**Morphometric characters and pods production of *Vachellia tortilis* subsp. raddiana (Savi) according to toposequence in the department of Goure (Niger)**

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**Abstract**

In Niger, the *Vachellia tortilis* is a well-known multi-purpose tree species with high morphological variability. Its fruits are available few months after raining season and use as excellent fodder for livestock. Our work aimed to examine characteristics variation in these pods or fruits according to site toposequence.

Dendrometric parameters were collected from feet belonging to different toposequences. These parameters made it possible to establish their structures in diameter class and height class. A total of 597 fruits with an average of 192 fruits per toposequence were measured. The data were analyzed using descriptive statistical tests, parametric and non-parametric tests.

The average values of morphometric parameters of fruits were found to be: 63.23±19.22 for grains’ number in ten fruits (6,32±1,92 seeds per pods); 38.43±16.06 for number of Healthy seeds, while the defective grains accounted for 58.84±18.34. One hundred grains weight 5.652±3.834 g. Although, the length and width of the fruits were found to be 8.465±2.303 cm and 1.993±2.092 cm respectively, and size of seeds was 6,01±0,63mm. Seeds number per pod and pods size were correlated to mensuration parameters. This study has highlighted the relationship between the mensuration parameters and morphometric variations in fruits following the toposequence.

**Keys words:** Variations, Morphometric, Pods, *Vachellia tortilis*, Toposequence, Niger

**Caractères morphometriques et production de gousses de *Vachellia tortilis* subsp. raddiana (Savi) suivant la totposéquence dans le département de Gouré (Niger)**

**Résumé**

Au Niger, *Vachellia tortilis* est une espèce d'arbre connue pour ses multiples services, avec une grande variabilité morphologique. Ses fruits sont disponibles quelques mois après la saison des pluies et sont utilisés comme excellent fourrage pour le bétail. L’étude vise à examiner la variation des caractéristiques de ces fruits selon la toposéquence du site.

Les paramètres dendrométriques ont été recueillis à partir de pieds-mères appartenant à différentes toposéquences. Ces paramètres ont permis d'établir leurs structures en classe de diamètre et en classe de hauteur. Un total de 597 fruits avec une moyenne de 192 fruits par toposéquence a été mesuré. Les données ont été analysées à l'aide de tests statistiques descriptifs, de tests paramétriques et non paramétriques. Les valeurs moyennes des paramètres morphométriques des fruits se sont avérées être les suivantes : 63,23±19,22 pour le nombre de grains dans dix fruits (6,32±1,92 graines par gousses) ; 38,43±16,06 pour le nombre de graines saines, tandis que les grains défectueux représentent 58,84±18,34. Cent (100) graines pèsent 5,652±3,834 g. Cependant, la longueur et la largeur des fruits étaient respectivement de 8,465±2,303 cm et de 1,993±2,092 cm, et la taille des graines était de 6,01±0,63 mm. Le nombre de graines par gousse et la taille des gousses ont été mis en corrélation avec les paramètres de mensuration. Cette étude a mis en évidence la relation entre les paramètres de mensuration et les variations morphométriques des fruits suivant la toposéquence.

