Jr. of Industrial Pollution Control 30(2)(2014) pp 277-280

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A REVIEW OF GUIZOTIA ABYSSINICA: A MULTIPURPOSE PLANT WITH AN ECONOMIC PROSPECTIVE

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Key words :

(Received ..... February, 2014; accepted ....., 2014)

ABSTRACT

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INTRODUCTION

In recent period, an aim on crop research has increased all over the world and large group of evidence has spotted to show vast potential of medicinal plants used in various traditional system. Medicinal plants are rich in secondary metabolites and essential oils of therapeutic use. The significant advantages claimed for therapeutic uses of medicinal plants in various ailments are their safety besides being economical, effective and their easy availability (Sumit and Geetika, 2012).

Nigerseed, Guizotia abyssinica (2n = 30) belongs to family Asteraceae. It is an important oilseed crop along with medicinal properties mainly grown in India and Ethiopia. It is also known by several names like noog, niger, nyger, nyjer khursani etc. It contributes about 3% of Indian and 50% of Ethiopian oilseed production. In Ethiopia, it is cultivated on water stagnated areas where the conditions are non congenial and contributes towards land rehabilitation and soil conservation.

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Plants are herbaceous annual with a height of 0.5–1.5 m tall, stems are pubescent, leaves are sessile, subcordate to ovate-lanceolate, serrate, subscabrous, upto 22 cm long, flowers are yellow in color with conspicuous, in solitary or clustered heads across, arranged in corymbs, it is cross-pollinated mainly through honey bees. Botanically nigerseed is known as achene. The achene is club-shaped, obovoid and narrowly long (Seegeler, 1983). The head produces around 40 fruits. The achenes are off black in color with white to yellow scars on the top and base and have a hard testa. The embryo is of white in color. Niger is usually grown on light poor soils with coarse texture (Chavan, 1961). In Ethiopia it is mainly cultivated as a sole crop on clay soils and survives on stored moisture.

Guizotia abyssinica (L.f.) cass.: A plant from the genus Guizotia

The plants of genus Guizotia belongs to the family of 'Compositae', tribe Heliantheae, subtribe 'Coreopsidinae'. A revision of taxonomy of the genus was based on the morphological traits which were presented by Baagoe (1974). The number of species was reduced within the genus Guizotia to six i.e. G. abyssinica (L. f.) Cass.; G. scabra (Vis.) Chiov. subsp. scabra and subsp. schimperi (Sch. Bip.) Baagoe; G. arborescens I. Friis; G. reptans Hutch; G. villosa Sch. Bip. and G. zavattarii Lanza. Guizotia scabra contains two subspecies, scabra and schimperi. Guizotia scabra subsp. schimperi is a common annual weed in Ethiopia. There is a controversy on the taxonomical category of G. abyssinica and G. scabra subsp. schimperi (Murthy et al. 1995).

The hybrid between G. abyssinica and G. scabra subsp. schimperi is fertile and forms 15 bivalents in 95% of the pollen mother cells. Indeed, G. scabra subsp. schimperi is closer to the G. abyssinica than to the perennial G. scabra subsp. scabra. On the basis of cytological evidence, Murthy et al. (1995) proposed that the two species G. abyssinica and G. scabra subsp. schimpri be merged into one species. However G. abyssinica was described by Cassini in 1829 and G. scabra in 1841 and the International Rules of Botanical Nomenclature would not support the inclusion of G. scabra subsp. schimperi as a subspecies of G. abyssinica. Since G. scabra subsp. schimperi is a wild species and it is unlikely that a wild species was derived from a cultivated species. Therefore, for the time being the original description by Baagoe (1974) of cultivated niger as G. abyssinica (L. f.) Cass. should be retained.

Properties

Several chemical properties have been attributed to Guizotia abyssinica which are present in seeds. The chemical composition of nigerseed is indicated in Tables 1. The oil content of nigerseed varied from 30 to 50% (Seegeler, 1983). In general, the Ethiopian leftovers nigerseed contains less protein and more crude fibre than the nigerseed leftovers grown in India (Chavan, 1961; Seegeler, 1983). Niger oil has a fatty acid composition typical for seed oils of the Compositae plant family (e.g. safflower and sunflower) with linoleic acid being the dominant fatty acid. The linoleic acid content of nigerseed oil was approximately 56 % in seed grown in India (Nasirullah et al. 1982) and 77 % in seed grown in Ethiopia (Seegeler 1983; Getinet and Teklewold, 1995; Table 1).

Table 1. Different arrays of fatty acid contents (%) of Indian and Ethiopian nigerseed oil.

Fatty acids	India[1]		Ethiopia[2]	
	Range	Mean	Range	Mean
Palmitic	6-9.4	8.2	7.6-8.7	8.2
Stearic	5	7.5	5.6-7.5	6.5
Oleic	13.4-39.3	28.4	17-30.6	23.8
Linoleic	45.4-65.8	56	74.8-79.1	76.6
Linolenic	-	-	0-0.9	0.6
Arachidic	0.2-1.0	0.6	0.4-0.8	0.5
Behenic	5		0.4-1.5	0.7

[1] Nagaraj, 1970

[2] Getinet and Teklewold, 1995 and Yohannes Petros *et al.*, 2009.

