Data in Brief 38 (2021) 107417

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Data on agronomic traits, biochemical composition of lipids, proteins and polysaccharides and rheological measurement in a brown mustard seed collection

Sophie Le Gall[a,b,*], Véronique Sole-Jamault[a], Marine Nars-Chasseray[c], Aude Le Goff[a], Lucie Le Bot[a,b], Thierry Guinet[c], Christelle Renaud[d], Jérôme Gervais[e], Stéphane Bansard[a,b], Laure Ohleyer[e], Sylvain Jeandroz[c,f]

[a] *INRAE, UR BIA, Nantes F-44316, France*
[b] *INRAE, BIBS facility, PROBE infrastructure, Nantes F-44316, France*
[c] *AgroSup Dijon, 26 boulevard du Docteur Petitjean, Dijon 21000, France*
[d] *Unilever – AMB, France*
[e] *Chambre agriculture Côte-D'Or, CS 70074, Bretenière F-21110, France*
[f] *Agroécologie, AgroSup Dijon, CNRS, INRAE, University Bourgogne Franche-Comté, Dijon F-21000, France*

ARTICLE INFO

Article history:
Received 14 September 2021
Accepted 20 September 2021
Available online 24 September 2021

Keywords:
Mustard seed
Agronomic traits
Biochemical composition
Microsatellite genotyping
Pedoclimatic variation
Technological quality trait

ABSTRACT

The data were collected from a brown mustard seeds collection of 18 accessions during two years and in three distinct sites of production in France. The 18 accessions of mustard seeds were selected to be representative of genetic, agronomical and technological variabilities. All accessions were produced in the "*Bourgogne*" area. This article describes agronomical data (PMG, yield), genotyping data, global composition of mustard seeds (lipids, proteins and polysaccharides) and fine composition of the previous macronutrients potentially involved in the technological properties (fatty acids, storage proteins and osidic composition of polysaccharides). Additional data regarding the potential rheological property of each accessions were also reported. These data can be reused by food industries, breeders and geneticists in order to understand pedoclimatic effects (year and location) and

* Corresponding author at: INRAE, UR BIA, Nantes F-44316, France.
E-mail address: sophie.le-gall@inrae.fr (S. Le Gall).

https://doi.org/10.1016/j.dib.2021.107417

the relation between mustard seed composition and the end-uses properties (paste mustard quality).

Specifications Table

Subject	Agricultural and Biological Sciences
Specific subject area	Food Science
Type of data	Tables Figures
How data were acquired	Genotyping: DNA extraction followed by PCR analysis (2720 Thermal Cycler, Applied Biosystems) using 14 microsatellites markers. Total lipids, proteins and fatty acid composition: Near Infra-Red Spectroscopy (NIR-6500 analysis system SYS II, FOSS©, calibration software: WINISI V4.10.0. 15326; acquisition software: ISISCAN version 2.85). Storage protein composition: Solid-liquid extraction with salt buffer followed by gel filtration chromatography analysis (Superdex 75 Increase, GE Healthcare). Polysaccharide composition: alcohol extraction followed by acid hydrolysis. Alditol acetate derivatization and gas chromatography analysis (TRACE GC ULTRA™, THERMO) for neutral sugars & colorimetric measurement for acidic sugars. Rheological data: seed grinding and soaking in a verjuice-like solution and rheological measurement using a Botswick consistometer (24cm, ENDECOTTS). Granulometry measurement: seed grinding followed by laser diffraction particle size Analyzer LA-960 HORIBA
Data format	Raw data Analyzed data
Parameters for data collection	Eighteen accessions of mustard seeds were grown in the French area "Bourgogne" in three different locations: Fauverney (47°15′20.14″ N and 5°09′20.34″ E, clay loam soil), Châlon-sur-Saône (46°43′59.07″ N and 4°46′14.20″ E, white silt/sandy soil) and Barges (47°12′49.47″ N and 5°01′52.46″ E, clay loam soil) for two years in the Fauverney plot (2017 & 2018).
Description of data collection	The biochemical composition of 18 mustard seeds accessions has been determined, considering the lipid, protein and cell wall polysaccharide content, the main fatty acids content, the storage protein content and the osidic composition of cell wall polysaccharides. Genotyping using chosen microsatellites markers and agronomical traits such as yield and 1000-grain weight were also reported. The rheological properties of each accessions were measured using Bostwick consistometer. The particle size distribution after seed milling were acquired by laser diffraction particle size analyzer.
Data source location	Biopolymers-Interaction-Assemblies (BIA) research unit from French National Research Institute for Agriculture, Food and the Environment (INRAE), FRANCE
Data accessibility	Data describes in this paper are accessible in the INRAE Dataverse repository and accessible as 3 Excel files. Repository name: Dataverse INRAE Data identification number: https://doi.org/10.15454/YJ33JC
Related research article	None