**Mots clés:** Variation, Morphométrie; Gousses, *Vachellia tortilis*, Toposéquence, Niger

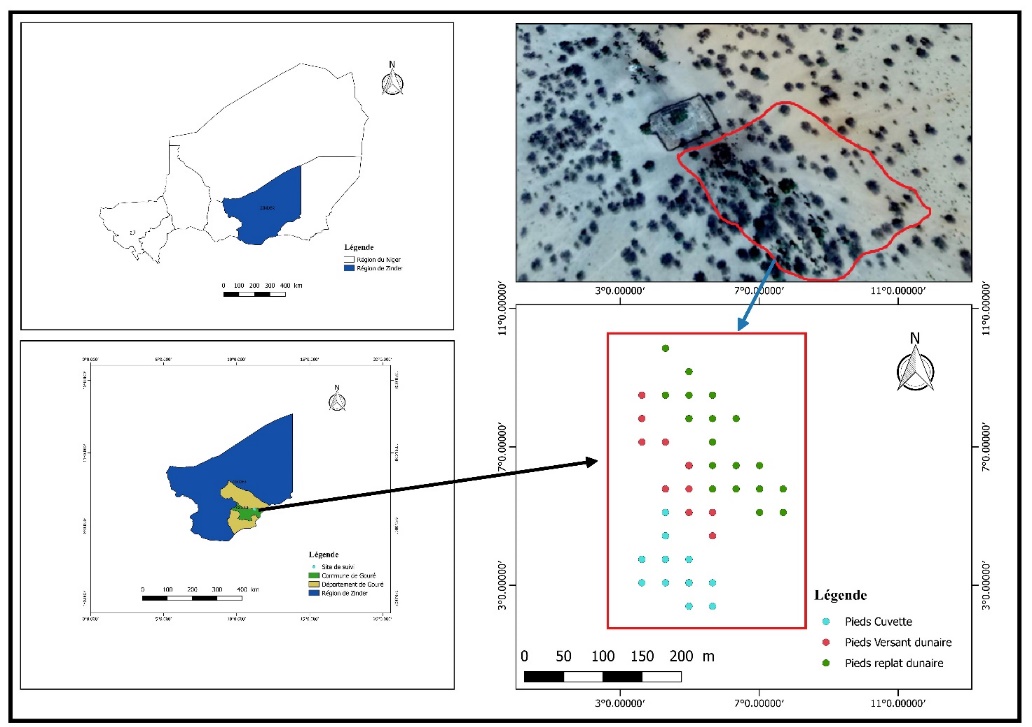
**Introduction**

The conservation status of many wild fruit species on which rural populations in Africa depend remains poorly documented despite its importance for the management of their populations (FANDOHAN et al., 2010). The term "genetic variability" is reserved for quantitative traits, while the term "genetic diversity" is used for quantitative traits, while the term "genetic diversity" is used for quantitative traits, while the term "genetic diversity" is used for quantitative traits qualitative (NANSON, 2004). Possessing a basic chromosome number X = 13 and with polyploidy present in several species, the genus Acacia (Leguminosae, Mimosoideae) comprises more than 1350 species (MASLIN, 2003). It is distributed in tropical and subtropical regions of the Americas, Australia, Africa and South Asia (BENNETT et al., 2000; LUCKOW, 2005). The interest of genetic variability stems from its importance in selection and evolution. Its measurement is used to assess a population's ability to adapt to environmental changes. Thus, a population with a variability its durability over time, because its variability allows it to be used in a wide range of applications to evolve rapidly by adapting to new environmental constraints (EL AYADI, 2012). Exploring natural variability allows tree breeders to make rapid genetic progress. Forest species with high heterozygosity also show considerable variation in pod size, seed trait morphology, hard seed coat, dormancy, pre-treatment requirements, length of stratification period, germination rate and cardinal temperature for storage and optimal germination (AHLAWAT et al., 2007). Morphological differences and their effect on the germination of seeds from different *V. tortilis* sources and the need for pre-treatment to accelerate germination have been reported (DANTHU et al., 2003; EL AYADI et al., 2012). Basic knowledge of the nature and extent of seed source variation in seed parameters such as seed size and weight, seed vigor, germination, seedling characteristics is essential to improve species genetics (FAO, 1985; RAMACHANDRA, 1996).

Several works have been carried out in the study of fruit morphological variations on *V. tortilis* in Southern Morocco by EL AYADI et al. (2012) and in Tunisia by JAOUADI et al. (2013); on *A. nilotica* in Northwest India by AHLAWAT et al. (2007); other studies have been carried out on *Faidherbia albida* in Nairobi by FREDRICK et al. (2015), on *Jatropha curcas* Linn. in Benin by GBEMAVO et al. (2015), on *Sclerocarya birrea* (A. Rich.) Hochst in Malawi by MKWEZALAMBA et al. (2015), on *Adansonia digitata* in Benin by ASSOGBADJO et al. (2005); on *Lannea microcarpa* in Burkina Faso by SEMDE et al. (2016). With a very wide geographical distribution in Niger, *V. tortilis* is one of the forest genetic resources of great importance for the conservation of pastoral rangelands. This species is of particular scientific interest as it represents a transition between semi-arid and desert vegetation, corresponding to semi-arid and arid ecosystems respectively. At present, little information exists on the morphological variability of *V. tortilis* pods in the Sahelian bioclimate of Niger. The objective of the present study is to quantify the morphological variability of pods and tree related seeds.

1. **Materials and Methods**
   1. **Study area**

The study was conducted in the department of Goure between 9°20' and 12°00' East longitude and 13°00' and 17°30' North latitude at the Central-East of Niger. It’s about the monitoring of phenology of *V. tortilis* in the site located at10°36'4''E and 13°59'4''N, a kilometre away from the village of Bitoa that falls in 10°36'33,49"E and 13°58'48,73"N (Figure 1). The climate of the study area is tropical aride with annual average rainfall of 20.16 mm. The rainy season is very short with (3 to-4 months) from July to September and the dry season is very long with (8 to-9 months without rainfall,) from October to June. The mean annual zone temperatures are is realtively high with 27.39 4 ± 3.3 ° C. The vegetation of the study area is dominantly steppe with locally either *Acacia tortilis*, and *Leptadenia pyrotecnica* or both as dominant species on the sandy soil. In the depression which have silty soil with high moisture, the vegetation is characterized by *Hyphaene thebaiaca*, *Phoenix dactylifera*, *Salvadora persica*.



