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Influence of plant growth regulators on fatty acid composition of *Simarouba glauca* DC.

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ABSTRACT

Simarouba glauca is a medicinally important oil yielding plant. It is a rainfed wasteland evergreen edible oil tree. Presowing soaked seeds of *Simarouba glauca* in various Plant Growth Regulators (PGRs) are analyzed to estimate their fatty acid composition. The fatty acids extraction was done using petroleum ether and fatty acid methyl esters (FAMES) were analyzed by Gas Chromatography with Flame Ionization Detector (GC-FID). Due to the application of growth regulators stearic acid, lingoceric acid and linolenic acid enhances noticeably, while, total saturated fatty acids are augmented due to cysteine, Salicylic Acid (SA) and methionine treatments and monosaturated fatty acids elevated due to the application of 6-Benzylaminopurine (6-BA) whereas polyunsaturated fatty acids enhanced in response to Gibberellic Acid(GA) and Chloromequat chloride (CCC). The PGR induced changes in fatty acid composition predominantly in polyunsaturated fatty acids may certainly recover the oil quality of *S. glauca* seeds.

KEYWORDS: 6-BA, GA, SA, CCC, Cysteine and Methionine

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INTRODUCTION

Simarouba glauca belongs to family Simaroubaceae. It is commonly known as Laxmitaru. It is rainfed wilderness, evergreen, oil tree. It is commonly nominated as 'dysentery bark' as bark is significant constituent of herbal medicine used in dysentery. The bark and leaf extract is prominent for their different types of medicinal properties used as haemostatic, antipyretic, antiparasitic, antidyseric, vermifuge and anticancerous. The bark is used to treat fever, malaria, abdomen and bowel disorders, haemorrhages, ameobiasis. The fruit pulp and seeds are also having curative property such as pain-relieving, antimicrobial, antiviral, stomachic tonic (Joshi & Joshi, 2002). Glaucarubinone isolated from the *Simarouba* plant, showed anticancer property (Encyclopedia of world medicinal plants). Numerous quassinoid from *S. glauca* seed have exhibited cytotoxic activity *in vitro* against KB cells (human oral epidermoid carcinoma), including glaucarubin, glaucarubinone, glaucarubol and glaucarubolone (Polonsky *et al.*, 1975; Valeriote *et al.*, 1998). Fatty acids usually found to be observed in the type of esters of glycerols *i.e.* triacyl glycerols in natural fats of animal and plant source. Myristic acid (C14:0), Palmitic acid (C16:0), stearic acid (C18:0), oleic

acid (C18:1) and linoleic acid are the most frequent fatty acids (Christie, 2003) All the plant cells consist of fatty acids, where they function as membrane integrant, storage products, metabolites and a energy source (Wada *et al.*, 1994). The fatty acids are also vital nutrient substances and metabolites in plants as well as animals (Chen & Chuang, 2002). The present study was aimed to study the effect of PGRs on the fatty acid composition of *S. glauca* seeds to assess any changes in the fatty acid composition with regards to germination studies or for oil extraction in future.

MATERIAL AND METHODS

Seeds of *Simarouba glauca* were pre-soaked in PGRs (6-BA, GA, SA, CCC, Cysteine and Methionine) 100 ppm concentration for 24 hrs and Kept for germination. After germination germinated seeds of *S. glauca* were dehydrated. The seed material was crushed and the lipids from the crushed seed were taken out in petroleum ether by means of soxhlet apparatus. To analyze FAS from the oil fractions by gas chromatography technique, the oil was subjected to transesterification to obtain the fatty acid methyl ester. The fatty acid methyl ester fractions were

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eluted with petroleum ether: diethyl ether = 50: 50 (V/V). The fractions were redissolved in hexane and used for GC analysis.

Fatty acid methyl esters (FAMES) were analyzed by GC-FID (A SHIMADZU GC-17-A gas chromatograph with flame ionization detector). The recognition of fatty acids was approved by comparing with the methyl esters of standard fatty acids.

RESULTS

It is revealed from the Table 1 and Figure 1 that the saturated, monounsaturated and polyunsaturated fatty acids are 44.50%, 51.70% and 3.70% respectively. The key fatty acids of *S.glauca* seed oil are methyl esters of palmitic acids, stearic acid, arachidic acid, oleic acid, lenoleic acid and linolenic acid. By application of growth regulators stearic acid, lingoceric acid and linolenic acid enhanced greatly, while, total saturated fatty acids are increased by application of cysteine, SA and methionine applications and monosaturated fatty acids elevated only in 6-BA and polyunsaturated fatty acids increases due to treatment of GA and CCC. Whereas methyl esters of elaidic acid and total of trans fat are not diagnosed from seeds of *S. glauca*. Evidence suggests that fatty acid content in oil seeds may be governed by levels of endogenous plant growth substances, which in turn may be altered by appliance of exogenous, synthetic PGRs.

