

Original Research Article

**IDENTIFICATION OF FACULTATIVE APOMIXIS IN FLUTED PUMPKIN
(*TELFAIRIA OCCIDENTALIS* HOOK. F)**

Abstract

Apomixis is a natural enigma in angiosperms, that allows seed formation without fertilization. A study was carried out from August, 2012 to May, 2014 in order to investigate the possibility of occurrence of apomixis in fluted pumpkin (*Telfairia occidentalis* Hook. F.). Five genotypes of fluted pumpkin were used. Ten plants from each genotype were planted out in a screened environment at the Federal University of Technology, Akure. The crop being dioecious, all the male plants were emasculated as soon as they were noticed, leaving only the female plants. After several flowers abortion of the Female flowers, they eventually set fruits. All the genotypes produced fruits (one or two) though at different times. Both apomictic and parthenocarpic fruits were produced. Fruits produced through apomixis were similar to those of sexually produced fruits. The seeds obtained from the apomictic fruits had high seedling emergence percentage and good seedling vigour. The observed facultative apomixis could be as a result of natural selection. This study confirms that sexual and apomixis forms of reproduction occur naturally in fluted pumpkin. The apomixis in the fluted pumpkin is reported for the first time and its implication in the genetic improvement of the crop is discussed.

Key words: *Telfairia occidentalis*; apomixis; dioecious; genotypes.

INTRODUCTION

Fluted pumpkin is among the important indigenous leaf and seed vegetables in West Africa. Its nutritional, medicinal, multi-utility, perennial and industrial potential earned it prominence among indigenous vegetables. Fluted pumpkin is a dioecious plant. The inability to distinguish sex at early stage and the preponderance of males in natural populations hinder

its productivity (Ajayi *et al.*, 2006). The female plants are known to produce large succulent leaves and fruits that attract high prices in the markets. The male plants, on the other hand, produce small with less attractive leaves and no fruit (Ogbonna, 2009). Thus, there is high discrimination against the male plants because they are of no economic importance to farmers.

Apomixis is a natural enigma in angiosperm reproduction. It is defined as the asexual formation of a seed from the maternal tissues of the ovule, avoiding the processes of meiosis and fertilization, leading to embryo development (Ross and Koltunow, 2004). Apomixis may be obligate or facultative, resulting in either only apomictic produced embryos and seeds, or a combination of apomictic and sexually-derived embryos and seeds, respectively (Hanna and Bashaw, 1987; Grossniklaus *et al.*, 2001).

Some characteristic features of fluted pumpkin include its exhibition of the polyembryonic, polyploidy and facultative perennial traits (Ajayi, 2003; Onovo *et al.*, 2009; Uguru and Onovo, 2011). Polyploidy is known to be associated with polyembryony and apomixis (Bicknell and Koltunow, 2004; Roche *et al.*, 2001). In addition, most apomicts are perennial and exhibit polyploidy Savidan (2001). An understanding of the reproductive biology of fluted pumpkin is necessary because the facultative perennial, polyembryonic and polyploid nature of the crop may imply the possibility of apomixis. Apomixis could help in genetic improvement of the crop and solve its problem of sex discrimination. Understanding apomixis would greatly facilitate the ability of plant breeders to fixate and propagate genetic heterozygosity and associated hybrid vigour in crop plants (Spillane *et al.*, 2001). Therefore, this study was initiated to investigate possible occurrence of apomixis in fluted pumpkin.

54 MATERIALS AND METHODS

55 Apomixis in fluted pumpkin could be verified through fruit setting of the female plant
 56 in absence of pollen. Based on this, this experiment was carried out from August, 2012 to
 57 May, 2014 using 5 genotypes in a screened environment beside the screen house of the
 58 Department of Crop, Soil and Pest Management Federal University of Technology, Akure).
 59 Ten seeds from each genotype were planted on flat. Regular weeding was done when
 60 necessary and the plants were staked. The crop being dioecious, all male plants were
 61 emasculated as soon as they were noticed. The remaining female plants were monitored for
 62 successful fruits set. Apomictic fruits harvested from isolated female plants were subjected to
 63 progeny test. The following data were collected from the fruits produced via apomixis
 64 number of fruits and number of seeds per fruit. Filled seeds were planted in the nursery in
 65 March, 2014 in order to test the viability of the progenies and compare them
 66 morphologically. Data were collected emergence percentage, vine length and seedling vigour.