**Figure 1:** Location of the site and distribution of *Vachellia tortilis* plant studied

* 1. **Sampling**

The samples of fruits were obtained from the monitoring of phenology in site located in the districts of Goure on three different geomorphological units (Flat dune, Slope and Basin) (Table I). Samples were taken from 97 mother plants of *V. tortilis* that were phenotypically healthy (not diseased) after fruit maturity. The plants are phenotypically healthy (not diseased). On each feet mother, dendrometric parameters such as diameter and height were measured. For all the stock plants, a total of 575 harvested fruits were quantitatively measured (Figure 2). Fruit harvesting consisted of shaking the branches of the stock plants with a pole. Data collection included measurements of the seven (7) morphometric characteristics (Table II) which are the number of seeds/10 fruits; the number of seeds in good condition/100seeds, the number of defective seeds/100seeds, the weight of 100 seeds, the length of fruit and the width of fruit.

**Table I:** Geographical and textural characteristics of the fruits collection site

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Geomorphological unit** | **Altitude** | **Latitude** | **Longitude** | **Sol texture** | **Level of water table** |
| Flat dune | 401 | 13°59'1'' | 10°36'6'' | Sandy | - |
| Slope | 395 | 13°58'59'' | 10°36'4'' | Sandy | - |
| Basin | 387 | 13°58'56'' | 10°36'3'' | Sandy loam | 5.6±0.12 m |

**Table II :** Measured parameters

|  |  |  |
| --- | --- | --- |
| **Acronyms** | **Descriptions** | **Measure unit** |
| DBH | Diameter at breast height of 1.30 m | cm |
| H | Height | m |
| R | Recovering | m² |
| NS/10F | Number of seeds/10 fruits | - |
| HS/100S | Seeds in good condition/100seeds | - |
| NDS/100S | Number of defective seeds/100seeds | - |
| W100S | Weight of 100 seeds | g |
| LF | Length of fruit | cm |
| WF | Width of fruit | cm |

**Figure 2: a:** Fruits;**b:** Seeds

* 1. **Data Analysis**

The data collected were analysed by using a Minitab 18, R.3.0 and Xlstat 2016 softwares for windows. A normality test (Ryan-Joiner test) was performed to verify the normal distribution of the data. A test of equality of variances and an analysis of variance (ANOVA) was applied to the data that verified the law of the normal distribution to compare the means. A non-parametric test (Kruskal-Wallis test) was applied to the data that did not follow the normal distribution. The Student-Newman-Keuls T test was also used to compare average values of parameters per geomorphological units and per two by two shape.

1. **Results**
   1. **Structure in diameter class per geomorphological unit**

The distribution in global diameter class of the phonologic monitoring site shows that individual-tree were concentrated into class of 3\_5 cm and 5\_7 cm and the trees in diameter class reveals (Figure 3) a distribution in like “reversed J”. This shows predominance of small diameter trees expressing a regular dynamic of *V. tortilis* populations within the site.According to the toposequence the distribution in diameter class (Figure 4) reveals that individuals trees of diameters 21\_23 cm, 5\_7 cm and 4\_6 cm represent those of high frequency with 22% for flat dune, 40% for the slope and 42% for the basin. The distribution per geomorphological unit were found to be in sawtooth for individuals of flat dune, in “reversed J” for those of slope and bell-shape for those of basin.

**Figure 3:** Structure in diameter class of the site

**Figure 4:** Structure in diameter class according to the toposequence of the site: **a:** Flat dune; **b:** Slope; **c:** Basin

* 1. **Structure of height class per geomorphological unit**

The distribution in height class shows that the class of 6\_7 m is broadly well represented (Figure 5). On the basis of morphological units of the site, the class 6\_7 m is mostly represented across the various morphological units (flat dune, slope and basin) with the same frequency of 26% (Figure 6)

