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Original Article

Ethnobotanical investigation and Morphobiometric characterization of different cowpea seeds (vigna unguiculata subsp. unguiculata (L.) walp.) in the Hoggar region (Algerian Sahara): acquisition and future investment project for food security in Algeria.

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ABSTRACT

This survey was conducted to establish an inventory of cowpea culture in the arid region of southern Algeria in 2018. To this end, missions were organized to collect accessions, provide information on cultural practices and traditional knowledge related to this culture a semi-questionnaire The European Commission has set up a European Agricultural Information Society. The study found that among the farmers surveyed. This study showed that of the farmers surveyed, 70.02% were men and 29.07% were women. Farmers cultivate cowpea on small areas, its production is used only for own consumption and a small one is marketed in villages where the plant is grown, the farmers interviewed use three main parts: seeds, green pods and hay. After harvest, the rest of the plant (leaves and stems) is used to feed livestock (sheep and cattle). Cowpea cultivation is in danger of extinction, according to the majority of farmers surveyed, diseases and insect attacks are low (32%). In addition, low rainfall, electricity and labor shortages during manual harvesting appear to be the main production constraints reported by the farmers interviewed. While farmers are satisfied with the yields obtained. The results obtained by biometric morpho characterization showed a wide phenotypic variability of the seeds However, significant differences were detected in several morphological characters.
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1. Introduction

Cowpea (Vigna unguiculata (L.) is a native legume crop, which is a commodity traded and grown in large regions throughout Africa, mainly in West and Sub-Saharan Africa, in Latin America and parts of Southeast Asia. [1, 2]. It is an important warm season legume, mainly grown by poor farmers in the semi-arid tropics for human and animal consumption, combined with cereals such as millet and sorghum [3, 4]. In addition, cowpea seeds and leaves are important sources of protein, carbohydrates, minerals, polyphenols, flavonoids and antioxidants [5, 6] . In addition, their leaves are a source of vitamin C, carotenoids and total chlorophylls [6].Their seed extracts can reduce the proliferation of certain cell diseases and improve the effect of 5-fluorouracil on human colorectal cancer cell lines [7, 8]. It covers

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cereals and tubers with a low protein content , considered a very important food and a reliable product that can generate income for farmers and traders [9]. In Algeria, a great phylogenetic richness and a very important plant and animal biodiversity, associated with various cultural traditions. It have accumulated for the culture of cowpea , divided into three distinct areas: the north (Kabylie, El Kala), the southwest, the oases of the Sahara (El Goléa, Adrar et Béchar) and the south-east of the country (Djanet, Tamanrasset) [10]. It known as Tedelaght or Tenzente in Tamachaq (Tergui dialect) and loubia in Arabic. Cowpea accessions preserved among the peasants, mainly cultivated on small areas, and often intended for self-consumption. The main objectives of this study were to specify the areas of distribution of cowpea culture in Hoogar, to the maximums of information on the knowledge and traditional practices related to this culture ,To estimate the level of morphological diversity between accessions by qualitative and quantitative characteristics , To establish the descriptive characteristics of each accession collected , To selection of accessions with interesting agronomic traits which will be the subject of inscription in the official catalogue to enrich the variety range, to preserve the country's genetic heritage and even include them in plant production and improvement programmers.

2. Materials and Methods

2. *1 Characteristics of prospecting and collection sites*

2. 1.1 Climatic description of study area

The Tamanrasset region is located in the south of Algeria and occupies a large area of its desert. This region lies at an altitude of 1400 m and has a warm desert climate typical of the Hoggar region, which is characterized by a long very hot summer and a short and also warm winter [11] .

2.*1.2 Collection of accession*

In order to collect the existing variability in Hoggar, several survey and collection missions were organized across the different areas of Hoogar, characterized by a great agro-climatic diversity. Ten randomly selected villages surveyed and 18 representative accessions of the Hoggar region were randomly harvested to carry out this study. Cowpea seeds are collected by the staff of the Agricultural Services Directorate of the wilaya of Tamanrasset and the farmers of each village surveyed, the collection sites of the different accessions are shown in (Annex .Table 1) .The MPS system is used to collect the origin of the surveyed sites (Basseddik *et al.,* 2021).

2.*2 Collection of agronomic data and ethno botanical investigations*

The data was assembling during 2018; cowpea was harvested between season (June and December) in Hoggar, farmers were interviewed. Farmers were randomly selected and ethnobotanical andagronomicinformationwascollectedusingasemi-structuredquestionnaire.Thevariablesused in the interviews included information about the farmer and his farm (age, sex, origin, agricultural or vocational training). his farm (geographical location, Age of the farm, Area used for cowpea, Cowpea related crops, Labor, Agricultural equipment, Livestock, Seed (vernacular name, Sources, Cost, Part used of the plant, Harvest destination, Geographical origin, planting and harvesting, and main cowpea dishes, do you think this plant will disappear? Planting period (the time of tillage, the time of flowering, the presence of nodules on the roots , availability of water and its origin, water quality, method of application and frequency of irrigation, fertilization practices, diseases and pests during cultivation ,use of phytosanitary products, storage diseases and pests and control methods, irrigation . Types of treatments applied, climatic accidents, harvesting period, packaging, means used in packaging, yield, existing constraints and solutions proposed by the farmers. A part concerning the economic management of the plant, production costs, financing of the farm, marketing, and product sales methods.

2.3 Morpho biometric data of the collected seeds (quantitative and qualitative traits)

In order to characterize the seeds of different accessions collected, we have retained several morphological characteristics. To facilitate this characterization , we have assigned certain codes according to the different qualitative characteristics studied [12]. The quantitative characters were determined, for the average pod size were determined on ten random pods in each of the collected accessions Diameter pod (PD) , thickness pod (PT) were measured using a digital caliper with an accuracy of 0.01 mm , Number of ovules per pod (CIP) , Number of seeds per pod(NSP). The average seed size was determined with 50 randomly seeds from each of the

accessions collected. Diameter seed (SD), thickness seed (ST) were measured with a digital caliper with an accuracy of 0.05mm .The weight of 100 seeds (WHS) was determined using an electronic balance with an accuracy of 0.01 g. For the same seeds, qualitative characteristics: Seed shape (FS), Seed color (SC), and seed Texture (ST), and Eye color (EC) were examined by a visual method.

2.4 Statistic analysis

The data obtained were subjected to a statistical analysis of differences: For all characters, descriptive statistics were calculated, as well as the Pearson correlation coefficient. A principal component analysis (PCA) and on standardized mean values was carried out to study the relationship between the quantitative characters, followed by a cluster analysis with the CLUSTER procedure using Ward's hierarchical minimum variance method. Qualitative traits were analyzed by multiple correspondence analyses (ACM). The statistical analyses were performed with the XLSTAT 2016.02 statistical program.

3. Results and Discussion

3.1 Agronomic data and ethno botanical investigations

3.1.1 Age and sex

The ethnobotanical and agronomic characteristics of the 18 accessions have been filled in 50 farmers were interviewed individually. The demographic data are summarized in Table 1. The age of the cowpea farmers in the different regions surveyed is generally very advanced. In fact, the majority of the individuals surveyed (68.36%) are over 65 years old, while 20.44% are between 45 and 65 years old. Young farmers, aged between 45 and 65 years old, represent only 16.59% of the total. In the ten site regions studied, women represent the majority of the individuals questioned (70.02%) they are involved in the harvesting operation.