DISCUSSION AND CONCLUSION

It is well known that generally plant hormones may change fatty acid composition of treated plants. In soybean zygotic embryo cotyledons are observed auxin-regulated change of fatty acid content (Liu *et al.*, 1995). Gibberellins influence the content of lipid of endoplasmic reticulum in aleurone layers of barley (Grindstaf *et al.*, 1996). Study of Hedin *et al.* (1988) revealed that in maize whole fatty acid content was decreased in response to GA. In the present study it is noticed the better level of stearic, lingoceric acid as saturated fatty acids and linoleic acid and linolenic acid as polysaturated fatty acids in reaction to GA presowing soaking applications as shown by Mostafa *et al.* (2005) and Bano *et al.* (2009). It is also noticed that myristoleic acid found to be detected in response to GA treatment only and not detected in control as well as other treatments.

Ivanova *et al.* (2008) studied cadmium induced changes in maize leaves and the protective role of salicylic acid. They observed pretreatment of maize plant with SA seems to have an insignificant effect on fatty acid content. There was a slight increase of linolenic acid and decrease of all saturated fatty acid. They further concluded that SA plays a protective role on the lipid membranes of Cd-treated maize plants. α -linolenic acid was stimulated in 6-BA treated plants as compared to control in *Lemna minor* (Hurtubise *et al.*,1992). Cytokinin treatment changes the lipid fatty acids of green leaves *Coleus blumei* Benth. and *Impatiens sultani* Hook (Kull *et al.*, 1978). In both species the proportion of linolenic acid increases and that of palmitic acid decreases. oil content in the seeds of sunflower (*Helianthus annuus* L.) was increased due to CCC treatment either at pre

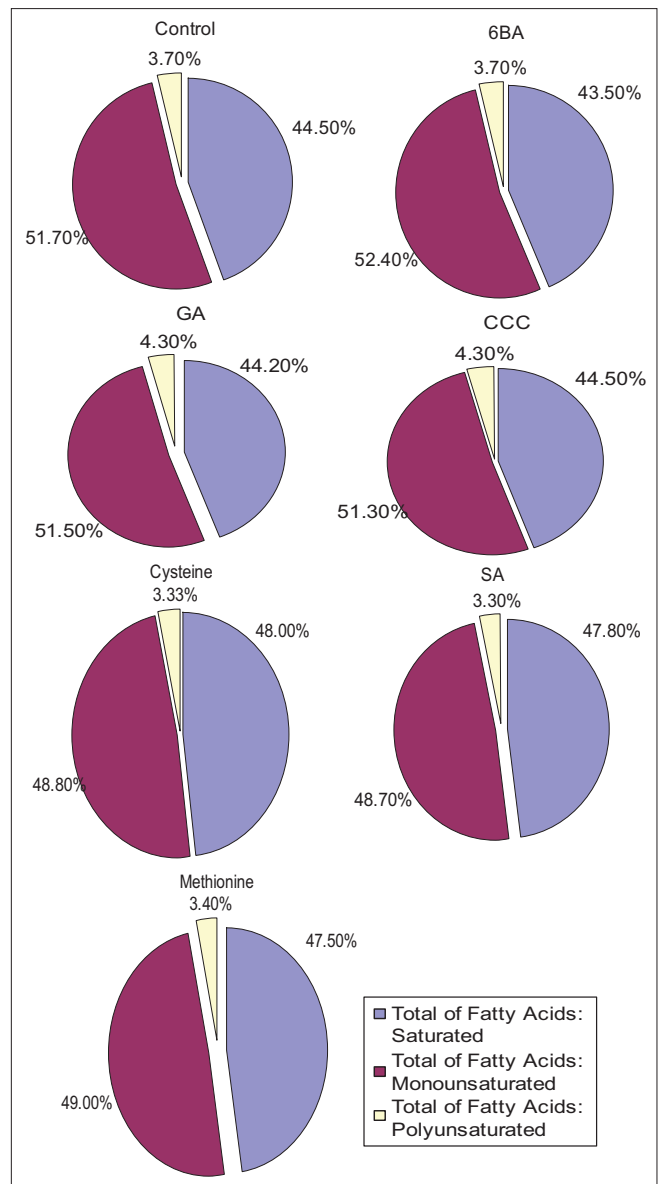


Figure 1: Relative proportion of saturated, monosaturated and polysaturated fatty acids of *S. glauca* seed oil

