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Physicochemical Properties of Flours Derived from Cassava Landraces (*Manihot esculenta* Crantz.) in Western Ghat Region

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ABSTRACT

Exploration was conducted at southern region of Western Ghats and 56 landraces were collected from 32 villages. The collected landraces were subjected to physicochemical, biochemical and pasting properties analysis at biochemical laboratory of the Department of Plant Genetic Resourecs, Tamil Nadu Agricultural University to unravel their potential in food and industrial applications. The analysis of variance showed a wide genotypic variation exists in proximate composition and pasting properties of cassava landraces. Amylose content ranged between 14.4-30.4 per cent and starch content between 10.0-39.7 per cent. Among the 56 landraces studied, paste clarity was high for eighteen landraces (>25 per cent). Swelling of cassava flours increases with increased temperature in landraces studied. The observed differences in pasting properties is indicative of the fact that cassava genotypes can be targeted for use in different food and industrial products. Correlation study revealed that the amylose content was positively correlated to the starch content and the peak viscosity and negatively correlated to paste clarity suggesting its importance in food, textile and paper industries. The identified two landraces *viz., Karialai Porian* (Tall) and *Yeathan Chivalai* which possessed low amylose content with high paste clarity can be used in food and non-food industries. The landrace *Olly marungu* recorded high swelling power with high amylose and starch content and used in food based industries especially in production of resistant starch. The results indicated the potential of selected landraces which can be used directly for industrial purposes or in breeding programme to evolve superior varieties/hybrids.

Key words *Cassava, landraces, amylose content, physicochemical, pasting properties*

Cassava (*Manihot esculenta* Crantz.) is a perennial woody shrub of the family Euphorbiaceae, native of South America that is extensively cultivated as an annual tuberous root crop in the tropical regions of Africa, Asia and Latin America as a subsistence crop on which more than 500 million people rely (FAO, 2008). Globally, cassava is grown in 18.57 million ha producing 230.27 million tones with 12.4 t/ha productivity (FAO, 2010). They are used into different products according to needs of local (Kawano, 2003). Cassava gives a carbohydrate production per hectare which is about 40 per cent higher than rice and 25 per cent more than maize and cheapest source for both human nutrition and animal feeding (Tonukari, 2004).

In India, cassava is potentially important sources of starch and is mainly grown in Kerala, Tamil Nadu and Andhra Pradesh. In Kerala, it is a major food crop whereas in Tamil Nadu and Andhra Pradesh it is grown for industrial production of starch and sago. India ranks first in the productivity (34.75t/ha) and seventh in the production (8.06 million tonnes) respectively (FAO, 2010). Cassava is the fifth important starchy food crop in India after rice, wheat, potato and maize. Lack of information on the properties of starches from cassava produced in India has contributed to limited utilization of starch in industry. Knowledge on properties of the starch from cassava therefore would unravel the opportunities offered by this root crop and help their utilization. This paper, therefore, concerns some characteristic properties of the flours from cassava landraces that will help in industrial utilization of the cassava and increase the inclusion of landraces for special traits in cassava breeding programme.

MATERIALS AND METHODS

Sample preparation:

The roots of 55 cassava landraces explored in Western Ghats and were harvested after ten months from experimental plot at HRS, Pechiparai, Tamil Nadu (Table 1). Fresh roots were washed, peeled manually, cut into small pieces with chips maker and dried. The dried chips were grounded finely with a coffee grinder and pass through a 300-μm sieve. The flour was then packed into a closed container and stored under dry conditions at room temperature until used for further analysis.

Proximate analysis of flours:

All extracted flours were assessed for moisture content in accordance with the AACC method (AACC, 2000). The apparent amylose content was determined using spectrophotometric methods by Juliano, 1971 and the starch content was analysed using anthrone reagent method of Sadasivam and Manickam, 1996.

Paste clarity:

Paste clarity of flour samples was determined based

Table 1. Details of cassava landraces collected from western Ghats of Tamil Nadu during exploration