Table 1. Demographics characteristics of farmers interviewed. Gender and age presented in percentages

Regions	Sex		Age		
	Women	Man	<45	45-65	>65
Abalessa	82, 36	17 ,64	11,76	11,76	76,48
Guezzam	100	00	00	00	100
In Saleh	100	00	00	00	100
In Amguel	100	00	00	00	100
Tit	75	25	12,5	50	37,5
Daghmoli	100	00	66,66	33,33	00
Tin Amsagh	50	50		25	75
Igléne	42,86	57,14	00	42,85	57,15
Selesken	25	75	00	00	100
Outoul	25	75	25	37,5	37,5
Average	70,02	29,97	16,59	20,04	68,36

3.3.2 Origin of seeds

In the communes studied, the origin of the seed is Niger, with 80% and 20% of respondents not knowing the origin of their seeds (Fig.1).

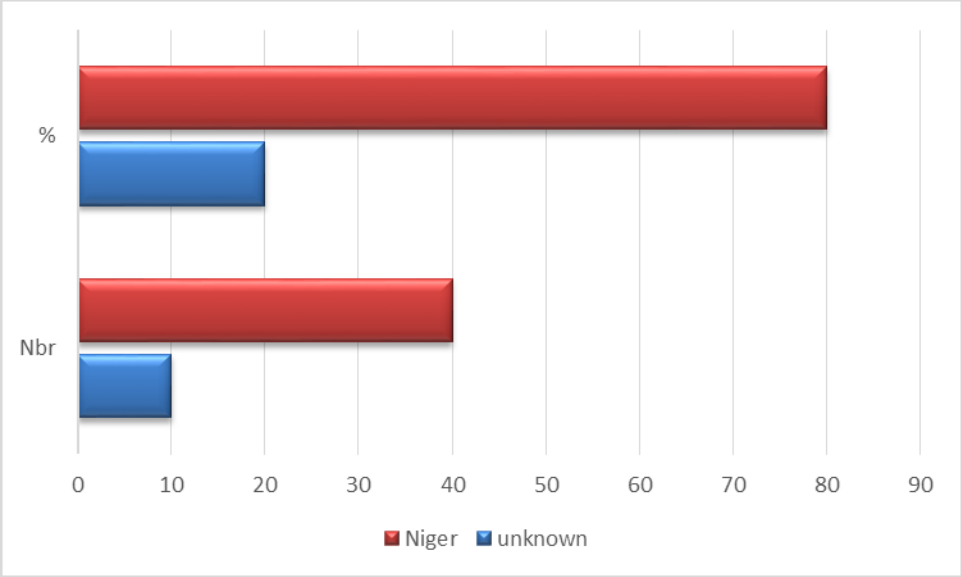

Fig. 1 Frequency of seed origin according to the individuals surveyed

3.3.3 Sowing period

In Hoggar, 46% of those interviewed sowed cowpea between April and May, whil e 28% sowed in March and 26% in June (Fig. 2).

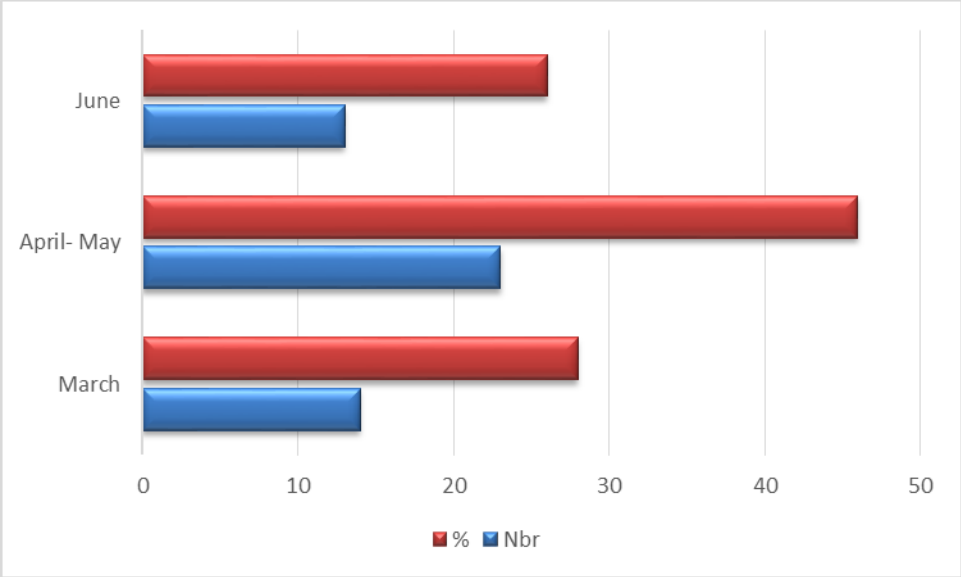

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Fig. 2 Frequency of sowing period according to individuals surveyed

3.3.4 Flowering period

Flowering appears to be later, with 76% of respondents reporting cowpea flowering one to two months after sowing and only 18% reporting flowering more than two months after sowing, while 6% of respondents reported flowering after one month of sowing (Fig. 3).

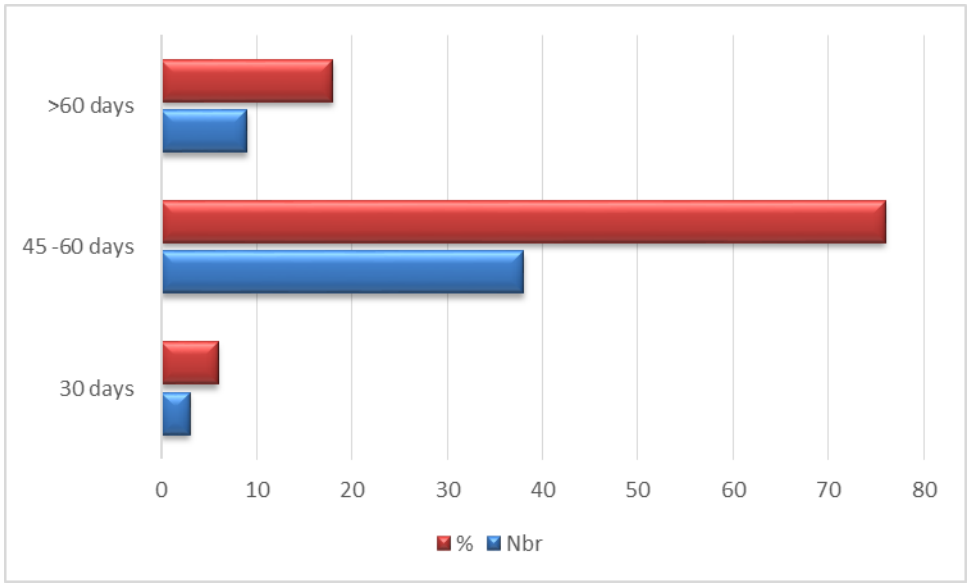


Fig. 3 Frequency of flowering time

3.3.5 Diseases and enemies

Regarding the diseases and pests causing the most damage to cowpeas in Hoggar, insect attacks were reported by 32% of the farmers surveyed, while the majority did not report any diseases 68% (Fig. 4).

