Research Article

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QUANTITATIVE ESTIMATION OF PROTEIN AND ESSENTIAL OIL CONTENT OF MUTANTS OF TWO MEDICINAL SPICES OF UMBELLIFERAE

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ABSTRACT

With the aim to develop superior plant type an induced mutagenesis programme was initiated in two medicinal spices namely Celery and Ajowan, belonging to the family Umbelliferae. Present investigation deals with quantitative estimation of seed protein and essential oil contents (from M_3 harvested seeds) of the macromutants (screened at M_2) obtained in two spices, in relation to control. Results indicate that protein and essential oil content enhanced in some of the mutants in comparison to control. These plant types can be selected directly and further hybridization followed by selection may offer scope to develop elite plant types which may exhibit maximization of the two parameters in one.

Keywords: Medicinal spices, Mutants, Estimation, Protein, Essential oil

INTRODUCTION

Celery (*Apium graveolens* L.) and Ajowan (*Trachyspermum ammi* L.) belonging to the family Umbelliferae, are the two frequently used spices in many of the culinary traditions of the world and is cultivated in many countries[1-2]. But it is not confined only in kitchen to add aroma and taste to food. It can bring potential health benefits due to its valuable nutritional composition specially consisting of phenolic compounds[1,3,4], dietary flavonol and flavone[5], vitamins and mineral salts[6] and others. Further these spices have different medicinal properties[7-13]. Their therapeutic potentials are well known for centuries in folk medicine[3]. The actual determinant of this therapeutic potential is the various components of essential oil present in seeds as well as in foliage[6,14]. The magical properties attributed to them have already given[15,16] their status as nutraceutical, i.e., have both nutritional and pharmaceutical values. Many works have been done regarding the chemical constituents, nutritional composition, and medicinal potentials of these spices. But very few efforts have been made to improve the spices through genetic manipulation. Keeping this view in mind the authors have initiated an induced mutagenesis programme to create desirable mutants. Present investigation deals with quantitative estimation of seed protein and essential oil content in control and screened macromutants of the two spices.

MATERIAL AND METHODS

In an induced mutagenesis (EMS and γ-irradiations) programme, total 13 macromutants [thick stem I, thick stem II (the trait was concomitantly associated with crumpled pinnae of leaves), pigmented stem, lax branching I, lax branching II (lax nature primary branches further formed dome shaped appearance), funnel, bushy, drooping branched, dwarf, broad pinnae, narrow pinnae, early flowering and late flowering] were screened in M_2 generations; the mutant traits were confirmed at M_3. Protein and essential oil content was estimated from control and all macromutant (three replicas in each case) plant types using selfed M_3 harvested seeds. In all the generations seeds were sown on 10th day of December and no fertilizer was applied ever.

Extraction of soluble protein was done following Osborne[17] and estimated quantitatively as per the method of Lowry *et al.*[18]. Extraction of essential oil was made following hydrodistillation process as was suggested by Simon *et al.*[19]. Two grams of dry seeds were used in each set of experiments (one set=one replica; three replicas for each plant type). The seeds were crushed slightly (to break the mericarp) before use and 2 to 3 hours' extraction time has been given for each sample. The oil extracted (room temperature) was separated from water (with diethyl ether) in a separating funnel and measured in a micrograduated tube designed for the purpose (data obtained for each plant type were pooled).

It is essential to note that seeds used were of identical maturity and sun dried for 2 consecutive days, 4 hour each day.

RESULTS AND DISCUSSION

Protein and essential oil content of control and macromutants are presented in Table 1. Protein content of untreated Celery and Ajowan estimated to be 20.73% and 14.81% respectively. In macromutants protein content varied from 14.89% (dwarf) to 25.81% (thick stem I) in Celery; while, it ranged from 11.43% (drooping branched) to 26.82% (thick stem I) in Ajowan. Protein content enhanced in thick stem I (25.81%), pigmented stem (21.58%), lax branching I (25.11%), funnel (24.78%) mutants of Celery and thick stem I (26.82%) and II (22.44%), pigmented stem (22.42%), lax branching I (19.66%) and II (25.33%), bushy (16.13%) and dwarf (18.97%) mutants of Ajowan than their respective controls.

Essential oil content was noted to be 2.1% in Celery and 2.5% in Ajowan. Essential oil content enhanced in bushy (2.8%), early flowering (2.6%) and dwarf (2.5%) mutants of Celery and drooping branched (3.0%) and dwarf (2.7%) mutants of Ajowan than their respective controls.

Table 1: Quantitative analysis of seed protein (%) and essential oil content (%) in controls and macromutants

Plant types	*Apium graveolens*		*Trachyspermum ammi*	
	Protein content (%)	Essential oil content (%)	Protein content (%)	Essential oil content (%)
Control	20.73	2.1	14.81	2.5
Thick stem I	25.81	1.5	26.82	2.0
Thick stem II	-	-	22.44	2.1
Pigmented stem	21.58	1.7	22.42	2.0
Lax branching I	25.11	1.5	19.66	2.1
Lax branching II	-	-	25.33	2.0
Funnel	24.78	1.8	-	-
Bushy	19.24	2.8	16.13	2.5
Drooping branched	-	-	11.43	3.0
Dwarf	14.89	2.5	18.97	2.7
Broad pinnae	19.91	1.7	-	-
Narrow pinnae	18.90	2.0	-	-
Early flowering	19.93	2.6	13.76	2.0
Late flowering	20.67	2.0	14.11	2.0

Several reports are there that essential oil content and its constituents depend on presence and availability of nutrients[20]; application of fertilizer[21-22]; plant density[22]; method of hydrodistillation[23]; latitude, climatic condition, day of sowing[24], salinity[21]; harvesting date[25] etc. In this investigation, all the data came from fertilizerless plants and seeds from uniform maturity. From the result, it is evident that except dwarf mutant of Ajowan, none of the mutants was superior to control both in protein and essential oil content but few of them shown betterment in either parameter.

