

Figure S1. Weather parameters recorded during winter-season of the year 2018-19 at ICAR-IIVR, Varanasi, India.

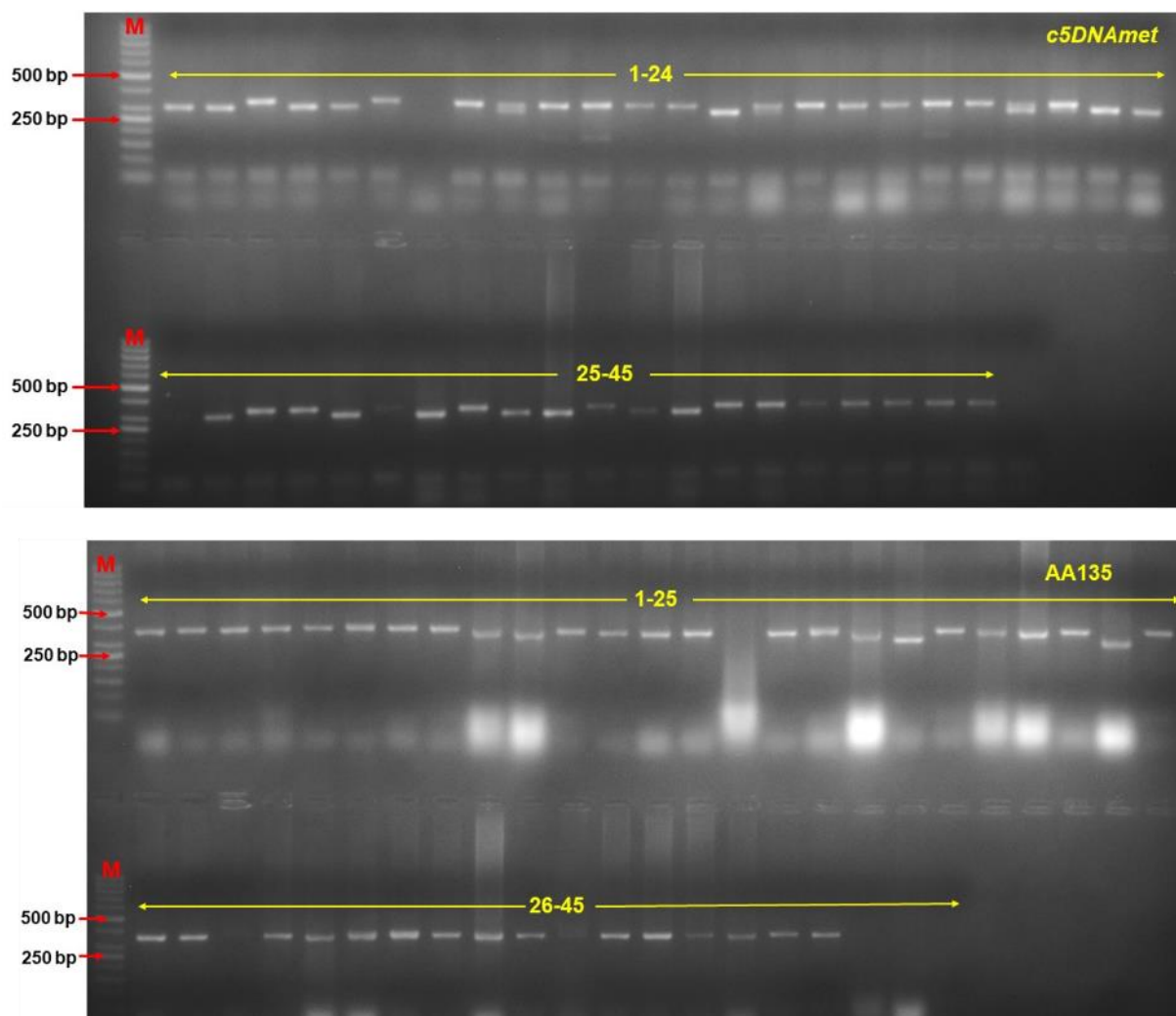


Figure S2. Amplification profile of the 45 peas genotypes, with markers c5DNAmet and AA135. M: 100 bp DNA ladder (Invitrogen, USA)