Ac.No	Local Name	Source	Ac.No	Local Name	Source	Ac.No	Local Name	Source
CL1	*Ullii Chigappan*	Pechiparai	CL20	Tall- *Karialai Porian*	Mallamuthankarai	CL39	Arriam Vellai	Kaatavilai
CL2	*Laxhmi Vellai*	Tiruvarambu	CL21	Tall-*Adukku Muttan*	Mallamuthankarai	CL40	Tall-Muttan	Kaatavilai
CL3	*Karialai Porian*	Pechiparai	CL22	*Yeathan Chivalai*	Vaiyanachallai	CL41	Olly Muttan	Kaatavilai
CL4	*Ottai Moodu*	Koruvakkuzhi	CL23	Tall-*Pachai Konntai*	Koruvakkuzhi	CL42	Tall-Marungu	Thumbally
CL5	*Karialai Porian*	Thanikunndu	CL24	*Nadan Karialai*	Chittar	CL43	Olly Marungu	Thumbally
CL6	*Karialai Porian*	Mothiramalai	CL25	*Allanchollai local*	Allanchollai	CL44	Karun Karialai	Mudavanpottai
CL7	*Karialai Porian*	Vazhibattukadavu	CL26	*Laxhmi Vellai*	Chittar	CL45	Chengambai	Valayamthukki
CL8	*Karialai Porian*	EB.Pachiparai	CL27	*Kaichi Kuttai*	Chittardam	CL46	Pachaikonda	Valayamthukki
CL9	*Dwarf Vellai*	Maramalai	CL28	*Nooru Muttan*	Allanchollai	CL47	Vellai Porian	Valayamthukki
CL10	*Ullii Chigappan*	Navalkadu	CL29	*Aana Karialai*	Nedumankaadu	CL48	Karialai Porian	Kayarkarai
CL11	*Kattu*	Koruvakkuzhi	CL30	Tall-*Laxhmi Vellai*	Allanchollai	CL49	Adukku Muttan	Kayarkarai
CL12	*Ullii Chigappan*	Koruvakkuzhi	CL31	*Karu Mundan*	Mantharam puthur	CL50	Chengambai	Kayarkarai
CL13	*Kerala Thadi Muttan*	Pathanamthittai	CL32	*Kailady*	Valia yela	CL51	Pachaikonda	Kayarkarai
CL14	Tall-*Ullii Chigappan*	Thanikunndu	CL33	*Black Karialai*	Valia yela	CL52	Karialai Porian	Kayarkarai
CL15	Tall-*Adukku Muttan*	Thanikunndu	CL34	*Mantharamputhur 1*	Mantharam puthur	CL53	Adukku Muttan	Arasanseri
CL16	Tall- *Karialai Porian*	Mookirakall	CL35	*Kottaram 1*	Kottaram	CL54	Mathur local	Mathur
CL17	Tall-*Laxhmi Vellai*	Mallamuthankarai	CL36	*Kottaram 2*	Kottaram	CL55	Ullii Chigappan	Mathur
CL18	Tall-*Kattu*	Mallamuthankarai	CL37	*Achankulam* local	Achankulam	CL56	Whiterose	Verkilambi
CL19	Tall-*Chilly Kallan*	Mallamuthankarai	CL38	*Azhakappapuram L*	Azhakappapuram			

on the percentage of their light transmittance at 650 nm against the water blank using a spectrophotometer (Craig *et al.*, 1989). The flour dispersion (1%) was prepared in a screw cap tube and heated at 100°C for 30 min with intermittent mixing to avoid sedimentation. The tubes were then cooled down at room temperature for 1 hour and the percentage of light transmittance was measured.

Swelling power :

Flour dispersion (2%) was prepared in falcon tubes and heated in a water bath at 50, 60, 70 and 80°C for 30 min with constant agitation to avoid sedimentation. This was followed by centrifugation at 3000 rpm 10 min. The sedimented fraction was weighed and its mass related to the mass of dry starch was expressed as swelling power (w/w) (van Hung, *et al.,* 2007).

Pasting properties by rapid visco-analyzer (RVA):

The pasting properties of flour were investigated using a rapid visco analyzer (RVA 3-D model) with Thermocline Windows control and analysis software, Version 1.2 (Newport Scientific, Sydney, Australia) according to Noda, *et al.*, 2004. An aqueous sample containing 8% w/w of flour was prepared and equilibrated at 50°C for 1 min, then heated from 50 to 95°C at 12.2°C/min, held at 95°C for 2.5 min, cooled to 50°C at 11.8°C/min, and held at 50°C for 1 min. The speed was 960 rpm for the first 10s, then 160 rpm for the reminder of the experiment. The pasting properties of each sample were inferred from acquired diagrams.

Statistical analysis:

All analyses were performed in triplicate. Data obtained was subjected to analysis of variance (ANOVA) at the significant level of 5% ($P<0.05$) using AGRIS software. When statistical differences were found, the least significant difference (LSD) was used to compare means at the 5% significance level. Relationships among different starch characteristics were analysed using correlation coefficient as described by Falconer and Mackay, 1996.

