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Correlation of seed quality traits with 100 seed weight in chickpea (*Cicer arietinum* L.) genotypes

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Abstract
The present studies were conducted to the estimation of correlation for physical and chemical quality traits in chickpea (*Cicer arietinum* L.) for seventy genotypes with 100 seed weight. Most of the physical quality viz., hydration capacity, swelling capacity and swelling index are generally positively correlated among themselves and with 100-seed weight. Hydration capacity was positively correlated with hydration index, swelling caacity and cooking time. Seed volume, swelling capacity are important traits for the consumers, particularly when whole grains are consumed after soaking and cooking. The negative correlation between protein content and 100-seed weight; positive correlation between seed weight and sugars including RFOs indicate that bolder seed types are greater in causing flatulence while the smaller to medium size one had greater protein per cent

Keywords: chickpea, correlation, physico-chemical traits, RFOs

Introduction
Chickpea (*Cicer arietinum* L.) is the world's third most important food legume cultivated in Indian subcontinent, West Asia, the Mediterranean, North Africa and the America. India contributes the major share of about 65% global chickpea area and 68% global production. In India, it is grown in 9.21 million hectare area with a production and productivity of 5.3 million tons and 995 kg/ha, respectively (Kumar *et al*., 2017) [1]. Chickpea is widely consumed as a supplement in protein, making it a well-balanced human food. 100 seed weight is of primary importance and the most complex trait as it is dependent upon the interaction of growth, environment and genetic makeup of the plant. Genotypic and phenotypic correlations are of value to indicate the degree to which various quantitative and qualitative traits of the plant are associated with economic productivity. Correlation study thus provides information on correlate response of important plant traits and therefore leads to a directional model for yield response in terms of 100 seed weight. However, present study was initiated with the prime objective of observing the mutual relationships of different physico-chemical and quality traits and extent of their contribution to 100 seed weight of chickpea. The studies thus clearly envisage augmenting the relatively scarce information available on these characters which may be profitably exploited in future breeding programmes of chickpea improvement. Therefore, it is imperative to assess the genetic interrelationship of the traits with 100seed weight.

Materials and methods
Seventy chickpea genotypes were evaluated in randomized block design with three replications at Division of Genetics, Indian Agricultural Research Institute, New Delhi under normal sowing condition during winter season. For 100-seed weight, three random samples of 100-seeds each were weighed from each replication and the average weight was recorded. Three composite samples were drawn randomly from each plot for recording observations on different traits viz., sphericity, hydration capacity, hydration index, swelling capacity, swelling index, cooking time, sucrose, raffinose, stachyose, total sugars and protein content.

Seed hydration capacity (g/seed) was calculated as percentage using the formula:
$HC = (W_f – W_0)/50$

Where, W_f is the weight of 50 seed soaked for 16 h and W_0 is the weight of 50 seed before

soaking. Seed hydration index was computed as the ratio between hydration capacity and seed weight and estimated according to equation:
HI = hydration capacity/seed weight.

Seed swelling capacity (ml/seed) was determined using the formula:
$SC = (V_f – V_0)/50$

Where, V_f is the volume of 50 seed after 16 h soaking and V_0 is the volume of 50 seed before soaking.
For seed volume, 50 seeds were taken in a 250 mL graduated cylinder and 25 mL of deionised water was put in it and volume of seed was found by Seed volume = total volume-25/50. Seed swelling index was measured as ratio between swelling capacity and seed volume and estimated according to equation:
Swelling index= swelling capacity/seed volume.
Raffinose, stachyose, Sucrose and Total sugar were estimated by HPLC chromatograms. Protein content was estimated through non-destructive method by NIR-instrument "Infratec TM 1241 grain analyser" of FOSS. For 100-seed weight, three random samples of 100-seeds each were weighed from each replication and the average weight was recorded in grams.

Statistical analysis
The data were used for working out of correlation coefficient with R studio software.