Uses

Niger seed is used as a food for human consumption. The seed is warmed in a kettle over an open fire, crushed with a pestle in a mortar and then mixed with crushed pulse seeds to prepare 'wot' in Ethiopia (Seegeler, 1983). 'Chibto' and 'litlit' are prepared from nigerseed crushed and mixed with roasted cereals which is preferred food for growing youths. In Ethiopia, nigerseed is mainly cultivated for its edible oil. There are reports that nigerseed oil is used for birth control and for the treatment of syphilis (Belayneh, 1991). Niger sprouts mixed with garlic and 'tej' are used for the treatment of coughs.

Rheumatoid arthritis

It is an autoimmune disease that results in a chronic, systemic inflammatory disorder that may affect many tissues and organs, but principally attacks flexible

joints resulting in severe pain. Nigerseed can be used to treat the Rheumatoid by application of oil on the parts where the pain is present. By periodically consumption of the nigerseed oil, the risk of the disorder can be avoided.

The RACGP (The Royal Australian College of General Practitioners) Guidelines for management of early rheumatoid arthritis recommend that gamma-linolenic acid for potential relief of pain, morning stiffness and joint tenderness in RA patients. Three systematic reviews pooled trials of plant derived gamma-linolenic acid from seed oils from evening primrose, blackcurrant and borage. At higher doses of between 1400–2800 mg there were significant improvements in pain, duration of morning stiffness and joint tenderness in patients with RA.

Parasiticide

Intensive use of parasiticides has sometimes led to severe resistance in arthropods and helminths of veterinary importance. During the last two decades considerable knowledge in parasite neurophysiology and endocrinology has accumulated which allows the development of new screening procedures and some biological approaches for the discovery of new drugs. Nigerseed is a novel biologically approaches to overcome against nematodes and arthropods.

Poultice

Nigerseed can be used as poultices which can be applied to the surface of the body to relieve pain, itching, swelling and inflammation, abscesses, boils, etc. A Nigerseed poultice is the most effective treatment available for many types of disorders. Even today, they may provide effective, economical benefits.

An approach in advancing *Guizotia abyssinica*

The current nigerseed accessions at the Biodiversity Institute were collected from different parts of Ethiopia. Niger germplasm apparently has only been collected from Ethiopia and India; there is no information regarding germplasm collecting from other countries. The nigerseed landraces in Ethiopia, India and other countries have been geographically collected for a very long time and therefore may carry different source of valuable genes. Collecting of germplasm should include wild relatives within the genus Guizotia.

Characterization and evaluation of the germplasm should be standardized using molecular techniques and proper descriptors should be developed. Germplasm evaluations would result in identification of valuable source of germplasm with high oil contents, high seed yield, and male sterile and dwarf lines. Documentation of the germplasm is also as important as the characterization. Germplasm exchange between Ethiopia and India, already a brittle issue, should be looked at further.

There are some striking genetic differences which exist between the Ethiopian and Indian nigerseed. These differences could be investigated using isozyme and molecular markers. It would be interesting to investigate which nigerseed ecotype migrated to India. The variation among 'abat', 'bungne' and 'mesno' nigerseed ecotypes could be differentiated using isozyme and molecular markers. All species within the genus Guizotia are diploids with chromosome number of 2n=30. Speciation within the genus Guizotia was not as a result of changes in chromosome number (Hiremath and Murthy, 1992).

The four species *G. abyssinica, G. scabra* subsp. *scabra, G. villosa* and *G. scabra* subsp. schimperi are not reproductively isolated (Dagne 1994a) so hybrids among these species could be obtained with ease. It would be very important to study the progenitor of nigerseed using isozyme and molecular markers such as random amplified polymorphic DNAs. Comparison of chloroplast and mitochondrial DNA pattern could be studied to investigate the progenitor of nigerseed.

It is often reported that nigerseed has an allopathic and mycorrhizal association. It will be interesting to identify the substance associated with the weed-depressing effect of nigerseed. It is very important to study the mycorrhizal association of nigerseed further. Efficient genotypes and the possibility of bio-fertilizers should be investigated.

CONCLUSION

Nigerseed crop is a good precursor for cereals, pulses and oilseeds, because crops following nigerseed have less weed infestation. It grows on heavy clay soil in Ethiopia, usually one or two ploughings are followed and without fertilizer or herbicide crops can be cultivated. It has less diseases and pests infestation than other oilseed crops. It contributes a great deal to soil health conservation and land rehabilitation, because of its mycorrhizal relationship and its potential as a bio-fertilizer. The oil extracted from the seed contains a high content of linoleic acid, an essential fatty acid for mono-gastric animals including humans. The nigerseed leftover remaining after the oil extraction is

an excellent feed for animals.

DISCUSSION

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