Table S1. Morphological description of the green-pea genotypes for plant, flower and seed characters along with other genotype specific traits of breeder interest

S. no.	Genotype ^[a]	Pedigree	Biological status	Traits ^[b]								
				FC	MG	PH	PN/A	Leaflets	PAP	SS	MSC ^[c]	Specific trait ^[d]
1	Kashi Ageti ¹	PM-5 × MG	Cultivar	White	Early	Short	Double	Present	Absent	Wrinkled	GGG195B	VT, E, HY,
2	Arkel ²	Introduced from England	Cultivar	White	Extra Early	Short	Double	Present	Absent	Wrinkled	GGG194B	VT, E
3	Lincoln ²	Introduced from USA	Cultivar	White	Mid	Medium	Double	Present	Absent	Round	GOG164C	VT
4	Kashi Nandini ¹	P 1542 × VT-2-1	Cultivar	White	Extra Early	Short	Double	Present	Absent	Dented	GGG194B	VT, E
5	Kashi Udai ¹	Arkel × FC-1	Cultivar	White	Extra Early	Short	Double	Present	Absent	Dented	GGG194B	VT, E
6	Kashi Shakti ¹	Hara Bona × NDVP-8	Cultivar	White	Mid	Short	Double	Present	Absent	Dented	GGG195A	VT
7	AP-3 ³	Azad P-1 × Arkel	Cultivar	White	Early	Medium	Double	Present	Absent	Wrinkled	GGG194A	VT, E, HY
8	Bonneville ²	Introduced from USA	Cultivar	White	Mid	Medium	Double	Present	Absent	Dented	GG138B	VT
9	VRPE-16 ¹	Azad P-5 or KS-225 × Ageta	Advance breeding line	White	Early	Short	Double	Present	Absent	Wrinkled	GGG194A	VT, E
10	Kashi Mukti ¹	Cross No. 7 × PM-5	Cultivar	White	Extra Early	Short	Double	Present	Absent	Wrinkled	GGG194A	VT, E
11	PC-531 ⁴	Introduced	Cultivar	White	Mid	Short	Double	Present	Absent	Wrinkled	GGG195B	VT, HSP, HAA, HY
12	Pusa Pragati ²	Unknown	Cultivar	White	Mid	Long	Double	Present	Absent	Wrinkled	GGG194C	VT
13	VRPM-903 ¹	VL-8 × PC-531	Advance breeding line	White	Mid	Medium	Double	Present	Absent	Wrinkled	GGG195B	VT, MF
14	Kashmiria ¹	Local selection	Germplasm	Purple	Early	Medium	Double	Present	Present	Round	GGG193A	PT
15	Pant Uphar ⁵	Unknown	Cultivar	White	Mid	Short	Double	Present	Absent	Round	GGG193A	VT
16	Mithi Phali ⁴	C-53744 (Oregon sugar pod)	Cultivar	White	Mid	Medium	Double	Present	Absent	Wrinkled	GGG193B	VT, E _d P
17	NDVP-250 ⁶	Unknown	Cultivar	White	Mid	Short	Double	Absent	Absent	Wrinkled	GYG161C	VT, <i>afila</i> , PMR
18	VRP-386 ¹	1/1-141 × RP-3	Germplasm	White	Mid	Medium	Double	Present	Absent	Dented	GBGN199B	VT
19	VRP-147 ¹	JP-83 × NDVP-8	Advance breeding line	White	Mid	Short	Double	Present	Absent	Wrinkled	GYG161C	VT, MDR, HAA