Value of the Data

- The data are useful to compare the environmental and the year effects on the biochemical composition of mustard seeds, since the accessions were grown in three distinct locations and under two years.
- Data provided in this article can be used by food industries, breeders and geneticists in order to understand the relation between mustard seed composition and the end-uses properties (paste mustard quality).
- These data provide a complete biochemical description of brown seed mustard and can allow new understandings towards macro constituent's relationship.
- These data increase the existing knowledge regarding brown seed mustard.

1. Data Description

This article provides 8 tables and 2 figures of the raw and analyzed data [6] corresponding to genotyping, agronomic traits, physico-chemical characterizations of mustard seed accessions (18 genotypes) grown under three different locations and for two years.

Table 1 provides averaged values of agronomics traits, *i.e.* yields (Qx/Ha) and 1000-grain weight (g). Table 2 provides genotyping data using the 20 microsatellite markers identified and selected [1–3] and allowing the characterization of the genetic diversity of the mustard seed collection and the selection of the 18 genotypes. The genetic diversity of the initial mustard seed collection (40 genotypes) was represented by the Neighbor Joining method (Fig. 1). Table 3 provides content of dry matters (% of seed weight), amounts of sinigrin (µmol/g DM) and total amounts of lipids and proteins. Tables 4–6 provides respectively amounts of fatty acids, storage proteins and cell wall polysaccharides. Table 7 provides rheological behaviour of each genotype subjected to coarse gridding and soaking in a verjuice-like buffer and Table 8 provides granulometric data after coarse gridding performed before rheological measurements. For each trait, the values provided correspond to the mean calculated for the 18 genotypes, three plots and 2 years of harvest in one plot, *i.e.* 72 independent values. For biochemical and rheological measurement, the values provided correspond to 2 or 3 replicates per genotype.

These data will be comprehensively discussed in a scientific article.

2. Experimental Design, Materials and Methods

2.1. Raw materials and agronomical traits

Eighteen accessions of mustard seeds were grown in the French area "Bourgogne" in three different locations: Fauverney (47°15′20.14″ N and 5°09′20.34″ E, clay loam soil), Châlon-sur-Saône (46°43′59.07″ N and 4°46′14.20″ E, white silt/sandy soil) and Barges (47°12′49.47″ N and 5°01′52.46″ E, clay loam soil) for two years in the Fauverney plot (2017 & 2018). The mustard seeds were sown using an experimental seeder (Hege) on 6 plots (20 m^2 per plot) and harvested at crop maturity using an experimental harvester (Aldrup). Samples were cleaned to remove broken seeds, dust and other undesirable matter before yield and 1000-grain weight (Contador, Pfeuffer) measurements.

3. Genotyping

3.1. DNA extraction

Genomic DNA was extracted as follow Punches of 8 mm diameter from young leaves were crushed, in 1.5 mL tubes, in 150 µL of an extraction buffer (EDTA 25 mM, Tris-HCl 200 mM,

Table 1
Agronomic traits (yield and 1000-grain weight) of the seed mustard collection grown in three locations (Ch: Châlon-sur-Saône; Bg: Barges; Fv: Fauverney) and two years (2017 & 2018).

