INTRODUCTION

*Simarouba glauca* belongs to family Simaroubaceae. It is commonly known as Laxmitaru. It is a 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, antidysentric, 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 antitumor agent (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 *Simarouba 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 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 Chlormequat 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
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, linoleic acid and linolenic acid. By application of growth regulators stearic acid, linoceric 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 poly unsaturated 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 aleurome layers of barley (Grindstaff 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, linoceric 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 seemes to have an insignificant effect on fatty acid content. There was a slight increase of linolenic acid and decrease of all saturated fatty acids. 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 Lemma 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 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 Eicosanoic acid methyl ester (C20:1), Cis-10-Heptadecanoic acid methyl ester (C17:1) and 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
polyunsaturated fatty acids might be playing role in stimulation of seed germination of S. glauca.

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

| No. | Name of the Fatty Acids | control | 6BA | GA | CCC | Cysteine | SA | Methionine |
|-----|------------------------|--------|-----|----|-----|---------|----|-----------|
| 1.  | Myristic acid methyl ester (C14:0) | 0.20%  | 0.10% | 0.10% | 0.20% | 0.10%  | 0.20% | 0.20%  |
| 2.  | Palmitic acid methyl ester (C16:0) | 14.70% | 14.40% | 14.70% | 15.10% | 9.80%  | 10.80% | 12.19% |
| 3.  | Heptadecenoic acid methyl ester (C17:0) | 0.10%  | ND  | 0.10% | ND  | 0.10%  | 0.10% | ND  |
| 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.  | Lignoceric 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% |

Total of Fatty Acids (Monounsaturated) | 51.70% | 52.40% | 51.50% | 51.20% | 48.70% | 48.60% | 49.00% |

Total of Fatty Acids (Polyunsaturated) | 3.70%  | 3.70%  | 4.30%  | 4.30%  | 3.33%  | 3.33%  | 3.40%  |

Total of Trans Fat | ND  | ND  | ND  | ND  | ND  | ND  | ND  |