{nd}$ (cm)** | **NB 2$^{nd}$** |
|---|---|---|---|---|---|---|---|---|---|
| **MT1** | 9.33±0.67$^{a}$ | 10.58±0.29$^{c}$ | 11.56±0.28$^{c}$ | 0.26±0.02$^{b}$ | 5.00±0.12$^{c}$ | 3.42±0.11$^{c}$ | 2.25±0.08$^{a}$ | 3.55±0.09$^{a}$ | 6.67±0.24$^{bc}$ |
| **MT2** | 10.33±0.67$^{a}$ | 10.87±0.81$^{c}$ | 12.07±0.55$^{c}$ | 0.37±0.02$^{a}$ | 5.25±0.25$^{c}$ | 3.54±0.17$^{c}$ | 2.67±0.21$^{a}$ | 4.00±0.27$^{a}$ | 5.78±0.15$^{c}$ |
| **MT3** | 9.33±0.88$^{a}$ | 15.24±1.08$^{b}$ | 22.34±1.02$^{a}$ | 0.40±0.02$^{a}$ | 10.78±0.57$^{a}$ | 6.28±0.21$^{a}$ | 2.17±0.12$^{a}$ | 3.20±0.20$^{a}$ | 10.78±0.52$^{a}$ |
| **MT4** | 6.67±0.88$^{a}$ | 22.58±0.88$^{a}$ | 17.33±0.85$^{b}$ | 0.34±0.02$^{a}$ | 8.19±0.37$^{b}$ | 4.89±0.21$^{b}$ | 2.24±0.20$^{a}$ | 3.42±0.26$^{a}$ | 7.11±0.20$^{b}$ |
| **Probability(P)** | 0,51 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.152 | 0,088 | 0.000 |

*Legend: NPL: number of plants raised; Haut Pl: plant height; Env Pl: plant span; Diam Col: collar diameter; Long Feuil: leaf length; Larg Feuil: leaf width; Long PF Ire: length of peduncles and primary flowers; Long PF 2nd: length of peduncles and secondary flowers, NB 2nd: number of secondary branches.*

### 3. 2.2. Variation in plant phenological cycle parameters

Analysis of variance showed a significant difference (P<0.05) between morphotypes for all parameters related to the plants' phenological cycle (Table 4). In fact, significant differences were observed within morphotypes for the variables dates of appearance of first flower bud, first flower and 50% flowering and the date of 95% maturity. Thus, morphotypes MT1 and MT2 were the earliest to have the first floral bud (25.00±1.00 JAS and 23.33±0.33 JAS), the first flower (30.67±0.88 JAS and 29.33±0.33 JAS), the 50% flowering (33.67±0.88 JAS and 32.67±1.20 JAS) and the 95% maturity (71.33±2.40 JAS and 69.00±2.52 JAS). On the other hand, morphotype MT4 was the late to have the first flower bud (38.33±0.67 JAS), the first flower (44.67±0.33 JAS), the 50% flowering (51.00±2.08 JAS) and the 95% maturity (85.33±0.67 JAS). Morphotype MT3 obtained an intermediate date for first flower bud (30.00±1.15 JAS), first flower (36.00±1.53 JAS), 50% flowering (40.33±1.33 JAS) and 95% maturity (77.67±3.28 JAS).

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**Table 4: ANOVA results for parameters related to plant phenological cycle**

| Morphotypes | 1[er] BF (JAS) | 1[ère] F (JAS) | 50% F (JAS) | 95% Mat (JAS) |
|---|---|---|---|---|
| **MT1** | 25.00±1.00[c] | 30.67±0.88[c] | 33.67±0.88[c] | 71.33±2.40[b] |
| **MT2** | 23.33±0.33[c] | 29.33±0.33[c] | 32.67±1.20[c] | 69.00±2.52[b] |
| **MT3** | 30.00±1.15[b] | 36.00±1.53[b] | 40.33±1.33[b] | 77.67±3.28[ab] |
| **MT4** | 38.33±0.67[a] | 44.67±0.33[a] | 51.00±2.08[a] | 85.33±0.67[a] |
| **Probability(P)** | 0.000 | 0.000 | 0.000 | 0.006 |

Legend: **1st BF**: date of appearance of first flower bud; **1st F:** date of appearance of first flower; 5**0% F**: date of 50% flowering; **95% Mat:** date of 95% maturity.

