

VARIABILITY FOR OIL, OLEORESIN AND THEIR COMPONENTS IN SELECTED GINGER ACCESSIONS

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Abstract

Forty one ginger accessions were evaluated for oil, oleoresin, gingerols and shogaols. (6), (8) and (10) gingerols and (6), (8) and (10) - shogaols are the pungent principles present in ginger oleoresin. Wide variability was noticed in the ginger germplasm. Accessions with high oleoresin, gingerol and shogaol are 2,22, 42,60, 86,141 and 197.

Introduction

Ginger, *Zingiber officinale* Roscoe, is a spice widely used in South East Asian countries. It is used both in culinary as well as pharmaceutical products. There are about 50 cultivars available in ginger. These cultivars have evolved over time. Significant variation for yield, dry recovery, volatile oil, extractive and fiber content is observed among the ginger cultivars grown in the country. (Govindrajan 1982, Nybe *et al* 1980 Shamina *et al* 1997). These variations are genetical and also influenced by agroclimatic conditions. The cultivars are generally known by the name of the region or area where they are regularly grown.

Ginger is traded as whole dried ginger, powdered ginger, fresh ginger products, crystallized ginger, ginger oil, ginger oleoresin etc. The oil and oleoresin again vary based on the flavor constituents and pungent principles. Some of the constituents of the essential oil are citral, citronellyl acetate, zingiberene, B- sesquiphellandrene and α - curcumene.

The nature of the pungency stimuli of ginger as phenylketones has been known for a long time. The pungency stimulating components, gingerols and shogaols do not have specific absorption maxima. Gingerols and shogaols have now been shown as components in commercial ginger and ginger extracts. It has generally been reported that pungency decrease in the order gingerol > shogaol > zingerone. Zachariah *et al* (1993) have reported that good variability exists in the ginger germplasm with regard to oleoresin and total gingerols. However reports regarding the variability in the homologues of the dominant compounds like (6) - gingerol, (8) - gingerol and (6) - shogaol is scanty. An attempt has been made in the present paper to evaluate about 40 ginger germplasm accessions collected from different parts of the country and maintained at the National repository of ginger germplasm at Indian Institute of Spices Research, Calicut to understand the extent of variability which may be exploited in the future breeding/selection programmes.

Materials and Methods

Forty ginger accessions collected from different ginger cultivating areas were used in the study. These were planted in beds in a Randomised Block Design with two replications. The rhizomes were harvested at full maturity as indicated by complete drying of aerial vegetative parts. Dry ginger is prepared by scraping off the outer skin of cleaned, harvested rhizomes and then dried in sunlight for 10-12 days to a moisture level of 10 %. Oleoresin was extracted by cold percolation of the comminuted sample with acetone and the percentage was computed gravimetrically. (ASTA 1968). The pungency homologues gingerols and shogaols were estimated using HPLC (ISO/DIS13685 : 1995). The quantitation was done by external standardization with nonanoic acid vanillyl amide (NVA) which has a retention time comparable to that of gingerol - (6) and a similar UV absorption spectrum. The analysis was carried out in a Shimadzu LC- 6A isocratic HPLC equipped with CR 4A integrator on ODS column using acetonitrile and aqueous acetic acid as mobile phase and by UV detection at 280 nm. Essential oil was extracted from the freshly powdered sample employing hydro distillation using Cleavenger apparatus (lighter than water type) (ASTA 1968). The essential oil constituents were analysed on a HS - 40 Perkin Elmer Autosystem GC interfaced with PE Nelson 1022 GC plus integrator using Flame Ionisation Detector. The compounds were identified using authentic standards.

Results and Discussion

Table 1 gives the percentage of oil, oleoresin and the gingerols and shogaol content of oleoresin whereas the variability available in the levels of major terpenes in the volatile oil is presented in Table 2. Geographical locations from where the accessions are collected are given in Table 3. Generally ginger possess about 1.2 to 2.5 % of oil and 4 to 8 % of oleoresin. Among the accessions evaluated here Acc. 50, 57, 86, 141 and 197 had more than 2% essential oil. Acc. 197 had 7.5% oleoresin and 22, 57, 60, 130 and 154 had more than 6% oleoresin. Thus the data indicate that variation for the different quality constituents such as essential oil, oleoresin and aroma and pungent principles are not related to any specific geographical location. Within the gene pools of a specific geographical area there are accessions possessing genes for different quality traits. In the present study since most of the accessions were from Orissa and Kerala it was but natural to find the elite accessions from these places. Kerala and North East India are considered as the centre of diversity of ginger in India (Ravindran *et al* 1994). The major pungent principles present in ginger oleoresin are gingerols and shogaols. The gingerols consist of (6), (8) and (10) gingerols. The prefixing number corresponds to the number of carbon atoms in the aldehyde which will be produced by alkaline hydrolysis (Connel and Sutherland 1969). Pungency decreases in the order gingerol > shogaol. Table 1 gives the percentage composition of (6) and (8) gingerol and (6) shogaol in the oleoresin. Other components like (10) gingerol and (8) and (10) shogaol were almost negligible in the accessions. (6) gingerol content ranged from 4.6 to 21 % and (8) gingerol content ranged from 1 to 10.3 %. (6) shogaol ranged from 1 to 8.7 %. Accessions with very high gingerol are 2, 22, 42, 60, 86 and 141. (>14%). Earlier studies indicate that levels of shogaols increase based on the storage of oleoresin. (Govindarajan 1982). The aroma of ginger accessions are mainly due to the concentration of zingiberene, ar-curcumene and citral content of the oil. Accessions with high zingiberene are 2, 114, 121, 135 and 197. Accessions with high pungency need not have high aroma. However accessions 2 and 121 have high (6) gingerol as well. The study revealed that some accessions possess both high oil and oleoresin content (Acc. 57 and 197) Acc. 197 has high amount of Zingiberene as well. Such accessions if possess moderately good yield can be short listed for releasing as new varieties.

