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Variability in gingerol and shogaol content of ginger accessions

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ABSTRACT

Eighty six ginger (*Zingiber officinale* Rosc.) accessions were evaluated for oleoresin, gingerol and shogaol, and the accessions were classified into high, medium and low quality types. The intercharacter association pattern showed that oleoresin is positively correlated with gingerol and shogaol.

INTRODUCTION

Ginger of commerce is the dried rhizome of *Zingiber officinale* Rosc., a rhizomatous herbaceous perennial belonging to Zingiberaceae. Several ginger types are available in our country, identified mainly after the locality of their cultivation or collection. Some of the common indigenous cultivars are Maran Himachal, Nadia, Kuruppampadi, Wynad local, Narasapattom, Assam and Thodupuzha. Popular exotic types cultivated in India are Rio-de Janeiro, China and Taffingiva (Govindarajan 1982).

Ginger is used mainly as raw ginger, dry ginger and as various ginger preparations (Natarajan et al 1980). Starch, protein and crude fibre contribute to the bulk of dry matter in ginger. Aroma and flavour in ginger are imparted by essential oils, the main constituents of which are zingiberene and phellandrene. The full taste of ginger including pungency is present in the oleoresin and the constituents responsible for pungency are gingerol and shogaol. Reghuveer and Govindarajan (1978) highlighted the importance of gingerol and related

pungent principles in ginger oleoresin. In fresh ginger, pungency is almost entirely due to gingerol, a mixture of three homologues (Namboodiri et al 1975). Nature of pungency stimuli of ginger as phenylalkylketones is known for a long time, but there were no quantitative methods developed for estimating them (Salzer 1975). The pungency stimulating components - gingerols and shogaols do not exhibit any usable specific wavelength absorptions. Ananthakrishnan and Govindarajan (1974) developed a quantitative estimation method using vanillin as standard. The present study is to find out infraspecific variability of gingerol and shogaol in the ginger germplasm collections maintained at NRCS.

MATERIALS AND METHODS

Eighty six ginger accessions consisting of known varieties and some unnamed collections were used in the study. These were planted in cement tubs (45 x 45cm) in a RBD with two replications. The rhizomes were harvested at full maturity as indicated by complete drying of aerial vegetative parts. Dry ginger is prepared by scrap-

ping off the outer skin of the cleared harvested rhizomes and then sun dried for 10 - 12 days, to a moisture level of 10%. The percentage of dry weight to fresh weight was calculated as percentage dry recovery. Oleoresin was extracted by cold percolation of the comminuted sample with acetone and the percentage was computed gravimetrically (Govindarajan 1982). Gingerol and shogaol contents were determined from ginger oleoresin by the method of Ananthkrishnan and Govindarajan (1974) using vanillin as standard. Correlations were calculated as per standard procedure.

RESULTS AND DISCUSSION

The compositions of ginger oleoresin, gingerol and shogaol are given in Table 1. The variability available in the germplasm accessions is clear from the data. Table 2 has further elucidated the information on some of the accessions with oleoresin above 7.4% a medium range of 5 - 7% and below 5%. Similarly accessions are classified based on high, medium and low gingerol and shogaol. The main natural principles of ginger are a homologous series of aldols which contain a phenolic group and are known as gingerols. (Baranowski 1986, Mc Hale et.al 1989). Oleoresin of ginger is the total extract of ginger containing all the flavouring principles of the spice. On long term storage of oleoresin the gingerol undergoes conversion to shogaol. (Govindarajan 1982). Mangalakumari *et.al* (1984) established with histochemical studies that the gingerol cells are located both in the pith and cortex and they are independent from, essential oil cells. The present study clearly showed the availability of many ginger cultivars with potentially high oleoresin contents and cultivars like Rio-de-Janeiro, Ernad chernad, Wynad, Kunnamangalam and Meppayur have high gingerol also. The BIS and other standards and specification agencies (IS 1976) recommended a minimum of 18% gingerol for good quality oleoresin. It is reported that the pungency decreases in the order gingerol > shogaol > zingerone (Kulka 1967). The intercharacter association (Table 3) showed a positive correlation with oleoresin, gingerol and shogaol. This establishes the fact that variety rich in oleoresin will

have high gingerol also.