Result and discussion
The chickpea genotypes studied in the present investigation consisting of both kabuli and desi types have large variation for seed size (100-seed weight ranging from 13.84 to 52.64) (Table1). The consumers' preference for seed size is different for these two types because of variation in the uses. Globally, the desi and the kabuli types account for about 80% and 20% of the chickpea production, respectively. The bulk of chickpea consumption is in the form of splits (*dal*) and flour (*besan*) and these are primarily made from desi type. For this reason, small to medium seed size (16 to 24 g 100-seed^{-1}) is preferred in the desi type. There is very little demand for large-seeded desi chickpea. On the other hand, large seed size (30 to 60 g 100-seed^{-1}) is preferred in the kabuli types which are largely used as whole grains in salads, vegetable curries and other preparations. In general, the large-seeded kabuli chickpeas fetch higher price than the small and medium-seeded kabuli chickpeas and the price premium increases as the seed size increases (Gaur *et al*., 2007). However there had been no in depth studies on the correlation patterns of the physio-chemical and quality parameters viz. hydration capacity, hydration index, swelling capacity, swelling index, raffinose, stachyose, ciceritol, sucrose, total sugar and protein with 100 seed weight. Land races have been reported to be valuable sources for many traits including drought (Tapan *et al* 2015) [12]. Significant and positive correlation was found between 100-seed weight and hydration capacity, swelling capacity in both *desi* and *kabuli* chickpeas. Negative correlation with RFOs (raffinose, ciceritol and stachyose) and protein content was also confirmed. Hydration index had significantly positive association with RFOs in case of *desi* genotypes.
Most of the physical quality viz., hydration capacity, swelling capacity and swelling index are positively correlated among themselves and with 100-seed weight. Hydration capacity was positively correlated with hydration index, swelling capacity and cooking time. Hydration index was positively correlated with swelling capacity and swelling index. These traits were also positively correlated with sucrose and total sugar also with 100-seed weights while they had a negative correlation with secondary sugar like raffinose, stachyose and also with protein content.
From the present investigation, a strong correlation between seed size with hydration capacity and swelling capacity was observed. The physico-chemical characters like water absorbing capacity of the seed was reported to be determined by cell wall structure, composition and compactness of the cells (Muller, 1967) [9]. It may also be related to increased permeability and softer seed coat. Seed size (100-seed weight) showed significant positive correlation with hydration capacity, hydration index, swelling capacity and seed volume in both the types of chickpea. Most of the earlier studies have reported positive relationship between seed weight and hydration capacity (Williams *et al*., 1983; Gil *et al*., 1996; Oberoi *et al*., 2010; Iqbal *et al*., 2006; Khattak *et al*., 2006; Bibi *et al*., 2007; Özer *et al*., 2010; Malik *et al*., 2010) [13, 3, 5, 4, 6, 10, 11, 8]. There are also reports on positive correlation of seed weight with swelling capacity (Gil *et al*., 1996; Oberoi *et al*., 2010; Malik *et al*., 2010) [8]. Williams *et al*. (1983) [3, 13, 5] suggested that the mechanism of water absorption was only slightly related to seed size, and more closely associated with permeability and water absorption by starch and seed coat components. Ozer *et al*. (2010) found that fiber content was negatively correlated with hydration capacity and swelling capacity. In chickpea, fiber is located in the seed coat, and the desi type has more fiber than the kabuli type. Gil *et al*. (1996) [3] reported that the significant negative correlation between fiber content and hydration capacity might be attributable to a seed coat barrier effect, as a thicker seed coat is correlated with higher fiber content, and also lower hydration capacity.
Seed volume, swelling capacity are important traits for the consumers, particularly when whole grains are consumed after soaking and cooking. Also in flour preparation, the blanching process for removal of seed coat would take longer with varieties having tighter seed coat with greater time for hydration capacity. From the present investigation, it can be inferred that large seeded chickpea genotypes were easier to hydrate compared to their smaller seeded counterpart. The negative correlation between protein content and 100-seed weight; positive correlation between seed weight and sugars including RFOs indicate that bolder seed types are greater in causing flatulence while the smaller to medium size one had greater protein per cent.