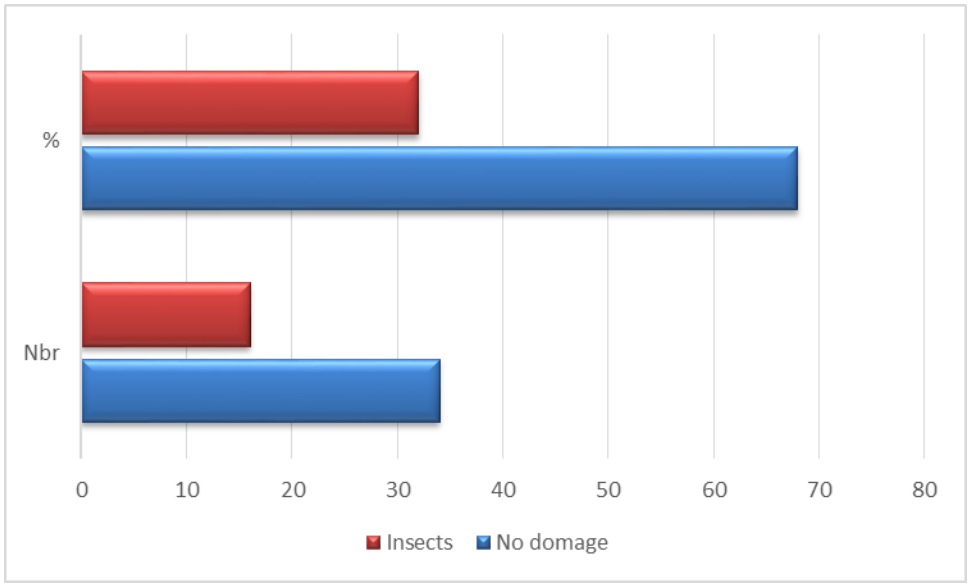


Fig. 4 Frequency of cowpea diseases and enemies

3.3.6 Origin of framers

Concerning the origin, 80% of the agricultures are from the region of Hoggar and only 20% are from the others wilaya of Algeria (Fig.5).

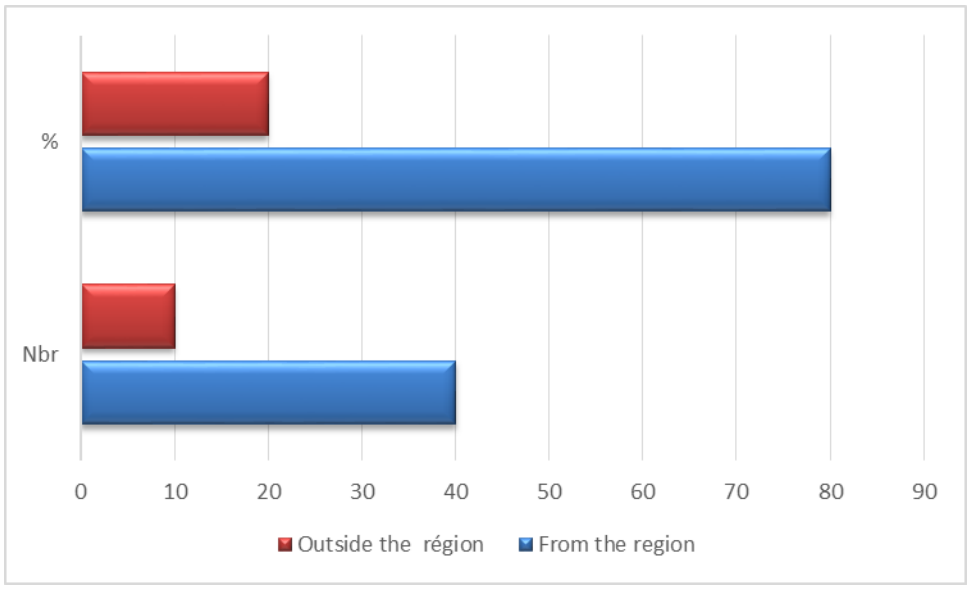


Fig.5 Frequency of origin of farmers.

3.3.7 Irrigation

The most commonly used irrigation method in the Hoggar is ray irrigation with a frequency of 78% (Figure 06). Drop irrigation is practiced with a frequency of 22% (Fig.6).

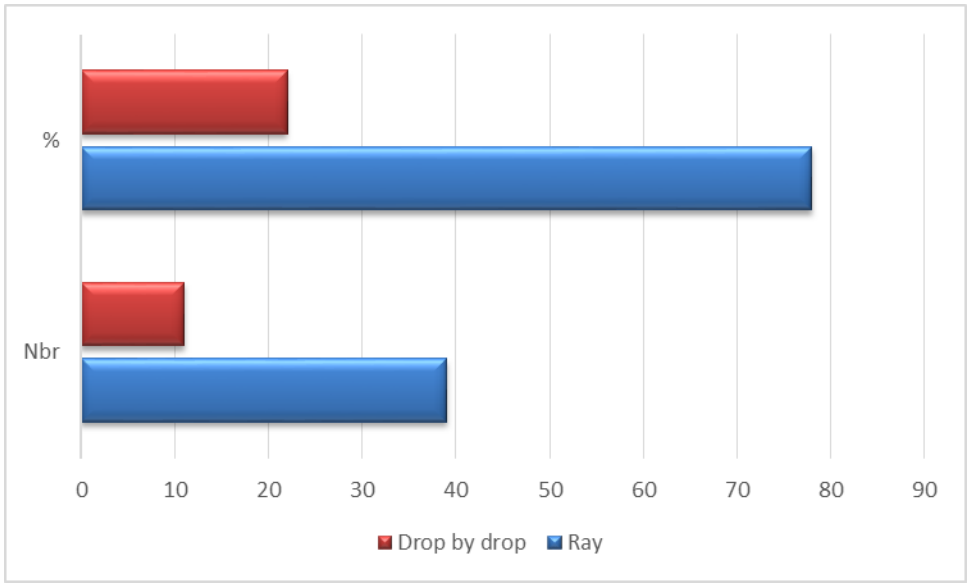


Fig. 6 Irrigation method frequency

In Hoggar, motorized pumping is the only method of irrigation application used by the farmers of Hoogar (Fig. 7).