### 3.2.3. Variation in yield parameters and components

According to the analysis of variance, significant differences (P<0.05) were revealed between morphotypes for the variables achene and dry haulm yields, while no significant differences (P>0.05) were observed for the variables number of plants harvested and fresh haulm yield (Table 5). The MT3 morphotype recorded a higher average achene yield (1.44±0.12 t/ha) and a higher dry haulm yield (4.23±0.26 t/ha). On the other hand, the MT4 morphotype had a low average achene yield (0.88±0.14 t/ha) and a low dry haulm yield (1.50±0.18 t/ha). However, morphotypes MT1 and MT2 recorded intermediate values for average achene yield (1.04±0.17 t/ha and 1±0.10 t/ha) and dry haulm yield (2.54±0.82 t/ha and 2.83±0.24 t/ha).

**Table 5: ANOVA results for parameters related to yield and its components**

| Morphotypes | NPIR | Rdt A (t/ha) | Rdt FF (t/ha) | Rdt FS (t/ha) |
|---|---|---|---|---|
| **MT1** | 5.00±1.15[a] | 1.04±0.17[ab] | 7.06±1.91[a] | 2.54±0.82[ab] |
| **MT2** | 7.00±0.58[a] | 1±0.10[ab] | 4.28±0.81[a] | 2.83±0.24[ab] |
| **MT3** | 5.66±0.88[a] | 1.44±0.12[a] | 10.08±0.31[a] | 4.23±0.26[a] |
| **MT4** | 5.00±0.58[a] | 0.88±0.14[b] | 6.52±1.58[a] | 1.50±0.18[b] |
| **Probability(P)** | 0.345 | 0.025 | 0.078 | 0.018 |

***Legend: NPIR:*** number of plants harvested;***Rdt A:*** achene yield***; Rdt FF:*** fresh haulm yield***; Rdt FS:*** dry haulm yield.

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Figure 1 shows the histogram of 1000 achene weight as a function of morphotype. Analysis of variance showed no significant difference (P=0.111) between morphotypes for the 1000 achene weight variable. Morphotypes recorded 1000 achene weightranging from 0.5 g to 0.7 g.