Year	location	Name	Yield [Qtx/Ha]	1000-grain weight [g]	Year	location	Name	Yield [Qtx/Ha]	1000-grain weight [g]
2018	Ch	Brown	15.4	2.8	2018	Fv	Brown	19.2	2.5
2018	Ch	BZ7/3	18.1	2.6	2018	Fv	BZ7/3	24.3	3.0
2018	Ch	CA119/3	19.3	3.1	2018	Fv	CA119/3	25.0	3.0
2018	Ch	CA98/1	18.5	2.8	2018	Fv	CA98/1	24.1	3.3
2018	Ch	CH25/1	20.2	2.5	2018	Fv	CH25/1	23.5	2.8
2018	Ch	CH7/1	19.5	2.5	2018	Fv	CH7/1	21.1	2.7
2018	Ch	CI114/2	26.9	3.0	2018	Fv	CI114/2	32.4	2.9
2018	Ch	CI2/3	22.4	2.6	2018	Fv	CI2/3	20.6	2.9
2018	Ch	CJ35/2	23.0	2.8	2018	Fv	CJ35/2	23.7	3.0
2018	Ch	CK17/1	18.6	2.6	2018	Fv	CK17/1	26.0	2.5
2018	Ch	DA1/2	22.0	2.8	2018	Fv	DA1/2	24.5	3.3
2018	Ch	DD84/3	21.1	2.8	2018	Fv	DD84/3	27.0	2.8
2018	Ch	DN107/1	23.9	2.7	2018	Fv	DN107/1	23.7	2.7
2018	Ch	DN76/3	21.1	2.8	2018	Fv	DN76/3	21.3	3.0
2018	Ch	DP32/1	20.2	2.7	2018	Fv	DP32/1	21.1	2.8
2018	Ch	DW7/1	23.1	2.4	2018	Fv	DW7/1	24.4	2.6
2018	Ch	Espérance	17.2	3.1	2018	Fv	Espérance	20.2	3.1
2018	Ch	Etamine	23.6	2.5	2018	Fv	Etamine	27.5	2.6
2018	Bg	Brown	17.9	2.7	2017	Fv	Brown	24.0	2.3
2018	Bg	BZ7/3	24.5	2.9	2017	Fv	BZ7/3	23.0	3.0
2018	Bg	CA119/3	27.0	3.1	2017	Fv	CA119/3	22.8	3.0
2018	Bg	CA98/1	25.2	3.0	2017	Fv	CA98/1	26.1	3.3
2018	Bg	CH25/1	22.7	2.6	2017	Fv	CH25/1	28.5	2.9
2018	Bg	CH7/1	20.1	2.5	2017	Fv	CH7/1	24.6	2.5
2018	Bg	CI114/2	30.2	3.0	2017	Fv	CI114/2	27.1	2.9
2018	Bg	CI2/3	21.5	2.7	2017	Fv	CI2/3	26.7	2.9
2018	Bg	CJ35/2	24.2	2.8	2017	Fv	CJ35/2	25.0	3.2
2018	Bg	CK17/1	26.1	2.4	2017	Fv	CK17/1	21.6	2.5
2018	Bg	DA1/2	22.4	2.9	2017	Fv	DA1/2	28.7	3.1
2018	Bg	DD84/3	25.3	2.8	2017	Fv	DD84/3	23.7	2.7
2018	Bg	DN107/1	25.9	2.6	2017	Fv	DN107/1	25.7	2.8
2018	Bg	DN76/3	23.6	2.8	2017	Fv	DN76/3	24.5	3.0
2018	Bg	DP32/1	22.2	2.7	2017	Fv	DP32/1	23.2	2.8
2018	Bg	DW7/1	24.3	2.3	2017	Fv	DW7/1	26.9	2.7
2018	Bg	Espérance	23.6	3.0	2017	Fv	Espérance	15.9	3.0
2018	Bg	Etamine	28.4	2.7	2017	Fv	Etamine	23.3	2.6

NaCl 250 mM, SDS 0.5%, pH8). The contents were centrifuged at 13,000g for 5 min. The supernatant was transferred to a fresh tube and warmed 10 min at 95 °C, and then, centrifuged again at 13,000 g for 5 min. The supernatant was transferred in a fresh tube and diluted in UHQ water to get a final concentration of 10 ng/µL. Total genomic DNA concentration and nucleic acids/proteins ratio were estimated by using an Eppendorf 6131 biophotometer.

