Cosmos Multidisciplinary Research E-Journal
Online Available at www.cmrj.in
Recognized International Peer Reviewed Journal
Impact Factor 5.3
ISSN No. 2456-1665

Effect of Gamma Rays and Sodium Azide on *Trachyspermum ammi* (L)Sprague, To Check Mutagenic Sensitivity

Saqib Ahmed and Anil Bhalerao
Department of Botany, S.S. and L.S. Patkar and
V.P. Varde College Goregaon, Mumbai.
dranilbhalerao@gmail.com

ABSTRACT

The present study deals with the effect of 10 KR,15KR, and 20 KR of gamma rays and 0.01 %, 0.02 % and 0.03 % of Sodium Azide doses on the two different varieties of *Trachyspermum ammi* (L) Sprague. The Variety AA-93 and AA-73 two varieties were used in present investigations. Important parameters like the percentage of seed germination, survival percentage, stem height and the number of nodes for deciding the mutagenic stativity.

A higher percentage of seed germination, survival percentage and stem height were found in 20 KR of gamma rays and 0.03 % of Sodium Azide of variety AA-93 as compared to all mutagenic doses. Whereas, in variety AA-73 of germination percentage, survival percentage and stem height were observed to progressively increased as the concentration of mutagenic doses increased.

Keywords: Trachyspermum ammi, gamma rays, Sodium Azide, mutagenic sensitivity

INTRODUCTION

Trachyspermum ammi (L.) Sprague is commonly known as carom, Bishop's weed or Ajowan caraway (Spice Board India, 2015). It is an annual herb belonging to the family Apiaceae or Umbelliferae. Both the leaves and seeds of carom are consumed by humans regularly (Aliza Green, 2006).

It is well established that induced mutational approach not only creates morphological variation but also alter the biochemical feature of the plants. Through the induced mutation, near about eight hundred varieties have been released directly or indirectly as commercial cultivar (Novak and Micke, 1987). In addition to crop improvement, the genetic variability induced by physical and chemical mutagens also helps in analysing and understanding genes, their regulation and organization (Newcombe, 1971).

Hugo de Vries (1901) suggested the classic mutation theory of evolution. According to him mutation is a sudden heritable change and has an important role in evolution The major advantage of the use of induced mutations has been the possibility to correct one or few negative characters or to get new gene combination, which is desirable without changing the major part of the systems total genetic makeup. Due to the advantages of mutation breeding many scientists are entering in this field, for the development of new cultivars in different crop plants.

It is widely grown in arid and semi-arid regions where soils contain high levels of salts [Munns R., 2002] Ajwain is a profusely branched annual herb, 60-90 cm tall. Stem is striated; inflorescence compound umbel with 16 umbellets, each containing up to 16 flowers; flowers actinomorphic, white, male and bisexual; corolla 5, petals bilobed; stamens 5, alternating with the petals; ovary inferior; stigma knob-like; fruit aromatic, ovoid, cordate,

cremocarp with a persistent stylopodium; leaves pinnate, with a terminal and 7 pairs of lateral leaflets.[Joy et.al,2001] Fruit, consists of two mericarps, greyish brown, ovoid, compressed, about 2 mm long and 1.7 mm wide, 5 ridges and 6 vittae in each mericarp, usually separate, 5 primary ridges.

Ajwain seed analysis has revealed it to contain fibre (11.9%), carbohydrates (38.6%), tannins, glycosides, moisture (8.9%), protein (15.4%), fat (18.1%), saponins, flavone and mineral matter (7.1%) containing calcium, phosphorous, iron and nicotinic acid.[Pruthi, 1992] Ajwain fruits yield 2% to 4% brownish essential oil, with thymol as the major constituent (35% to 60%).[Ishikawah et.al., 2001] The nonthymol fraction (thymine) contains para-cymene, γ-terpenine, α- and β-pinenes, dipentene, α-terpinene, and carvacrol.[Chopra, 1982.] Minute amounts of camphene, myrcene, and α-3-carene also have been found in the plant. Alcoholic extracts contain a highly hygroscopic saponin. From the fruits, an yellow, crystalline flavone and a steroid-like substance has been isolated and it also contains 6-O-β-glucopyranosyloxythymol,[Garg and Kumar, 1998] glucoside and yields 25% oleoresin containing 12% volatile oil (thymol, γ-terpinene, para-cymene, and α- and β-pinene).[Nagalakshmi et.al., 2000] The principal oil constituents of *T. ammi* are carvone (46%), limonene (38%), and dillapiole (9%).[Choudhury , 1998].