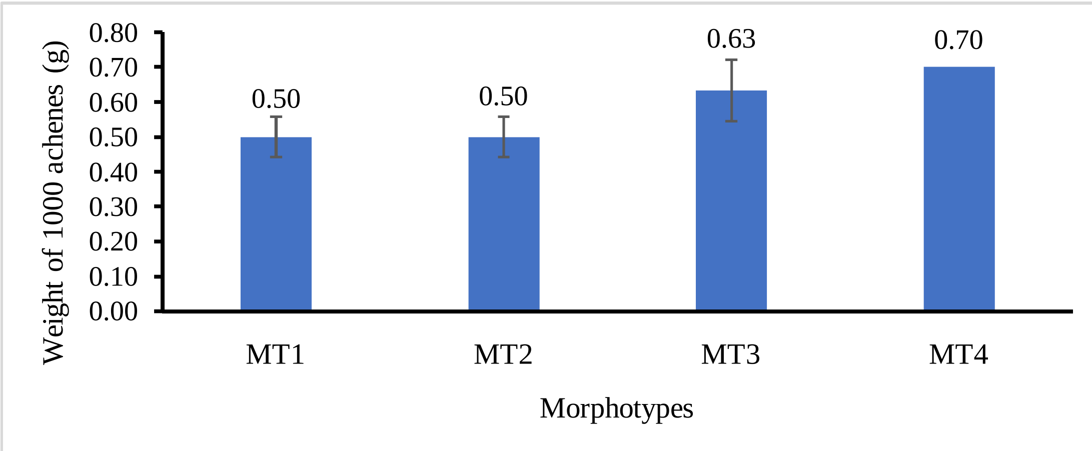


**Figure 1: weight of a thousand (1000) achenes of *C. americanum* morphotypes**

No significant differences (P=0.254) were revealed within morphotypes for the frequency of fertile achenes per flower and sterile achenes per flower. The frequency of fertile achenes per flower ranged from 70% to 73%, while that of sterile achenes per flower varied from 27% to 30%(Figure 2).

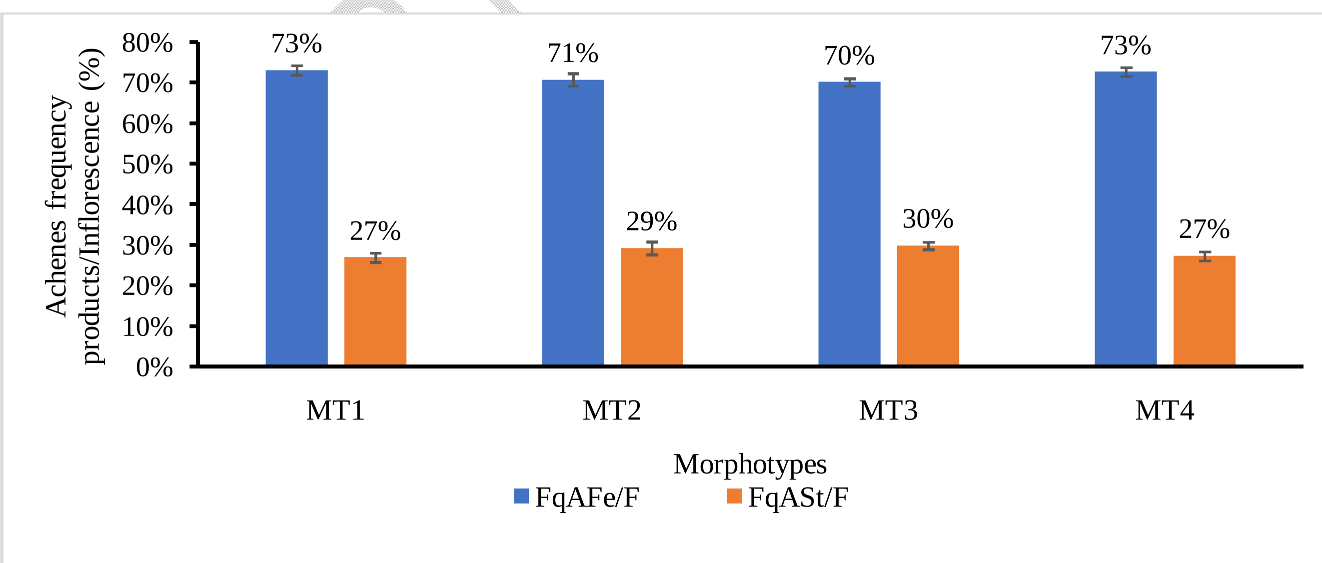


**Figure 2: Achenes frequency per flower of C. americanum morphotypes**

Legend: **FqAFe/F:** average frequency of fertile achene production per flower; **FqASt/F**: average frequency of sterile achene production per flower.

Pearson correlations of agronomic parameters related to seedling growth, seedling phenological cycle and yield of *Chrysanthellum americanum* L. VATKE.

### 3.2.4. The correlation test highlighted relationships within agronomic parameters related to plant growth, plant phenological cycle and yield.

The level of correlation was observed through correlation coefficients in Pearson's correlation matrix with a significance threshold of 5% (Table 6).