The present study clearly shows that there exists good variation for essential oil, its constituents, oleoresin and pungent principles in the ginger germplasm of the country.

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Table.1 Levels of Essential oil , oleoresin and gingerols in selected ginger accessions


Acc. No.	Essential oil (%)	Oleoresin (%)	6-Gingerol (%)	8-Gingerol (%)	8-shogaol (%)
2	1.4	4.7	14.3	1.9	1.5
12	1.9	4.6	9.9	1.5	4.7
13	1.2	4.1	7.0	1.3	1.3
18	1.2	3.1	9.3	1.0	4.4
21	1.8	4.3	11.0	2.0	2.0
22	1.7	6.0	21.5	2.1	2.2
24	1.7	5.4	10.3	3.0	5.1
26	1.8	6.8	11.3	4.5	6.0
42	1.6	5.3	16.6	2.2	2.1
50	2.0	5.7	12.7	2.3	1.8
57	2.2	6.6	12.8	2.1	2.1
58	1.4	4.3	13.2	4.1	6.0
60	1.6	6.0	14.2	10.3	8.7
72	1.5	4.7	10.6	1.8	1.3
77	1.5	5.2	11.3	6.9	5.0
79	1.2	4.4	10.6	1.8	1.3
86	2.0	4.9	14.0	3.0	7.0
94	1.2	3.7	4.6	1.0	1.0
95	1.4	2.5	8.1	1.4	1.3
97	1.6	4.4	5.4	1.1	1.0
98	1.8	4.1	10.7	3.4	4.1
101	1.6	4.7	7.0	2.2	3.1
103	1.1	3.9	5.5	1.0	1.0
107	1.3	4.3	6.5	1.0	1.2
111	1.3	4.0	9.4	1.3	4.0
117	1.3	5.0	11.7	2.6	4.2
121	1.7	5.7	12.4	6.1	5.0
127	1.5	4.3	13.1	1.7	1.6
130	1.5	6.1	10.9	5.0	4.1
135	1.8	5.8	10.6	2.9	3.8
137	1.0	4.7	5.8	1.0	1.2
141	2.1	5.7	17.6	3.1	3.2
154	1.8	6.2	10.0	2.0	1.4
159	1.4	4.6	7.7	1.3	1.0
162	1.1	3.7	10.2	2.8	5.4
167	1.8	5.2	10.8	5.7	4.1
179	1.2	4.3	10.5	3.6	4.6
197	2.4	7.5	10.1	4.1	4.7
213	1.7	5.3	9.5	1.0	3.0
217	2.2	4.8	8.5	3.0	1.3

Table.2. Variability in terpene levels in selected ginger accessions

Acc.no	Citral (%)	Zingiberene(%)	ar-Curcumene(%)
2	1.08	57.70	10.6
12	1.12	27.50	7.90
13	1.30	37.20	14.80
26	0.60	49.90	11.06
42	1.20	40.40	16.10
49	1.20	40.20	16.40
58	0.76	35.19	10.25
60	0.74	47.30	13.05
72	1.20	35.20	14.20
86	1.30	36.20	15.50
96	1.20	18.40	8.47
98	0.70	45.50	8.67
101	1.37	40.50	15.77
107	1.09	36.80	14.57
114	1.90	55.00	-
115	1.27	40.30	14.55
121	0.72	50.68	16.03
130	0.80	47.14	13.69
135	0.63	51.15	13.36
139	1.20	38.16	6.70
154	1.27	31.28	13.80
158	1.30	37.21	5.10
162	0.77	20.85	14.85
197	1.10	55.70	11.07
213	0.80	42.67	12.70
217	1.20	38.10	5.90

Table.3. Popular names and locations of the ginger collections

Acc.no	Popular name	Location
2	Baharica	Orissa
12	Erattupetta	Kerala
13	Ernad Chernad	Kerala
18	Jugigan	Exotic
21	Kottagarh	Orissa
22	Kunduli	Orissa
24	Maran(Ambalavayal)	Kerala
26	Nadan	Kerala
42	Pottangi	Orissa
50	Pottangi	Orissa
57	Pulpally	Kerala
58	Pulpally (Thrissur)	Kerala
60	S.558	Orissa
72	Thang Chang	Arunachal.P
77	V ₂ -S1.7	Orissa
79	Wynad Kunnamangalam	Kerala
86	508(Pottangi)	Orissa
94	639(Pottangi)	Orissa
95	840(Pottangi)	Orissa
97	Turalocal	Meghalaya
98	Mowshow	Meghalaya
101	Baratisogan	Assam
103	Diphu	Assam
107	Mizo	Assam
111	Maran	Kerala
117	Pampadumpara	Kerala
121	Amaravaty	Andhra.P
127	Mudigere local	Karnataka
130	Nepal	Nepal
135	Tura	Meghalaya
137	PGS-4	Orissa
141	PGS- 43	Orissa
154	V ₂ E ₄ - 5	Orissa
159	V ₅ E ₅ - 4	Orissa
162	Meppayur	Kerala
167	Panamaram(Wynad)	Kerala
179	Himachal	Kerala
197	Nadan(Pulpally)	Kerala
213	Malayattur	Kerala
217	Thodupuzha	Kerala


 15 - V₂
 3 - H₂
 1 - H₁
 1 - H₁₁₁
 1 - K₂
 1 - E₅
 3 - A₅