INFLUENCE OF FORMALDEHYDE ON SEED GERMINATION OF OKRA *(Abelmoschus esculentus L. Moench)*

T.C. IBEABUCHI, M.J. EKA and E.B ADIE
DEPARTMENT OF AGRONOMY, MICHAEL OKPARA UNIVERSITY OF AGRICULTURE UMUDIKE, ABIA STATE NIGERIA,
DEPARTMENT OF CROP SCIENCE, UNIVERSITY OF CALABAR, NIGERIA.
Corresponding author: thankgodibeabuchi@yahoo.com

ABSTRACT

A research was conducted on the influence of varying concentrations of formaldehyde: 0 %(w/v), 30% (w/v), 60% (w/v) and 90 %(w/v) on the germination percentage of okra (*Abelmoschus esculentus* L. Moench) seeds at Eastern Research Farm of Michael Okpara University of Agriculture, Umudike. This research was informed by the need to increase variability and availability of okra fruits as a step to close the gap created by increase in consumption demand due to its pile of nutrients. Four different sets of okra seeds were soaked in afore mentioned concentrations respectively for 30minutes after which they were sieved out and washed under running water for 10 minutes and allowed to sun dry before planting. First mutant (M0) generation was raised in polythene bags in a completely randomized design (CRD) and data on germination percentage was generated. However, the germinated okra seeds were allowed to grow to maturity and harvested seeds served as parent stock for the second (M1) generation planting which was carried out in the open field using randomized complete block design (RCBD). Germination percentage date from both generations were statistically analyzed for variance using the GenStat. The treatment ($P \leq 0.05$) led to a significant reduction in the germination percentage of the okra seeds with increasing treatment concentrations. 0% (w/v)

treatment gave the highest germination percentages (95.00% and 100%) in both generations while the 90% (w/v) treatment concentration gave the lowest germination percentages (64.50 and 69.80) in both generation. This research reveals that high concentration doses of chemical mutagens has the capacity to interfere with the viability of seed embryo which reduced the germination rate in *A. esculentus* L. Moench

Key words: *Abelmoschus esculentus,* Concentration, Formaldehyde, Mutation.

INTRODUCTION:

Mutation is the remodeling of heritable features of an organism. It could be unpremeditated or vise- versa in both seeds and vegetative propagated crops. Willfully, it may be induced using physical, biological or chemical mutagens.

Formaldehyde which is a typical chemical mutagen (Harris. 2011) has been identified to be genotoxic and mutagenic to mammalian cell (Ma and Harris. 1988; IARC.1995; Conaway *et.al.,* 1996).

Okra (*Abelmoschus esculentus* L. Moench) is a crop consumed mainly for its green tender fruits as vegetable in countless ways. The fruits are vitamins and mineral fortified, the matured seeds supplies protein and oil rich in unsaturated fatty acids (linoleic acid) while the matured fruit and stem contains crude fiber which can also be used in paper industry (Kumar *et.al.,* 2013).

Following the colossal economic and nutritional gravity of okra, it's of no doubt that its demand is outweighing its variability and availability. To bridge the demand space, mutation breading which is a source of increasing variability and improvement without significantly altering acceptable phenotype is needed to supplement conventional breeding (Ojomo *et.al.*, 1979).

In this research, four different concentrations of formaldehyde were used to treat four different sets of okra seeds by soaking for 30 minutes before planting.

The objective of this research was to establish the influence of formaldehyde on the germination percentage of okra seeds.

MATERIALS AND METHOD

This research was carried out at the Eastern Research farm of Michael Okpara University of Agriculture Umudike, Abia State Nigeria. The site is located within altitude 07°33E and latitude 05°29N with altitude of 122m above sea level. Umudike is a humid tropic with total average rainfall of about 286mm/annum and classified as sandy loam ultisol (Agboola, 1979).

The okra seeds (Clemson spineless) were sourced from National Agricultural Seeds Council of National Root Crop Research Institute Umudike, Abia state, Nigeria.

The four concentrations of formaldehyde were prepared based on standard methods in the laboratory.

Four different sets of 250 okra seeds each were completely soaked in the four different formaldehyde concentrations for 30 minutes. The seeds were afterwards sieved out and washed under running water for 10 minutes to reduce the effect of residual mutagen on the seed coat and sundried. The treated seeds were planted in polythene bags to raise the first mutant (M0) generation using the completely randomized design (CRD). Agro-cultural practices like mulching was done to retain water in the soil and also prevent the attack of rodents. Data were generated (germination was recorded for 7 days and percentage was calculated). The survived okra seedlings were nurtured(weeding by hand pulling, pest and disease were greatly controlled by avoiding excessive irrigation of the crop leaf area till maturity and seeds were harvested for M1 generation which were

later raised in the open field in a randomized complete block design (RCBD) and M1 data on germination was generated.

DATA ANALYSIS

All generated data were subjected to analysis of variance using Gen stat.

RESULT

Table.1. Influence of formaldehyde on seed germination of okra (*Abelmoschus esculentus* L. Moench)

Concentration %(w/v)	M_o	M_1
0	95.00	100.00
30	71.00	96.62
60	84.00	95.00
90	64.50	69.80
LSD(0.05)	***	***

NS= not significant; **= very significant; *= highly significant**

The result from table 1 above shows a decrease in germination percentage in okra seeds as the treatment concentration was increased.

