

Variability studies in some qualitative characters of cowpea (*Vigna unguiculata* (L.) Walp) accessions from four cowpea-growing regions of Ghana

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SUMMARY

Forty-five cowpea accessions, randomly selected from cowpea germplasm from four cowpea-growing regions of Ghana, namely, Upper East, Upper West, Northern, and Eastern Regions, were characterized and evaluated to determine the range of variability in qualitative characters in the samples. Variability was observed in growth habit, twining tendency, plant and pod pigmentation, and raceme position. Accessions from the Upper West, Northern and Eastern Regions showed three types of growth habit: prostrate, semi-prostrate and intermediate, with the semi-prostrate type in the majority, whilst the Upper East Region showed only the semi-prostrate type. Accessions from the Northern and Eastern Regions showed three types of twining tendency, namely, no twining, slight, and intermediate twining, whilst the Upper East Region accessions showed only none twining types. Majority of the accessions showed the no twining type. All the regions showed great variability in plant and immature pod pigmentation in the cowpea accessions. Two types of flower colour were observed, purple and white. With the exception of the Upper East Region accessions which showed only white flower colour, accessions from all the other regions showed both white and purple colours with the accessions with purple colour in the majority. In most of the accessions from the Upper West, Northern and Eastern Regions, the racemes were held above the canopy.

RÉSUMÉ

BENNETT-LARTEY, S. O. & OFORI, I.: *Etudes de la variabilité de quelques caractères qualitatifs des accessions de dolique (Vigna unguiculata (L.) Walp) de quatre régions de la culture dolique du Ghana.* Quarante-cinq accessions de dolique sélectionnées au hasard de germeplasm de quatre régions de la culture dolique du Ghana, à savoir, les Régions de Haute-Est, de Haute-Ouest, de Nord et d'Est, étaient caractérisées et évaluées pour déterminer l'écart de variabilité des échantillons des caractères qualitatifs. La variabilité était observée dans l'habitude de croissance, la tendance voluble, la pigmentation de plante et de cosse et la position du racème. Les accessions des Régions de Haute-Ouest, de Nord et de l'Est montraient trois espèces d'habitude de croissance: prostrée, demi-prostrée et intermédiaire avec la demi-prostrée en majorité alors que la Région de Haute-Est montrait l'espèce de demi-prostrée seulement. Les accessions des Régions de Nord et d'Est démontraient trois espèces de tendance volubile à savoir, nul volubilisme, volubilisme léger et intermédiaire alors que la Région de Haute-Est montrait aucune des espèces de volubilisme. La majorité des accessions montraient l'espèce de nul volubilisme. Toutefois les Régions montraient une grande variabilité en plante et une pigmentation de cosse qui n'est pas mûr en les accessions de dolique. Deux espèces de couleur de fleur étaient observées: pourpre et blanche. A l'exception des accessions de la Région de Haute-Est qui montraient uniquement une couleur de fleur blanche, les accessions de tous les autres Régions montraient les couleurs pourpre et blanche à la fois avec les accessions de la couleur pourpre en majorité. Dans la plupart d'accessions des Régions de Haute-Ouest, de Nord et d'Est, les racèmes étaient tenus au-dessus de la voûte.

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Introduction

Cowpea is one of the most important legumes in Ghana. It was assigned first priority for germplasm collection and conservation in West Africa by the International Board for Plant Genetic Resources (IBPGR, 1981), since West Africa is regarded as a centre of domestication and diversity of the crop (Steele, 1976; Steele & Mehra, 1980).

When germplasm has been assembled, it is necessary to characterize and evaluate it both quantitatively and qualitatively. The information is very useful for users of the germplasm, especially the plant breeder.

Information on variability in crop plants is of much importance to the plant breeder. Ng & Maréchal (1985) attributed the variability in cultivated species to artificial selection under diverse environments. By characterizing and evaluating cowpea germplasm, wide variability will be observed in several characters of the crop which will be of benefit to the breeder.

Doku (1970) reported many different grain colours in cowpea found in the Ghanaian market. Working on a world collection of cowpea at IITA, Porter *et al.* (1974) observed variability in several characters including growth habit, twining tendency, eye colour and pattern, days to flowering and maturity, and susceptibility to pests and diseases. Information from these variability studies provides the breeder with the necessary tools to work with.

The study aimed at characterizing and assessing the genetic variability in some qualitative characters of cowpea genotypes from four cowpea-growing regions of Ghana.

