

## Review

# Comparative study of the karyotypes of two *Vigna* sub species

ADETULA O.A.

National Horticultural Research Institute, P.M.B. 5432, Idi -Ishin, Ibadan, Nigeria. E-mail: Olagorite@yahoo.com.

Accepted 21 October, 2005

The chromosomes of the two *Vigna* sub species were individually identified in order to gain insight into variations in the chromosome morphology that may contribute to interspecies cross incompatibility. Diploid chromosome number of 22 was established for *V. unguiculata* (TVu14476) while *V. unguiculata* ssp. *dekindtiana* var. *pubescens* was different with mitotic chromosome number of 23. The total lengths of chromosome ranged from 2.0 – 5.2  $\mu\text{m}$ . Identification of individual chromosomes was carried out using chromosome length, ratio between arms and centromeric positions. The 11 pairs of homologues were classified as metacentric, submetacentric, subtelocentric and acentric using a centromeric index which was between 0 and 50. Idiograms were constructed for each *Vigna* sub species based on the average length of each chromosome.

**Key words:** Triploid, metaphase and mitosis.

## INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is an important tropical grain legume crop with high protein content (20-30%). Over 850,000 tons of cowpea is produced annually in Nigeria. The grain legume is attacked by an array of insect pests that cause varying degrees of crop loss. Crosses between cultivated *V. unguiculata* and members of wild *Vigna* was carried out by Agwaranze 1992 and Adetula 1999. The results showed that fertilization did not occur in most of the crosses. Information on the chromosome morphology of the two species will be incorporated in plant breeding programs.

Colchicine (0.05%) treated root tips of *Vigna unguiculata* TVu14476 and *Vigna unguiculata* ssp. *dekindtiana* var. *pubescens* (TVNu 110-3A) were fixed in 3:1 alcohol:glacial acetic acid for 12-24 h at 4°C. Root tips were then hydrolysed in 1 N HCl at 60°C for 10 min, macerated, squashed and stained using formic lactic propionic-orcein (FLP-orcein). Karyotypes of the two genotypes of the *Vigna* species were carried out by taking the measurement of the chromosomes from photomicrographs in  $\mu\text{m}$ . The chromosomes on the photographs were numbered and arranged in order of decreasing length and long – short arm were taken and converted to microns. The chromosomes were paired and compared.

## RESULT AND DISCUSSION

Mitotic chromosome number of 22 was observed in cowpea accession *V. unguiculata* (TVu14476) (Figure 1). The chromosome number varied in *V. unguiculata* ssp. *dekindtiana* var. *pubescens* (TVNu110-3A). About 20% of the observed cells showed mitotic chromosome number of 23 (Figure 2). This is unique and it has been confirmed in the meiotic chromosome by Adetula (1999). On the basis of arm ratios, the chromosomes of *Vigna* were classified as metacentric, submetacentric, subtelocentric, and acentric. Means of chromosome lengths, arm ratio, centromere index and centromere position of TVu14476 and TVNu110-3A are presented in Tables 1 and 2, respectively, while their ideograms are depicted in Figures 3 and 4, respectively. The characteristics of TVu14476 and TVNu110-3A chromosomes are presented in Tables 3 and 4, respectively. The karyotype of *V. unguiculata* TVu14476 consisted of seven metacentric, one submetacentric, one subtelocentric, and two telocentric chromosomes. The karyotype of TVNu110-3A consisted of six metacentric, one submetacentric, two subtelocentric, and two telocentric chromosomes.

**Table 1.** Means of chromosome lengths, arm ratio, centromere index and centromere position of *Vigna unguiculata* spp. *unguiculata* (TVu14476).

Chromosome	Short arm (mm)	Long arm (mm)	Total Length (mm)	Long/short arm ratio	Centomere index	Centomere position
1	1.50±0.05	2.09±0.02	3.64±0.04	1.39	41.21	M
2	1.42±0.02	1.43±0.01	2.85±0.02	1.01	49.82	M
3	1.21±0.02	1.49±0.01	2.70±0.02	1.23	44.81	M
4	1.34±0.01	1.35±0.02	2.69±0.02	1.01	49.82	M
5	1.28±0.03	1.29±0.01	2.39±0.01	1.01	49.81	M
6	1.19±0.01	1.20±0.01	2.39±0.01	1.01	49.79	M
7	1.19±0.01	1.20±0.01	2.40±0.01	1.01	49.58	M
8	1.20±0.00	1.95±0.00	3.15±0.01	1.63	38.10	SM
9	0.83±0.01	1.58±0.01	2.40±0.01	1.90	34.58	ST
10	0.00±0.00	2.78±0.00	2.78±0.00	0.00	0.00	T
11	0.00±0.00	2.78±0.01	2.78±0.01	0.00	0.00	T

M = metacentric, SM = submetacentric, ST = subtelocentric, T = telocentric.

**Table 2.** Means of chromosome lengths, arm ratio, centromere index and centromere position of *V. unguiculata* ssp. *dekindtiana* var. *pubescens* (TVNu110-3A).