20	VRPE-105 ¹	Pusa Prageti × VRP-5	Advance breeding line	White	Mid	Short	Double	Present	Absent	Dented	GG138C	VT, E
21	VRPD-2 ¹	MG× JP-19	Advance breeding line	White	Mid	Medium	Double	Present	Absent	Round	GGG195B	VT, EaP, PMR
22	VRPD-3 ¹	MG× JP-19	Advance breeding line	White	Mid	Medium	Double	Present	Absent	Round	GGG195A	VT, EaP, PMR
23	Arka Sampoorna ⁷	(Bonneville × IIHR 209) × Freezer 656 × Oregon Sugar).	Cultivar	White	Mid	Medium	Double	Present	Absent	Round	OG27D	VT, EaP
24	Kashi Samridhi ¹	FC-1 × PM-5	Cultivar	White	Late	Medium	Double	Present	Absent	Round	YGG145D	VT, PMR
25	VRP-500 ¹	VRP-5 × PC-531	Advance breeding line	White	Mid	Long	Multiple	Present	Absent	Dented	GG139D	VT, MF
26	VRPM-501 ¹	PC-531 × PP	Advance breeding line	White	Mid	Short	Multiple	Present	Absent	Wrinkled	GG138D	VT, MF
27	VRPM-502 ¹	VRP-186 × VRP-500	Advance breeding line	White	Mid	Short	Multiple	Present	Absent	Wrinkled	GG139D	VT, MF
28	VRPM-503 ¹	Arkel × AP-3	Advance breeding line	White	Mid	Short	Multiple	Present	Absent	Wrinkled	GG139D	MF
29	VRPM-901 ¹	VL-8 × PC-531	Advance breeding line	White	Mid	Long	Multiple	Present	Absent	Wrinkled	YGG150D	VT, MF
30	Solan Nirog ⁸	Unknown	Cultivar	White	Mid	Long	Double	Present	Absent	Round	YGG148D	VT, PMR
31	VRP-343 ¹	EC-90898×26	Germplasm	White	Mid	Short	Double	Present	Absent	Round	GYG162C	VT, MDR
32	HUDP-15 ⁹	PG 3 (PG 3 × S-143) FC1	Cultivar	White	Late	Long	Double	Absent	Absent	Round	OG27C	PT, PMR
33	EC865921 ⁹	Exotic collection	Germplasm	Pink	Late	Medium	Multiple	Absent	Present	Round	GBG199D	PT, MF, <i>afila</i>
34	EC865925 ⁹	Exotic collection	Germplasm	Pink	Late	Long	Double	Absent	Present	Round	GRG179C	PT, <i>afila</i>
35	EC865943 ⁹	Exotic collection	Germplasm	Pink	Late	Long	Double	Absent	Present	Round	GRG179D	PT, <i>afila</i> ,
36	EC865944 ⁹	Exotic collection	Germplasm	Purple	Late	Long	Multiple	Absent	Present	Dented	RG179D	PT, MF, <i>afila</i> , PMR
37	EC866019 ⁹	Exotic collection	Germplasm	Pink	Late	Long	Double	Absent	Present	Round	GOG173B	PT, <i>afila</i>
38	Arka Karthik ⁷	(Arka Ajit× IIHR 554)	Cultivar	White	Mid	Medium	Double	Present	Absent	Dented	GGG193A	VT, PMR
39	Arka Ajit ⁷	(Bonneville × IIHR 209) × Freezer 656)	Cultivar	White	Mid	Long	Double	Present	Absent	Wrinkled	GGG195C	VT, PMR
40	Kashi Samrath ¹	VL-3 × Arkel	Cultivar	White	Late	Long	Double	Present	Absent	Wrinkled	YWG158A	VT, PMR
41	IC-208366 ¹⁰	Unknown	Germplasm	White	Late	Medium	Double	Absent	Absent	Round	GYG161C	VT, PMR