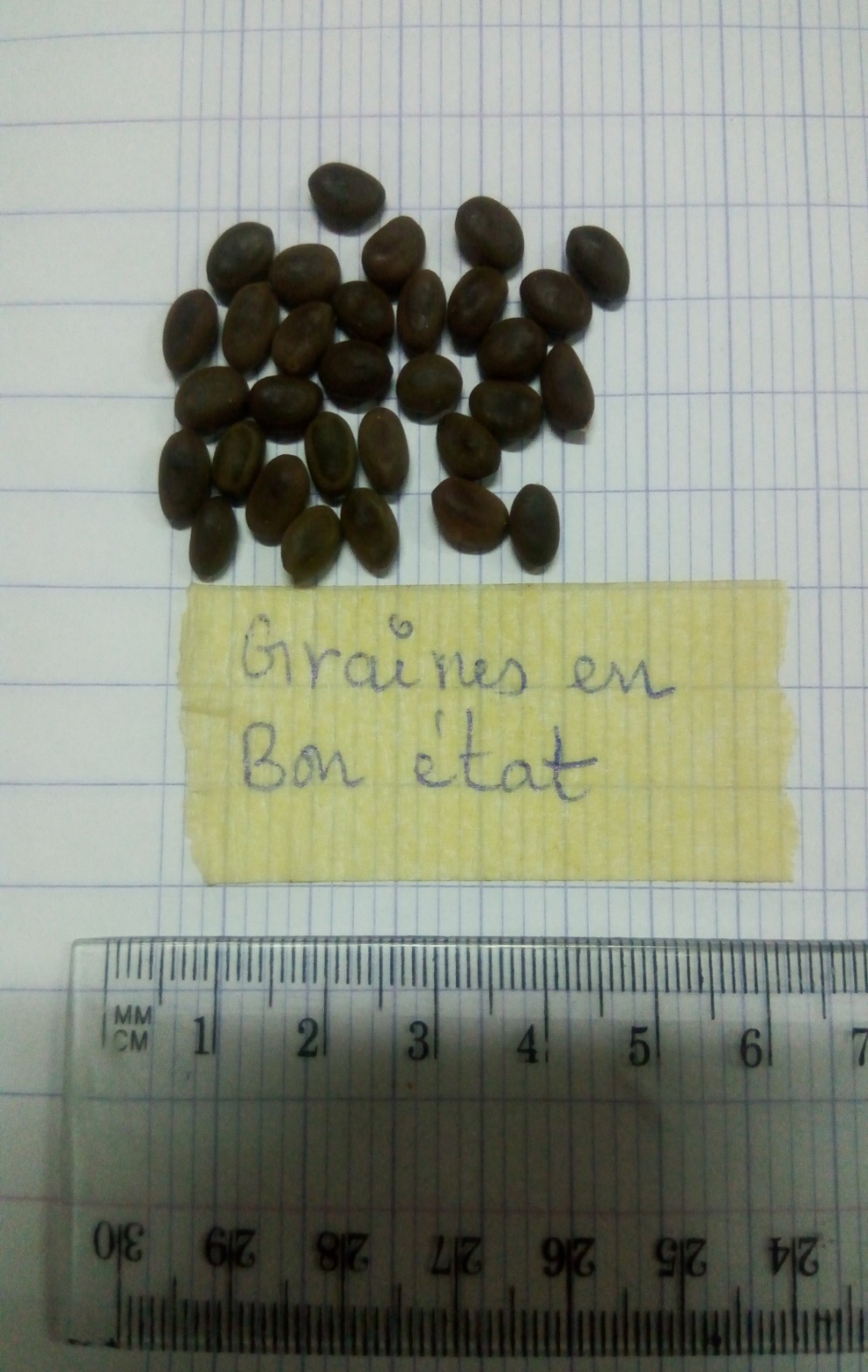
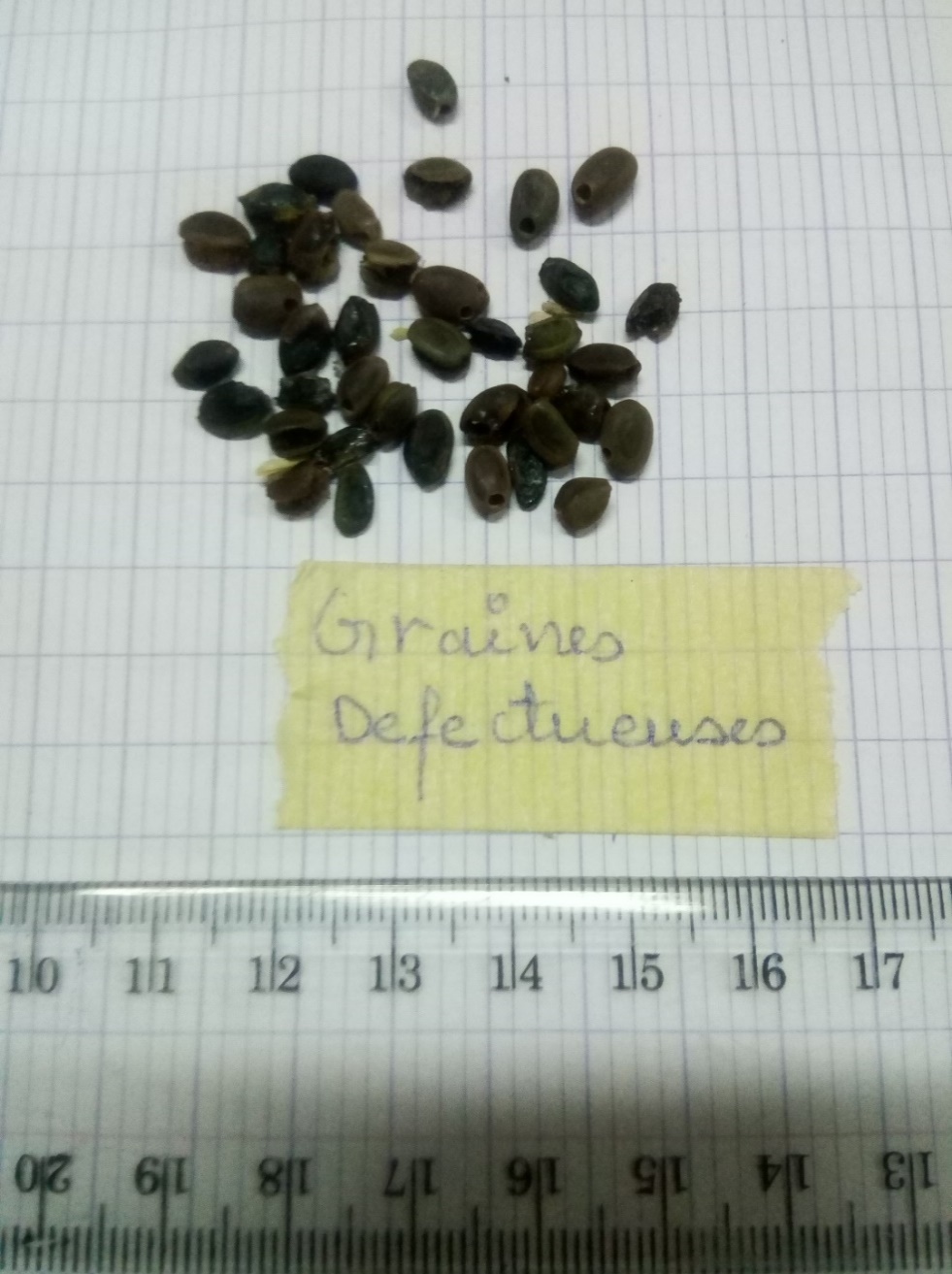
**Figure 5:** Structure in height class of the site