Chromosome	Long arm (mm)	Short arm (mm)	Total Length (mm)	Long/short arm ratio	Centomere index	Centromere position
1	1.28±0.06	1.28±0.07	2.56±0.11	1.00	50.00	M
2	1.10±0.08	1.11±0.03	2.21±0.08	1.01	49.77	M
3	1.00±0.35	1.11±0.03	2.15±0.34	1.11	46.51	M
4	0.85±0.01	0.99±0.03	1.84±0.04	1.16	46.20	M
5	1.01±0.05	0.99±0.04	2.00±0.04	0.98	50.50	M
6	0.64±0.01	1.42±0.03	2.06±0.03	2.22	31.07	M
7	0.49±0.03	1.42±0.03	1.61±0.03	2.29	30.43	SM
8	0.57±0.04	1.49±0.00	2.06±0.03	2.61	27.67	ST
9	0.50±0.01	1.70±0.12	2.20±0.10	3.40	22.73	ST
10	0.00±0.00	2.40±0.01	2.40±0.01	0.00	0.00	T
11	0.00±0.00	1.70±0.06	1.70±0.06	0.00	0.00	T



2µm

**Figure 1.** *Vigna unguiculata* (TVu 14476); 2n =22.

4 µm

**Figure 2.** *Vigna unguiculata* ssp. *dekindtiana* var. *pubescens* (110-3A); 2n=23.

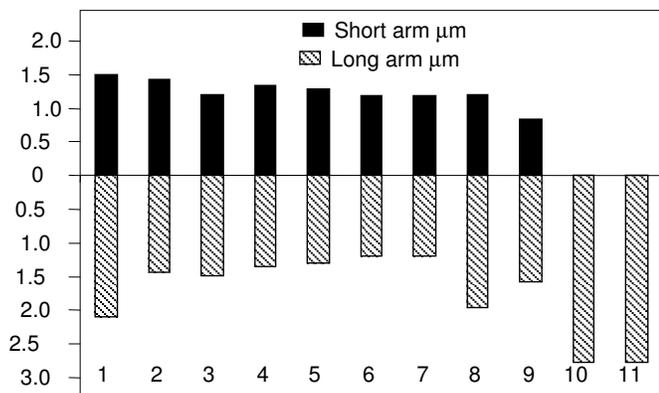


Figure 3. Idiogram of cowpea line *V. unguiculata* TVu14476.

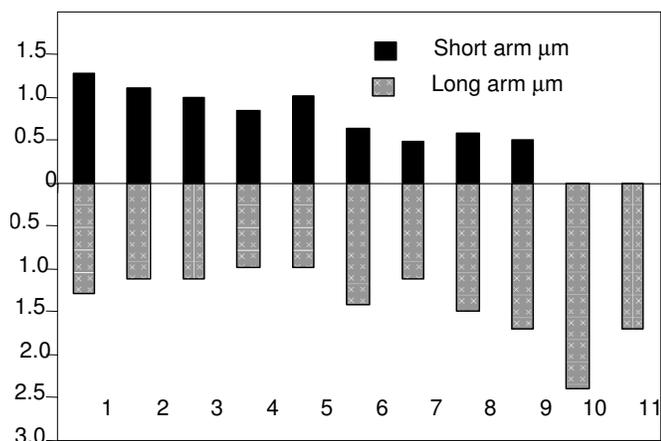


Figure 4. Idiogram of *V. unguiculata* ssp. *dekindtiana* var. *pubescens* (TVNu110-3A).

Table 3. Characteristics of *V. unguiculata* (TVu14476) chromosomes.

Chromosome	Characteristics
1 and 8	Chromosome 1 was the largest in the group followed by chromosome 8 which was sub metacentric.
2, 3 and 4	Medium, closely similar size and metacentric.
5, 6 and 7	Similar sizes and metacentric.
9	Subtelocentric; the centromere was close to the terminal and darkly stained.
10 and 11	Acentric chromosomes.

Table 4. Characteristics of *Vigna unguiculata* ssp. *dekindtiana* var. *pubescens* (TVNu110-3A) chromosomes.

Chromosome	Characteristics
1	Long metacentric with satellites.
2	Metacentric with bands on the short arm.
3	Medium, metacentric with bands on both arms.
4	Medium, metacentric with bands on both the short and long arms.
5	Medium, metacentric with prominent band on the short arm.
6	Medium, metacentric with bands on both the short and long arms.
7	Long, submetacentric uniformly stained.
8	Long, submetacentric with band on the short arm.
9	Long, subtelocentric with band on the long arm.
10	Long, telocentric.
11	Small, telocentric.

ACKNOWLEDGEMENT

This work was carried out at the Biotechnology Laboratory of International Institute of Tropical Research Institute, Ibadan ,Nigeria

REFERENCES

Adetula OA (1999) Karyotype and Centromeric banding pattern of chromosomes in *Vigna* species. PhD Thesis University of Ibadan, Ibadan. Nigeria.

Agwaranze NF. (1992) Morphological variability Inheritance of pubescence in *Vigna vexillata* (L) Rich and the Histology of hybrid between wild *Vigna* and cultivated Cowpea (*Vigna unguiculata* (L) Walp). PhD Thesis University of Ibadan, Ibadan. Nigeria.