42	IC-296678 ¹⁰	Unknown	Germplasm	White	Late	Long	Double	Absent	Absent	Round	OWG159A	VT, PMR
43	VRPSel-17 ¹	Unknown	Germplasm	White	Mid	Long	Single	Present	Absent	Round	GYG161C	PT, 1F, HAA, PMR, RR
43	EC-44485 ¹⁰	Unknown	Germplasm	White	Late	Long	Double	Present	Absent	Round	GOG174D	VT
45	VRPE-101 ¹	Harbhajan × NDVP-8	Advance breeding line	White	Extra Early	Short	Double	Present	Absent	Wrinkled	GGG194B	VT, E, TSS

^[a] Source: ¹ ICAR-IIVR, Varanasi. ² ICAR-IARI, New Delhi. ³ CSAUA&T, Kanpur. ⁴ PAU, Ludhiana. ⁵ GBPUAT, Pantnagar. ⁶ NDUAT, Ayodhya. ⁷ ICAR-IIHR Bangalore. ⁸ UHF, Solan. ⁹ BHU, Varanasi. ¹⁰ NBPGR, New Delhi.

^[b] FC: flower colour. MG: maturity group. MSC: mature seed colour. PAP: plant anthocyanin pigmentation. PH: plant height. PN/A: pod number/axil. SS: seed shape. Characterization for FC, MG and PH followed DUS descriptors of PPV & FRA (2007). MSC using RHS colour chart (1986) while SS from Tzitzikas et al. (2006).

^[c] GGG: Greyed Green Group. GOG: Green Orange Group. GYG: Greyed Yellow Group. OWG: Orange White Group. YWG: Yellow White Group.

^[d] 1F: single flowered. E: earliness. EaP: edible podded. HAA: high antioxidant compounds. HSP: high shelling percentage. HY: high yield. MF: multi-flowered. PMR: powdery mildew resistance. PT: pulse type. RR: rust resistance. VT: vegetable type.

Table S2. Detail of primers used for molecular characterization of the 45 pea genotypes

Marker	Forward primer sequence	Reverse primer sequence	LG	Reference
AA135	CCGTTACACATCATTAAGATG	TCCATATCCAGATTAGTCAGA	VII	Ahmad et al., 2015
AA163.2	TAGTTTCCAATTCAATCGACCA	AGTGTATTGTAAATGCACAAGGG	V	Ahmad et al., 2015
AA205	TACGCAATCATAGAGTTTGGAA	AATCAAGTCAATGAAACAAGCA	II	Tar'an et al., 2005
AA339	GTGTAGAAGTATTTACTTGATG	CATCTATTGAAGGAAAATTAT	VII	Ahmad et al., 2015
AA491	GAGGTGGTGTGAATTTGTG	CCTAATTTTACCCCTCTCTCTCT	III	Ahmad et al., 2015
AB140	CCAGATTCATGAAGGGCATAACA	GATGAAATTTTCGTTTCTCTCTGTCTC	III	Ahmad et al., 2015
AB40	AAATAGACCCTTGTGTAGAAGC	GGAAAAGTGGGTTTTGAA	II	Ahmad et al., 2015
AD147	AGCCCAAGTTTCTTCTGAATCC	AAATTCGCAGAGCGTTTGTAC	I	Ahmad et al., 2015
AD270	CTCATCTGATGCGTTGGATTAG	AGGTTGGATTTGTTGTTTGTG	III	Ahmad et al., 2015
AD56	GAAACATTGGTTGAAGAGCGAG	GTTGTCGCGTGAACACAAGTAA	VII	Ahmad et al., 2015
AD61	CTCATTCAATGATGATAATCCTA	ATGAGGTAATCGACGATGCCTT	III	Ahmad et al., 2015
AD73	CAGCTGGATTCAATCATTGGTG	ATGAGTAATCCGACGATGCCTT	III	Ahmad et al., 2015
AnMtL6	CAAGAGTACAAGATTACAACCTTGACC	CTTTGGAATATCTACTGCTTCGCC	III	Ellwood et al., 2008; Jain et al., 2015
C-20BF	GAGTTCCTCCGTAATAGAAGGCT	CACTCTGTTCTGCTTCATCATC	I	Prakash et al., 2015
c5DNAmet	TTCTTACTGTTCGTGAATGCGCC	GCCCTAATCCTCTAATTGGCGCTC	VI	Suli et al., 2015
Fw_Trap_220	GCCAATAGATTCTTCTTCCACTAT	GAGGATGCTACTGGTTTAGTCTTT	III	Kwon et al., 2012
Fw_Trap_340	GAGTTTTGGGTTGTGAGGATTT	ATCTACACTCACAATCCCTCTCCT	III	Kwon et al., 2012
Mt5_056	TTTGCACTGTGTTGTTGTTGGGGG	CTTGGTAGCATAGAGCCTGAGTCGG	III	Jain et al., 2015
P1188	CTCTCCCTTTTCATTCCAT	TTTCGCTTGTCTCCTTGT	-	Gong et al., 2010
P248	GAGCAGCATTTTGTGGA	CTGGAGGAGGCTTTCATT	-	Gong et al., 2010
P636	ATGAAGCACATGAAAAAT	TGGTGAGGAGGAAACTAT	-	Gong et al., 2010
P66	GCCGAGGTACAAAAGAAGT	CTGGAAACCAAGAAAAGTG	-	Gong et al., 2010
PEA120	TCGTCACCGATTTCAGTTC	ACGGAGGAGCGATAGGAT	-	Xu et al., 2012; Nisar et al., 2017
PEA132	GACACTGCTCCTCCACGAA	CCCTGCCGCATGTACCTTA	-	Xu et al., 2012; Nisar et al., 2017