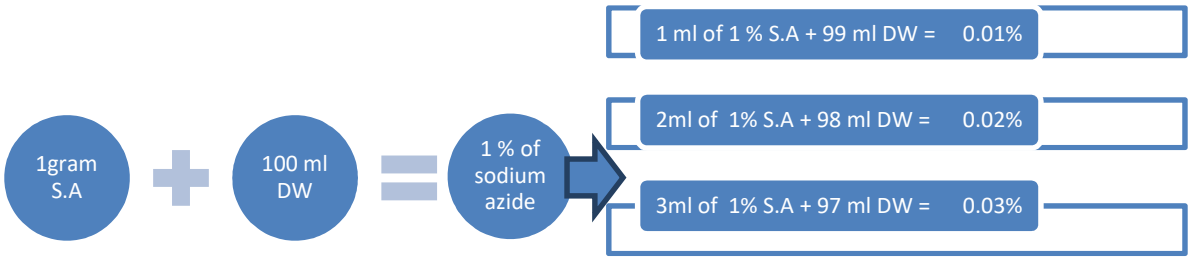
The major advantage of the use of induced mutations has been the possibility to correct one or few negative characters or to get new gene combination, which is desirable without changing the major part of the systems total genetic makeup. Due to the advantages of mutation breeding many scientists are entering in this field, for the development of new cultivars in different crop plants.

MATERIAL AND METHODS

. The seed material for this study was procured from the regional station of the Indian Council of Agricultural Research, "National Research Centre On Seed Spices Ajmer, Rajasthan, India". The study was carried out in the research laboratory at the Department of Botany, Sir Sitaram and Lady Shantabai Patkar College of Arts and Science and V.P Varde college of commerce and Economics, Goregaon, Mumbai-400062

Uniform size seeds were used in all the doses of gamma rays and sodium azide. The seeds of *Trachyspermum ammi* (L) Sprague were subjected to gamma irradiation at Bhabha Atomic Research centre (BARC) Trombay, Mumbai. The seeds were treated with different concentrations of sodium azide in a research laboratory, at Patkar college Goregaon, Mumbai.

Seeds of *Trachyspermum ammi* (L) Sprague soaked for 24 hours and were subjected to irradiation of gamma rays viz,10KR,15KRand 20KR. The seeds were soaked into distilled water for 6 hours and then kept in 0.01 %,0.02% and 0.03% solution of sodium azide for 4 hours in sterilized conical flask. Treated seeds has been washed thoroughly and immediately sown at research laboratory Patkar college. A laboratory shaker was used to homogenize, disperse and mix samples at precise speeds and with precise control. The experimental seeds of different concentrations of sodium azide was arranged in Randomize Block Design (RBD) to rise the M1 generation. Meanwhile the control seeds were dipped into distilled water for 14 hours. Proper labelled was displayed to all the samples of both of the varieties of seeds.



RESULTS AND DISCUSSION

During the present study two types of seeds of *Trachyspermum ammi* (L) Sprague were used and employed for induced mutation by physical and chemical mutagens like gamma rays and sodium azide. Both the varieties showed that the morphological appearance in respect of the number of nodes and stem height are different.

It was observed that the highest number of nodes and stem height in all the doses of irradiation of gamma rays i.e.10 KR, 15 KR and 20 KR were enhanced but with the use of 20 KR of gamma rays, the highest number of nodes and stem height were seen to be highest. And 0.03 % of solution of sodium azide also enhanced the length of stem and nodal number in AA-93 variety of seeds.

The germination percentage, number of nodes and stem length rose at the application of concentration of 20 KR of gamma rays whereas the size of stem and nodal number were recorded to be increasing more due to the use of 0.03 % of sodium azide. The concentration of 0.03 % of sodium azide also showed the highest result comparing to the concentration of 0.01 % and 0.02 %.

In the two different varieties AA-93 and AA-73 was also observed variation between the germination percentage, seedling viability and stem height. The growth of shoot was reached up to the 43 cm in AA-93 within the period of 61 days. While shoot height reached at 40 cm in the variety of AA-73 requiring the same period.

Table 1: Effect of gamma rays on in vivo seed germination, seedling height, survival percentage and number of nodes in the variety **AA -93** Of ***Trachyspermum ammi*** (L) Sprague.