CONCLUSION

This result opens the possibility of direct selection of these superior plant types as well as offer scope of further improvement related to maximizing desirable quantitative parameters through hybridization followed by proper selection.

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REFERENCES

1. Fazal SS, Singla RK. Review on the Pharmacognostical & Pharmacological Characterization of *Apium graveolens* Linn. Indo Global J Pharm Sci 2012; 2(1):36-42.
2. Mohammad MZ, Mahmoodreza M, Soliman MS, Peyman P. An Overview on Ajwain (*Trachyspermum ammi*) Pharmacological Effects; Modern and Traditional. J Nat Remedies 2014; 14(1):98-105.
3. Dwivedi SN, Mishra RP, Alava S. Phytochemistry, Pharmacological studies and Traditional benefits of *Trachyspermum ammi* (Linn.) Sprague. Int J Pharm Life Sci 2012; 3(5):1705-9.
4. Kamal J, Nisha D, Thakur N, Tomar S, Shalta L,Thakur R. *Trachyspermum ammi* (Ajwain): A comprehensive review. Int Res J Pharm 2012; 3(5):133-8.
5. Zhang Y, Li Y, Cao C, Cao J, Chen W, Zhang Y *et al*. Dietary flavonol and flavone intakes and their major food sources in Chinese adults. Nutr Cancer 2010; 62(8):1120-7.
6. Kooti W, Sara A, Majid A, Hosna G, Damoon A. A review on medicinal plant of *Apium graveolens*. Adv Herb Med 2015; 1(1):48-59.
7. Gilani AH, Jabeen Q, Ghayur MN, Janbaz KH, Akhtar MS. Studies on the antihypertensive, antispasmodic, bronchodilator and hepatoprotective activities of the *Carum copticum* seed extract. J Ethnopharmacol 2005; 98(12):127-35.
8. Al-Howiriny T, Alsheikh A, Alqasoumi S, Al-Yahya M, ElTahir K, Rafatullah S. Gastric antiulcer, antisecretory and cytoprotective properties of celery (*Apium graveolens*) in rats. Pharm Biol 2010; 8(7):786-93.
9. Qureshi AA, Kumar KE. Phytochemical constituents and pharmacological activities of *Trachyspermum ammi*. Plant Archives 2010; 10(2):955–59.
10. Ranjan B, Manmohan S, Singh SR, Singh RB. Medicinal Uses of *Trachyspermum ammi*: A Review. Pharma Res 2011; 5(2):247-58.
11. Chauhan B, Kumar G, Ali M. A Review on phytochemical constituents and activities of *Trachyspermum ammi* (L.) Sprague fruits. American J Pharmatech Res 2012; 2(4):329-40.
12. Saini N, Singh GK, Nagori BP. Spasmolytic potential of some medicinal plants belonging to family Umbelliferae: A review. Int J Res Ayurveda Pharm 2014; 5(1):74-83.
13. Gauri M, Ali SJ, Khan MS. A review of *Apium graveolens* (*Karafs*) with special reference to Unani Medicine. IAIM 2015; 2(1):131-6.
14. Raut JS, Karuppayil SM. A status review on the medicinal properties of essential oils. Ind Crops Prod 2014; 62:250–64.
15. Srinivasan K. Role of Spices Beyond Food Flavoring: Nutraceuticals with Multiple Health Effects. Food Rev Int 2005; 21:167–88.
16. Sowbhagya HB. Chemistry, Technology, and Nutraceutical Functions of Celery (*Apium graveolens* L.): An Overview. Crit Rev Food Sci Nutr 2014; 54(3):389-98.
17. Osborne DJ. Effects of kinetin on protein and nucleic acid metabolism in *Xanthium* leaves during senescence. Plant Physiol 1962; 87:595-602.
18. Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurement with Folin phenol reagent. J Biol Chem 1951; 193:265-75.
19. Simon JE, Quinn J, Murray RG. Basil: A source of essential oils. In: Advances in new crops (Edited by J. Janick and JE Simon), Portland, OR: Timber Press; 1990. p. 484-9.
20. Renata N. Does mineral fertilization modify essential oil content and chemical composition in medicinal plants? Acta Sci Pol, Hortorum Cultus 2013; 12(5):3-16.
21. Olle M, Bender I. The content of oils in umbelliferous crops and its formation. Agron Res 2010; 8(spl.III):687-96.
22. Ardalan G, Mohammad TD, Mohammadreza HSH. Effects of biofertilizer and plant density on essential oil content and yield traits of Ajowan (*Carum copticum*). Middle-East J Sci Res 2013; 14 (11):1508-12.
23. Gamiz-Gracia L, Luque de Castro MD. Continuous subcritical water extraction of medicinal plant essential oil:

comparison with conventional techniques. Talanta 2000; 51(6):1179-85.
24. Behnaz S, Morteza K, Sadrollah R. Planting date effects on growth, seed yield, essential oil content and chemical composition of ajowan. J Appl Biol Sci 2011; 5(3):7.
25. Rożek E, Renata N, Andrzej Sałata, Gumiela P. The chemical composition of the essential oil of leaf celery (*Apium graveolens* L. var. *Secalinum* Alef**.)** under the plants' irrigation and harvesting method. Acta Sci Pol, Hortorum Cultus 2016; 15(1):149-59.

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