Materials and methods

Forty-five accessions of cowpea randomly selected from cowpea germplasm from four cowpea-growing regions of Ghana, namely, Upper East, Upper West, Northern, and Eastern Regions, were used for the study (Table 1). Seeds from the 45 accessions were sown in the field at the Plant Genetic Resources Centre at Bunso, under rainfed conditions. The seeds were sown at a spacing of

TABLE 1

Number of Cowpea Accessions from Each of the Four Regions of Ghana Used in the Study

<i>Region</i>	<i>Number of accessions</i>
Northern	16
Upper East	6
Upper West	8
Eastern	15
Total	45

90 cm × 90 cm and three seeds per hill. The seedlings were thinned to one per stand 2 weeks after planting. There were 10 stands per accession. There was no replication because of the few number of seed samples available. The recommended rate of 50 kg of P₂O₅ fertilizer per hectare was applied at time of planting (GGDP, 1989).

The accessions were characterized based on growth habit, twining tendency, plant pigmentation, flower colour, raceme position, and immature pod pigmentation.

The standard descriptors for cowpea (IBPGR, 1983) was used for the characterization.

Bunso is located in the semi-deciduous forest ecological zone of the Eastern Region. Total annual rainfall is about 1 450 mm. A distinct dry period is observed between November and March even though it rains occasionally during the period. Temperatures are high with monthly means ranging from 14.8 to 35.5 °C

The soils of Bunso range from red clay loams of elevated ground to heavier alluvial soils near the Birim River. The soils are typical of the Birim valley and surrounding hills. The underlying rock formations are of the Upper Birimian Series.

Results and discussion

Growth habit

Fig. 1 shows the distribution of growth habit of cowpea germplasm from the four cowpea-growing regions of Ghana. The three main growth habits were intermediate, semi-prostrate and prostrate. Germplasm from the Upper East Region showed 100 per cent of the semi-prostrate habit.

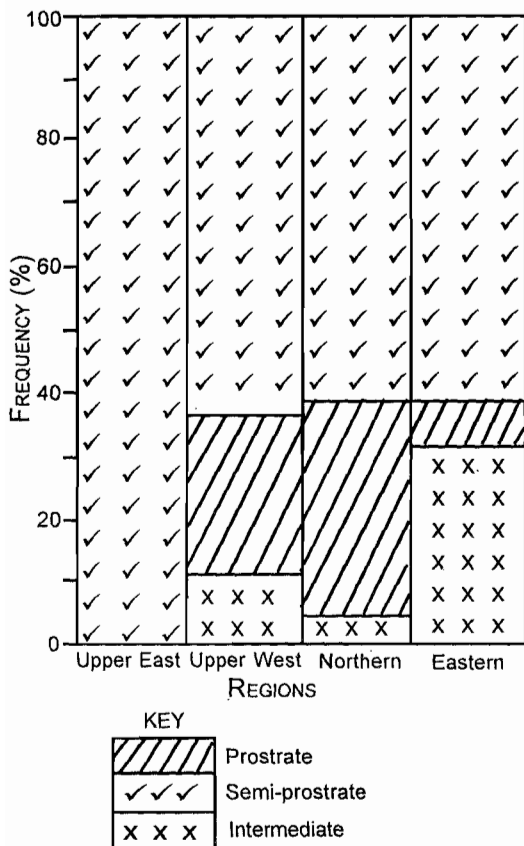


Fig. 1. Frequency distribution of growth habit of cowpea germplasm from four regions of Ghana.

Germplasm from the Upper West Region showed 25 per cent of the prostrate, 63 per cent of the semi-prostrate, and 12 per cent of the intermediate types. Those from the Northern Region showed 32 per cent of prostrate, 62 per cent of semi-prostrate, and 6 per cent of the intermediate types. Germplasm from the Eastern Region was composed of 6 per cent prostrate, 60 per cent semi-prostrate, and 34 per cent intermediate types.

The semi-prostrate habit was the most prevalent among the cowpea germplasm studied (71.3 per cent). This was followed by the prostrate (15.7 per cent) and intermediate (13 per cent) types. In similar studies at IITA by Porter *et al.* (1974), most cowpea accessions characterized were of the intermediate, semi-prostrate, and prostrate types.

Growth habit is very important in the cropping system of cowpea in Ghana. Growth habits in cowpea germplasm range from the climbing to the erect types. There are also the intermediate, semi-prostrate, and prostrate types (IBPGR, 1983).

Doku (1970) and Rachie & Rawal (1976) observed that most landraces show the prostrate and climbing types of cowpea, and that the prostrate types are used by peasant farmers in mixed cropping.