Mutagen dose(AA 93) day 61	Number of seeds	Seed germination percentage	Seedling survival percentage	Seedling height	Number of nodes per plant
Control	100	85.5	62.6	28.8	4.5
10 KR	100	75.2	45.1	29.6	4.1
15 KR	100	71.4	44.8	36.5	5.3
20KR	100	65.6	38.8	43	7.4

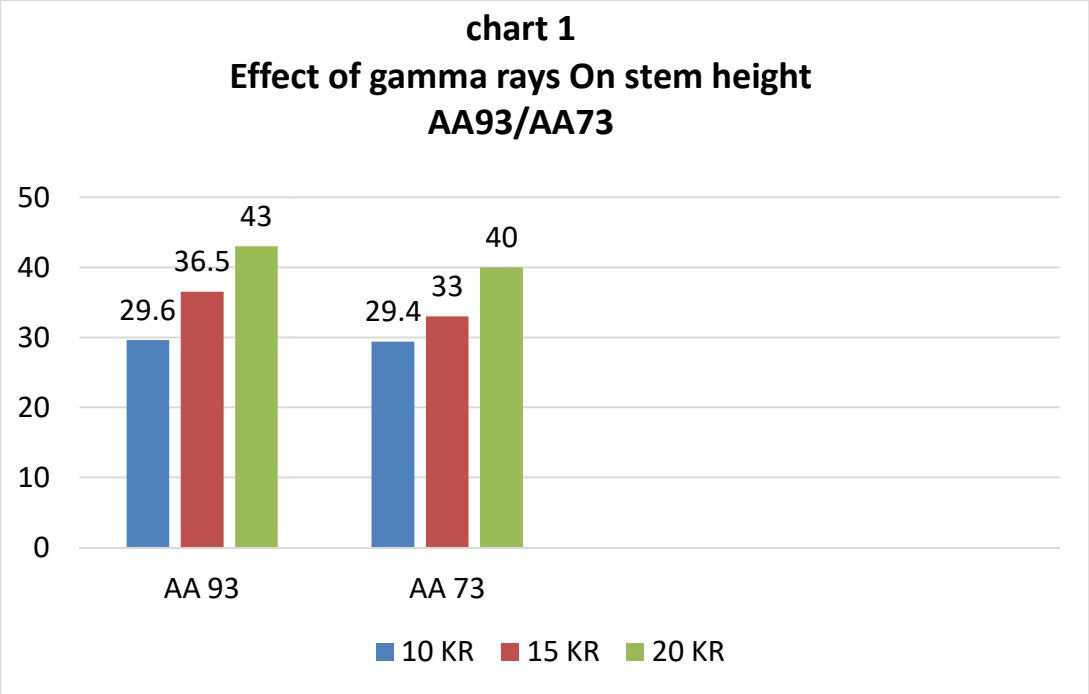


Table 2: Effect of gamma rays on in vivo seed germination, seedling height, survival percentage and number of nodes in the variety **AA -73** Of ***Trahyspermum ammi*** (L) Sprague.

Mutagen dose(AA 93) day 61	Number of seeds	Seed germination percentage	Seedling survival percentage	Seedling height	Number of nodes per plant
Control	100	89.6	64.7	28.7	4.6
10 KR	100	78.7	52	29.4	5.5
15 KR	100	75.9	49.8	33	5.9
20 KR	100	68.5	42.2	40	6.6

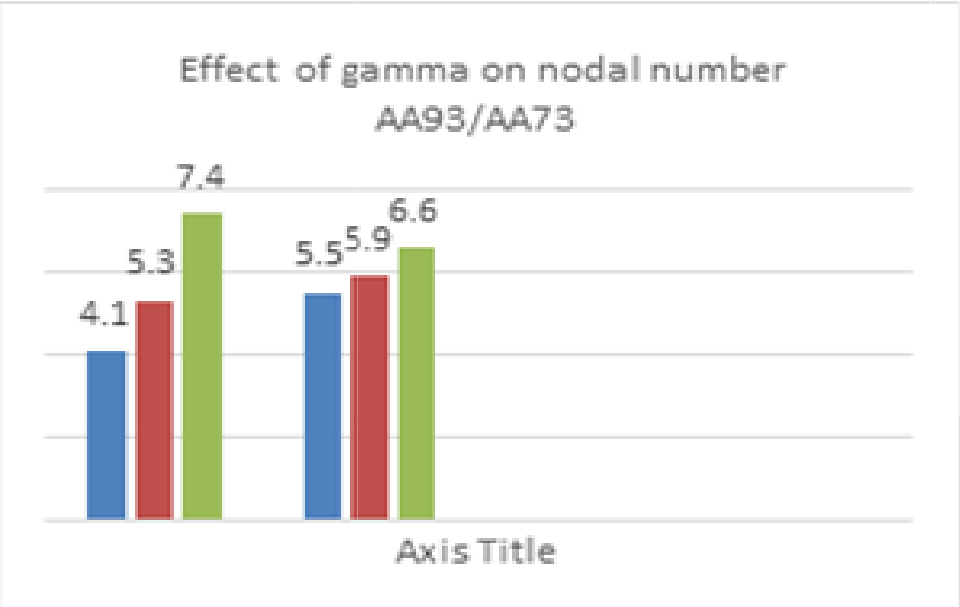


Table 3: Effect of Sodium Azide on in vivo seed germination, seedling height, survival percentage and number of nodes in the variety **AA -93** Of ***Trahyspermum ammi*** (L) sprague.