RESULTS AND DISCUSSION

Biochemical properties of cassava:

The amylose and starch contents among the 56 collected landraces showed the presence of significant variation among genotypes (Table 2). Starch is an important raw material for industrial applications, such as in the paper, textile, plastics, food and pharmaceutical industry. Amylose content is important starch property and low amylose starch gelatinise easily, yielding clear pastes. Low amylose with high starch content is preferred in paper and textile industries. The average contents of amylose and starch were 22.2 and 24.9 per cent respectively. In this study, the landraces *Krialai Porian* (Tall) and *Yeathan Chivalai* possessed lower amylose contents of 14.4 per cent which can be a suitable genotype for paper and textile industries (Table 2). It also used as a stabiliser and thickener in food products and as an emulsifier for salad dressings (Jobling, 2004). The landraces, *Karialai Porian* and *Kaichi Kuttai* with high amylose content of 30.4 per cent and starch content of above 30 per cent can be processed into resistant

Table 2. Physicochemical, biochemical and pasting properties of cassava landraces

Entries	MC%	PC%	SP50	SP60	SP70	SP80	AC%	SC%	PV (cP)	HPV (cP)	BDV (cP)	CPV (cP)	SBV (cP)	PT (min)	Ptemp (^{0}C)
CL1	13.25	20.56	2.21	11.63	12.61	17.40	25.40	38.88	1500	891	609	1217	326	3.9	75.4
CL2	10.25	10.97	4.15	12.74	12.88	16.05	20.00	18.45	1284	913	371	1262	349	4.7	74.6
CL3	9.25	18.81	2.06	11.79	12.80	15.89	24.40	17.46	1415	1121	294	1395	274	4.5	76.3
CL4	13.00	19.26	4.38	12.58	13.33	18.38	23.40	10.44	1198	1089	109	1287	198	5.4	73.9
CL5	6.50	22.21	2.09	13.12	12.43	16.06	21.20	18.36	1330	832	498	1132	300	3.6	75.4
CL6	8.75	18.19	2.31	11.69	14.01	14.31	30.40	39.69	1323	918	405	1293	375	3.7	76.3
CL7	12.25	16.25	2.43	11.97	12.66	16.16	25.40	32.40	1254	834	420	1157	323	3.6	73.9
CL8	13.00	19.96	2.90	12.64	12.98	15.43	22.40	15.39	1220	825	395	1182	357	3.7	73.9
CL9	12.75	22.83	2.34	11.55	12.57	16.21	22.40	25.29	1104	700	404	943	243	4.1	75.5
CL10	13.75	16.05	2.65	11.38	11.41	16.24	25.40	34.02	1354	972	382	1277	305	5.1	73.8
CL11	12.50	18.82	3.92	13.56	13.47	16.46	17.20	16.74	1115	743	372	999	256	4.7	72.3
CL12	11.00	20.13	2.13	11.23	12.01	15.20	14.40	14.49	1024	783	241	1025	242	4.9	73.9
CL13	13.25	24.84	2.32	10.35	10.51	13.13	18.40	22.05	1116	895	221	1244	349	5.1	74.7
CL14	9.50	31.71	2.21	10.72	12.14	14.38	15.20	16.02	1118	911	207	1231	320	4.6	74.6
CL15	11.25	25.67	2.21	10.91	11.55	15.84	14.40	10.35	964	581	383	862	281	4.1	74.6
CL16	12.25	30.55	2.26	11.16	12.03	15.61	14.40	13.38	1231	981	250	1352	371	3.9	76.3
CL17	8.50	25.25	2.17	13.49	13.37	16.50	17.20	12.92	1283	928	355	1267	339	3.9	74.6
CL18	12.75	27.00	2.28	10.88	12.41	16.82	14.40	19.08	1227	956	271	1283	327	4.5	75.4
CL19	14.00	28.64	2.82	12.29	13.73	16.04	16.00	11.07	823	547	276	780	233	3.8	74.0
CL20	10.25	26.44	2.15	11.28	12.43	16.56	20.00	14.67	871	534	337	731	197	4.1	75.4
CL21	7.00	17.64	1.98	12.27	12.27	15.60	26.40	35.28	1121	734	387	981	247	3.9	75.4
CL22	8.75	41.09	2.37	11.11	12.53	16.21	14.40	10.67	1129	864	265	1139	275	4.7	74.0
CL23	8.25	26.82	2.33	9.91	10.48	14.98	16.00	25.65	1138	1038	100	1391	353	5.8	75.5
CL24	13.00	26.37	3.22	9.80	11.12	15.20	20.40	20.88	583	542	41	754	212	5.3	73.8
CL25	9.25	41.01	1.89	12.12	12.88	14.50	16.00	15.84	1407	876	531	1176	300	4.8	73.8
CL26	11.50	15.35	2.46	10.10	11.20	16.20	25.40	38.07	883	603	280	767	164	3.7	74.7
CL27	11.00	23.67	2.32	10.27	10.44	16.55	30.40	32.40	1082	935	147	1227	292	5.0	74.7
CL28	11.75	32.80	2.38	11.78	13.06	16.46	20.40	20.52	1225	955	270	1328	373	4.1	73.9
CL29	11.50	28.97	2.93	12.35	13.89	18.89	22.40	20.97	959	732	227	1030	298	4.2	73.1
CL30	10.50	21.08	2.39	11.50	13.99	14.61	24.60	32.22	1065	615	450	799	184	4.7	73.9
CL31	11.00	24.50	2.41	13.20	14.56	15.81	19.80	13.56	962	530	432	700	170	4.8	73.9
CL32	10.25	22.70	2.34	10.55	12.03	16.36	19.40	9.95	1233	766	467	1026	260	5.2	73.9
CL33	12.25	19.68	2.77	10.69	11.53	15.51	26.40	33.21	1054	859	195	1156	297	4.9	73.9
CL34	8.50	21.83	3.12	10.97	12.41	14.88	27.40	36.90	1021	764	257	1060	296	4.1	73.2
CL35	7.25	21.81	4.87	9.19	9.91	13.90	22.40	15.21	752	586	166	750	164	5.1	85.7
CL36	14.00	18.36	3.29	10.83	11.73	16.03	14.40	19.80	905	668	237	938	270	4.4	73.9
CL37	11.25	16.90	2.81	10.59	11.77	17.68	24.40	24.66	965	760	205	1032	272	4.8	73.9
CL38	10.50	18.88	1.99	15.21	14.21	10.48	20.40	15.21	1081	573	508	748	175	3.8	74.7
CL39	14.00	18.60	1.66	11.34	12.06	15.94	25.40	36.72	1226	771	455	1054	283	3.7	76.2
CL40	11.75	27.52	3.22	8.39	9.11	13.29	20.40	19.08	756	565	191	765	200	5.2	77.0
CL41	11.50	24.70	2.20	12.89	13.85	15.50	19.60	22.77	1104	617	487	820	203	3.9	76.3
CL42	13.00	28.16	2.44	13.09	15.94	17.10	25.70	30.60	1043	691	352	985	294	4.8	73.9
CL43	13.75	14.11	3.90	12.76	13.88	18.03	28.40	35.28	1113	887	226	1232	345	5.1	73.1
CL44	13.00	33.59	3.64	8.26	9.20	13.75	20.40	31.32	667	620	47	926	306	6.0	79.4
CL45	12.25	17.98	3.50	9.23	9.58	13.89	22.40	34.38	715	489	226	692	203	4.9	74.6
CL46	8.75	23.88	2.98	9.15	10.12	13.45	24.40	33.12	825	556	269	829	273	4.8	76.2
CL47	13.00	37.18	2.95	8.79	10.69	14.71	23.40	22.95	1081	905	176	1205	300	5.2	76.2
CL48	10.25	15.16	2.71	9.75	10.99	15.65	26.40	36.54	1060	857	203	1197	340	4.9	77.0
CL49	11.25	17.68	3.14	10.93	11.73	16.76	24.40	35.64	1016	838	178	1288	450	5.5	74.7
CL50	14.00	21.98	3.11	10.64	11.34	14.57	26.40	39.69	1019	694	325	995	301	3.9	75.4
CL51	10.50	16.47	2.73	7.78	10.98	13.95	24.40	19.53	956	873	83	1182	309	5.4	77.8
CL52	11.75	16.94	2.36	11.13	12.61	15.75	28.40	27.36	1147	910	237	1264	354	3.8	75.5