67 RESULTS

68 All the female plants left on the field produced numerous flowers (>100 per plant).
 69 Abortion rate was very high. Normal flowering was also observed for example tendrils
 70 produced flowers (Plate 2a and 2b) and twin flowers (Plate 2c). Look about 8 weeks of
 71 flower production before there were successful fruits set. Observation of fruit developmental
 72 traits indicated that fluted pumpkin comprises both traits of apomixis and parthenocarpy
 73 (Plate 2a and 2b). As soon as fruits set were successful in each of the female plants, flower
 74 production ceased. All the genotypes evaluated produced fruits but at different times. Each
 75 plant produced one or two fruits (Table 1). Fruits produced through apomixis were similar to
 76 those of sexually produced fruits. All the seeds obtained from the apomictic fruits had good
 77 germination percentage and good seedling vigour (Table 1).

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DISCUSSION

The result from this study revealed that sexual reproduction and apomixis occur simultaneously in fluted pumpkin. All isolated female plants from different genotypes set fruits successfully in absence of pollination. The Fruits and seeds of apomictic plants are morphologically similar to sexually produced fruits and the apomictic seeds are viable. Thus, the breeding system of fluted pumpkin is facultative apomixis. Apomixis has been reported in more than 300 species and at least 36 different families, and commonly may be identified in the *Gramineae*, *Compositae*, *Rosaceae*, *Euphorbiaceae*, *Rutaceae* and *Musaceae* (Hanna and Bashaw, 1987; Grossniklaus *et al.*, 2001; Okoro *et al.*, 2011). Occurrence of facultative apomixis in fluted pumpkin can be supported by the fact that the crop being dioecious, it is an outcrossing species and apomixis is much more prevalent among outcrossing species than inbreeding species (Asker and Jerling 1992). Fluted pumpkin exhibits polyploidy, polyembryony and facultative perennial. Also, strong correlation between apomixis and polyploidy, polyembryony perennial have been reported (Lakshmanan and Ambegaokar, 1984; Asker and Jerling, 1992; Savidan, 2001). Apomicts are often found in highly disturbed areas or where individuals are widely dispersed (Asker and Jerling, 1992), so it is possible that isolation of the female may be an influencing factor for apomixis in fluted pumpkin. Therefore, occurrence of apomixis may be as a result of sexual evolution through natural selection. This is the first time apomixis will be reported in this crop. Hence, this discovery of the occurrence of apomixis in fluted pumpkin is a great opportunity for the improvement of the crop. Apomixis could provide solution to sex discrimination which is the major problem affecting commercial cultivation of the crop.

CONCLUSION

This study confirms that sexual and apomictic forms of reproduction occur naturally in fluted pumpkin. Both produce morphologically similar fruits and viable seeds. The observed facultative apomixis could be as a result of natural selection. Apomixis in the fluted pumpkin

is reported for the first time. This has great implication in the genetic improvement of the crop especially in enhancing leaf and fruit yield which can only be obtained from the female plant.

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Plate 2a. Apomictic fruits



Plate 2b. Parthenocarpic fruit

Plate 2. Apomictic fruits and parthenocarpic fruit of fluted pumpkin.

187 Table 1. Mean performance of fruit and seedling characteristics of apomictic fruits obtained
188 from five genotypes.

Genotypes	Number of fruits	Number of seeds/fruit	Emergence %	Vine length (cm)	Seedling vigour
Ftm12	2	66	68.18	23.00	15.68
Ftn62	1	80	95.00	52.00	49.40
Ftn64	1	81	80.25	20.10	16.13
Ftn63	2	50	80.00	18.00	14.40
Ftm11	2	33	96.97	33.50	32.48

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Flower bud on tendrils (a)



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Flower bud on tendrils (b)



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Twins flower bud (c)

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216 Plate 3. Abnormality in flowering of female plants