Mutagen dose (AA73) day 35	Number of seeds	Seed germination percentage	Seedling survival percentage	Seedling height	Number of nodes per plant
Control	100	89.6	64.7	10.6	2.2
0.01%	100	54.6	57	11.4	2.3
0.02%	100	52.2	52.5	16.6	3.5
0.03%	100	48.8	45.6	20	3.6

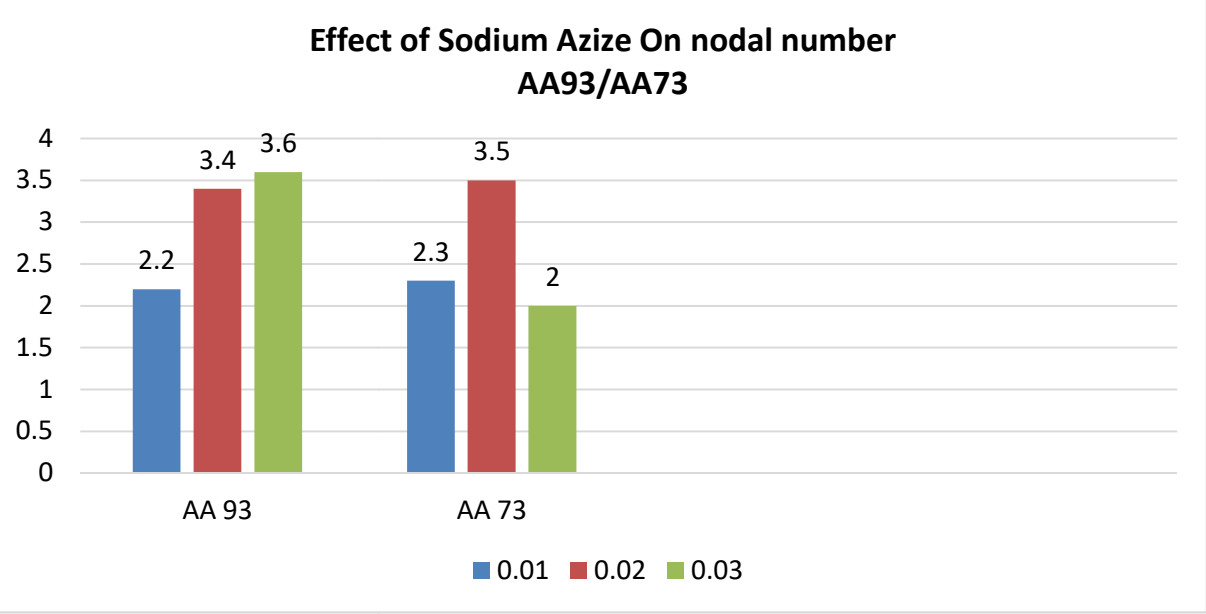
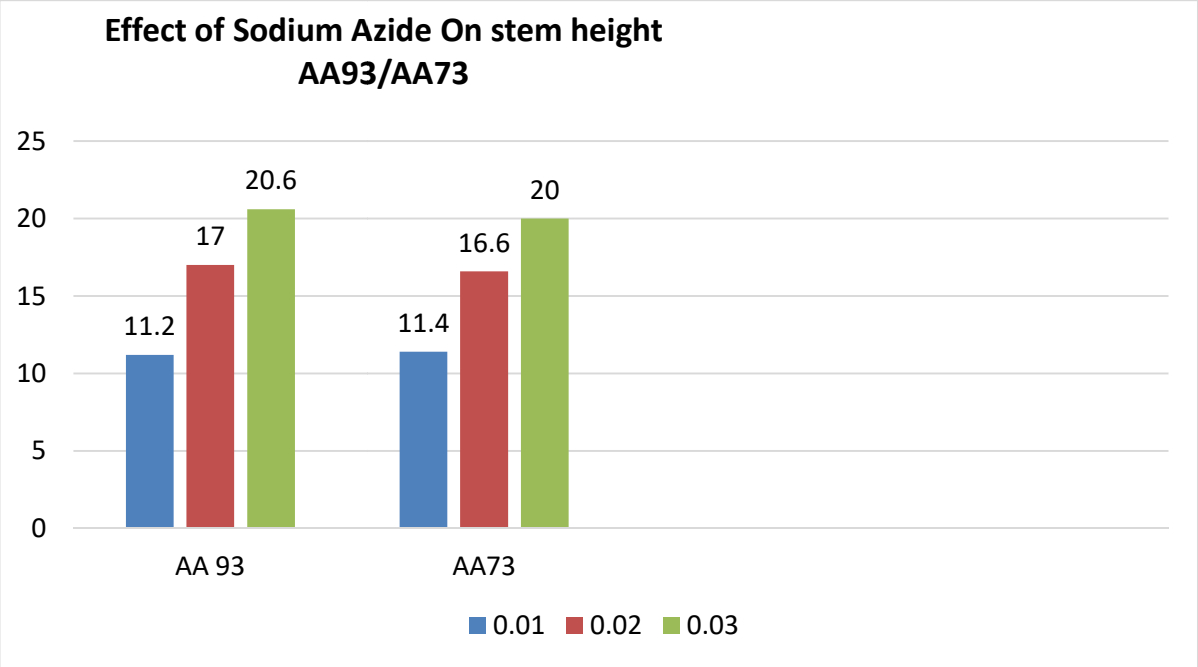