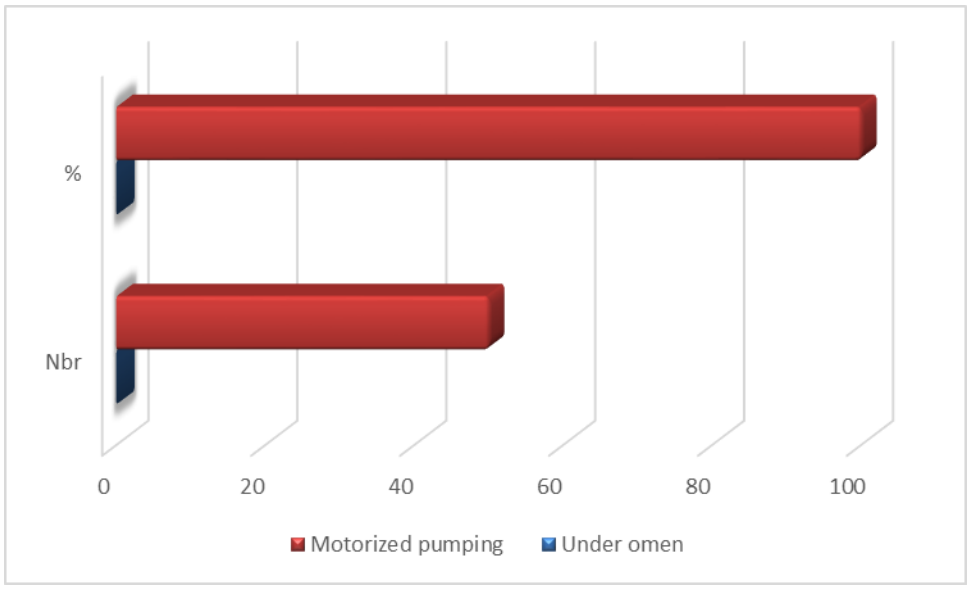


Fig7. Irrigation application mode frequency

In Hoggar, the frequency of cowpea irrigation varies from two to three times a week with 80% and 20% respectively. (Fig. 8).

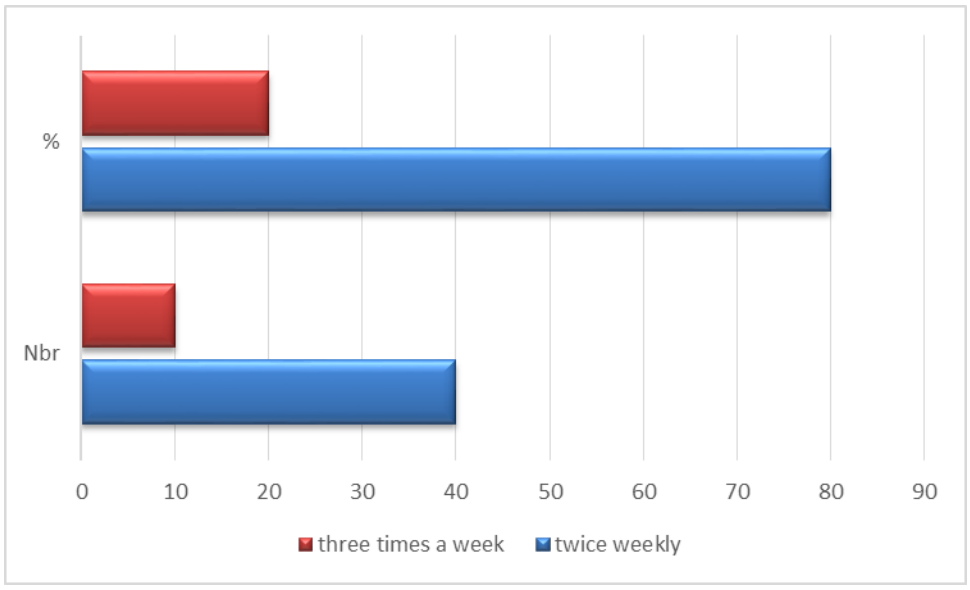


Fig.8. Irrigation frequency

3.3.8 Nodules on roots

For the majority of respondents in Hoggar, nodules are absent in cowpeas with 80% of individuals and only 20% reported the presence of nodules in their plants (Fig.9).

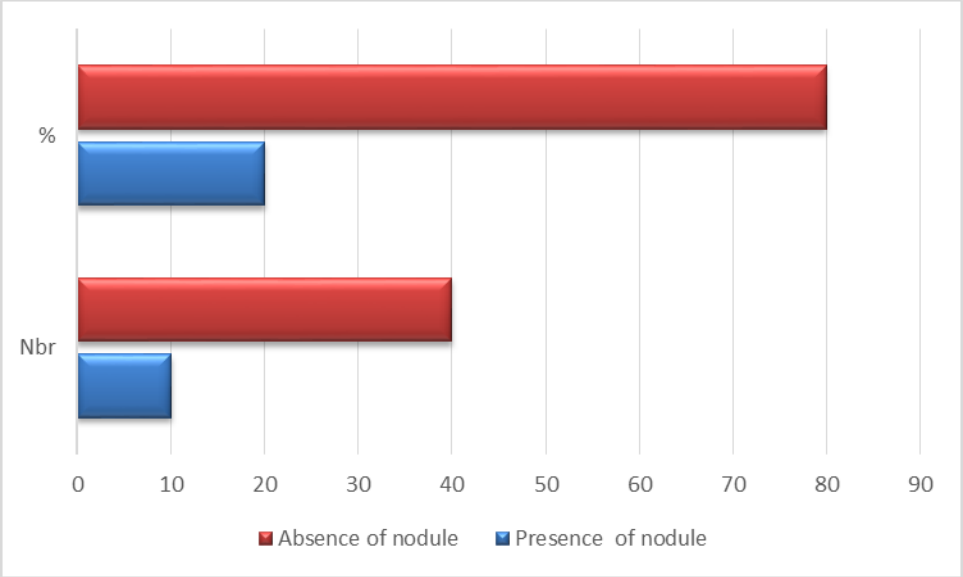


Fig 9 . Frequency of nodules on roots

3.3.9 Speculation cultivated with cowpea

Date palms and vines are the two most cultivated crops in the Hoggar region , followed by cereals (durum and soft wheat, barley and sorghum), alfalfa, onions, watermelons, mint and others (cowpeas, parsley) (Fig.10).

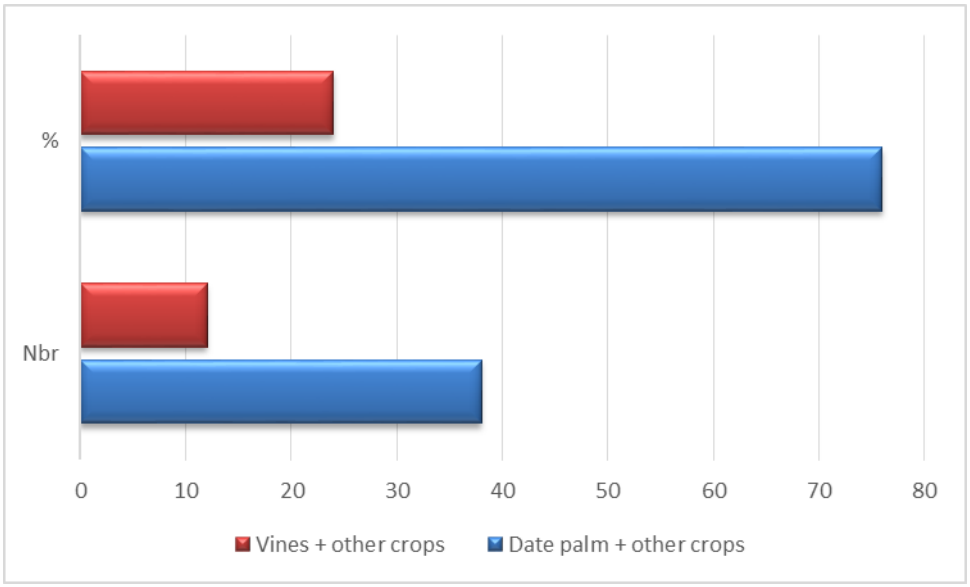


Fig10. Frequency of other speculation cultivated with cowpea.