**Figure 6:** Structure in height class according to toposéquence: **a:** Flat dune; **b:** Slope; **c:** Basin

* 1. **State of seeds in *Vachellia tortilis***

A seed is considered healthy when it has no visible or closed hole. However, a seed is said to be infested when it has a physically seen inlet, closed hole or black in colour (Figure 7).

Figure 8 shows that there are more defective sheaths (more than 50%) in the fruits of all geomorphological units than seeds that are in good condition (less than 50%). Fruits from the slope have the largest number of seeds in good condition (40.03± 18,21%) followed by those from the flat dune (38.7±14.01%). The highest proportion of defective seeds is observed in the fruits of the basin (64.36±19.22%) followed by those of the slope fruits (55.6±22.16%) (Table III).

**Figure 7:** **A:** Healthy seeds of *Vachellia tortilis;* **B:** Defective seeds of *Vachellia tortilis*

**Figure 8:** State of seeds after shelling of *Vachellia tortilis’* fruits

**Table III:** Performance of species based on various morphological units

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Source** | **Mean** | **Variance** | **CV (%)** | **Minimum** | **Maximum** |
| D (cm) | Global | 26.11±21.19 | 449.01 | 81.15 | 3.18 | 124.2 |
| Basin | 65.91±25.13 | 631.28 | 38.12 | 32.5 | 124.2 |
| Flat dune | 18.506±6.289 | 39.554 | 33.98 | 3.183 | 35.205 |
| Slope | 17.82±6.4 | 40.98 | 35.92 | 10.06 | 39.41 |
| H (m) | Global | 7.4±1.575 | 2.481 | 21.28 | 4.5 | 10.5 |
| Basin | 7.726±1.374 | 1.888 | 17.78 | 5.75 | 10.5 |
| Flat dune | 7.608±1.846 | 3.406 | 24.26 | 4.5 | 10.5 |
| Slope | 6.921±1.058 | 1.119 | 15.29 | 5.75 | 9.5 |
| R (m²) | Global | 57.42±23.62 | 557.9 | 41.14 | 9.62 | 139.9 |
| Basin | 64.67±34.17 | 1167.83 | 52.84 | 18.47 | 139.9 |
| Flat dune | 48.34±18.2 | 331.27 | 37.65 | 9.62 | 86.55 |
| Slope | 67.65±19.41 | 376.79 | 28.69 | 21.64 | 116.84 |
| NS/10F | Global | 63.23±19.22 | 369.23 | 30.39 | 15 | 102.09 |
| Basin | 53.72±20.37 | 415.02 | 37.92 | 18.25 | 99.5 |
| Flat dune | 63.53±19.68 | 387.49 | 30.98 | 15 | 101.62 |
| Slope | 67.52±16.53 | 273.31 | 24.49 | 39.09 | 102.09 |
| HS/100S | Global | 38.43±16.06 | 258.07 | 41.8 | 7.79 | 90 |
| Basin | 35.13±17.73 | 314.45 | 50.48 | 15.57 | 81.3 |
| Flat dune | 38.47±14.01 | 196.36 | 36.43 | 13.51 | 90 |
| Slope | 40.03±18.21 | 331.44 | 45.48 | 7.79 | 74.07 |
| NDS/100S | Global | 58.84±18.34 | 336.34 | 31.17 | 8.94 | 92.21 |
| Basin | 64.36±19.22 | 369.5 | 29.87 | 8.94 | 84.43 |
| Flat dune | 59.17±14.83 | 219.99 | 25.07 | 10 | 86.49 |
| Slope | 55.6±22.16 | 491.01 | 39.86 | 16.22 | 92.21 |
| W100S (g) | Global | 5.652±3.834 | 14.703 | 67.84 | 0 | 25 |
| Basin | 5.789±1.873 | 3.509 | 32.35 | 5 | 10 |
| Flat dune | 5.052±3.41 | 11.629 | 67.5 | 1 | 10 |
| Slope | 6.5±4.936 | 24.365 | 75.94 | 0 | 25 |
| LF (cm) | Global | 8.465±2.303 | 5.303 | 27.2 | 3.6 | 13.2 |
| Basin | 7.165±1.134 | 1.285 | 15.82 | 5.32 | 9.16 |
| Flat dune | 7.069±1.45 | 2.103 | 20.51 | 3.6 | 9.92 |
| Slope | 11.246±0.779 | 0.607 | 6.93 | 9.62 | 13.2 |
| WF (mm) | Global | 6.0111±0.627 | 0.3931 | 10.43 | 5 | 7 |
| Basin | 5.767±0.728 | 0.53 | 12.62 | 5 | 7 |
| Flat dune | 6.233±0.568 | 0.323 | 9.12 | 5 | 7 |
| Slope | 6.0333±0.4901 | 0.2402 | 8.12 | 5 | 7 |

**Legend: D :** Diameter (cm) ; **H :** Height (m) ; **R :** Recovering (m²) ; **NS/10F :** Number of seeds/10 fruits ; **HS :** Healthy seeds/100 seeds ; **NDS :** Number of defective seeds /100 seeds ; **W100S :** Weight of 100 seeds ; **LF :** Length of fruit ; **WF :** Width of fruit

**Table VI:** Characteristics of geomorphologic units: average mean, standard deviations of parameters per unit, value of Newmann Keuls’ statistics and their significance

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Basin** | | **Sloppy** | | **Flat dune** | | **Global** | | **Test statistics** | | |
|
| **m** | **s** | **m** | **s** | **m** | **s** | **m** | **s** | **CV (%)** | **F** | **Probability** |
| D | 65.91**a** | 25.13 | 17.8b | 6.4 | 18.506**b** | 6.289 | 26.11 | 21.19 | 81.15 | 20.284 | < 0.0001\* |
| H | 7.726**a** | 1.374 | 6.921b | 1.058 | 7.608**a** | 1.846 | 7.4 | 1.575 | 21.28 | 7.9205 | <0.005\* |
| R | 64.67**a** | 34.17 | 67.65b | 19.41 | 48.34**c** | 18.2 | 57.42 | 23.62 | 41.14 | 5.5058 | <0.005\* |
| NS/10F | 53.72**a** | 20.37 | 67.52b | 16.53 | 63.53**c** | 19.68 | 63.23 | 19.22 | 30.39 | 2.7297 | 0.06958 |
| HS/100S | 35.13**a** | 17.73 | 40.03b | 18.21 | 38.47**c** | 14.01 | 38.43 | 16.06 | 41.8 | 4.3997 | 0.01447\* |
| NDS/100S | 64.36**a** | 19.22 | 55.6a | 22.16 | 59.17**a** | 14.83 | 58.84 | 18.34 | 31.17 | 0.346 | 0.7083 |
| W100S | 5.789**b** | 1.873 | 6.5a | 4.936 | 5.052**b** | 3.41 | 5.652 | 3.834 | 67.84 | 5.9624 | <0.005\* |
| LF | 7.165**b** | 1.134 | 11.246a | 0.779 | 7.069**b** | 1.45 | 8.465 | 2.303 | 27.2 | 5.3209 | <0.005\* |
| LG | 0.6518**a** | 0.1063 | 4.754b | 1.326 | 0.6234**a** | 0.1279 | 1.993 | 2.092 | 10.43 | 89 | < 0.0001\* |
| WF | 5.767**a** | 0.728 | 6.0333b | 0.4901 | 6.233**b** | 0.568 | 6.0111 | 0.627 | 104.96 | 69.528 | < 0.0001\* |