PSAC75	CGCTCACCAAATGTAGATGATAA	TCATGCATCAATGAAAGTGATAAA	V, VI,1	Prakash et al., 2015; Singh et al., 2021
Psat8487	TGTTTCCAGAAGGTTATGGCCC	AGATTCTTCGTTGCCTTTGCTTTGA	-	Nisar et al., 2017
PSGAPA1	GACATTGTTGCCAATAACTGG	GGTTCTGTTCTCAATACAAG	V	Ahmad et al., 2015
PSMPA6	CTTAAGAGAGATTAATGGACAA	CCAACTCATAATAAAGATTCAAA	VI	Tar'an et al., 2005; Kwon et al., 2012
PSMPD23	ATGGTTGTCCCAGGATAGATAA	GAAAACATTGGAGAGTGGAGTA	-	Tar'an et al., 2005; Singh et al., 2021
PSMPSA9	GTGCAGAAGCATTGTTCAGAT	CCCACATATATTTGGTTGGTCA	VI	Tar'an et al., 2005; Kwon et al., 2012
PSMPSAD51	ATGAAGTAGGCATAGCGAAGAT	GATTAAATAAAGTTCGATGGCG	VI	Ek et al., 2006

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Table S3. Analysis of variance and descriptive statistics for nine horticultural traits

Traits	Mean square			Mean	SD	CV	Minimum value	Maximum value
	Replications	Genotypes	Error					
	2	44	88					
10 Pod-weight (10-PW; g)	39.09	463.55**	12.03	59.7	12.7	5.8	34.0	93.0
100-Green seed weight (100-GSW; g)	6.70	111.50**	13.54	46.6	6.8	7.9	25.0	64.0
Days to 50% flowering (DTF; No)	36.05	675.03**	6.53	60.0	15.1	4.3	30.0	86.0
Plant height (PH; cm)	6.96	2228.37**	17.58	71.9	27.3	5.8	32.0	170.4
Pod length (PL; cm)	0.07	1.56**	0.14	7.6	0.8	5.0	5.9	9.8
Pods per plant (PPP; No.)	5.88	84.39**	2.32	11.9	5.4	12.8	4.2	28.0
Pod width (PW; cm)	0.01	0.09**	0.01	1.3	0.2	6.7	1.0	1.9
Pod yield per plant (YPP; g)	927.65	2429.91**	71.77	62.1	29.3	13.7	15.0	180.0
Seeds per pod (SPP; No)	0.24	3.46**	0.20	6.8	1.1	6.6	4.3	9.8