Table 1: Genotypes and their parentage used for studying the correlation of physico-chemical and quality traits with 100 seed weight

Sl.no.	Genotypes	Parentage	Seed type
1	ILC 72	INIA	*Kabuli*
2	ILC 195	Vysokoroshyj 30	*Kabuli*
3	ILC 464	ACC no 26595-68	*Kabuli*
4	ILC 482	International Legume Chickpea Line 482	*Kabuli*
5	ILC 484	ACC no 26783-68	*Kabuli*
6	ILC 1929	Syrian local	*Kabuli*

7	ILC 2555	ICC 7589	*Kabuli*
8	ILC 3279	Stepnoj 1	*Kabuli*
9	FLIP 81-71C	X79 TH151/ILC 72 x ILC 897	*Kabuli*
10	FLIP 81-293 C	X79 TH293/ILC 191 x ILC 496	*Kabuli*
11	FLIP 82-150 C	X79TH101/ILC 523 X ILC 183	*Kabuli*
12	FLIP 83-7C	X80 TH264/(ILC 480 x ILC 72) x ILC 263	*Kabuli*
13	FLIP 84-48C	X81 TH55/ILC 1920 x ILC 2956	*Kabuli*
14	FLIP 84-79C	X80 TH176/ILC 72 x ILC 215	*Kabuli*
15	FLIP 84-92 C	X80 TH176/ILC 72 x ILC 215	*Kabuli*
16	FLIP 84-182 C	X80 TH176/ILC 72 x ILC 215	*Kabuli*
17	FLIP 84-188C	X81 TH48/ILC 1920 x ILC 201	*Kabuli*
18	FLIP 85-1C	X82 TH60/ILC 95 x ILC 2956	*Kabuli*
19	FLIP 85-17C	X83 TH19/FLIP82-65C x FLIP82-69C	*Kabuli*
20	FLIP 86-5C	X81 TH199(ILC 202(WH) x ILC 3355	*Kabuli*
21	FLIP 86-6C	X81 TH203(ILC 3279(WH) x ILC 3355	*Kabuli*
22	FLIP 87-8C	X85 TH246/ILC 3398 x FLIP 83-13C	*Kabuli*
23	FLIP 87-45 C	X80 TH176/ILC 72 x ILC 215	*Kabuli*
24	FLIP 88-85 C	X85 TH143/ILC 629 x FLIP 82-144C	*Kabuli*
25	FLIP 90-96 C	X87TH26/ILC 5342xFLIP 84-93C	*Kabuli*
26	FLIP 90-166	Food Legume Improvement Programme Line 166	*Kabuli*
27	FLIP 91-77 C	X89TH7/ ILC 1254 X FLIP 82-150C	*Kabuli*
28	FLIP 93-58 C	X90TH294/ (ILC 5342 X FLIP 84-78C)XILC 1272	*Kabuli*
29	FLIP 93-93	X89TH258/ (FLIP 85-122CXFLIP 82-150C)XFLIP 86-77C	*Kabuli*
30	FLIP 93-146 C	X89TH49/ ILC 4297 X FLIP 84-102C	*Kabuli*
31	FLIP 97-137C	X94TH12/FLIP90-132CXS91347	*Kabuli*
32	FLIP 97-263C	X94TH71/FLIP87-59CXUC 15	*Kabuli*
33	FLIP 97-266C	X94TH75/FLIP87-58CXUC 15	*Kabuli*
34	FLIP 97-281C	X94TH75/FLIP87-58CXUC 15	*Kabuli*
35	FLIP 97-503C	X94TH8/FLIP86-6CXFLIP90-109C	*Kabuli*
36	FLIP 97-530C	X94TH103/(FLIP91-186CXFLIP91-96C)XFLIP90-109C	*Kabuli*
37	FLIP 97-677 C	X94TH12/FLIP90-132CXS91347	*Kabuli*
38	FLIP 97-706C	X94TH114/(FLIP91-138CXFLIP85-60C)XFLIP91-133C	*Kabuli*
39	FLIP 98-121C	X95TH 42 /(FLIP90-15CXILC5362)XFLIP93-2C	*Kabuli*
40	Pusa 1053	ICCV 3 x Flip 88-120	*Kabuli*
41	Pusa 5023	(Flip 90-166 x BG 1072)x(BG 1082 x BG 1073)	*Kabuli*
42	Pusa 2024	(BG 261 x ICC 88503) x (GL 920 x BG 1003)	*Kabuli*
43	Pusa 1088	(Pusa 256 x ICCV 32) x ICCV 32	*Kabuli*
44	Pusa 1108	(BG 315 x ILC 72) x (ICC 13 x Flip) x (ICCV 32 x Surutoto 77)	*Kabuli*
45	PG 0515	Kabuli extra-large seeded local selection material from Rahuri, Maharastra	*Kabuli*
46	FLIP 90-166	Kabuli extra-large seeded breeding line from ICARDA	*Kabuli*
47	Pusa 1105	(C 104 x BG 1003) x (ICC 88503 x BG 1048)	*Kabuli*
48	Pusa 1003	ICCV 32 x Rabat	*Kabuli*
49	Elixir	Advance Breeding line	*Kabuli*
50	Pusa 391	ICC 3935 x Pusa 256	*Desi*
51	Pusa 372	P1231 x P1265	*Desi*
52	Pusa 362	(BG 203 x P 179) x BC 203	*Desi*
53	Pusa 256	(JG62x 850-3/27) x (L550 x H 208)	*Desi*
54	Pusa 72	(Pusa 256 x E 100 YM) x Pusa 256	*Desi*
55	Pusa 1103	(Pusa256 x *C.reticulatum*) x Pusa 362	*Desi*
56	BGD 112	(BG 209 x GL 84038) x Pusa 212	*Desi*
57	SBD 377	ICCV 88109 x PRR 1) x ICC 4958	*Desi*
58	Pusa 5028	(SBD 377x Pusa 362) x (SBD 377x BGD 72)	*Desi*
59	ICCV 00104	JG 74 x ICCL 83105	*Desi*
60	ICCV 03102	(ICCV 92014 x JG 23) x BG 1032	*Desi*
61	ICCV 03103	(ICCV 92014 x JG 23) x BG 1032	*Desi*
62	ICCV 03210	(ICCV 92014 x JG 23) x BG 1032	*Desi*
63	ICCV 03211	(ICCV 92014 x JG 23) x BG 1032	*Desi*
64	ICCV 04110	(ICCV 89224 x JG 11) x BG 390	*Desi*
65	ICCV 04111	(ICCV 93001 x JAKI 9218) x BG 256	*Desi*
66	ICCV 05112	ICCV 2 x PDG 84-16	*Desi*
67	ICCV 06108	ICCV 2 x PDG 84-16	*Desi*
68	ICCV 06109	ICC 4958 x ICCV 97303	*Desi*
69	ICCV 97022	ICCL 84226 x ICCL 86103	*Desi*
70	ICCV 97114	ICCV 10 x K 850	*Desi*

