RESEARCH ARTICLE

QUANTITATIVE ESTIMATION OF SEED PROTEIN AND ESSENTIAL OIL CONTENT IN EIGHT PLANT TYPES OF FENNEL (*FOENICULUM VULGARE* MILL.)

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Received-29.12.2016, Revised-13.01.2017

Abstract: Investigation highlights quantitative estimation of seed protein and essential oil contents (from M_3 harvested seeds) in seven macromutants (screened at M_2), along with control. Results indicate that in comparison to control protein content enhance in *early flowering* mutant; while, essential oil content is higher in *thick stem*, *slender stem*, *pigmented stem* and *elongated pinnae* mutants. It opens up the scope of efficient breeding for raising desirable 'plant types' of interest.

Keywords: Fennel, Macromutants, Estimation, Seed, Protein

INTRODUCTION

Fennel (*Foeniculum vulgare* Mill.; Family-Umbelliferae) is a spice yielding plant of commerce and is cultivated worldwide (Muckensturm *et al.*, 1997; Grover *et al.*, 2013). Apart from spice yielding property, fennel possess immense therapeutic (Özbek *et al.*, 2003; Choi and Hwang, 2004; Tognolini *et al.*, 2007; Pradhan *et al.*, 2008; Mohamad *et al.*, 2011; El-Soud *et al.*, 2011; Saini *et al.*, 2014) and nutritional (Barros *et al.*, 2010; Blazewicz-Wozniak, 2010; Das *et al.*, 2013; Badgujar *et al.*, 2014) values. Therapeutic potentiality is mainly due to presence of essential oil in seeds and foliage (Blazewicz-Wozniak, 2010; Taie *et al.*, 2013). Sustainable work on clinical aspects of fennel has been performed (Oktay *et al.*, 2003; Joshi and Parle, 2006; Mohsenzadeh, 2007; Faudale *et al.*, 2008; Shahat *et al.*, 2011; Koppula and Kumar, 2013) but limited efforts (Ramkrishna, 2008; Mostafa and Abou Alhamd, 2015) have been focused on genetic manipulation of the species. With the view to it, the authors have initiated an induced mutagenesis programme to create desirable mutants rich in essential oil as well as nutritional content. Present investigation reports on the quantitative estimation of seed protein and essential oil content in control and mutant plant types of fennel.

MATERIAL AND METHOD

In an induced mutagenesis (EMS and γ-irradiations) programme, seven macromutants (*thick stem*, *slender stem*, *pigmented stem*, *dwarf*, *elongated pinnae*, *narrow pinnae* and *early 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 macromutants (three replicas in each case) of fennel using selfed M_3 harvested seeds. Extraction of soluble protein from seed was done following Osborne (1962) and estimated quantitatively as per the method of Lowry *et al.* (1951). Quantitative estimation of essential oil was made also from seeds in controls and in macromutants (M_3 harvested seeds) following hydrodistillation process as was suggested by Simon *et al.* (1990). Two grams of dry seeds were used in each set of experiment (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 microgradiated 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.

RESULT AND DISCUSSION

Protein and essential oil content of control fennel seed are 11.94% and 7.0% respectively (Table 1). In macromutants protein content varies from 7.28% (*thick stem* mutant) to 16.78% (*early flowering* mutant) and essential oil content range from 6.0% (*late flowering* mutant) to 8.0% (both in *thick stem* and *slender stem* mutant). Protein content enhances in *early flowering* mutant only than control. Blazewicz-Wozniak (2010) showed that protein content is related to sowing time.
Essential oil content is higher in *thick stem*, *slender stem*, *pigmented stem* and *elongated pinnae* mutants

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than control. Previous reports suggest that essential oil content depends on fruit maturity (Telci *et al.*, 2009), application of fertilizer (Khan *et al.*, 1992; 1999; Ali *et al.*, 2012), spraying of salicylic acid (Hashmi *et al.*, 2012), method of hydrodistillation (Mimica-Dukic *et al.*, 2003) among others. In the present study no fertilizer is applied during any stage of cultivation. From the result it is evident that none of the mutants is superior to control both in protein and essential oil content but few of them show betterment in either parameter.

Table 1. Seed protein and essential oil content in 8 plant types (control and macromutants).

Plant types	Protein content (%)	Essential oil content (%)
Control	11.94	7.0
thick stem	7.28	8.0
slender stem	9.28	8.0
pigmented stem	8.60	7.3
dwarf	10.60	7.0
elongated pinnae	11.33	7.7
narrow pinnae	11.23	7.0
early flowering	16.78	6.0

CONCLUSION

This result opens up the possibility of direct selection of these superior plant types as well as offer scope of further improvement through hybridization followed by proper selection.

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