or post flowering stage (Pando & Srivastava, 1987). Outcome of PGRs on productivity of corn (*Zea mays* L.) was studied by Hedin *et al.* (Hedin *et al.*, 1988. They observed CCC enhanced the fatty acid substances. In the present study, it is also evident that the Behenic acid methyl ester (C22:0), Myristoleic acid methyl ester (C14:1), Cis-11 Eicosenoic acid methyl ester (C20:1), Cis-10-Heptadecanoic acid methyl ester (C17:1) and omega 3 fatty acid Cis-11,14,17- Eicosatrienoic acid methyl ester (C20:3n3) are found to be induced in response to presowing soaking of these PGRs which are not detected in control seeds. With these alterations in fatty acids during germination of *S. glauca* seeds it reveals that there is a significant change in the fatty acid content in response to plant growth regulators. The present study reveals that the PGR induced changes in fatty acid composition especially in polyunsaturated fatty acids may certainly improve the oil quality of *S. glauca* seeds and these

Table 1: Effect of plant growth regulators on fatty acid composition of *S. glauca* seed oil

No.	Name of the Fatty Acids	Plant growth regulators						
		control	6BA	GA	CCC	Cysteine	SA	Methionine
1.	Myristic acid methyl ester (C14:0)	0.20%	0.10%	0.10%	0.20%	0.10%	0.10%	0.20%
2.	Palmitic acid methyl ester (C16:0)	14.70%	14.40%	14.70%	15.10%	9.80%	10.80%	12.19%
3.	Heptadecanoic acid methyl ester (C17:0)	0.10%	ND	0.10%	ND	0.10%	0.10%	0.10%
4.	Stearic acid methyl ester (C18:0)	28.40%	28.90%	29.10%	29.20%	34.80%	34.0%	32.00%
5.	Arachidic acid methyl ester (C20:0)	1.00%	ND	ND	ND	2.50%	2.20%	1.60%
6.	Behenic acid methyl ester (C22:0)	ND	ND	ND	ND	0.30%	0.20%	0.30%
7.	Lingoceric acid methyl ester (C24:0)	0.10%	0.10%	0.20%	ND	0.40%	0.30%	0.40%
Total of Fatty Acids (Saturated)		44.50%	43.50%	44.20%	44.50%	48.00%	47.80%	47.50%
8	Myristoleic acid methyl ester (C14:1)	ND	ND	0.10%	ND	ND	ND	ND
9	Palmitoleic acid methyl ester (C16:1)	0.10%	ND	0.10%	ND	ND	0.10%	ND
10	Oleic acid methyl ester (C18:1n9c)	51.60%	52.40%	51.30%	51.20%	48.70%	48.60%	49.00%
11	Cis-11 Eicosenoic acid methyl ester (C20:1)	ND	ND	ND	ND	0.10%	ND	ND
12	Cis-10-Heptadecanoic acid methyl ester (C17:1)	ND	ND	ND	0.10%	ND	ND	ND
Total of Fatty Acids (Monounsaturated)		51.70%	52.40%	51.50%	51.30%	48.80%	48.70%	49.00%
13	Linoleic acid methyl ester (C18:2n6c)	3.40%	3.60%	3.90%	4.00%	3.10%	3.30%	3.00%
14	Linolenic acid methyl ester (C18:2n6c)	0.20%	0.40%	0.30%	0.20%	0.20%	0.20%	0.30%
15	Cis-11,14,17- Eicosatrienoic acid methyl ester (C20:3n3)	ND	ND	ND	ND	ND	ND	0.10%
16	Cis-5,8,11,14,17- Eicosapentaenoic acid methyl ester (C20:5n3)	0.10%	0.10%	0.10%	ND	ND	ND	ND
Total of Fatty Acids (Polyunsaturated)		3.70%	3.70%	4.30%	4.30%	3.33%	3.30%	3.40%
1	Elaidic acid methyl ester (C18:1n)	ND	ND	ND	ND	ND	ND	ND
2	Total of Trans Fat	ND	ND	ND	ND	ND	ND	ND

polyunsaturated fatty acids might be playing role in stimulation of seed germination of *S. glauca*.

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