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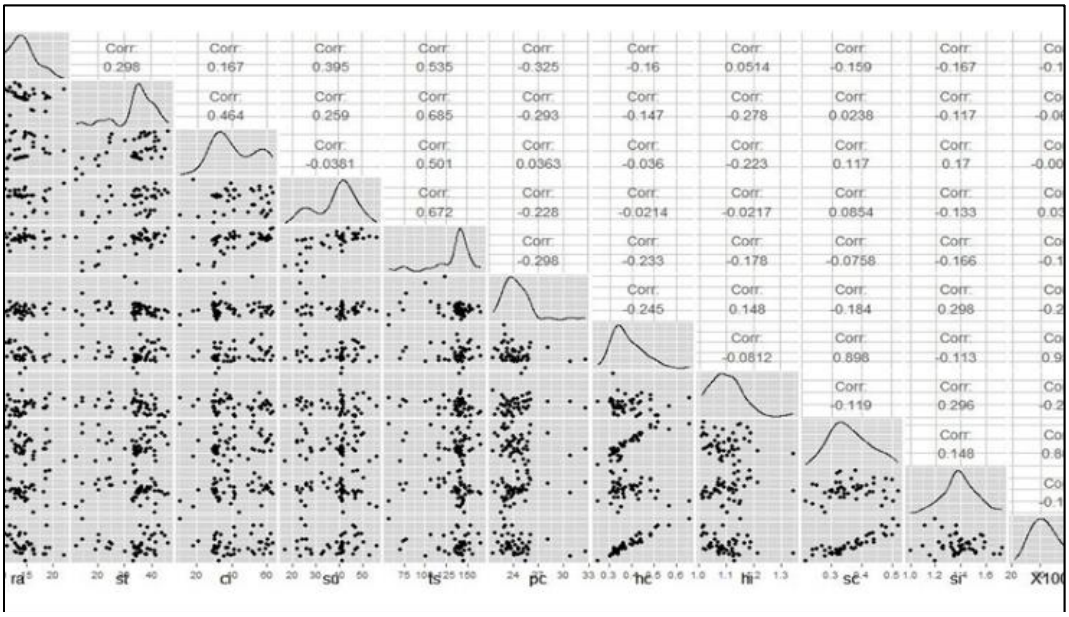