Entries	MC%	PC%	SP50	SP60	SP70	SP80	AC%	SC%	PV (cP)	HPV (cP)	BDV (cP)	CPV (cP)	SBV (cP)	PT (min)	Ptemp (^{0}C)
CL53	14.00	13.38	4.65	8.63	9.10	13.84	24.40	36.09	1037	1023	14	1321	298	7.0	82.6
CL54	11.25	10.99	6.06	12.01	13.29	17.60	28.40	39.06	1227	886	341	1152	266	4.7	72.3
CL55	13.75	26.54	3.15	9.99	11.90	13.93	28.40	37.44	1062	767	295	1049	282	4.3	75.5
CL56	14.00	12.02	8.78	12.16	14.13	14.95	28.50	36.99	1427	858	569	1264	406	4.3	71.0
Mean	11.38	22.51	2.91	11.18	12.18	15.56	22.19	24.94	1086	789	297	1074	285	4.6	75.1
SED	0.68	2.34	0.4	0.5	0.57	0.75	0.5	1.11	7.98	6.52	5.56	8.41	2.61	0.01	0.06
CV%	7.27	12.75	16.79	5.48	5.72	5.91	2.73	5.44	0.9	1.01	2.29	0.96	1.12	0.38	0.1
P<0.05	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

starch, which has nutritional benefits (Richardson, 2000) because it more resistant to digestion than amylopectin due to its compact linear structure. The amylose content was positively correlated to the starch content (r= 0.780, P d" 0.01) (Table 3 and Fig. 1). The above genotypes may also be utilized in breeding programme for cassava nutritional improvement.

