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Full Length Research Paper

Genetic Compatibility Assessment of Cowpea (Vigna unguiculata) Cultivars with Wild Relative var. pubescens TVNu110-3A

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Crosses were made between five cultivated cowpea varieties (Dandunga, IT89KD-288, IT93K-452-1, IT97K-499-38 and IT81D-994) and their wild relative, var. *pubescens* (TVNu 110-3A) to investigate their cross-compatibility as well as reproductive potential of the respective F_1 hybrid plants. The wild relative, which was used as pollen parent, crossed well with the cultivated cowpea varieties with pod set ranging from 54 – 63.9%. F_1 hybrid plants grew vigorously and produced viable seeds. The result showed high level of cross-compatibility between the cultivated cowpea varieties and the wild relative. Seeds of the F_1 hybrid plants, which were advanced to F_2, indicated sufficient reproductive potential of the hybrids.

Keywords: Crossability, cowpea, var. *pubescens,* F_1 hybrid, reproductive potential.

INTRODUCTION

Cowpea is a major crop world wide, producing a source of economic livelihood and nutritional well-being for millions of farmers and urban consumers in the developed and developing world (Timko, 2006). Cowpea currently ranked 23rd among important crop species which is grown on over 14.5 million hectares world wide (IITA, 2004), and with an average annual grain production of 12 million tones of which more than two-third (about 7.6 million tones) is produced in sub-Saharan Africa (AATF, 2006).

Cowpea has several advantages. The crop is cultivated in the semi-arid regions of lowland tropics and sub-tropics where the soil is poor in fertility and rainfall is scanty (Mortimore *et al*., 1997). Cowpea is shade provides ground cover, conserves moisture, suppresses weeds, provides protection against soil erosion (Quin, 1997).

Tender leaves and green pods are used as vegetables while, haulms are used as fodder for cattle. Seeds are boiled and eaten with rice or alone, and can be processed and eaten as moi-moi (steamed paste) and bean cake (fried paste) (Mohammed *et al*., 2009 Despite all the aforementioned advantages, the major drawback of cowpea is its low yield, mainly due to among other factors, severe attacks from extensive pest complexes (Rachie, 1985). Most elusive among cowpea insect pests are cowpea legume pod borer (*Maruca vitrata*) and a complex of pod sucking bugs both of which can cause high seed yield losses (Fatokun *et al*., 1997; Jackai, 1995). However, chemical insecticides approach seem to be the most effective mean of controlling these pests but with consequent residual effect on the user and environmental pollution as well (Fatokun *et al*., 1997).

Thus, availability of cowpea varieties with resistance to these pests would be attractive to cowpea farmers so that the crop could be grown with less dependence on expensive, often adulterated chemicals that are not particularly environmentally friendly (Fatokun, 2000). TVNu 110-3A, which is a wild *Vigna* species was screened and found to confer some degree of insect

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Table 1. Number of flowers pollinated, number of pod set and the percentage of pod set in crosses involving cultivated and wild* cowpea varieties.

Cross	No. of flowers pollinated	No. of pod set	Percentage pod set (%)
Dandunga x wild type	172	66	38.4
IT89KD-288 x wild type	176	104	59.1
IT93K-452-1 x wild type	194	124	63.9
IT97K-499-38 x wild type	124	69	55.6
IT81D-994 x wild type	134	69	51.5
Total	800	432	54 (average)

resistance on cowpea (Fatokun *et al*., 1997; Fatokun and Singh, 2001). The reason for the insect resistance was due to presence of hairs (*pubescens*) on the plants. Thus, it will be of interest to transfer the hairiness trait from the wild *Vigna* species to the cultivated cowpea varieties.

Cultivated cowpea and TVNu 110-3A belong to section *Catiang*, but different species. However, several reports have shown that members of section *Catiang* are cross compatible; hence gene exchange should not be difficult to accomplish (Fatokun *et al*., 1997). In light of the aforementioned, this work was initiated to confirm crossability between some cultivated cowpea varieties and their wild relative var. *pubescens* (TVNu 110-3A) as well as reproductive potential of the F_1 hybrids.

MATERIALS AND METHOD

Screen house and field experiments were conducted at the Abubakar Tafawa Balewa University, Bauchi. Bauchi is in the northern Guinea savannah, located $10^{o}22$'N and $9^{o}46$'E, and 609 meters above sea level with an annual rainfall of 805.9mm per annum. Materials used in this study were four improved cultivated cowpea varieties and one non-cultivated wild relative cowpea, var. *pubescens* (TVNu 110-3A) obtained from the International Institute of Tropical Agriculture, Kano sub-Station, Kano, Nigeria. The improved cultivated cowpea varieties are: IT89KD-288, IT93K-452-1, IT97K-499-38 and IT81D-994, while Dandunga, a local cowpea variety from Bauchi was included as check.

The screen house experiment involved hand crosses between the five cultivated cowpea varieties and TVNu 110-3A. This exercise was carried out from 10 – 29 September, 2003, as described by Myers (1991). TVNu 110-3A was used as pollen parent and crossed to each of the five cultivated cowpea varieties. Pods containg F_1 seeds were harvested at maturity. The F_1 seeds were advanced to F_2. Data recorded in the screen house include: number of flowers emasculated and pollinated and number of mature pods set. These were compared using percentage.

In the second phase, two seeds each of the six parent lines and their five F_1 genotypes were sown in the field during 2004 rainy season in a randomized complete block design with three replications. One plant was maintained to each stand and spaced 75cm x 1m within and between rows, respectively. Twelve plants were thus maintained to each of the 33 plots so that the entire experiment had 396 plants. The plots measured $4.5m^2$ each for the parent lines and the F_1 genotypes. All cultural practices were duly observed. Data recorded in the field include: Mean number of flowers and number of pods plant^{-1}. These were subjected to analysis of variance, and further separated using New Duncan's Multiple Range Test. Percentage was also employed to compare these parameters.