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Table 1. Distribution of oleoresin, gingerol and shogaol in ginger accessions

Accession constituents	Range%	Mean	Cv
Oleoresin	3.2 - 9.5	6.1	21.5
Gingerol	14 - 25	19.95	15
Shogaol	2.8 - 7.0	4.10	23.7

Table 2. Categorisation of ginger accessions on the basis of levels of oleoresin, gingerol and shogaol

Constituent	Accession	Category and level of constituent	
Oleoresin	Rio-de-Janeiro, Wynad, Kunnamangalam, Meppayur, Santhingppin (Manipur-I) Ernad chernad Erattupetta, Tamarassery local PGS - 33, PGS - 11	High	7.4
	<i>Jugigam</i> Thingpui, Mudigere local Pulpally Nadan, <i>Jugigam</i> Karakkal, Nadan, Barati Sogaon, Sargiguda, Maran, Mowsham, Jamaica, Sirsaguda local, Neelamaran, Nadan Pulpally Tura local, Kadan Narianpara Burdwan-I, Singhi hara, Machiplavu local, Ernad Manjeri Amaravathy-I, Himachal Karamukhi Vengara, Pampadumpara, Wynad local, Mizo, Nadia, Zahirabad, Edapalayam, PGS-16, PGS-43	Medium	4.78 - 7.4
	Thaliparamba, Anamica, Dhipu, Burdwan-2, Taffingiva, Dhansiri, Bokalia, Kuruppampadi local	Low	4.78
Gingerol	Mizo, Nadia, Maran, Ernad chernad, Kada Narianpara	High	22.0% of Oleoresin

	Rio-de-Janeiro, PGS-33, Wynad Kunnamangalam, Meppayur, Santhing pin (Manipur-I) Vengara, Jorhat local, Taliparamba Pampadumpara, Wynad local, Zahirabad Edapalayam, Ambalavayalan, Taffingiva Burdwan-2, Jamaica, Sirsaguda local Neelamaran, Erattupetta, Bittur Kallai Nadanpulpally, Thamarassery local, Turalocal, Kadan Nariampara, Burdwan-I Singhihara, Ernad Manjeri, Amaravathy-I Himachal Karamukhi.	Medium	15-22
	PGS-6, Anamica, Mowsham, Kuruppampadi local, Velliyar, Dhansiri, Tingpui	Low	15
Shogaol	Rio-de-Janeiro, Santhing pin (Manipur-I), PGS-37, S-641 Maran, Erattupetta, Nadan Pulpally, Jorhat local PGS-16, Mizo, Nadia.	High	5% of Oleoresin
	Vengara, Thaliparamba, Pampadumpara Zahirabad, Edapalayam, Ambalavayalan Mowsham, Ernad Chernad, Jamaica, Sirsaguda local, Neelamaran, Bittur- kallai, Thamarassery local PGS-11 Santhing, Dhipu, PGS-39, Kadan Nariampara, Singhihara, Machiplavu local, Ernad Manjeri, 620, Anamica, Amaravathy, Himachal Karamukhi, PGS-26, V ₁ S ₁ 9. PGS-33, Wynad Kunna- mangalam, PGS-17, Meppayur, Karakkal	Medium	3-5%
	Thingaladium, Thingpui, S-666, Dhansiri, Bokalia, Velliyar, Jugigan Barati Sogaon.	Low	3

Table 3 : Intercharacter association in ginger

	Oleoresin	Gingerol	Shogaol
Oleoresin	1.000		
Gingerol	.506**	1.000	
Shogaol	.348**	.671**	1.000

** Significant at P < 0.01.