Physicochemical properties of cassava flour:

Moisture content of flour:

Water is an important parameter in the storage of cassava flour; very high levels greater than 12% allow for microbial growth and thus low levels are favourable and give relatively longer shelf life (Padonou, *et al*., 2010; Harris and Koomson, 2011) and indicator of low rancidity (Nuwamanya, *et al*., 2011). The moisture content in the flour ranged from 6.5 to 14.0 per cent which were low relative to values of 9.2% to 12.3% and 11% to 16.5% reported by Charles, *et al*., 2005 and Shittu, *et al*., 2007 respectively. The lowest moisture content of 6.5 per cent was observed in the landrace *Karialai Porian* and the landrace *Mantharampudur local* possessed low moisture (8.5%), high amylose (27.4%) and starch (36.9%) can be a good source in food industries. Among the samples, 32 landraces possessed low moisture levels (<12%) and hence have the potential for better shelf life.

Paste clarity in cassava:

Paste clarity is a much desirable functionality of starches for its utilization in food industry since it directly influences brightness and opacity in foods that contain it as thickeners (Mweta, *et al*., 2008). In our study, paste clarity varied between 10.97 and 41.09 per cent (Table 2). Within the germplasms, the landraces *Yeathan Chivalai* and *Karialai Porian* (Tall) had high clarity values of 41.09%

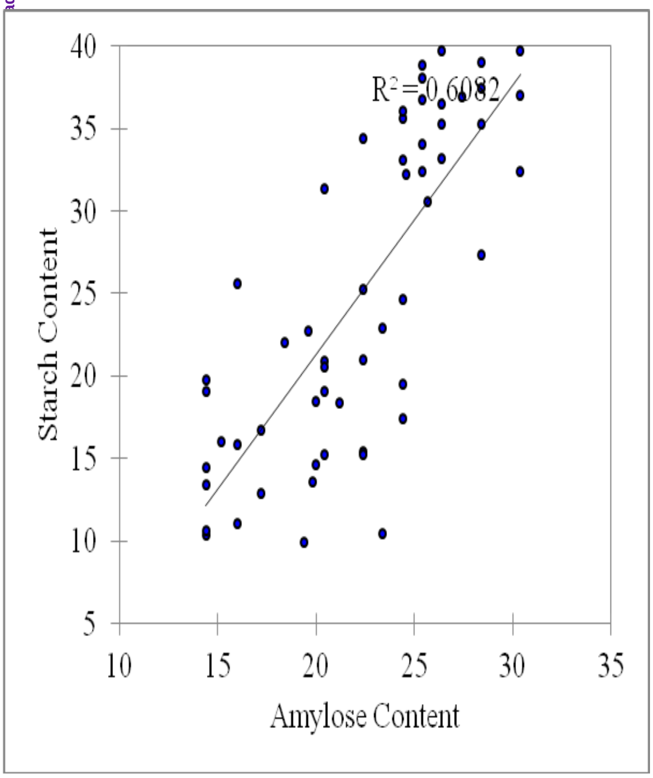

Fig. 1. Relationship between amylose and starch content

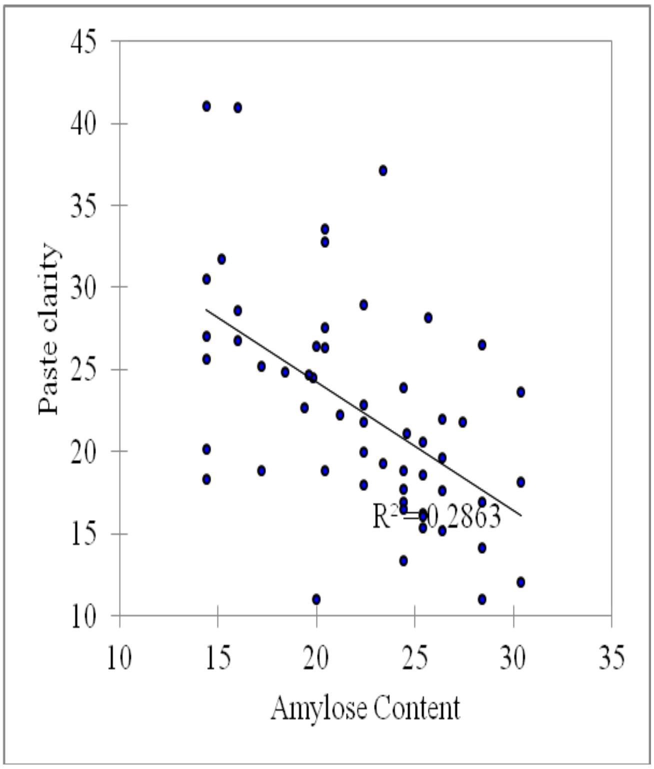

Fig. 2. Relationship between amylose and paste clarity

Table 3. Correlation matrix for different physico-chemical, biochemical and viscosity characteristics of cassava germplasms

