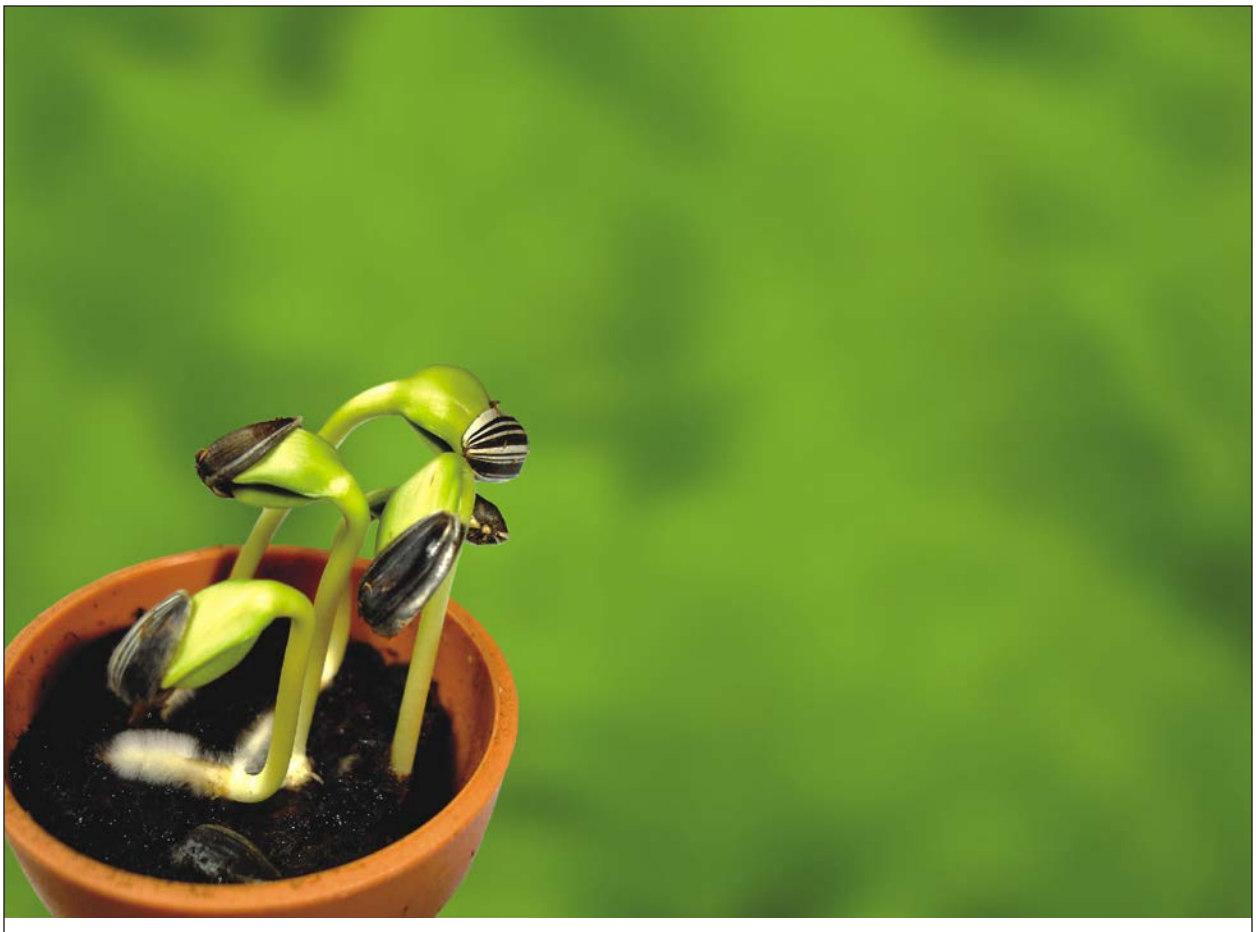

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Plant Breeding for Food Security Sustainability and Industrial Growth

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ABSTRACT

Hybridization was carried out between two species of pepper namely *Capsicum annuum* and *Capsicum frutescens* to raise F_1 so as to assess the expression of heterosis or hybrid vigour for food security sustainability and industrial growth as shown in weights of fruits of the parental plants compared with the F_1 hybrid. This was done by emasculating *Capsicum annuum* using it as female parent and transferring ripe pollen grains from *Capsicum frutescens* (the male parent) using artificial means instead of natural as shown by insect pollination. Result showed that the F_1 fruits shown combined the characters of the parental plants and also added additional genetic attributes.