The control treatment (0% w/v) in both generations gave 95% and 100% germination percentages respectively which were the highest percentages recorded. Whereas the 30% (w/v) 71.25 and 96.62, 60% (w/v) 84.50 and 95.00, 90% (w/v) 64.50 and 69.80 were recorded. As the

concentration dose was increasing, the germination percentage was decreasing. The analysis of variance carried out also shows that at $P \leq 0.05$, there was a highly significant difference between the treatments.

This therefore shows that increased concentration doses of formaldehyde reduces the germination percentage in *A.esculentus*.

DISCUSSION

Exposure of plant materials to chemical mutagens such as formaldehyde, Sodium axide, colchicine, Ethyl nitrosourea, vinyl chloride etc. is capable of inflicting physiochemical stresses thus inducing growth and physiological modification (Kirtane and Dhumal, 2004). The effect of chemical mutagens are damaging, particularly at high doses.

The result obtained in this research agrees with the report of Mensah *et.al.*, (2006) in *Sesamum indicum* L. treated with sodium axide and colchicine. Rajib Roychowdhury and Jagatpati Tah (2011) also reported a decrease in germination percentage in Dianthus cultivar when treated with high concentration of ethyl methane sulphonate (EMS) and sodium axide. Similar results were also reported for EMS in soybean (Padavi and Dhanavel. 2004) and in mungbean (singh and kole. 2005).

The research result and available literatures underscore the fact that the mutagenic treatment interfered with the viability of the embryo which led to poor germination. At higher concentrations the embryo and the seeds died outright.

The decrease in the seed germination (%) after mutagenic treatments may be ascribed to the chromosomal aberrations, disturbances in DNA and auxin synthesis and to the impaired cell metabolism (Kirtane and Dhumal, 2004). High concentration of chemical mutagen hampered ATP biosynthesis resulting in decrease availability of ATP molecules which slows germination rate (Pearson *et.al.*, 1974; Cheng and Goa, 1988).

CONCLUSION

It is therefore established that treatment of okra seeds using high concentration of formaldehyde reduces germination rate. For an increased germination rate in okra seeds to the obtained, 0% (w/v) of formaldehyde treatment is recommended.

ACKNOWLEDGEMENT

I thank almighty God for the grace to carry out this research work and to Dr. Mathias, J. Eka, I feel indebted to you. Having considered the great supervisory role you played in the success of this research work, may God bless you more.

REFERENCES

Cheng, X.M. (1988): Biological and Genetic Effects of combined treatments of Sodium axide, gamma rays and EMS in Barley. *Environmental Experimental Botany* 28:281-288

Conaway, C.C., Whysner, J., Verna, L.K and William, G.M. (1996): Formaldehyde mechanistic data and risk assessment: Endogenous protection from DNA adduct formation. *Pharmacol. Ther*; 71:29-55.

Harris, Gardiner. (2011): "Government says two common materials pose risk of cancer" New York times retrieved 2011-06-11.

IARC (1995): IARC Monographs on evaluation of carcinogenic risk to humans. Vol.62, wood dust and formaldehyde. IARC Lyon.

Kirtane, S. and Dhumal,K.N. (2004). Studies on induced mutations in onion: Biological and cytological effects of mutagen in M1 generation. Int. J. Mendel 21, 11-13, 2004.

Ma, T.H and Harris, M.M. (1988): Review of genotoxicity of formaldehyde. *Mutat Res*. 196:37-59

Mensah. J.K., Obadoni, B., Akomeah, P.A; Ikhajiagbe, B and Ajibolu, Janet. (2006): The effect of sodium axide and colchicine treatment on morphological and yield traits of sesame seeds (*Sesame indicum.* L*)*

Mensah, J.K., Akomeah, P.A and Ekpekuruede, E.O. (2005): Gamma irradiation induced variation of yield parameters in cowpea (*Vigna unguiculata* L. Walp). *Global journal of pure and applied science 11(3):327-330.*

Mensah, J.K and Akomea, P.A. (1997). Mutagenic effects of hydroxylamine and streptomycine on growth and seed yield of the cow pea, (*Vigna unguiculata*. L. Walp). *Legume Res*. 15:39-44.

Ojomo, A.O; Omueti, O and Raji, J.A. (1979): Studies in induced mutation in cowpea 5. The variation in protein content following ionization radiation. *Nig J. Appl. Sci*. 21:61-64.

Padavai, P. and Dhanavel,D. (2004). Effect of EMS, DES and Colchicine treatment in soybean. *Crop Res*. 28 (1, 2 & 3): 118-120.

Pearson, O.W., Nillen, R.A and Sander, C. (1974): The effect of sodium axide on the cell cycle of the embryonic Barley shoot. *Barley genetic newsletter* 4:61

Rajib Roychowdhury and Jagatpati Tah (2011): Germination Behaviors in M2 Generation of Dianthus after Chemical Mutagenesis. *International journal of advanced scientific and technical research*. Issue 1 Vol 2. Dec 2011. ISSN 2259-9954

Sathish-kumar, D., Eswar-Tony, A., Praven-Kumar, K., Ashokumar,D., Bramha, Srinivasa Rao and Ramarao, Nadendia.(2013): A review on *Abelmischus esculentus* (Okra). *International research journal of pharmaceuticals and applied sciences* 3(4): 129-132.

Singh, R. and Kole, C.R. (2005): Effect of mutagenic treatments with EMS on germination and some seedling parameters in mungbean. *Crop Res.* 30(2): 236-240

Wahua, T.A.T. (1981): Simplified Experimental Statistics (1) Department of Agronomy, University of Ibadan.