Characters	MC%	PC%	SP	AC%	SC%	PV	HPV	BDV	CPV	SBV	Ptemp
MC%	1	-0.119	0.132	0.109	0.215	-0.080	-0.022	-0.090	0.013	0.097	-0.186
PC%		1	-0.107	-0.535**	-0.445**	-0.141	-0.091	-0.097	-0.082	-0.040	0.037
SP			1	0.068	-0.031	0.270	0.278	0.063	0.265	0.160	-0.404**
AC%				1	0.780**	0.133	0.122	0.049	0.138	0.141	0.011
SC%					1	0.050	0.050	0.013	0.116	0.249	0.017
PV						1	0.724**	0.591**	0.715**	0.498**	-0.295*
HPV							1	-0.129	0.971**	0.635**	-0.041
BDV								1	-0.108	-0.026	-0.377*
CPV									1	0.801	-0.078
SBV										1	-0.149
PT	0.109	0.028	-0.141	-0.042	0.024	-0.317	0.171	-0.657**	0.132	-0.001	0.344*

*, **-Significant at 5% and 1% level respectively; MC = moisture content; PC = paste clarity; WBC = water binding capacity; SP = swelling power; AC = amylose content; SC = starch content, PV = peak viscosity; HPV = hotpaste viscosity; CPV = coolpaste viscosity; BDV = breakdown viscosity; SBV = setback viscosity; PT = pasting time.

and 30.55% respectively (Table 2). Amylose content is known to influence the clarity of starch pastes as lower amylose starches are easily dispersed, increasing transmittance and clarity, hence the genotypes with high paste clarity possessed low amylose contents of 14.4 and 16 per cent. Negative correlation were existed between amylose and paste clarity (r = -0.535, P d" 0.01) suggesting its importance in the preparation of solution and pasting properties and it was in accordance with results of Kaur, *et al.*, 2007 (Fig. 2). The above two landraces due to their high clarity and low amylose can be used as better parent in designing breeding programme to develop varieties/ hybrids for paper and textile industries.

Swelling power of cassava flour:

Swelling power is an important parameter in characterisation of starch related crops which display different swelling powers at a given temperature (Charles, *et al.*, 2007; Nuwamanya, *et al.*, 2011). In the present study, swelling power increased with temperature increases from 50 to 80°C due to the possibilities of interactions between starch and other components at this temperature

