



GINGER GERMLASM COLLECTION, CHARACTERIZATION, EVALUATION AND CONSERVATION IN EASTERN GHAT HIGH LAND ZONE OF ODISHA

SIAL PARSHURAM^{1*}, BEHERA S.K.² AND TARAI R.K.³

¹High Altitude Research Station, Orissa University of Agriculture and Technology, Pottangi, Koraput, Odisha

²AICRP on Dry Land Agriculture, Orissa University of Agriculture and Technology, At/Po: Phulbani, Dist: Kandhamal, Odisha

³College of Horticulture, Orissa University of Agriculture and Technology, Chiplima, Sambalpur, Odisha

*Corresponding Author: Email-subrat_behera@rediffmail.com

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Abstract- Field experiments were carried out during *Kharif*, 2012-13, 2013-14 and 2014-15 in the Eastern Ghat High Land Zone at the research farm of High Altitude Research Station (Orissa University of Agriculture and Technology), Pottangi, Koraput, Odisha to evaluate the performance of 173 ginger germplasm collected across the country in augmented block design. It was revealed from the pooled data analysis that, out of 173 ginger germplasm studied, 10 accessions gave more than 10 Kg/3 m² fresh rhizome yield, the range of plot yield being 2.2 Kg (PGS-34) to 19.0 Kg/3 m² (PGS-36) with the mean yield of 5.2 Kg/3 m² in tested germplasms. The highest fresh rhizome yield was recorded by PGS-36 (19.0 Kg/3 m²) followed by S-692 (16.5 Kg/3 m²), Tura Local (14.8 Kg/3 m²), Tura Local-1 (14.3 Kg/3 m²), S-642-1 (12.5 Kg/3 m²), GCP-31 (12.0 Kg/3 m²), PGCAL-1 (11.5 Kg/3 m²) etc. The clump weight of germplasm varies from 110 g (S-554) to 450 g (PGS-36) with the mean value of 204.6 g. China (88.5 cm) was the tallest among all. KG-132 (13.0) had the highest number of tillers per plant. V₁K₁-1 (15.2 cm) had longest fully opened last leaf. GCP-5 (2.5 cm) had the wider leaves.

Keywords- Ginger germplasm, genetic variability, Eastern Ghat High Land Zone, rhizome yield, clump weight, tillers per plant.

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Introduction

Ginger (*Zingiber officinale* Rosc.) belongs to family Zingiberaceae which comprises 47 genera and about 1400 species. It is believed to have originated in South- East Asia probably in India or China [1]. India produces 715100 tonnes of ginger annually from an estimated area of 137990 ha with the productivity of 5182 Kg/ha (http://dasd.gov.in/images/kerala/pdf/files/spices-area_production_and_productivity_in_india.pdf). Ginger was brought to Mediterranean region from India by traders during 1st century [2] and by Arabs to East Africa during thirteenth century. It was spread to West Africa by Portuguese for commercial cultivation. It is grown in almost all the tropical countries of which China, Taiwan, India, Phillipines, Jamaica and Nigeria are important. Kerala is the leading state in area and production of ginger followed by Odisha, Meghalaya, Himachal Pradesh, Karnataka, Mizoram, Manipur, Tamil Nadu, Maharashtra, Bihar, Tripura, Gujarat, Uttar Pradesh, Nagaland, Rajasthan, Haryana, Assam and to some extent in Jammu and Kashmir, Sikkim and Arunachal Pradesh.

Odisha has been divided into 10 agro climatic zones based on the basis of soil structure, humidity, elevation, topography, vegetation, rainfall and other agro climatic factors. The state can be broadly divided into two Agro-Climatic zones i.e. Coastal Region and Highland Region. Eastern Ghat High Land Zone of Odisha is an excellent avenue with exclusive climatic situation, which is, situated at 18° 42'N, 82° 30'E elevation and 884m above mean sea level. It is around 8% of total geographical area of the state accounting an area of 12,456 sq km. The climate was hot and humid, with an annual average rainfall of 1567 mm, most of which (90%) was received during monsoon months (June to September), mean summer and winter temperature were 34°C and 12°C respectively. The soil type was red and late rite with sandy to clay loam in texture. The pH of the soil was 5.8 with low in organic carbon (0.03-0.05%), available N (150-170 kg/ha), P (16-18 kg/ha) and K (152-160 kg/ha) as reported by [3].