3.3.10 Fertilization

In general, the majority of individuals questioned 80 % use fertilizers and organic fertilization is the most widely used

by the farmers of Hoogar, who use sheep manure as background fertilizer (Fig.11).

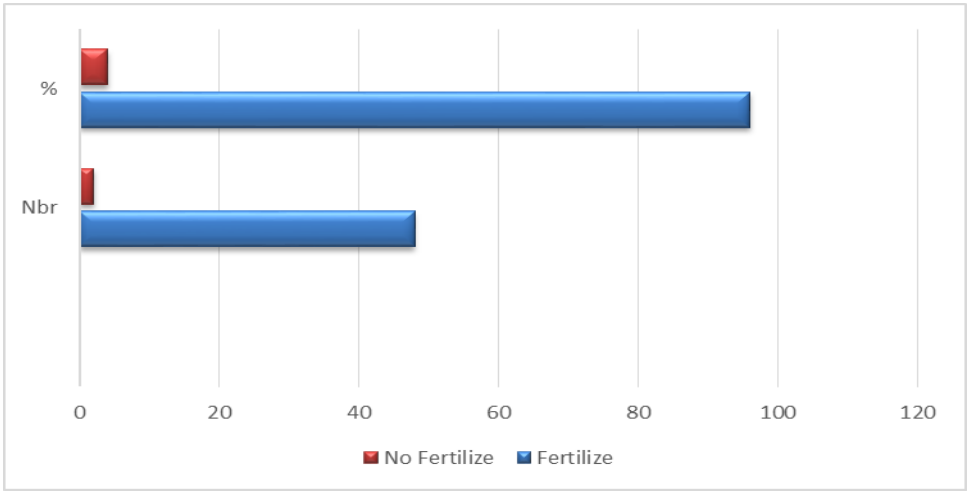


Fig 11. Frequency of fertilization practice

3.3.11 Animal husbandry

The practice of animal husbandry is marked among the totality of Hoggar's peasants with a percentage of 100%

3.3.12 water of irrigation

The water used in irrigation in the region of Hoogar is 100% from natural reservoirs.

3.3.13 Plant parts used

The majority of farmers use the seeds plus the green pods to prepare traditional dishes with 80%, while 20 in a trend of using the seeds the pods and the leaves as well (Fig.12).

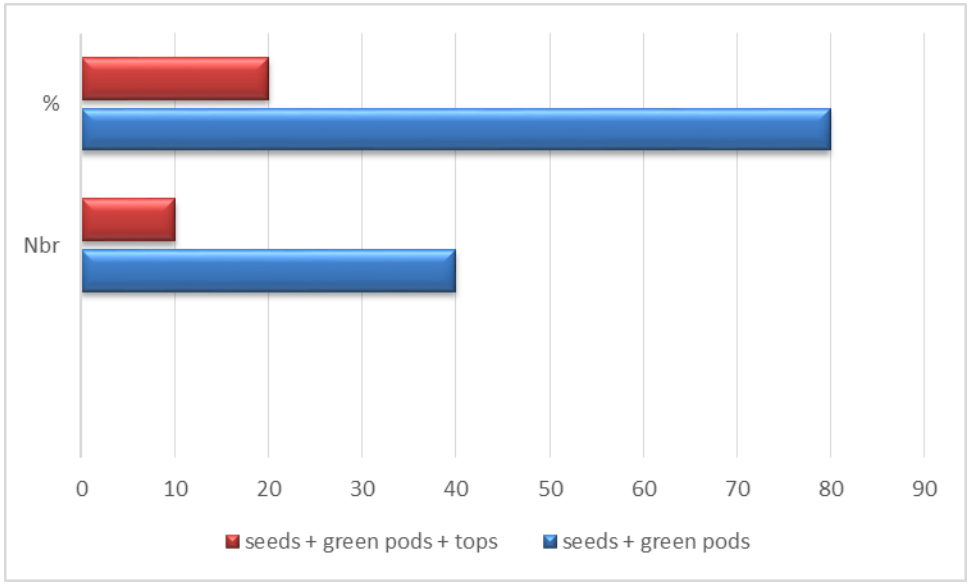


Fig12. Frequency of used plant parts

3.3.14 Means in storage of seeds

The only method used to preserve seeds during storage is cold with a percentage of 5%, while the rest of the farmers do not use any means of control (Fig.13**).**

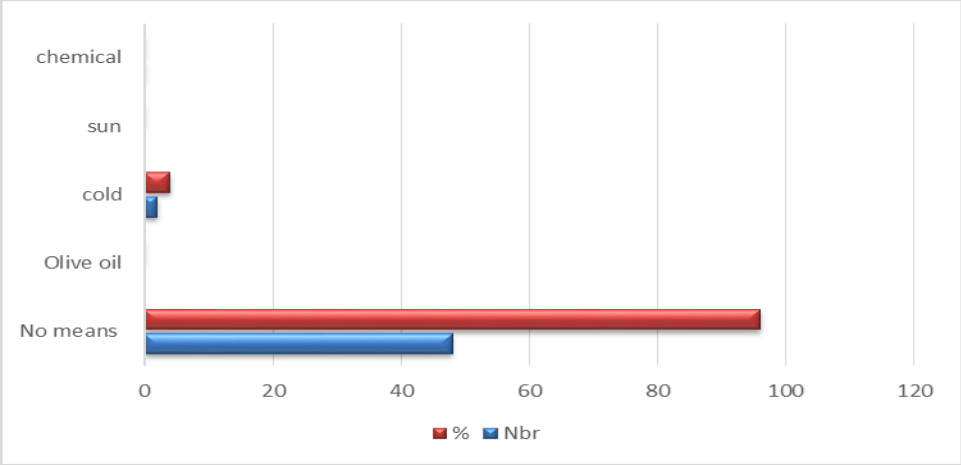


Fig 13 Frequency of means in storage

The majority of Hoggar's farmers use organic fertilizers only and they do not use plant protection products to fight against pathological diseases affecting their cowpea plants.

3.2 Biometric Characterization of seeds

3.2.1 Qualitive traits

Table 2 grives descriptives quantitatives traites of seeds coloration des graines, couleur de hile, forme et texteur des graines

Table 2. Qualitive characteristics of Hoggar cowpea seeds

Ecotypes	*CG*	EC	F	T
NEA1	cream	green	reniform	smooth
NEA2	beige-olive	green	reniform	smooth
NEA3	red	green	reniform	smooth
NEA4	brown	green	reniform	smooth
NEA5	Black	green	reniform	smooth
NEA6	white	Black wide	Arondie	rough
NEA7	brown	brown	reniform	smooth to rough
NEA8	white	green	rhomboid	rough
NEA9	cream	green	reniform	smooth
NEA10	brown	green	reniform	smooth
NEA11	cream	green	reniform	smooth
NEA12	white	brown	reniform	smooth to rough
NEA13	Black	green	reniform	smooth
NEA14	cream	green	reniform	smooth
NEA15	Cream	Green	Reniform	Smooth
NEA16	white	brown wide	rhomboid	rough
NEA17	beige	green	rhomboid	smooth
NEA18	white	Black	Rhomboide	rough

CG: Seed color, CE: Eye color, F: Seed form, T: Seed text

3.2.2 Descriptive Statistics and Analysis of Correlations (Pearson (n))

Table 3gives descriptive Statistics quantitative traits of pod size (diameter and thickness), number of sees by pod, number of ovule by pod, seed size (length and thickness) and weight of cowpea seeds (WHS).