RESULTS AND DISCUSSION

The five cultivated cowpea varieties crossed well with the hairy wild relative var. *pubescens* (TVNu 110-3A) via conventional hand pollination. A total of 800 flowers were emasculated and pollinated out of which 432 formed mature pods, representing 54% of pod set. An average of 54% of pod set arising from hand crossing using the wild type as pollen source compared favourably with 50% arising from natural crossing among the parent genotypes (Tables 1 and 2). Also, about 64-73% of the flowers in the F_1 crosses formed mature seeds and each of the five crosses had very high percentage of mature pods than either of the two parents. This clearly shows that there was high parent heterosis for pod set in this crosses and with these parents, and hence devoid of any incompatibility problems.

Seeds of the five F_1 crosses were viable thus suggesting good reproductive potential (Table 2). The wild type significantly produced higher number of flowers than the five cultivated parents and the F_1 genotypes. However, the cultivated parents and the F_1 genotypes had higher percentages of mature pods than the wild type. The result clearly showed that many flowers of the wild type were wasted, while many flowers of the cultivated parents formed pods. In a similar work, Fatokun and Singh (1987) reported that the F_1 crosses were vigorous, but partially sterile. However, from this study, the F_1 plants were also vigorous and had high reproductive potential. Hence, no reasonable abortion of flowers was observed in the F_1 plants.

Furthermore, the five F_1 crosses produced higher number of flowers relative to the cultivated parents (the maternal parents). The fact that the pollen parent (var. *pubescens*) had higher number of flowers per plant, suggested partial dominance for number of flowers per plant. Similarly, the F_1 crosses had higher number of pods set and percent mature pods per plant than most

Table 2. Mean number of flowers per plant and percentage (%) of flowers that produced mature pods per plant among parents and F_1s in crosses involving cultivated and wild* cowpea varieties.

Genotype	Mean number of flowers per plant	No. of pod per plant	% mature pods
Parent:			
Dandunga	23d	16e	69.6
IT89KD-288	29d	16e	55.2
IT93K-452-1	33cd	13e	39.4
IT97K-499-38	28d	13e	46.4
IT81D-994	32cd	20e	62.5
Wild (var. *pubescens*)	122a	23cd	29.5
Mean	44.5	19.0	50.4
F_1 cross:			
Dandunga x wild type	66b	48abc	72.7
IT89KD-288 x wild type	60bc	44abcd	73.3
IT93K-452-1 x wild type	86b	55a	64.0
IT97K-499-38 x wild type	64b	40bcd	62.5
IT81D-994 x wild type	76b	50ab	65.8
Mean	70.4	47.4	66.7
S.E±(0.05)	2.82	1.00	

[1]Means followed by the same letter(s) within the same column are not significantly different at 5% level of probability (DMRT)**Vigna unguiculata* var. *pubescens*

of their respective parents.

CONCLUSION

The results obtained in this study showed that, interspecific hybridization between cowpea and its wild relative, var. *pubescens* (TVNu 110-3A) is attainable using conventional hand crossing with good result. The F_1 hybrids showed good reproductive potentials, hence devoid of any incompatibility problems associated with interspecific hybridization. The study suggested careful selection of parents for good compatibility between parents during any interspecific hybridization studies.

REFERENCES

African Agricultural Technology Foundation (AATF) (2006). Accessing proprietary technology for improving cowpea productivity. Ann. Report 38 pp.

Fatokun CA (2000). Breeding cowpea for resistance to insect pests: attempted crosses between cowpea and Vigna vexillata. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamo M (eds) Challenges and opportunities for enhancing sustainable cowpea production. IITA, Ibadan, Nigeria, pp 52–61.

Fatokun CA, Singh BB (2001). Improving cowpea-cereals systems in the dry savannas. Ann. Report 2001 IITA, Ibadan, Nigeria, 79 pp.

Fatokun CA, Perrino P, Ng NQ (1997). Wide crossing in African Vigna species. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds) Advances in cowpea research. IITA/JIRCAS IITA, Ibadan, Nigeria, pp 50–57.

International Institute of Tropical Agriculture (IITA) (2004). Improving and intensifying cereal–legume systems in moist and dry savannas of West and Central Africa. Annual Report, IITA, Ibadan, Nigeria 170 pp.

Jackai LEN (1995). The legume pod borer, Maruca vitrata and its principal host plant Vigna unguiculata (L.) Walp. Use of insecticide sprays as an aid in the identification of useful levels of resistance. Crop Prot. 14:299–306

Mortimore MJ, Singh BB, Harris F, Blade SF (1997). Cowpea in traditional cropping systems. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds) Advances in cowpea research. IITA/JIRCAS, IITA, Ibadan Nigeria pp 99–113.

Myers GO (1991). Hand crossing of cowpea. IITA Research Guide No. 42. IITA, Ibadan, Nigeria, 18 pp.

Mohammed MS, Russom Z, Abdul SD (2010). Inheritance of hairiness and pod shattering, heritability and correlation studies in crosses between cultivated cowpea (Vigna unguiculata (L.) Walp.) and its wild (var. *pubescens*) Euphy. 171:397–407.

Quin FM (1997). Introduction**.** In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds) Advances in cowpea research. IITA/JIRCAS IITA, Ibadan, Nigeria pp ix–xv.

Rachie KO (1985). Introduction. In: Singh SR, Rachie KO (eds) Cowpea research, production and utilization. Wiley, NY pp xxi–xxviii.

Timko MP (2006). The cowpea genomics initiative, 2nd edn. Dept. of Bio., Univ. of Virginia, USA.

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