Table 4: Effect of Sodium Azide on in vivo seed germination, seedling height,

Mutagen doseAA93) day 35	Number of seeds	Seed germination percentage	Seedling survival percentage	Seedling height	Number of nodes per plant
Control	100	85.5	62.6	10.2	2.1
0.01%	100	45.9	47	11.2	2.2
0.02%	100	44.9	40.9	17	3.4
0.03%	100	39	37.2	20.6	3.6



Field Photo - Comparison between different concentration

Stem height reaches at 54 cm long

Flowering developed

CONCLUSION

In respect of the survival of seedlings, the effect of gamma radiation caused the decrease in the survival percentage of seedlings. Similar observations were observed by several Researchers: Chowdary (1978) in seedlings of wheat, Akbar et al. (1978) in the seedling of rice and in the

previous year in 1976 by Constantain et al. in the seedlings of soybean as it has been recorded in the present investigation. In the present investigations, increasing the doses of gamma radiation exhibited gradual increasing effect on the growth of height of seedlings. The effects of mutagens were found to be detrimental to the mechanism of germination as well as survival of seedlings at maturity. Thus, it is clear that physical and chemical mutagen indicated the mutagenic effect on seed germination, seedling height and seedling percentage in *Trachyspermum ammi* (L) Sprague.

REFERENCES

Ayurvedic Pharmacopoeia of India (1999). Government of India, Ministry of Health and Family Welfare Department of Ayush. Part 1-. 1999-2011;1:170

Bentely R, Trimen H. (1999): Medicinal Plants. New Delhi: Asiatic Publishing House;. pp. 107–15.

Broertjes G. and Van Harten A. M. (1978). Application of mutation breeding methods in the improvement of vegetatively propagated crops. Elsevier, Amsterdam. : 316.

Choudhury S. (1998). Composition of the seed oil of *Trachyspermum ammi* (L.) Sprague from northeast India. J Essent Oil Res. 10:588–90.

Hugo de Vries (1901). Die mutations theoric I. Von Viet & Co., Leipzing.: 1- 648.

Ishikawah T, Sega Y, Kitajima J. (2001). Water-soluble constituents of ajowan. Chem Pharm Bull. 49:840–4.

Malik, Saima & Amin, Ruhul & Ansari, Shazia & Jahan, Roshan & Khan, Samiullah. (2018). Induced mutagenesis for sustainable production of aromatic Plant Ajwain (Trachyspermum ammi): A Review article.

Muller H. J. (1927). Artificial transmutation of the genes. *Sci.* 66:84 - 87.

Nagalakshmi S, Shankaracharya NB, Naik JP, Rao LJM.(2000). Studies on chemical and technological aspects of ajowan (*Trachyspermum ammi* syn. Carum copticum) J Food Sci Technol.37:277–81.

Newcombe H. B. (1971). *Adv. Gent*. 16: 240-290.

Pruthi J.S. (1992). Spices and Condiments. 4th ed. New Delhi: National Book Trust.

Siguribojornsson B. and Mike M. S. (1969). Progress in mutation breeding, Proc. "Induced mutation in plants". IAEA, Vienna. : 16 – 17.

Spice Board of India (2015): Bishop's weed, archived from the original on 14 October 1999. Retrieved.