3.2. PCR assay and capillary electrophoresis

Twenty microsatellites markers (SSR) were chosen [1–3] (Table 2).

DNA extract (5 µL of 10 ng/µL) from each plant was added to 20 µL of a master mix [2.5 µL 10x reaction buffer (NEB), 0.5 µL 25 mM dNTPs (NEB), 0.5 µL 10 mM Primer 1, 0.5 µL 10 mM Primer 2, 0.15 µL 5 U/µL Taq DNA polymerase (NEB) and 15.85 µL UHQ water] . Forward primers are 6-FAM-labeled at the 5′ end. PCRs were conducted with a 2720 Thermal Cycler (Applied Biosystems) with the following program: one cycle of 5 min at 95°C, 35 cycles of 30 s at 95°C, 30 s at 52 °C, 1 min at 68 °C and a final extension step of 10 min at 68 °C. PCR products were screened by capillary electrophoresis using the ABI 3730 XL (Applied Biosystems) of the

Table 2
Description of the primers of the microsatellite markers used in the genetic diversity study.

SSR name	Forward Primer (5′-3′)	Reverse Primer (5′-3′)	References, *Code**	*Number of different amplified fragments*
SSR_Bj_1	CCGTTGGGCCATTTGATGTC	TCACACGCTCCACTGTTACC	Singh et al., 2016, *BjSSR-133*	*2*
SSR_Bj_2	CTCGGCTCGAACTCCGTC	CAAACGTGCTGAGAAACGCA	Singh et al., 2016, *BjSSR-1645*	*0*
SSR_Bj_3	CGGTCGGAACCCTCTTGATT	AGCCCTTCCGATCTCCTCTT	Singh et al., 2016, *BjSSR-1938*	*5*
SSR_Bj_4	ACTCTCCGGATGGGAAAAGC	AGAAGGAAGCAAAGCTGAGACT	Singh et al., 2016, *BjSSR-2242*	*0*
SSR_Bj_5	GCTTCTAGTTCCATTCGCTGC	CCGCTGCAGCCATTTTTCTT	Singh et al., 2016, *BjSSR-2349*	*3*
SSR_Bj_6	GCATGAGCTTATTTTTCTTTTGATGA	TGGGCTTCTCGTTCCAGTTC	Singh et al., 2016, *BjSSR-2490*	*3*
SSR_Bj_7	TGGAGGCACTTCTTCAGCTG	TGCCGCTCTTTCATCGTGAG	Singh et al., 2016, *BjSSR-278*	*1*
SSR_Bj_8	CGTCGATAGCTTCCTCCACC	CTCCCGTGGTCTCTTGTTCC	Singh et al., 2016, *BjSSR-578*	*2*
SSR_Bj_9	CCGGTTTGTTCCTCTCTCCC	TCTCCCCTTTGCTCACACAC	Singh et al. 2016, *BjSSR-678*	*0*
SSR_Bj_10	GTCTTTCTTCCTGTGCGACC	AGTCAGCTTTCTTCGTGGGA	Chen et al., 2013, *sN9875*	*3*
SSR_Bj_11	AAGGAGCAAACACAAGCGAT	GCACAAGCACTCTACGGTGA	Chen et al., 2013, *sN2025*	*3*
SSR_Bj_12	TTCTTGGTGTGTCCTGCAAA	GAGCTATGGCAATCCTCCTG	Chen et al., 2013, *sR12156*	*7*
SSR_Bj_13	CAGATGAGACAACACAGGAAACA	ACTCAATACGTTTTTCGCGG	Chen et al., 2013, *sS1702*	*0*
SSR_Bj_14	AATTAAGGGACCACGCAACA	CCAGAACCCTCTTGATTCACTT	Chen et al., 2013, *sS2066*	*0*
SSR_Bj_15	CTAAGAAGGAACCGGGAAGG	AACCGGAATCAGAACACACA	Chen et al., 2013, *sN3514F*	*0*
SSR_Bj_16	CAGCTGGTTATCCTCGGTTT	CCTCAGGTGGACAGAGAAGC	Chen et al., 2013, *sR9477*	*6*
SSR_Bj_17	CATGGTTAAAACAATGGCCC	CAAGAAACACCATCATTTCTCA	Chen et al., 2013, *Na10-A08*	*0*
SSR_Bj_18	AAGGAGATTGTTTTTGGGGC	AAGACTAATAAACACACGGCG	Sudan and Khajuria, 2016, *BniB.Ni2-B01.1*	*1*
SSR_Bj_19	TTATCTGCTTGTCTTGGGGC	AAGGAAATCGTCTCACTTGG	Sudan and Khajuria, 2016, *BniB.Ni2-E12.5*	*4*
SSR_Bj_20	CACAGGAAACCGTGGCTAGA	AACCCAACCTCAACGTCTTG	Sudan and Khajuria, 2016, *SSRRa3-D02B*	*0*