Positive correlations were observed between : plant height and 1000 achene weight (r=0.629); plant span and collar diameter (r=0.657); plant span and leaf length (r=0.973); plant span and leaf width (r=0.978); plant span and number of secondary branches (r=0.837); collar diameter and leaf length (r=0.610) ; collar diameter and leaf width (r=0.623); leaf length and leaf width (r=0.992); leaf length and number of secondary branches (r=0.850); leaf width and number of secondary branches (r=0.869); number of secondary branches and yield of fresh tops (r=0.777).

Table 6**:** Pearson correlation matrix between agronomic parameters linked to plant growth, their phenological cycle and their yield.

| Characters | Haut Pl | Env Pl | Diam Col | Long Feuil | Larg Feuil | NB $2^{nd}$ | P1000 A | Rdt A | Rdt FF |
|---|---|---|---|---|---|---|---|---|---|
| **Haut Pl** | 1 | | | | | | | | |
| **Env Pl** | 0.509 | 1 | | | | | | | |
| **Diam Col** | 0.292 | **0.657** | 1 | | | | | | |
| **Long Feuil** | 0.501 | **0.973** | **0.610** | 1 | | | | | |
| **Larg Feuil** | 0.496 | **0.978** | **0.623** | **0.992** | 1 | | | | |
| **NB $2^{nd}$** | 0.270 | **0.837** | 0.495 | **0.850** | **0.869** | 1 | | | |
| **P1000 A** | **0.629** | 0.517 | 0.250 | 0.496 | 0.469 | 0.331 | 1 | | |
| **Rdt A** | -0.174 | 0.341 | 0.261 | 0.333 | 0.374 | 0.556 | 0.281 | 1 | |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Rdt FF** | 0.287 | 0.505 | 0.238 | 0.533 | 0.576 | **0.777** | 0.133 | 0.462 | 1 |

*Legend: **Top Pl**: height of the plants; **Env Pl**: size of the plants; Collar diameter: collar diameter; **Long Leaf:** length of leaves; **Width** Leaf: width of the leaves; **NB 2nd**: number of secondary branches; **1st F**: date of appearance of the first flower; **50% F**: date of 50% flowering; **95% Mat**: date of 95% maturity; **P1000 A**: weight of 1000 achenes; **Yield A**: achene yield; **Yield FF**: yield of fresh tops*

## 4. DISCUSSION

The significant differences recorded among the agro-morphological characters of the *Chrysanthellum americanum* accessions studied show the existence of variability within this plant material. In fact, all the accessions scored purple, dark green and yellow for stem, leaf and inflorescence color parameters respectively.  For achene color, it revealed variability within accessions. Our results are similar to those obtained by[4]in 1967 and [5]. in 1994, who noted dark achenes and bright yellow inflorescences. However, small size, hairy texture of achenes and triangular shape of leaves and ovoid achenes were recorded by the parameters size, texture and shape of achenes and leaf. These results are similar to those obtained by [5]. in 1994 and by [6] who had triangular leaf shape and small achene size. In addition, our results are similar to those recorded by [7] in 2017, who observed an ovoid shape and hairy texture of achenes. This difference in seed color can be explained by genetic variability within accessions. According to [8] in 1987, seed color is conditioned by the C gene, which combines with other genes to produce different seed colors. In the absence of this C gene, the seed is white in color. In terms of stem habit, variability was observed between accessions, notably creeping habit for accessions E1 and E2, semi-creeping habit for accession E3 and erect habit for accession E4. Creeping accessions play a very important role in providing adequate soil cover and conserving moisture during hot periods. This type of habit also limits the proliferation of weeds. In the context of this study, these differences in qualitative traits observed within accessions therefore enable better identification and classification of accessions in the farming environment. However, the results for the parameters of first flower bud, first flower and 50% flowering showed a highly significant difference. In contrast, [9],found little variability between the sunflower varieties studied at the three sites. They observed that, whatever the variety, flowering was reached on average between the 42nd and 53rd JAS.  These flowering results can be explained by