Fig 1: Correlation coefficients of different physico-chemical quality traits in *desi* chickpea genotypes.
ra- raffinose; st- stachyose; ci- ciceritol; su- sucrose; ts- total sugar; pc- protein content; hc- hydration capacity; hi- hydration index; sc- swelling capacity; si- swelling index

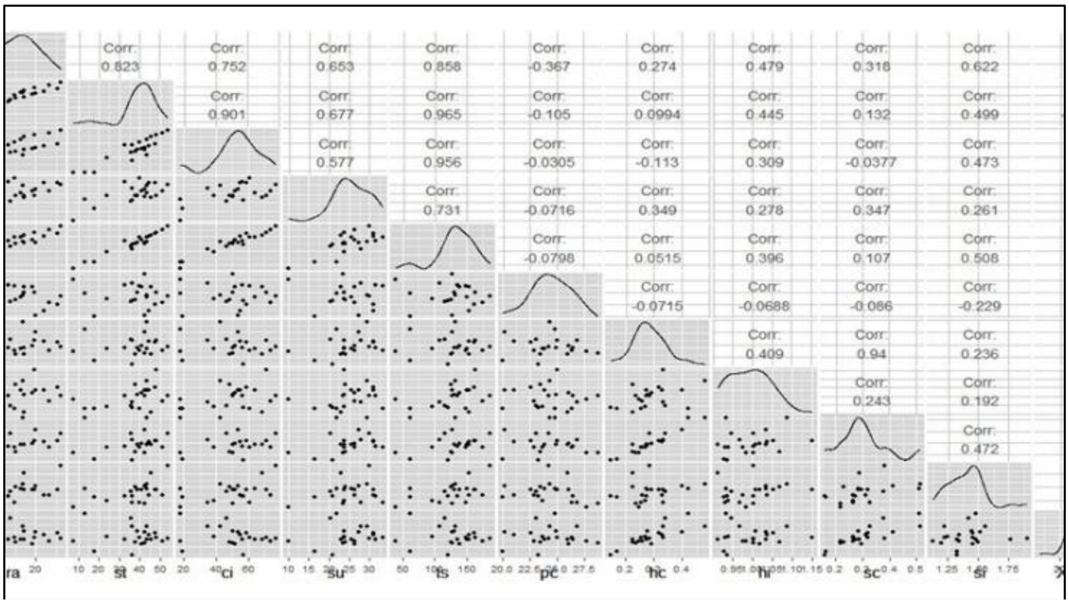

Fig 2: Correlation coefficients of different physico-chemical quality traits in *kabuli* chickpea genotypes
ra- raffinose; st- stachyose; ci- ciceritol; su- sucrose; ts- total sugar; pc- protein content; hc- hydration capacity; hi- hydration index; sc- swelling capacity; si- swelling index

Table 2: Mean values of physico-chemical and quality traits of *Desi* chickpea genotypes

Genotypes	ra	st	ci	su	ts	pc	Hc	hi	sc	si	100sw
Pusa 391	9.550	42.653	50.590	23.387	126.517	28.717	0.234	1.004	0.216	1.200	21.960
Pusa 372	7.697	36.443	56.970	20.967	121.303	23.237	0.145	0.939	0.160	1.330	13.840
Pusa 362	14.730	39.730	61.110	33.237	148.943	26.320	0.255	0.932	0.264	1.220	26.060
Pusa 256	13.283	32.653	56.400	31.400	134.607	26.493	0.273	1.004	0.272	1.330	24.980
Pusa 72	9.733	24.017	38.910	23.793	96.047	23.643	0.268	0.941	0.264	1.245	26.600
Pusa 1103	2.940	7.437	18.050	9.997	38.617	27.683	0.248	0.985	0.216	1.125	23.480
BGD 112	8.747	17.883	18.810	16.607	61.837	20.033	0.169	0.931	0.164	1.323	16.700
SBD 377	8.660	13.210	18.020	21.897	62.277	24.833	0.420	0.935	0.510	1.478	42.540
Pusa 5028	8.420	36.070	34.880	27.763	107.809	26.853	0.331	0.969	0.328	1.224	33.300
ICCV 00104	19.633	48.237	71.230	23.717	162.980	25.033	0.333	1.151	0.320	1.455	25.800
ICCV 03102	26.043	53.957	76.930	29.870	186.540	24.233	0.283	1.003	0.380	1.900	25.227
ICCV 03103	16.987	45.370	68.430	22.870	154.020	26.000	0.226	0.914	0.289	1.763	24.907
ICCV 03210	23.143	51.240	74.130	26.233	175.257	22.900	0.256	0.977	0.264	1.347	23.740
ICCV 03211	16.207	43.243	64.230	25.428	149.358	23.900	0.271	1.035	0.284	1.479	24.453
ICCV 04110	15.007	37.693	48.400	23.860	125.290	23.500	0.224	1.069	0.228	1.500	22.673
ICCV 04111	19.097	40.853	51.800	26.260	137.917	26.067	0.293	1.020	0.296	1.451	21.833