**Significant at $p=0.01$

Table S4. Mean performance of genotypes for nine different horticultural traits

S. no.	Genotype	DTF	PH	PL	PW	PPP	10-PW	SPP	100-GSW	YPP
1	Kashi Ageti	40.0	38.0	8.5	1.4	6.2	74.3	8.3	52.0	39.0
2	Arkel	34.0	34.0	7.5	1.4	4.4	62.0	7.1	50.0	22.3
3	Lincoln	57.7	64.3	7.0	1.2	6.0	57.3	6.9	52.3	30.3
4	Kashi Nandini	32.0	33.7	8.2	1.4	5.5	72.3	7.4	56.0	36.0
5	Kashi Udai	33.3	36.0	7.8	1.3	5.6	74.3	7.3	52.0	36.7
6	Kashi Shakti	62.7	58.0	8.0	1.2	7.4	72.0	8.2	48.3	46.0
7	AP-3	41.0	79.7	8.4	1.4	8.0	70.7	8.8	57.3	52.7
8	Bonneville	60.3	73.3	7.6	1.3	7.8	64.3	7.1	48.0	45.0
9	VRPE-16	40.0	40.3	7.3	1.2	5.9	60.0	7.0	47.3	31.0
10	Kashi Mukti	35.0	37.7	7.6	1.4	6.1	66.3	7.6	55.0	36.0
11	PC-531	56.0	58.0	8.3	1.1	11.5	73.7	9.2	48.0	77.7
12	Pusa Pragati	62.0	100.0	7.0	1.2	14.7	57.7	7.3	50.0	80.0
13	VRPM-903	56.3	60.7	8.2	1.4	13.6	75.3	8.5	50.0	96.7
14	Kashmiria	49.0	76.7	7.2	1.1	15.3	58.3	5.3	45.2	83.3
15	Pant Uphar	59.3	56.7	7.2	1.3	6.4	57.7	5.5	44.3	31.7
16	Mithi Phali	66.7	79.7	6.9	1.6	10.4	50.0	5.4	43.0	46.3
17	NDVP-250	53.3	50.0	7.0	1.2	11.1	55.3	6.5	47.3	55.0
18	VRP-386	61.0	61.0	6.9	1.3	15.8	54.7	7.3	44.0	81.7
19	VRP-147	63.3	47.0	7.6	1.3	12.1	57.7	6.8	46.0	62.7
20	VRPE-105	56.3	50.0	8.7	1.5	16.4	67.3	8.5	50.0	101.3
21	VRPD-2	54.0	71.3	9.2	1.8	11.3	88.3	7.6	55.0	91.7
22	VRPD-3	58.7	76.7	9.0	1.8	12.4	90.3	7.4	51.7	101.0
23	Arka Sampoorna	52.0	70.7	6.5	1.6	7.8	49.0	5.0	40.0	33.3
24	Kashi Samridhi	76.3	74.3	7.2	1.3	12.2	49.7	6.3	44.0	53.3
25	VRP-500	58.3	86.7	7.4	1.1	22.6	52.7	6.0	46.0	108.3
26	VRPM-501	60.0	52.3	8.7	1.4	12.4	73.7	8.5	57.0	81.7
27	VRPM-502	63.7	54.7	7.5	1.2	9.0	62.7	6.1	40.0	49.3
28	VRPM-503	57.0	56.0	7.3	1.2	8.1	65.3	5.9	53.0	45.7
29	VRPM-901	55.0	101.8	8.1	1.2	26.3	72.7	6.8	47.7	165.0
30	Solan Nirog	64.3	92.3	7.8	1.2	11.7	49.3	5.8	42.0	50.0
31	VRP-343	60.7	50.3	7.8	1.3	15.5	61.3	6.3	48.0	83.3
32	HUDP-15	85.3	91.7	6.6	1.2	14.3	47.7	4.9	45.0	61.3
33	EC865921	81.3	76.0	6.9	1.4	20.3	38.3	6.5	38.0	69.3
34	EC865925	80.0	94.0	6.8	1.5	24.2	40.7	5.7	39.3	86.7
35	EC865943	81.0	90.3	7.5	1.3	12.8	44.0	6.2	45.0	48.0
36	EC865944	80.0	88.0	7.5	1.3	22.8	48.3	6.5	42.0	100.7
37	EC866019	85.0	89.3	6.9	1.3	16.6	46.7	6.4	44.0	72.7
38	Arka Karthik	63.0	74.7	6.6	1.1	9.1	55.7	7.1	42.0	42.7
39	Arka Ajit	65.7	133.3	8.5	1.2	14.2	65.0	5.7	46.0	81.7
40	Kashi Samrath	79.0	117.3	8.1	1.2	13.1	46.3	6.5	40.0	53.3
41	IC-208366	78.0	65.0	7.3	1.1	7.3	59.3	6.7	44.0	34.0
42	IC-296678	80.7	94.3	6.1	1.0	8.7	43.7	6.1	37.3	31.0
43	VRPSel-17	50.0	170.2	6.3	1.0	14.9	35.0	5.0	26.7	50.0
44	EC-44485	78.7	84.0	7.3	1.3	7.2	53.3	7.0	41.3	34.0
45	VRPE-101	34.3	44.0	7.6	1.4	11.4	65.7	8.1	55.7	73.3