Twining tendency

Fig. 2 shows the frequency distribution of twining tendency in the cowpea accessions studied. Three categories of twining tendency were observed: no twining, slight twining, and

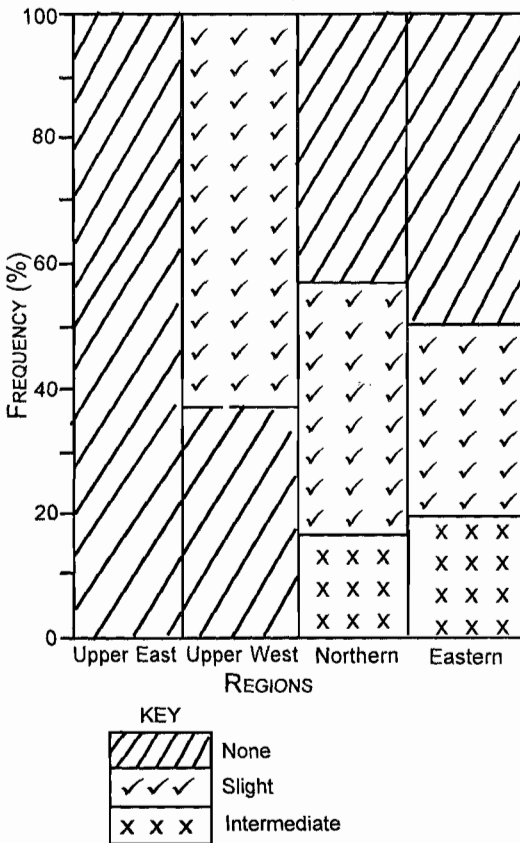


Fig. 2. Frequency distribution of twining tendency of cowpea germplasm from four regions of Ghana.

intermediate twining. All accessions collected in the Upper East Region showed no twining. Accessions collected in the Upper West Region showed no twining (38 per cent) and slight twining (62 per cent). Most of the accessions from the Northern Region showed no twining (44 per cent), followed by slight twining (38 per cent), and intermediate twining (18 per cent). Accessions from the Eastern Region showed similar trend to those from the Northern Region. Most accessions showed no twining (52 per cent) whilst 26 and 22 per cent showed slight and intermediate twining, respectively. Generally, most of all accessions showed no twining (58.5 per cent), followed by slight twining (31.5 per cent) and intermediate twining (10 per cent). This implies that most of the accessions trail on the ground which is a characteristic of most cowpea landraces.

Plant pigmentation

Fig. 3 shows the frequencies of various plant pigmentation types in the germplasm studied. The five pigmentation types observed in the study were no pigmentation (green), very slight, moderate, intermediate, and extensive. Accessions from the Upper East Region showed the following trend: no pigmentation (18 per cent), very slight pigmentation (50 per cent), and moderate pigmentation (32 per cent). Those from the Upper West Region showed similar trend: no pigmentation (14 per cent), very slight pigmentation (62 per cent), and moderate pigmentation (24 per cent). All accessions from the Northern Region were pigmented with the following types of pigmentation: very slight (33 per cent), moderate (33 per cent), intermediate (20 per cent), and extensive (14 per cent). Similarly, all accessions from the Eastern Region were pigmented with most accessions showing slight pigmentation (60 per cent); the others were moderate (28 per cent) and intermediate (12 per cent). Generally, most of the accessions from all regions had slight plant pigmentation (51 per cent).

Pigmentation in the cowpea plant ranged from

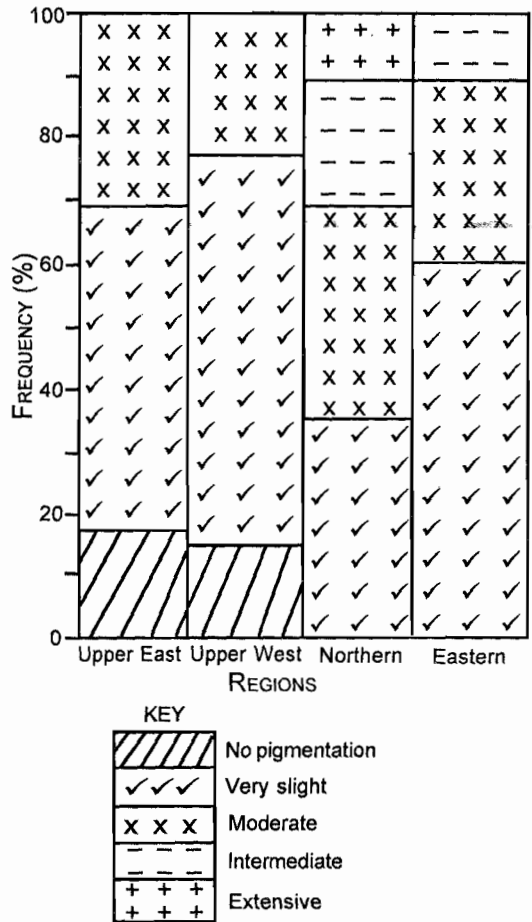


Fig. 3. Frequency distribution of plant pigmentation of cowpea germplasm from four regions of Ghana.

green (no pigmentation) to purple, with different intensities of the purple colouration. This is dependent on the concentration of arthocyanin in the plant part (Fery, 1985; Harland, 1919).