ICCV 05112	21.997	44.540	55.200	30.830	153.007	21.067	0.328	1.038	0.312	1.345	27.613
ICCV 06108	25.343	47.497	58.600	30.893	162.307	22.567	0.318	1.053	0.320	1.455	29.133
ICCV 06109	16.920	43.450	42.780	29.370	132.637	24.367	0.480	1.087	0.512	1.561	33.707
ICCV 97022	13.767	35.533	46.700	20.507	116.310	23.067	0.338	0.948	0.376	1.424	39.120
ICCV 97114	17.083	38.703	50.100	23.677	130.027	24.867	0.276	1.010	0.284	1.449	30.107
ICCV 10107	19.827	42.330	53.500	27.340	127.700	20.233	0.397	1.035	0.412	1.515	29.440
Mean	334.814	822.742	1115.770	549.903	2811.307	535.613	6.366	21.980	6.671	31.119	587.213
Std.dev.	6.036	11.703	16.586	5.186	36.138	2.211	0.075	0.058	0.090	0.175	6.343

Table 3: Mean values of physico-chemical and quality traits of *Kabuli* chickpea genotypes

Genotypes	ra	st	ci	su	ts	pc	Hc	hi	sc	si	100sw
ILC 72	18.220	38.110	41.220	39.200	156.220	24.133	0.340	1.073	0.324	1.350	25.867
ILC 195	18.763	33.670	37.660	46.110	139.230	24.533	0.307	1.146	0.328	1.708	25.980
ILC 464	11.707	20.603	33.400	41.327	107.210	26.133	0.486	1.143	0.500	1.563	40.493
ILC 482	16.210	41.120	44.220	42.000	146.220	22.533	0.339	1.105	0.280	1.000	29.050
ILC 484	19.400	34.280	36.280	48.120	141.280	25.733	0.371	1.186	0.380	1.727	31.307
ILC 1929	22.233	41.560	39.260	53.150	144.750	24.133	0.306	1.148	0.240	1.154	25.733
ILC 2555	18.760	23.407	37.410	36.383	116.247	24.567	0.350	1.075	0.368	1.586	31.280
ILC 3279	11.067	12.230	18.240	56.230	142.110	23.633	0.351	1.085	0.270	1.102	32.510
FLIP 81-71C	16.337	24.623	49.320	26.417	116.927	25.267	0.348	1.079	0.252	1.467	30.367
FLIP 81-293 C	12.700	36.210	29.220	42.120	136.230	25.233	0.339	1.123	0.324	1.397	28.193
FLIP 82-150 C	12.900	35.900	29.560	41.890	137.120	24.133	0.328	1.074	0.304	1.357	27.893
FLIP 83-7C	10.303	41.070	61.800	28.520	141.710	22.800	0.314	1.094	0.316	1.519	26.867
FLIP 84-48C	12.203	39.093	60.600	24.497	136.157	24.800	0.398	1.059	0.388	1.406	37.020
FLIP 84-79C	14.693	38.460	59.400	22.507	135.350	23.700	0.370	1.093	0.372	1.431	30.127
FLIP 84-92 C	13.120	35.590	29.900	41.660	138.010	25.633	0.362	1.067	0.344	1.387	32.438
FLIP 84-182 C	13.330	35.280	30.240	41.430	138.900	23.400	0.362	1.048	0.344	1.323	31.893
FLIP84-188C	16.417	37.690	58.200	28.253	140.967	24.600	0.314	1.111	0.304	1.382	26.300
FLIP 85-1C	18.950	35.957	57.000	25.870	138.403	23.033	0.569	1.087	0.468	1.114	47.647
FLIP 85-17C	10.173	24.680	55.800	50.743	141.437	25.933	0.443	1.190	0.440	1.594	34.900
FLIP 86-5C	10.670	40.960	51.280	48.287	151.550	23.433	0.487	1.059	0.476	1.368	41.180
FLIP 86-6C	11.287	40.137	30.070	40.897	123.087	22.633	0.487	1.180	0.480	1.579	40.207