Table 3. Average seed size (length, thickness, weight of 100 seeds), and Average pod size (PD, PT), CIP, NSP. Standard deviation data from 72 observations

Variables	**Min**	**Max**	**Mean**	**SD**
PD(cm)	7,50	20,00	10,63	0,86
PT(cm)	0,30	0,80	0,42	0,04
NEP	5,00	21,00	10,75	1,21
NSP	4,00	21,00	10,18	1,27
SD(cm)	0,30	0,80	0,55	0,09
ST(cm)	0,50	1,01	0,61	0,04
WHS(g)	6,56	18,35	9,57	0,03

PD: Pod diameter, PT: Pod thickness, NEP: number of eye by pod, NSP: number of seeds by Pod, SD: seed diameter, ST: Seed Thickness

3.2.3 Correlation matrix

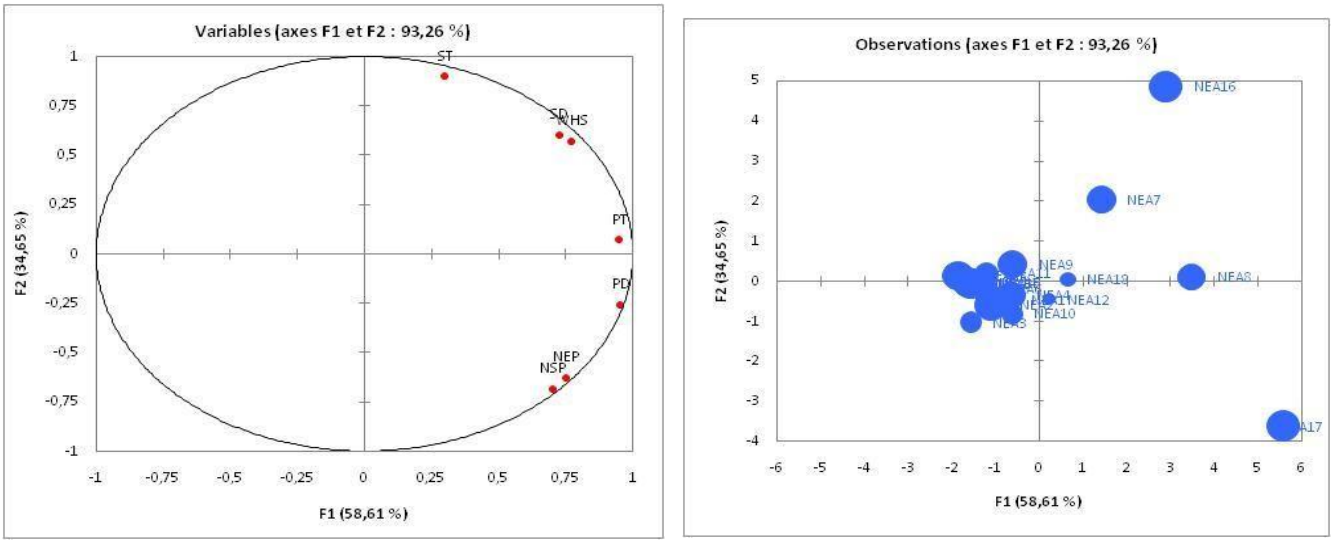
Table 3 shows Pearson's correlation coefficients between quantitative traits. PD was positively and significantly correlated with NEP, PT, NSP, SD and WHS. As well , PT was positively and significantly correlated with PD, NEP, NSP, SD, and WHS. In addition, NEP and NSP were highly significantly correlated and correlated with PT, PD. Whereas, WHS was significantly correlated with Seed seize (ST, SD), and pod seize (PT, PD).

Table 3 Pearson's correlation coefficients between quantitative traits

variables	PD	PT	NEP	NSP	SD	ST	WHS
PD	**1**	**0,884**	**0,875**	**0,847**	**0,530**	0,039	**0,613**
PT	**0,884**	**1**	**0,663**	**0,594**	**0,696**	0,350	**0,745**
NEP	**0,875**	**0,663**	**1**	**0,966**	0,157	-0,293	0,209
NSP	**0,847**	**0,594**	**0,966**	**1**	0,114	-0,378	0,146
SD	**0,530**	**0,696**	0,157	0,114	**1**	**0,702**	**0,870**
ST	0,039	0,350	-0,293	-0,378	**0,702**	**1**	**0,705**
WHS	**0,613**	**0,745**	0,209	0,146	**0,870**	**0,705**	**1**

PD: Pod diameter, PT: Pod thickness, NEP: number of eyes by pod, NSP: number of seeds by Pod, SD: seed diameter, ST: Seed Thickness; Values in bold are different from at significance level alpha=0.05.

3.2.4 Principal Components Analysis



a) b)

Fig .14 Principal Component Analysis (PCA) for variables (a) and observations (b) along the F1 and F2 axis.

Only the first two axes of the principal components analysis (Fig.14), which accounted for nearly 93.26% of the variability expressed, were considered. Axis 1 absorbed 58.61% of the variation. This axis associated the characteristics length and width of the pod, number of eggs per pod, number of pod grains, Diameter of grains and Weight of 100 seeds (WHS). They are positively correlated on this axis. Axis 2, which explained 34.65% of the variation, defines the variables number of ovules by pod, number of seed by pods, Diameter and weight of 100 seeds, which contributed to 96.99 % of the total variation. This F2 axis was negatively correlated to NEP, NSP and positively correlated to WHS, PD and PS.

3.2.4 Own values

Table 4 gives the Own value of cowpea seeds. The Eigen values of the first two main components were greater than 1 and accounted for 93.26% of the variance

Table 4 Own value of cowpea seeds.

	F1	F2	F3	F4	F5	F6	F7
Own value	4,103	2,425	0,184	0,136	0,114	0,026	0,011
Variability (%)	58,612	34,650	2,631	1,949	1,628	0,370	0,162
% cumulated	58,612	93,261	95,892	97,841	99,469	99,838	100,000

3.2.5 Cluster Analysis

To study and categorize the accessions studied, the Ward method was used in cluster analysis (Dissimilarity index= based on traits assessed in three classes (Fig.15). The first class consists of 13 accessions: NEA1, NEA2, NEA3, NEA4, NEA5, NEA6, NEA09, NEA10, NEA11, NEA12, NEA13, NEA14, NEA15 and NEA18. These accessions have a short pod length and width and a low weight of 100g. The second class has three accessions: NEA16, NEA07, NEA8 have a weight of 100g (WHS) and the highest grain length and width (SD).The third class has only one NEA17 accession has the best characters: length and width of pods, number of ovule by r pod and the highest number of grains by pod