Key words: Hybridization, *Capsicum annuum, Capsicum frutescens*

INTRODUCTION

Man is almost absolutely dependent on plants for his food. The things he eats, virtually without exception, are either plant materials or derived rather directly from plants as meat, eggs and dairy products. Plants are also the major source, directly or indirectly of most clothing, fuel, drugs and construction materials. Moreover, as ornamentals, they are both useful and aesthetically pleasing. Considering the prime importance of plants, it is not surprising that man has long been concerned with developing types better suited to satisfying their needs. By genetically manipulation of plants, (plant breeding otherwise) the service of man would directly or indirectly be solved. Plant breeding has placed its emphasis on increasing agricultural productivity towards attaining food security and industrial growth.

Through plant breeding, the areas of production of a particular crop could be expanded, possibly by development of crop varieties that are early maturing, drought resistant, increase yield and disease resistant, particularly in some cereals. For example the case of sorghum, a tropical corn with origin in tropical Africa, has now been produced in temperate countries of America. America can breed sorghum that is adapted to summer condition of temperate regions of the world.

Again, Mexico in America never produced wheat until 1943 when some scientists took wheat to Mexico, by 1946 Mexico was self sufficient for wheat and was also exporting wheat.

Early varieties are also able to thrive in areas where such crops never grew before. In Northern Nigerian, rainfall is small, peak is very short, most of the time crops do not mature fully before the rains stops but if a crop that can flower, tassel and starts fruiting within a short time could be developed, it can then take advantage of the short rainy season in that zone.

Pests and diseases could cause death and starvation in a country by reducing the yield and quantity of production in that area but through cross breeding a variety that can resist the diseases and pests could be developed. Hybridization helps to produce superior offspring resulting in hybrid vigour.

Furthermore, the present demands by modern man for good quality crops, crops that contain most of the essential food ingredients and crops that can provide the immediate needs of man in terms of food and raw materials has been the interest of plant breeders.

In response to this, plant breeders try to substitute the undesirable qualities and traits in plants with desirable ones so that it would result-in higher yield of crops of improved quality and this is achieved through the process of cross breeding or hybridization (Emedo *et al*., 1995).

Pepper is a herb or under shrub, extensively cultivated in all tropical countries and in many Indian states. According to the scientific literature on selected herbs, aromatic and medicinal plants of the temperate zone, pepper refers primarily to *Capsicum annuum* and *Capsicum frutescens* (Simon *et al*., 1984). These are plants used in the manufacture of selected commercial products known for their pungency and colour.

Some varieties of peppers are stomachic, pungent, stimulating and carminative. It has been reported that the leaves and stem of the pepper plant have been effective as an anti-biotic (Cichewicz and Thorpe, 1996). In small doses, they help secretion of saliva and gastric juice and also induce peristaltic movement. Peppers are used all over the world as a condiment, in raw, ripe or dried forms. They are also used for flavouring curries, chutneys, salads etc. The dried fruit is ground into a fine powder and sold as Cayennne pepper. Extracts from peppers have many pharmaceutical uses. Hence, the research on hybridization of two species of peppers *Capsicum annuum* and *Capsicum frutescens* to produce a hybrid that might combine the qualities of the two varieties, with the removal of their bad traits for improvement in yield of pepper so as to meet the popular demands of society towards food security sustainability and industrial growth. Such a hybrid of the two varieties is likely to be of better qualities and demand than either of the two varieties. Accordingly, the problem and focus of the researcher was to compare the hybrid and the *Capsicum annuum* as well as the hybrid and the *Capsicum frutescens*. It would cover the first filial F_1 generation in related qualities.