FLIP 87-8C	12.647	38.510	40.960	47.163	139.443	22.923	0.509	1.013	0.480	1.250	46.100
FLIP 87-45 C	13.540	34.970	30.580	41.200	139.790	23.800	0.359	1.124	0.344	1.410	30.307
FLIP 88-85 C	13.750	34.660	30.920	40.970	140.680	25.000	0.314	1.347	0.296	1.370	27.227
FLIP 90-96 C	13.960	34.350	31.260	40.740	141.570	23.100	0.341	1.018	0.328	1.262	30.447
FLIP 90-166	8.910	20.473	21.030	22.500	73.943	24.067	0.407	1.138	0.384	1.391	35.900
FLIP 91-77 C	14.170	34.040	31.600	40.510	142.460	21.600	0.339	1.216	0.316	1.520	26.727
FLIP 93-58 C	14.380	33.730	31.940	40.850	143.350	23.733	0.319	1.040	0.296	1.254	31.173
FLIP 93-93	14.590	33.420	32.280	41.080	144.240	22.633	0.366	1.038	0.344	1.265	32.253
FLIP 93-146 C	14.800	33.110	32.620	41.310	145.130	25.433	0.246	1.128	0.216	1.200	21.127
FLIP 97-137C	14.740	37.480	62.020	49.570	163.987	25.033	0.438	1.028	0.428	1.354	41.247
FLIP 97-263C	15.467	36.263	60.820	35.207	147.837	24.233	0.405	1.111	0.396	1.414	33.320
FLIP 97-266C	15.893	25.230	59.620	41.547	142.487	23.333	0.396	1.133	0.388	1.470	33.593
FLIP 97-281C	9.537	41.600	56.780	39.103	147.243	22.233	0.414	1.070	0.416	1.465	35.480
FLIP 97-503C	11.730	42.530	52.260	46.417	153.287	23.933	0.515	1.017	0.520	1.368	47.327
FLIP 97-530C	13.627	43.817	31.050	42.980	132.203	21.767	0.434	1.019	0.436	1.363	42.273
FLIP 97-677 C	15.010	32.800	32.960	41.540	146.020	23.333	0.431	1.111	0.384	1.231	35.073
FLIP 97-706C	13.613	44.760	41.940	46.983	147.413	24.067	0.420	1.010	0.416	1.317	39.820
FLIP98-121C	12.730	46.097	63.000	44.070	166.277	23.567	0.364	1.043	0.356	1.328	34.467
Pusa 1053	7.550	30.350	51.570	33.530	123.210	32.637	0.321	1.071	0.328	1.519	28.480
Pusa 5023	6.810	14.577	30.360	26.193	78.293	28.207	0.439	1.125	0.440	1.507	37.160
Pusa 2024	7.130	39.503	41.250	28.180	116.323	23.157	0.320	1.025	0.332	1.431	29.600
Pusa 1088	4.357	19.503	29.680	16.970	70.263	25.857	0.338	1.086	0.240	1.491	29.540
Pusa 1108	14.433	35.500	55.640	46.943	153.050	24.617	0.329	1.078	0.316	1.339	29.567
PG 0515	8.457	14.487	10.630	24.240	57.290	22.867	0.658	1.153	0.504	1.200	52.640
Pusa 1105	9.567	33.420	52.700	32.970	128.390	25.737	0.315	1.131	0.320	1.667	26.460
Pusa 1003	7.540	34.423	35.260	23.733	101.160	30.897	0.303	1.127	0.280	1.346	24.800
Elixir	10.220	36.120	38.770	41.770	152.110	25.133	0.426	1.167	0.400	1.449	34.247
Mean	628.601	1616.353	1979.580	1843.880	6406.564	1172.893	18.437	52.792	17.406	66.695	1593.607
Std.dev.	3.633	8.013	13.112	9.074	23.006	1.990	0.077	0.062	0.075	0.151	6.663

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