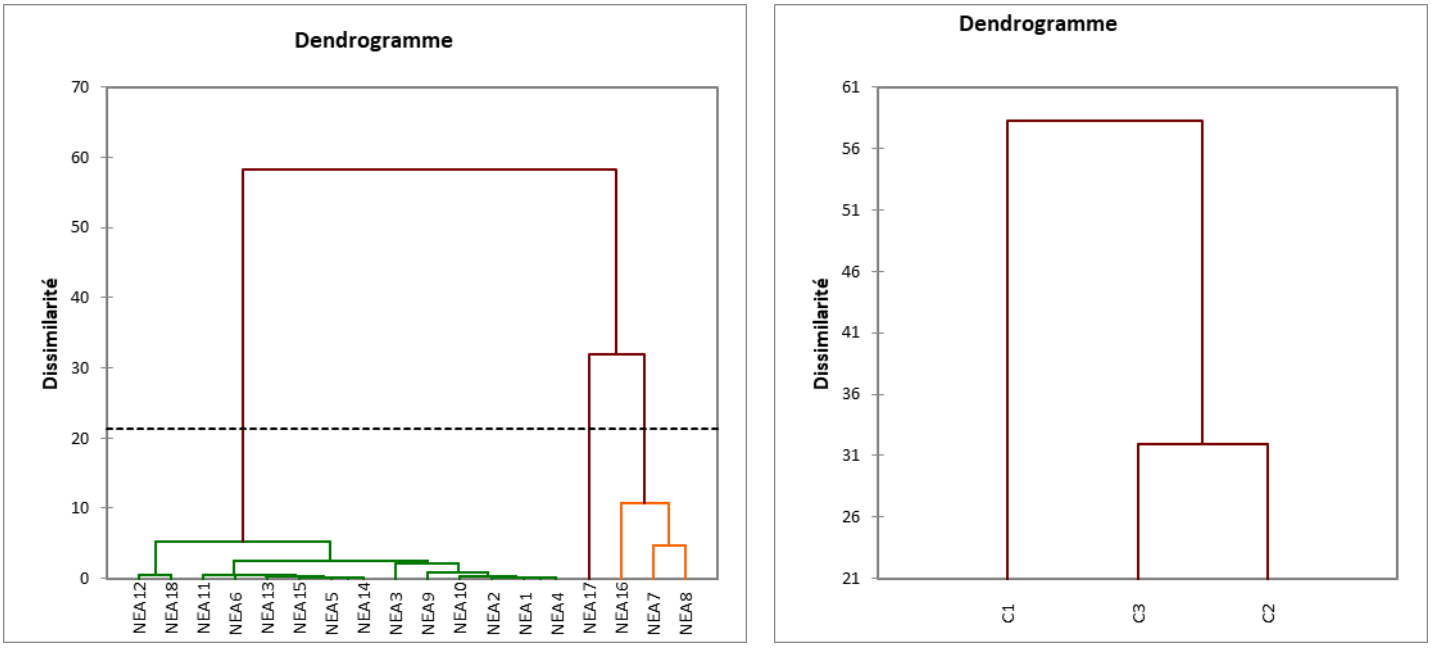


Fig 15. a) Dendrogram for 18 accessions of cowpea using Ward method. b) C1: classec1, C2:classe 2, C3:classe3.

3.2.6 Multiple correspondences Analysis (MCA)

The applied of multiple correspondence analysis showed that the total explained inertia is equal to 4.75 (percentage of inertia: 19.40% is due to the first axis and 15.31% is due to the second axis). A visualization of the results is presented in Fig .17. the profiles of the shape of the grains : the rounded shape is very different and in particular characterized by a white color, black and wide eye color (NEA6) , the reniform shape seems to characterize the smooth to rough texture of seeds, spotted white color, cream, olive beige, red , beige and green or brown eye color . On the other hand, Rhomboid seeds are characterized by a white and beige color and a wide brown, green or black eye color.

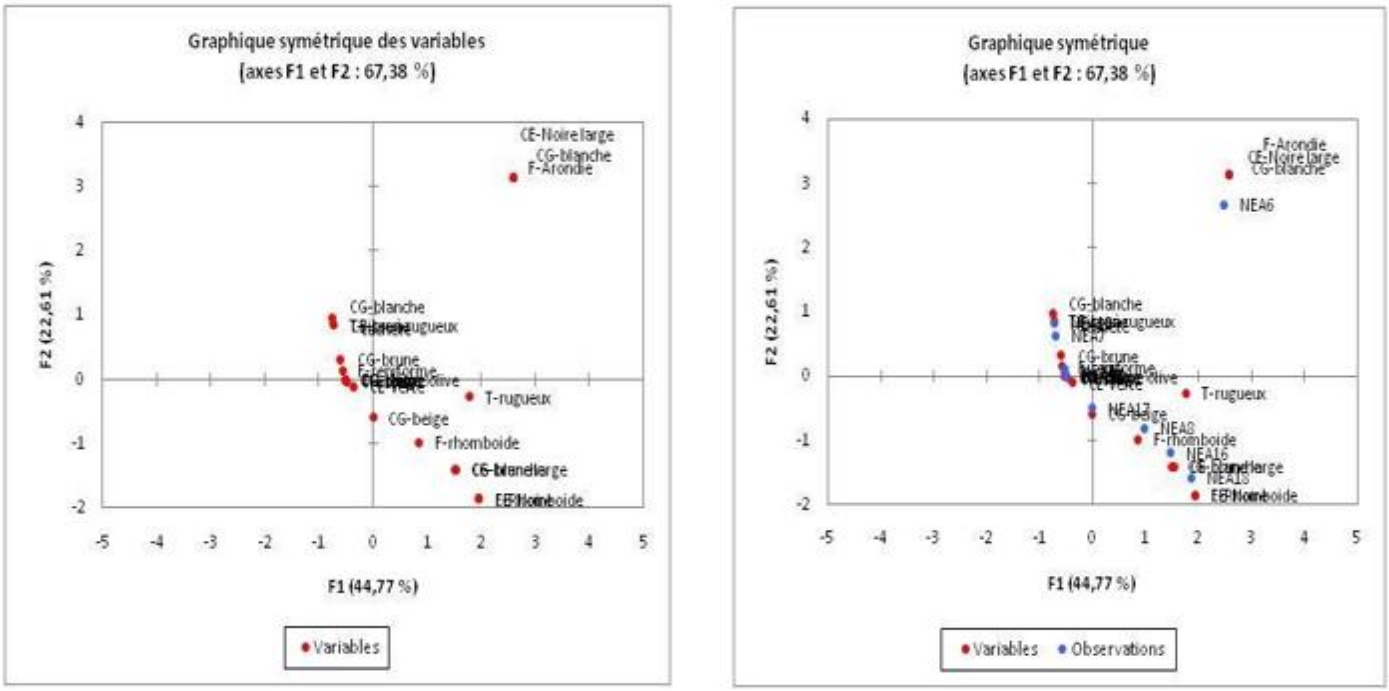


Fig 17. Multiple correspondence analyses of qualitative characters of morphological variables of cowpea seeds collected in Hoogar (Algeria).

4. Discussions

4.1 Ethno botanical investigations and biometric data

The Analysis of the questionnaire showed that the majority of farmers were women, , the men were rarely involved. However, women are more active than men in the traditional cultivation of cowpea are, these result are similar to the results obtained by (Ghalmi 2011).

Cultural information is held by the older generation of farmers is disappearing with an important form of heritage. This trend shows that there is relatively little conservation of know-how. The seeding is carried out on small area all along the Abadou. Cependant [13] montre que le semis de niébé est effectuées dans de petites zones appelées Guemmoun, en rangs tout le long de la "seguia" ou dans des parcelles dans le djeddaouel .