Flower colour

Fig. 4 shows the distribution of flower colour of cowpea germplasm from the four regions under study. Accessions studied had either purple or white flowers. Most accessions had purple flowers. All the accessions from the Upper East Region had white flowers. Eighty-eight per cent

of the accessions from the Upper West Region had purple flowers whilst 12 per cent were white. Accessions from the Northern Region had 80 per cent purple flowers and 20 per cent white. The trend in the Eastern Region was similar: 87 per cent of the accessions had purple flowers whilst

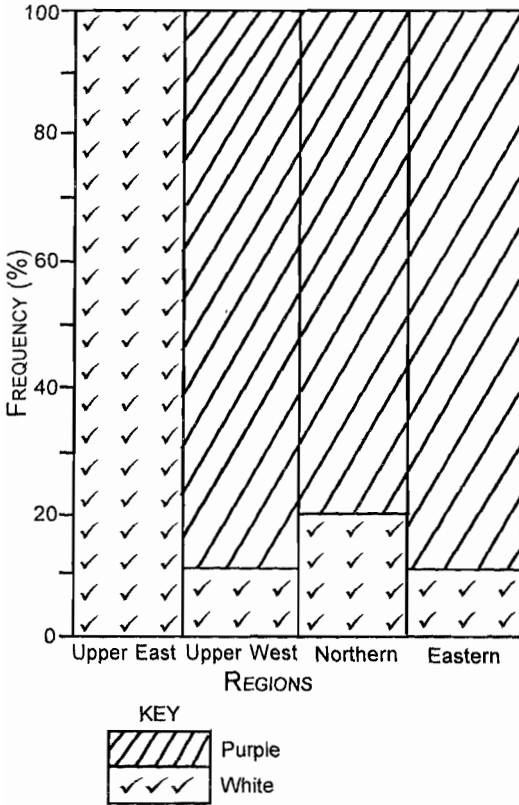


Fig. 4. Frequency distribution of flower colour of cowpea germplasm from four regions of Ghana.

13 per cent had white. Ezueh & Nwoffiah (1984) had similar observations in cowpea accessions in Nigeria, with the purple-flowered accessions being the most.

Immature pod pigmentation

Fig. 5 shows the frequency distribution of pigmentation observed in immature pods of cowpea germplasm. Six patterns of pigmentation were observed: no pigmentation (green pods),