The National Bureau of Plant Genetic Resources collected ginger germplasm through all India survey in collaboration with National Plantation Crops Research Institute, Kasaragod and Himachal Agricultural University, Palampur during the year 1976-77 and considerable germplasm was collected [8]. Gene erosion was visible because an introduced exotic cultivar Rio-de-Janeiro had replaced the local land races/ cultivars in many areas. Now, Varada, Suprabha, Suravi, Suruchi, Nadia etc. released varieties of India were also replacing the local land races. Thus, collection and conservation of ginger germplasm on priority basis was essential. In the present paper, an attempt has been made to provide useful information on evaluation and classification of ginger germplasm collected at Eastern Ghat High Land Zone of Odisha.

Materials and Methods

The All India Coordinated Spices Improvement Project, Pottangi, Odisha has collected 173 accessions from different ginger growing areas in collaboration with the different Centres of All India Research Project on Spices of country along with IISR, Kozhikode and different state functionaries. These have been maintained at High Altitude Research Station, Pottangi, Koraput, Odisha with an altitude of 914.4 m above mean sea level, latitude 18° 34' N and longitude 82° 52' E. Two wild relatives, three exotic types and 168 indigenous types [Table-1] were grown in Augmented Block Design and evaluated systematically during *Kharif*, 2012-13, 2013-14 and 2014-15 for evaluating 24 different morphological and economic characters.

The entire experimental field was conducted in raised bed of 3 m length and 1m width. The ginger rhizomes were planted in flat beds with a spacing of 30 cm×25 cm. Farm yard manure (FYM) @ 20 tonnes ha⁻¹ and neem cake @ 4 tonnes ha⁻¹ were applied during planting time. Recommended Dose of Fertilizer (125 kg N, 100 kg P₂O₅ and 100 kg K₂O ha⁻¹) were also applied based on soil test

recommendations following proper package of practices time to time. The observations were recorded from randomly selected 10 plants in each plot.

Table-1 Sources of ginger germplasm collected and maintained at HARS, Pottangi.

Sources of collection	Number of collections
Exotic germplasm from Brazil, China, Zamaica	3
Indigenous germplasm from Odisha, Kerala, Meghalaya, Himachal Pradesh, West Bengal, Andhra Pradesh, Madhya Pradesh, Karnataka, Mizoram, Manipur, Tamil Nadu, Maharashtra, Bihar, Tripura, Gujarat, Uttar Pradesh, Nagaland, Rajasthan, Sikkim and Assam	170
Total	173

Results and discussion

The 173 accessions were classified according to the source of collection and

categories. The land races were named after the place of collection. The wild ginger collected from Eastern Ghat is shown under wild taxa. Mutants were created by mutagenesis with gamma rays, EMS, Sodium Azide and Colchicine [5]. Lines were selected from local land races and named in Pottangi Ginger Series (PGS). Three varieties (Suprabha, Suravi and Suruchi) have been released by High Altitude Research Station, Pottangi [Table-2]. Now, Subhada is being proposed to be released soon.

It was revealed from the pooled data of three years (Kharif seasons of 2012-13, 2013-14 and 2014-15) that considerable genetic variability was observed in plant height (26.2-88.5 cm), tillers per plant (2.4-13.0), leaves per tiller (5.0-17.8), length of fully opened last leaf (7.6-15.2 cm), width of fully opened last leaf (1.1-2.5 cm), fresh rhizome yield per plant (110-450 g), projected fresh rhizome yield (48.8-421.8 q ha⁻¹), dry ginger recovery (13.0-30.0%), oleoresin content (5.0-10.8%), essential oil (0.5-2.5%), crude fibre (3.3-6.5%) [Table-3].

Table-2 Characteristics of released varieties of Orissa University of Agriculture and Technology.

Variety	Parentage	Year of Release	Avg. Yield (t/ha)	Maturity (days)	Dry Recovery %	Crude Fibre %	Oleoresin %	Ecological Adaptability
Suprabha (PGS-35)	Clonal selection from Kunduli local	1988	16.6	229	20.5	4.4	8.9	Hills & Planes
Suruchi (PGS-19)	Clonal selection from Kunduli local	1990	11.6	218	23.5	3.8	10.0	Hills & Planes
Suravi (V ₁ K ₁ -3)	Gamma irradiation in Rudrapur Local	1991	17.5	225	23.5	4.0	10.2	Hills & Planes

The rhizome yield per plant was maximum with PGS-36 (450g) followed by S-692(413g) and Tura local (370g) with the mean value of 204.6g. Tiwari (2003) [7] reported the highest rhizome yield per plant in SG 646 (214 g) under the mid-hill conditions of Himachal Pradesh.