**Legend: m :** Mean ; **s :** Standard deviation; **D :** Diameter (cm) ; **H :** Height (m) ; **R :** Recovery(m²) ; **NG :** Number of seeds/10 fruits ; **HS :** Healthy seeds/100 seeds ; **NDS :** Number of defective seeds /100 seeds ; **W100S :** Weight of 100 seeds ; **LF :** Length of fruit ; **WF :** Width of fruit; **m**: mean; **s**: standard deviation ; **\*** Significant at the probability threshold (α =5%).

* 1. **Relationship between mother stock trees and size of fruits**

The coefficients of correlation between different measured parameters are shown in table V. The features related to the fruits size (its length and width) are correlated by measured parameters (diameter, height and recovering) measured from the feet. This correlation is negative between the fruits’ size, the diameter and the height. It is positive between the size of the fruits and the recovering of feet from crowded trees. However, the number of seeds / 10 fruits and number of healthy seeds have positive correlation with the defective grains, the weight of 100 seeds, the length and width of fruit.

**Table V:** Relationship between morphologic characteristics being observed inter individual.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **DBH** | **H** | **R** | **NS/10F** | **HS** | **NDS** | **W100S** | **LF** | **WF** |
| **DBH** | 1 |  |  |  |  |  |  |  |  |
| **H** | 0.291\* | 1 |  |  |  |  |  |  |  |
| **R** | 0.423\* | 0.412\* | 1 |  |  |  |  |  |  |
| **NS/10F** | 0.106 | 0.062 | 0.209\* | 1 |  |  |  |  |  |
| **HS** | -0.044 | 0.088 | 0.22\* | 0.714\* | 1 |  |  |  |  |
| **NDS** | 0.172 | 0.042 | 0.154 | 0.933\* | 0.431\* | 1 |  |  |  |
| **W100S** | 0.041 | -0.033 | 0.167 | 0.429\* | 0.669\* | 0.223\* | 1 |  |  |
| **LF** | -0.242\* | -0.224\* | 0.192\* | 0.276\* | 0.392\* | 0.158 | 0.289\* | 1 |  |
| **WF** | -0.231\* | -0.2\* | 0.346\* | 0.185\* | 0.29\* | 0.089 | 0.257\* | 0.804\* | 1 |

**Legend: D :** Diameter (cm) ; **H :** Height (m) ; **R :** Recovery(m²) ; **NS/10F :** Number of seeds/10 fruits ; **HS :** Healthy seeds/100 seeds ; **NDS :** Number of defective seeds /100 seeds ; **W100S :** Weight of 100 seeds ; **LF :** Length of fruit ; **WF :** Width of fruit; **\*** Coefficient of significant correlation threshold (Probability α < 0.05)

**Table VI:** Results of univariate analysis and multivariate of discriminating power of groups par variables: R² value and significance

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **R²** | **F value** | **Probability** |
| D | 70.43 | 133.41 | < 0.001 |
| H | 4.68 | 2.75 | 0.001 |
| R | 15.34 | 10.15 | 0.005 |
| HS | 1.03 | 0.58 | 0.07 |
| NDS | 2.57 | 1.48 | 0.014 |
| NS/10F | 5.75 | 3.42 | 0.014 |
| W100S | 2.90 | 1.67 | 0.003 |
| LF | 72.62 | 148.56 | 0.006 |
| WF | 86.73 | 366.14 | < 0.001 |
| Statistics of Wilks’ Lambda |  | 2 (ddl = 112) | < 0.0001 |

**Legend: D :** Diameter (cm) ; **H :** Height (m) ; **R :** Recovering (m²) ; **NS/10F :** Number of seeds/10 fruits ; **HS :** Healthy seeds/100 seeds ; **NDS :** Number of defective seeds /100 seeds ; **W100S :** Weight of 100 seeds ; **LF :** Length of fruit ; **WF :** Width of fruit.