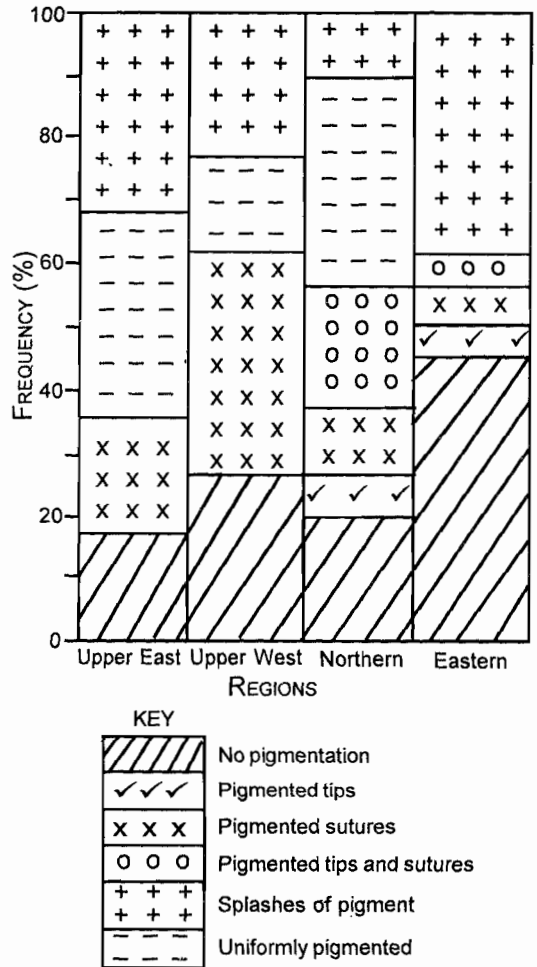


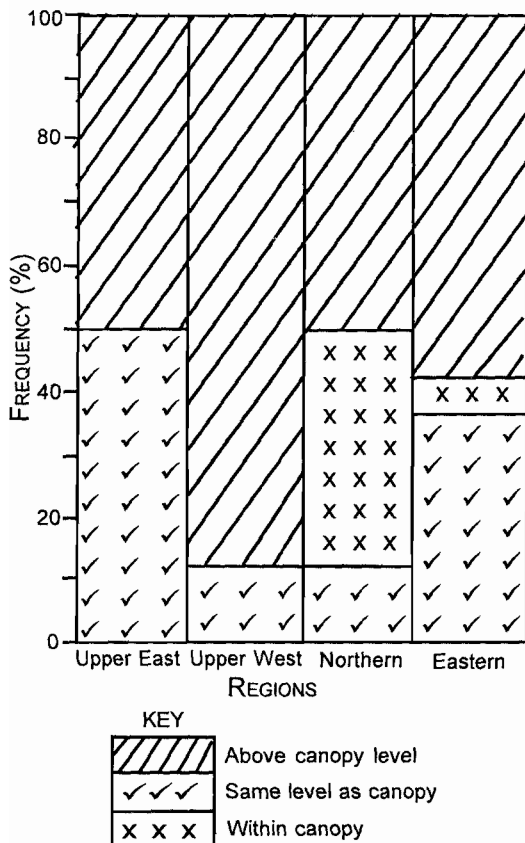
Fig. 5. Frequency distribution of immature pod pigmentation of cowpea germplasm from four regions of Ghana.

pigmented sutures, pigmented tips, pigmented tips and sutures, splashes of pigment and uniformly pigmented. The purple pigment in the pod is due to anthocyanin. The Upper East accessions had 18 per cent of immature pods with no pigmentation, 18 per cent with pigmented sutures, 32 per cent with splashes of pigment, and 32 per cent with uniformly pigmented pods. Accessions from the Upper West Region had 24 per cent with splashes of pigment and 14 per cent with uniformly pigmented pods. Accessions from the Northern

Region had all the patterns of pigmentation in the following proportions: no pigmentation (20 per cent), pigmented tips (6 per cent), pigmented sutures (12 per cent), pigmented tips and sutures (18 per cent), splashes of pigment (12 per cent), and uniformly pigmented (32 per cent). Most accessions from the Eastern Region had immature pods with no pigmentation (44 per cent). The others were pigmented sutures (6 per cent), pigmented tips (6 per cent), pigmented tips and sutures (6 per cent), and splashes of pigment (38 per cent).

Raceme position

Fig. 6 shows the frequency distribution of types of raceme positions in the cowpea germplasm from



four regions. Three types of raceme positions were observed: racemes held above the canopy level, at the same level as the canopy, and those found within the canopy. The general trend was that in 60.5 per cent of the accessions, the raceme was held above the canopy level; 27.5 per cent of the accessions had racemes at the same level as the canopy, and 12 per cent had the racemes within the canopy. The Upper East accessions had racemes above the canopy (50 per cent) as well as at the same level as the canopy (50 per cent). The Upper West accessions had most racemes above the canopy (88 per cent) as well as others at the same level as the canopy (12 per cent). Accessions from the Northern Region had all the three raceme positions: above canopy (50 per cent), same level as canopy (38 per cent), and within canopy (38 per cent). The Eastern Region accessions had the following raceme positions: above canopy (58 per cent), same level as canopy (36 per cent), and within canopy (6 per cent). It is more desirable to have racemes above the canopy than either at the same level of the canopy or within the canopy, since that position facilitates harvesting of the mature pods. Porter *et al.* (1974) observed that accessions with racemes within the canopy were the commonest among 4 000 accessions they studied.

Conclusion

Most cowpea accessions from the four regions studied had the semi-prostrate growth habit. Generally, most of the accessions showed no twining. Most of the cowpea accessions showed very slight plant pigmentation whilst the immature pods of most accessions did not have any pigmentation. The Northern Region showed the most variability; in each of the characters studied, the cowpea accessions from the region showed the widest range of variability available. The Northern Region was followed by the Eastern, Upper West, and Upper East Regions in that order. The low variability in the Upper East and Upper West accessions may be due to the fewer number

Fig. 6. Frequency distribution of raceme position of cowpea germplasm from four regions of Ghana.

of accessions used for the study.

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