The products are intended for self-consumption and the surplus will be sold, this explains the rarity of occurs on the market.

The main source of accessions collected is Niger, obtained by commercial exchange between the Tuareg populations of Niger and those of Hoogar. Indeed, [13] indicate that the Saharan forms of cowpea introduced into North-East Africa, currently considered as a presumed domestication area and the original genetic stock preserved due to the extreme isolation of oases.

In general, organic fertilization is the most widely used, as farmers use sheep manure as a background fertilizer. In addition, the water used for irrigation comes from natural reservoirs; livestock farming is marked among all the farmers of Hoggar, the price of one kg of local cowpea seed is between 900 and 1000 DA, which makes it a scarce resource and a very important source of income in this region. This species considered as important food crop in several regions s in Algeria [14].

Farmers reported the risk of loss of this essence with future generations, they said they have sown seeds in the past, which are no longer available now, and that the frequency of cowboy practice becomes very low and very limited in Hoogar compared to the past. On the other hand, the conservation of traditional Algerian adhesions is urgent before they are lost. On

the other hand, the conservation of traditional Algerian accessions is urgently before they are losted [10, 14, 15].

According to the interviewers, low rainfall, lack of water, lack of electricity, pests and diseases and lack of labor for harvesting were the main constraints limiting cowpea cultivation in the study area. As a result, farmers are turning to more productive and economical crops such as market gardening, and fodders.

In Hoogar, cowpeas are mainly cultivated for food purposes. Farmers use cowpea seeds mainly for the preparation of a traditional Tewasse dish or consumed in gradient in traditional dishes (Merdoude, kessera) mixed with other legumes such as lentils. The leaves are used as fodder.

The method of sowing in random pots are the most practiced in the regions of Hoogar. While, in Kabylia the sowing in line is the most used [10].

The attack of diseases and enemies seems to be weak or even nil in cowpeas grown in Hoogar. This can be explained by the arid climate, the environment does not favors the development of diseases but insect attacks are reported and by the fact that farmers sow their seeds and do not buy the seeds which can be sources of contamination.

L'attaque des maladies et des ennemis semble être faible, voire nulle, Cela peut s'expliquer par le climat aride, l'environnement ne favorise pas le développement de maladies.

L'utilisation du froid s'avère être la méthode la plus courante de protection des graines de niébé en Hoogar. Nos résultats ce diffère à ceux obtenus par (Ghalmi 2011) dans les régions Djanet et Tidikelt qu'ils utilisent le piment. Alors que, l'utilisation de l'huile d'olive est la méthode la plus utilisée contre les attaques de Bruches en Kabylie.

Le cycle du niébé peut durer plus de trois mois de mars à novembre, ce qui permet de réaliser plusieurs cueillettes (3 cueillettes) de juin à novembre et le rendement est assez élevé avec un coût de production faible.

The nodules are absent in the roots , can be explained by the harvest period, which takes place in most cases after more than 120 days of sowing , or by the lack of symbiotic microorganisms of the genus Rhizobium in the rhizosphere of the Hoogar region, which are the origin of the formation of nodulations .

4.2 Biometric Characterization of seeds

Our results regarding size of pods and seeds, number of eye by pod, number of seeds by Pod are recorded with previous studies reporting characterization of seeds cowpea for Saharan Algerians forms reported by [10, 15]. Similarly with results from other cowpea varieties in Nigeria and Togo [16], Ghana and Mali [17]. However, the Weight of 100 seeds (WHS) are recorded an average low than some researchers have found in this field [18-23] . this differences are due to the adaptation to the specific arid conditions of Hoogar which results in reduction in the size and weight of the pods and seeds , Hoover the dimensions of cowpea and their weight of 100-seed give indication of the space the flour would occupy as well as their bulkiness [19, 24] .

The analysis of the correlation matrix indicated that the most significant correlations at the 5% threshold validating + 0.530 and +0.884, positive correlations + 0.530 between thigh and diameter , between diameter and thickness pods +0,884 for PD and PT, which indicated the proportional relationship between seed and pod diameter.

The Principal Component Analysis (A.C.P) and of Multiple Correspondence Analyses (MCA) showed great distinctions between accessions , seems to indicate a distribution of accessions related to the variations of the ecological conditions , in particular climatic conditions. The dendrogram shows an arrangement in three different classes with great diversity, this variability is in relation with the origin of seed, endogenous factors and the environmental conditions of Hoogar. These accessions highlighted the opposition to the accessions collected in the north of Algeria by [10, 15], [25] in Bulgaria , and [26] in Thailand.

5. Conclusion

The results of the surveys showed the importance nutritional and forage of cowpea in the diet of the population of Hoogar .This ethnobotanical survey made it possible to define the focus area for cowpea in the Hoogar region , as the culture is limited to communes far from the center of the wilaya chief (Tamanrasset) such as Abalessa , Igléne , Tit , Outoul

. On the other hand, these missions made it possible to collect this local plant resource of Hoogar associated with cultural traditions related to the knowledge of cowpea cultivation such as period of sawing, method of irrigation, period of harvest. For mother, this study revealed the presence of great genetic variation, in terms of quantitative traits and qualitative characters among of cowpea seeds cultivated in the region of Hoogar, which has not yet been studied. It was possible to identify the most promising genotypes for inclusion in the cowpea-breeding program. Knowing the knowledge and know-how that enables farmers to preserve local cowpea accessions and maintain it for several centuries in arid and very difficult conditions, this collected plant heritage constitutes a wealth that must be exploited and studied on the different agro morphological traits in different condition climatic to estimate their productive performance. Similarly, a molecular characterization of materials collected by genetic markers is essential, they allow to identify polymorphism as well as phylogenetic relationships between individuals, and this to confirm the results obtained following phenotypic characterization that are influenced by the environmental factor. On other hand, given the reported risk of loss of local cowpea seeds by Hoggar farmers, there is a need to set up an in situ gene bank to preserve and enhance these genetic resources, which are becoming rare and to encourage farmers to continue growing this plant. The culture of cowpea remains not preserved and not valued in Algeria. They become very urgent to create an official catalogue on pulses view that there does not exist in Algeria, in order to register these accessions collected. **Acknowledgements.**

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Annex

Table 1 Geographical location of the eighteen-cowpea ecotypes collected in Hoggar (Tamanrasset, Algeria).

Accessions	Origin	Longitude	Latitude
NEH1	Igléne	4°5	22°53
NEH2	Abalessa	5°24	23°21
NEH3	In Salah	02°30	27°14
NEH4	Tin Amsagh	5°09	22°84
NEH5	Inghar	2°4	27°11
NEH6	Igléne	4°89	22°88
NEH7	In Guezzam	5°48	19°44
NEH8	Daghmoli	5°13	22°94
NEH9	In Salah	2°26	27°11
NEH10	Igléne	4°89	22°88
NEH11	Aoutol	5°34	22 °85
NEH12	Amsal	5°38	22°27
NEH13	Tit	5°14	22°58
NEH14	Tit	5°20	22°96
NEH15	Aoutol	5°21	22°52
NEH16	Téfogine	5°37	22°43
NEH17, NEH18	In Amguel	5°14	23°69

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