MATERIALS AND METHODS

Sources of materials: The two species were collected from Agricultural and Natural Resources Department Market Garden Amawbia, Awka South Local Government Area Anambra State, Nigeria. The *Capsicum* species were authenticated by Prof. C.U. Okeke, a plant taxonomist in Department of Botany, Nnamdi Azikiwe University Awka Anambra State were the voucher specimens were deposited.

The experiment was carried out at Nnamdi Azikiwe University Awka, behind the Faculty of Natural Sciences Building. The design of the study was pure experimentation of Randomized complete block design.

The materials used were two species of dry peppers *Capsicum annuum, Capsicum frutescens,* 20 buckets, weighing balance, measuring cylinder, pair of forceps, foil, animal manure, sandy loamy soil. The two species of *Capsicum* were separated into two groups of 10 each, group one was used for *Capsicum annuum,* the other group *Capsicum frutescens*. The twenty buckets were perforated to allow free movement of water. Twenty seeds were sown in each of them and watered immediately. Germination started in five days, transplanting was done in the evenings after 4-5 weeks when the seedlings were 10 cm high. Seedlings were transplanted into the 20 buckets. Flowering started eight weeks for *Capsicum annuum* and nine weeks for

Capsicum frutescens (Fig. 1). It was at this stage that the crossing was done. Artificial crossing was adopted because pepper is a self-pollinating crop. This involved the removal of anthers with a pair of forceps from *Capsicum annuum,* thus using it as female parent before it dehisces and covering it with study bag (foil) to avoid natural crossing by insects. This was followed by the collection and transference of ripe pollen grains from *Capsicum frutescens* (the male parent) to the stigma of the emasculated plant (*Capsicum annuum*). This pollination process was followed by fertilization and subsequent production of fruits.

The qualities of the parent plants and the F_1 generation were compared to determine:

- Relative weights of the fruits of *Capsicum annuum, Capsicum frutescens* and F_1
- Whether the F_1 generation differs significantly from *Capsicum annuum* in weight of fruits
- Whether the F_1 generation differs significantly from *Capsicum frutescens* in weight of fruits

Statistical analysis: Data was analysed, using one way analysis of variance (ANOVA).

Fig. 1(a-d): Different species and crosses of (a) *Capsicum frutescens,* (b) *Capsicum annuum*, (c) F_1 hybrid and (d) Fruits of parents compared with fruit of F_1

RESULTS

Table 1, shows that the average weights of fruits of *Capsicum annuum* in the 1st, 2nd, 3rd and 4th replications were 0.05, 0.06, 0.06 and 0.05, respectively. The average weights of fruits of *Capsicum frutescens* in the 1st, 2nd, 3rd and 4th replications were insignificant. Similarly, the average weight of fruits of F_1 in the 1st, 2nd, 3rd and 4th replications were 0.03, 0.02, 0.03 and 0.03 respectively showing slight increase even though insignificant.

Table 2, shows that difference in average weights of fruit of *Capsicum annuum* and F_1 fruits were insignificant.

Difference in weights of *Capsicum frutescens* and F_1 fruits: This does not require any statistical analysis because the weight of fruits of *Capsicum frutescens* from the table were insignificant. Accordingly, the fruits of the F_1 generation were significantly higher in weight than those of the *Capsicum frutescens*.

DISCUSSION

Results of this study showed that when two pepper plants of different but closely related varieties are crossbred, a new variety which possesses enhanced characters of the two parent plants and some additional genetic attributes are produced. This is a strong expression of hybrid vigour or heterosis thus helps in ensuring food security. Secondly, when two plants with any pairs of contrasting characteristics are hybridized, one of these characteristics would often appear in the offspring while the other remains masked. The findings showed that there was a significant difference between the weights of the fruits of *Capsicum frutescens* and those of F_1 supporting hybrid vigour. Accordingly, the fruits of the F_1 generation were significantly higher in weight than those of *Capsicum frutescens* so no statistical analysis was required.