1. **Discussion**

The evaluation of quantitative traits on fruits of *V. tortilis* shows morphometric variability base on toposequence. The average length of the fruits from the sloppy, basin and flat dune were found to 11.246±0.779 cm; 7.165±1.134 cm and 7.069±1.45 cm (*P <0.005*) respectively. While the average width varied from 4.754±1.326 cm for the slope; 0.6518±0.1063cm for the basin and 0.6234±0.1279 cm for the flat dune (*P < 0.001*). These results were less than those found by JAOUADI et al. (2013) on morphometric variation of *V. tortilis* in Tunisiawhich are as followed 13.14±3.49cm for the length of fruits, 7.4±0.92mm for the width and 6.56±1.28g of the weight of 100 grains. The overall average value of morphometric parameters was; 63.23±19.22 for the number of seeds in 10 fruits; 38.43±16.06 for healthy fruits; 58.84±18.34 for the defective ones and 5.652±3.834g for the weight of 100 seeds; 8.465±2.303 cm for the length of fruits; 1.993±2.092 cm for the width and 6.01±0.63 mm for the length of seeds The analysis showed that average mean is clearly superior for fruits from the slope compare to those from basin and flat dune, that is 2 times the length of fruits of other geomorphological units. The average width of fruits from slope area is 4 times the width of those in basin and flat dune. This difference would be due on the one hand to the pressure exerted on the feet of the dune bed and the basin and on the other hand to the geographical position of the geomorphological units. Being on a sloping ground, the sampling of fruits on the feet of the slope by men is not easy compared to the other units.

* 1. **State of seeds in *Vachellia tortilis***

Defective and healthy grains were observed under quantitative traits evaluation on fruits of *V. tortilis* using 100 seeds. Therefore, the defective seeds were higher than the healthy ones across all geomorphological units. The highest number of healthy seeds were observed from the feet in slope site, followed by grains of feet on flat dune and those in basin with average value of 40.03±18.21; 38.47±14.01 et 35.13±17.73 respectively.

On the basis of a geomorphological unit, the number of defective seeds is clearly superior than those of healthy seeds. This can be explained by a merely early maturity of fruits within the geomorphological unit. Some feet from the basin matured earlier followed by those on flat dunes then on slope. The feet in the basin are fed by a water table of 5.6±0.12 m deep. However, for the feet on flat dune, soil water infiltration is due to the roughness of existing herbaceous layer. While for those on the sloppy, their position and lack of roughness are limiting factors of water infiltration. Moreover, the sools on the slope produce fruits of bigger size compare to those from basin and flat dune. the morphometric variations such as number of grains per 10 fruits, healthy seeds per 100 grains, weight of 100 seeds, length of fruits (*P < 0.05*), width of fruits (*P < 0.001*) were observed on fruits according to the toposequence of the site (flat dune, slope and basin).

The findings substantiate those of the following: EL AYADI et al. (2012) on morphometric variations in fruits of *V. tortilis* carried out in Morocco, and JAOUADI et al. (2013) on morphometric variations in seeds of *V. tortilis* in the pseudo savannah of Northern Tunisia. The morphometric variations observed during this study could be a result of dendrometric parameters of the feet and the topography of the site. Many scholars have obtained such similarities in different acacia species and other wood species (NASRI et al., 2004, AHLAWAT et al., 2007, EL AYADI et al., 2012, JAOUADI et al., 2013, FREDRICK et al., 2015, GBEMAVO et al., 2015).

* 1. **Relationship mother stock trees and size of fruits**

The relationship between the fruits and dendrometric parameters of feet had been examined. According to SAIDOU et al. (2014), the correlations were found to be essential tool to make relevant choice of characteristics that should be incorporated in selection programs. The number of defective grains was not correlated by the dendrometric parameters of feet and the results confirm findings of JAOUADI et al. (2013).

From the view of the above authors, the percentage of infested seeds was positively correlated by the diameter and the height. The weight of seeds (W100S) was also positively by the number of defective ones. This result did not match with findings of JINDAL et al. (1990) and JAOUADI et al. (2013).

**Conclusion**

The variability across the geomorphological units was a basic criteria to differentiate pods or fruits of *V. tortilis* in Sahelian bioclimate of Niger. The findings showed morphologic diversity according to the toposequence and also the necessity to use qualitative approach in order to acquaint the existing diversity a part from shape of fruits of *V. tortilis* in Niger. The size of the crown has shown positive effect on the number of seeds per fruit, the weight, length and width of fruits. The study has contributed to highlight the relationship dendrometric parameters of feet and size of fruits.

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**Acknowledgement**

Special thanks goes to the Panafrican Agency of the Great Green Wall (APGMV) for the awarded scholarship. We are also grateful to the University of Diffa the various endless supports. Our gratitude is also express to the people of the villages and the government officials for their warm welcome and availability.

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