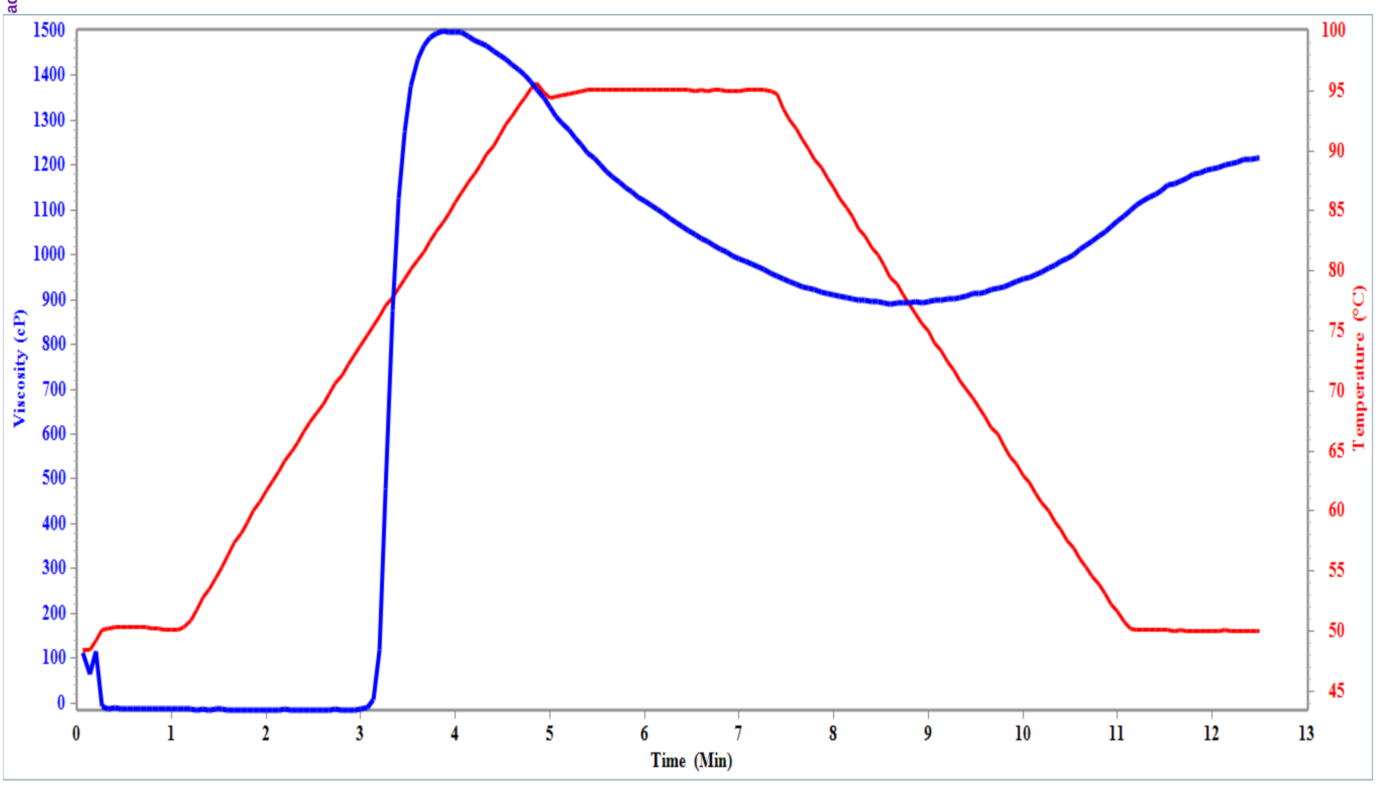

Fig. 3. Pasting profiles of cassava landrace, *Ullii chigappan* (CL1)