Ten accessions gave more than 10 Kg/3m² fresh rhizome yield, the range of plot yield being 2.2 Kg (PGS-34) to 19.0 Kg/3 m² (PGS-36) with the mean yield of 5.2 Kg/3 m² in tested germplasms. The highest fresh rhizome yield was recorded by PGS-36 (19.0Kg/3 m²) followed by S-692 (16.5 Kg/3 m²), Tura local (14.8 Kg/3 m²), Tura Local-1(14.3 Kg/3 m²), S-642-1 (12.5 Kg/3 m²), GCP-31 (12.0 Kg/3 m²), PGCAL-1 (11.5 Kg/3 m²) etc.

The present investigation indicated highest oleoresin content with Suravi (10.8%)

and the lowest with Anamika (5.0%). Dutta et al. (2003) [4] reported highest oleoresin in Suravi (10.30%) in the sub tropical humid region of West Bengal. Quality analysis revealed that some amount of variation existed with respect to the locations, as the oleoresin percentage of IISR Mahima and IISR Rejatha was 4.48% and 6.64%, respectively under Kerala condition [6]. Maximum dry recovery (30.0%) was recorded with Suprabha. The lowest dry recovery was obtained with Anamika (13.0%). Dutta et al. (2003) [4] obtained the dry recovery of 20.60%, 23.45% and 20.30% with Suprabha, Suravi and Gorubathan, respectively. Sasikumar et al. (2003) [6] reported 21.12% and 20.81% dry recovery with IISR Mahima and IISR Rejatha, respectively.

Table-3 Characteristics of evaluated ginger germplasm at HARS, Pottangi

Sl. No.	Characters	Range	Mean	Best 3 types with value in parenthesis
1	Plant height (cm)	26.2-88.5 (S-646 - China)	60.1	China(88.5), KG-41(82.2), Suravi (79.6)
2	Number of tillers per plant	2.4-13.0 (PGS-3 - KG-132)	7.0	KG-132(13.0), Zo-18(12.6), PGS-38(12.2)
3	Number of leaves per tiller	5.0-17.8 (PGS-2-1-S-642-1)	12.0	S-642-1(17.8), S-666 (16.8), No.1(16.6)
4	Length of fully opened last leaf (cm)	7.6-15.2 (Nadia - V ₁ K ₁ -1)	11.4	V ₁ K ₁ -1 (15.2), V ₁ E ₇ -5-1(14.9), Wild ginger-1(14.9)
5	Width of fully opened last leaf (cm)	1.1-2.5 (PGS-107-GCP-5)	1.5	GCP-5(2.5), PGS-104(2.3), Wild ginger(2.3)
6	Fresh rhizome yield per plant (g)	110-450 (S-554 - PGS-36)	204.6	PGS-36(450), S-692(413), Tura local(370)
7	Rhizome yield per plot (Kg/3m ²)	2.2-19.0 (PGS-34 -PGS-36)	5.2	PGS-36 (19.0 Kg/3 m ²), S-692 (16.5 Kg/3 m ²), Tura local (14.8 Kg/3 m ²)
8	Projected fresh rhizome yield (q/ha)	48.8-421.8 (PGS-34- PGS-36)	114.8	PGS-36 (421.8q/ha), S-692 (366.3q/ha), Tura local (328.6q/ha)
9	Dry ginger recovery (%)	13.0-30.0 (Anamika- Suprabha)	20.6	Suprabha(30.0), Tura local-2(29.0), Suruchi(28.6)
10	Oleoresin content (%)	5.0-10.8 (Anamika - Suravi)	7.9	Suravi (10.8), China (10.0), Karakkal (9.6)
11	Essential oil (%)	0.5-2.5 (IG-2- Suprabha)	1.5	Suprabha(2.5), Suravi(2.3), Karthika(2.3)
12	Crude fibre (%)	3.3-6.5 (Suravi- Anamika)	4.0	Suravi(3.3), China(3.4), Jamaica(3.6)

Conclusions

The study indicated that the rhizome yield per plant was maximum with PGS-36 (450g) followed by S-692 (413g) and Tura local (370g) with the mean value of 204.6g. Highest oleoresin contents were found in variety Suravi (10.8%) and the lowest with ZO-2 (5.0%). The lowest dry recovery was obtained with Anamika (13.0%). The study also indicated that there is a wide range of variation among the accessions. Though the collection, conservation and evaluation of ginger germplasm is an expensive activity, it may be continued to protect the crop from infection of bacterial wilt and soft rot and to obtain higher yield and quality. There is an ample scope for conservation. This may be carried out.

Conflict of Interest: None declared

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