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seed viability, germination speed, seed weight and climatic conditions such as temperature and photoperiodism. Indeed, numerous studies have shown that day length has variable effects on the vegetative and physiological development of plants [10]. The appearance of the first flower depends on temperature and photoperiodism [11]. In terms of plant height, spread and collar diameter, leaf length and width, and number of secondary branches, the results showed considerable variability between accessions. These results contrast with those of [6] who found a non-significant difference with an average height of 5±0.57 cm and a collar diameter that varied on average from 0.6±0.15 cm to 0.7±0.14 cm. Furthermore, these results are similar to those of [9], who noted a significant difference between sunflower varieties in plant height, with a coefficient of variation of 11% and mean values varying from 94 cm to 127 cm for the three sites studied, and similar to those recorded by [12]., who reported variability in plant height between sunflower accessions from the north and those from the east. Also, the results are superior to those of [6] who had 03±0.2 secondary branches. The significance of the results obtained could be explained by the absence of soil amendments applied to the accessions, by the variation in nutrients contained in the soil in the various pots, by genetic variability and by environmental conditions such as humidity, temperature, sunshine, etc. With regard to primary and secondary inflorescence lengths and the number of sterile achenes per plant, no variability was observed among the accessions. This would indicate that the accessions are statically the same in terms of inflorescence size and sterile achene production. As for the number of fertile achenes per plant and the 95% ripening date, they showed variability between accessions. These results are similar to those presented by [12], who found variability in the maturity of sunflower accessions from the North and East. These results can be explained by environmental conditions, genetic variability and edaphic factors such as soil fertility and soil type. However, better thousand (1000) achene weight were observed, ranging from 0.5 g to 0.7 g, and the best frequency of fertile achene production per flower was 73%. These results differ from those of [13],, who noted a weight ranging from 57.93 ± 0.08 g to 79.98 ± 0.07 g for sunflower cultivars and from 39.39 ± 0.00 g to 72.69 ± 0.06 g for sunflower varieties. This variation in weight and frequency could be explained by the accumulation of nutrient reserves in the achenes, soil fertility and environmental

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conditions. The yield parameter for achenes and fresh and dry tops showed variability between accessions. Cycle length also varied from 69 days to 85 days. These results contrast with those of [9],, who found no significant difference in seed yield per variety at any site, with average values ranging from 424 kg/ha to 1,560 kg/ha for the sunflower varieties studied. [9], also noted a cycle length of between 106 and 108 days for sunflower varieties at the three sites studied. These results can be explained by seed quality, insect pest attacks (caterpillars and locusts), disease attacks, total drying of certain plants observed, very low germination and environmental conditions (temperature, photoperiod, light, wind, etc.). For example, winds led to a considerable reduction in achene yield through achene fall. The yield parameter is also a function of germination,growth,flowering and ripening time5.

## CONCLUSION

The domestication of Chrysanthellum americanum in the agromorphological field was carried out with a view to large-scale, high-yield production and to alleviating malnutrition, which is responsible for numerous diseases. Four *Chrysanthellum americanum* accessions were studied for quantitative parameters such as color (stems, leaves, achenes, flowers), stem habit, achene appearance, leaf shape, achene size; quantitative parameters such as plant dimensions (height, span, length and width), number of achenes/plants, yields (achenes and haulms). Seed color and stem habit are essential characteristics for distinguishing *Chrysanthellum*accessions in the farming environment. Accessions E1 and E3 showed the highest yields of fresh achenes and haulms. For thousand (1000) seed weight, varieties E3 and E4 gave the best performance. In view of the above, accession E3 proved to be the best-performing of the other accessions, with a large number of secondary branches, a wide spread, higher achene and haulm yields, and higher thousand-seed weight.These accessions are therefore an asset for industrial processing, breeding for varietal creation and/or improvement, and in the effective fight against malnutrition and oxidative stress diseases.

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Option 2:

Author(s) herebydeclarethatgenerative AI technologies such as Large LanguageModels, etc. have been usedduring the writing or editing of manuscripts. This explanationwillinclude the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are givenbelow:

1.

2.

3.

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