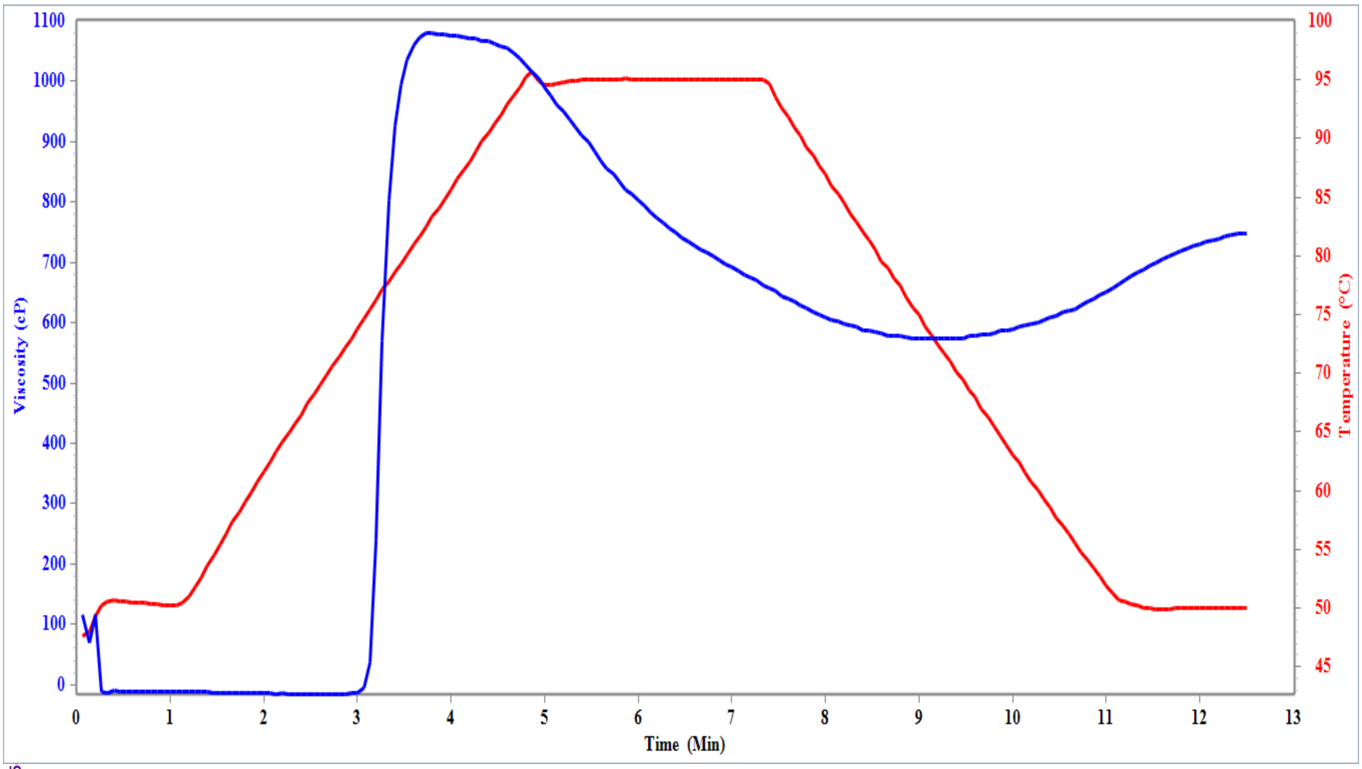

Fig. 4. Pasting profile of cassava landrace, *Azhakappapuram local* (CL38)

as reported earlier by Zuluaga, *et al.,* 2007 and Nuwamanya, *et al*., 2011. Swelling may be attributed to the disruption and uptake of water by starch granules at higher temperatures (Charles, *et al*., 2007). Three landraces *viz., Aana Karialai, Ottai Moodu* and *Olly Marungu* showed higher swelling power (>18 g/g) than other cassava varieties. The result shown in this study is indicating that starch swelling is a function of increase in temperature as supported by the report of Oludare and Macdonald, 2010. The high swelling power is an indicator of high digestibility and the landrace *Olly marungu* had high SP with high amylose and starch content of 28.4 and 35.28 per cent respectively. These landrace may be good donors for evolving cultivars suitable for food industries and various dietary applications.

Pasting properties of cassava flour:

Viscosity parameters are important in the characterisation of starch and the differences observed in this study provides an opportunity for selection of cultivars for the use of industrial and food applications. There were significant ($P < 0.05$) variations in all the pasting properties among the varieties analysed (Table 2). Peak viscosity indicates the water-binding capacity of the starch. It is often correlated with the final product quality and also provides an indication of the viscous load likely to be encountered during mixing. The increase in viscosity during cooling is known as setback viscosity. Setback has been correlated with texture of various products. Final viscosity is the most commonly used parameters to define a particular sample's quality, as it indicates the ability of the material to form a viscous paste or gel after cooking and cooling as well the resistance of the paste to shear force during stirring. The value of peak viscosity ranged from 583 to 1500 cP; breakdown viscosity from 13 to 609 cP; coolpaste viscosity from 692 to 1395 cP and setback viscosity ranged from 164 to 450 cP (Fig. 3 and 4). The time to reach peak viscosity and pasting temperature ranged from 3.60 to 7.00 min and 71.02–85.70^{0}C respectively. The landraces *Azhakappapuram local* and *Laxhmi Vellai* had low cool paste viscosity of 748 cP and 799 cP as compared to the peak viscosity of 1081 cP and 1065 cP respectively indicate the low tendency to retrograde (Cameron, *et al*., 2007). The average peak time (4.6 min) and pasting temperature (75.1^{0}C) of flours were higher than earlier reports in cassava by Zaidul, *et al*., 2007 and Maziya-Dixon, *et al*., 2007. The lower viscosities recorded in this study might not be unconnected with the fact that we used flour while the latter worked on starch. The landraces which possessed high peak and low setback viscosities form paste much easier than others and can be used in food and other applications. PV showed significant positive relationship with BDV (r = 0.533, P d” 0.01), HPV (r= 0.613, P d” 0.01), CPV (r= 0.615, P d” 0.01) and SBV (r= 0.559, P d” 0.01) as pointed by Kaur, *et al*., 2007 and Nuwamanya, *et al*., 2010 (Table 3). The above results are indicative of the wide genetic variations existing in the cassava genotypes analysed and hence, the flour from the various genotypes will find wide applications for household and industrial uses.

The research demonstrates the effect on different properties of flours from various landraces of cassava collected in different locations of southern region of western Ghats. The study has shown that wide genotypic variations exist in proximate composition and pasting properties of cassava landraces. The two landraces *Krialai Porian* (Tall) and *Yeathan Chivalai* identified for low amylose and high clarity can be used in paper and textile industries. The landrace *Mantharampudur local* possessed low moisture, high amylose and starch can be good source in food industries. The landrace *Olly marungu* showed high swelling power with good amylose and starch can be utilized for food related applications especially for production of resistant starch. Study revealed evaluation of proximate composition and functional properties of cassava flour will establish wider areas of human and industrial uses as well as development of new products from the flour. Furthermore, the elite landraces identified in this study can be utilized as donors in crossing programme for evolving varieties/hybrids with food and industrial applications.

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