10-PW: 10-pod weight (g). 100-GSW: 100-green seed weight (g). DTF: days to 50% flowering. PH: plant height (cm). PL: pod length (cm). PPP: pods per plant (No). PW: pod width (cm). SPP: seeds per pod (No). YPP: yield per plant (g).

Table S5. Simple correlation matrix for nine horticultural traits

Traits	PL	PW	PPP	10-PW	SSP	PH	100-GSW	YPP
DTF	-0.329*	-0.173	0.432**	-0.564**	-0.400**	0.497**	-0.564**	0.132
PL		0.455**	-0.041	0.812**	0.638**	-0.256	0.647**	0.369*
PW			-0.034	0.416**	0.231	-0.291	0.392**	0.155
PPP				-0.295*	-0.213	0.483**	-0.312*	0.842**
10-PW					0.677**	-0.493**	0.788**	0.235
SPP						-0.490**	0.660**	0.136
PH							-0.633**	0.255
100-GSW								0.097

1 **Table S6.** Eigenvalues and proportion of variance and traits that contributed to two principal
 2 components (PCs).

Component	Initial eigenvalues			Contribution of traits ^[a]	PC1	PC2
	Total	% of Variance	Cumulative %			
1	4.226	46.958	46.958	DTF	-0.68	0.27
2	2.156	23.961	70.919	PH	-0.70	0.37
3	0.817	9.082	80.000	PL	0.77	0.44
4	0.584	6.489	86.489	PW	0.50	0.25
5	0.547	6.082	92.571	PPP	-0.42	0.85
6	0.307	3.414	95.986	10-PW	0.91	0.18
7	0.207	2.298	98.284	SSP	0.78	0.13
8	0.141	1.571	99.855	100-GSW	0.90	0.04
9	0.013	0.145	100.000	YPP	0.04	0.96

3 ^[a] 10-PW:10-pod weight (g). 100-GSW: 100-green seed weight (g). DTF: days to 50% flowering (No).
 4 PH: plant height (cm). PL: pod length (cm). PPP: pods per plant (No). PW: pod width (cm). SPP: seeds
 5 per pod (No). YPP: yield per plant (g).

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