This finding conforms with what Mendel (1866) pointed out that when two plants with a pair of contracting characters are hybridized, one of the characters would often appear in the offspring while the other remained masked. The characteristic that appeared or manifested in the offspring he called dominant characteristic while the characteristic that did not appear he called recessive characteristic.

Hence, Mendenlian first law of segregation states that, the characteristics of an organism are controlled by genes which occur in pairs, of such a pair of genes only one can be carried in a

Table 1: Average weights of fruits of *Capsicum annuum* and *Capsicum frutescens* in relation to the fruits of the F_1 generation (Relative weight in grams)

Replications	*Capsicum annuum*	*Capsicum frutescens*	F_1
1	0.05	Insignificant	0.03
2	0.06	-	0.03
3	0.06	-	0.03
4	0.05	-	0.02
Mean	0.06	-	0.03

Table 2: Difference in weight of *Capsicum annuum* and F, fruits

Fruits	$\bar{X}$	N	SD	Standard error	df	Level of significance	t. cal	t. crit
Capsicum annuum	0.06	4	0	0	6	0.05	0	2.45
F_1	0.03	4	0					

t. cal: t-calculated, t. crit: t-critical value

single gamete. Similarly, the difference in weights of the fruits of *Capsicum annuum* and *Capsicum frutescens* in relation to the F_1 generation showed that *Capsicum annuum* has a number of dominant characters. Furthermore the F_1 of the cross although showed expression of hybrid vigour had fruits that are smaller than that of *Capsicum annuum* but bigger than that of *Capsicum frutescens* this is in line with the findings of Anaso (1982), he crossed *S. aethiopicum* and *S. anomalum*. Moreover, the difference in weights of fruits of *Capsicum frutescens* and F_1 was insignificance. Thus, it conforms to what Anthony (1990) said, "Hybridization can lead to increase in genetic variation in the population. Generally, the F_1 generation combines the characters of *Capsicum annuum* and *Capsicum frutescens*, although the characters of *Capsicum annuum* dominated that of *Capsicum frutescens*.

This is in line with the view of Emedo *et al.* (1995), that when two plants are hybridized, a new variety which possesses the characters of the two parents plants is shown but more of the characters are shown in F_1 closely to one parent than another. It also agrees with Allard (1960), opinion that the progeny of hybridization will combine many of the qualities of both parents, thus producing a crop which is superior in some extent, to either of the parents.

CONCLUSION

The results of this study showed that the F_1 generation combined the characters of *Capsicum annuum* and *Capsicum frutescens* and also had additional genetic attributes for better yield improvement.

REFERENCES

Allard, R.W., 1960. Principles of Plants Breeding. John Wiley and Sons Inc., New York, USA.

Anaso, H.U., 1982. Cytogenetic studies of some non-tuberiferous *Solannum* species. M.Sc. Thesis, Department of Biological Sciences, Ahmadu Bello University, Zaria, Egypt.

Anthony, I.S., 1990. Food Crops of the Tropics. Macmillan Press Ltd., London, UK.

Cichewicz, R.H. and P.A. Thorpe, 1996. *Capsicum* species and their uses. J. Ethnopharmacol., 8: 101-103.

Emedo, A.B.C., B.C. Maduka and S.C. Oranekwulu, 1995. Comprehensive Agricultural Science for West African Senior School. Diamond Publishers, Onitsha, Nigeria.

Mendel, G., 1866. Versuche uber p?anzenhybriden. Verhandlungen Naturforschenden Vereines Brunn, 4: 3-47.

Simon, J.E., A.F. Chadwick and W.E. Cracker, 1984. The Scientific Literature of Selected Herbs and Aromatic and Medicinal Plants of the Temperate Zone. Columbia University Press, New York, USA.