Table 3
Average values of dry matter (DM), sinigrin, total lipids (Oil) and proteins (Prot) measured using NIR spectroscopy.

Year	Location	Name	Dry matter [% seed weight]	Sinigrin [µmol/g DM]	Oil.NIRS ([% DM]	PROT.NIRS [% DM]	Year	Location	Name	Dry matter [% seed weight]	Sinigrin [µmol/g DM]	Oil.NIRS ([% DM]	PROT.NIRS [% DM]
2018	Ch	Brown	94.6	109.8	36.1	27.8	2018	Fv	Brown	93.9	104.3	35.5	28.0
2018	Ch	BZ7/3	94.3	100.5	36.6	28.3	2018	Fv	BZ7/3	93.6	107.0	36.0	28.3
2018	Ch	CA119/3	94.3	103.6	34.7	28.9	2018	Fv	CA119/3	93.6	104.1	35.9	28.6
2018	Ch	CA98/1	94.4	127.0	35.2	29.7	2018	Fv	CA98/1	93.5	120.0	36.4	29.0
2018	Ch	CH25/1	94.8	90.8	42.7	24.5	2018	Fv	CH25/1	94.5	96.2	42.4	24.5
2018	Ch	CH7/1	94.4	105.4	41.1	23.8	2018	Fv	CH7/1	94.0	108.8	41.2	24.0
2018	Ch	CI114/2	94.4	103.5	39.9	24.5	2018	Fv	CI114/2	93.9	100.0	39.0	25.0
2018	Ch	CI2/3	94.8	94.4	43.2	24.5	2018	Fv	CI2/3	94.1	98.7	40.1	25.4
2018	Ch	CJ35/2	94.2	111.6	36.4	26.7	2018	Fv	CJ35/2	93.7	113.0	36.2	27.4
2018	Ch	CK17/1	94.8	94.0	37.0	25.8	2018	Fv	CK17/1	94.0	93.9	37.1	25.8
2018	Ch	DA1/2	94.8	79.6	37.2	24.3	2018	Fv	DA1/2	94.1	80.0	39.2	23.7
2018	Ch	DD84/3	94.6	110.8	36.6	28.0	2018	Fv	DD84/3	93.8	115.1	35.7	28.9
2018	Ch	DN107/1	94.1	99.3	36.3	24.9	2018	Fv	DN107/1	93.8	97.3	36.4	24.8
2018	Ch	DN76/3	94.6	85.5	37.8	22.6	2018	Fv	DN76/3	94.1	84.1	37.9	22.7
2018	Ch	DP32/1	94.9	83.0	40.9	25.2	2018	Fv	DP32/1	94.2	88.8	38.9	26.3
2018	Ch	DW7/1	94.9	105.2	39.1	25.3	2018	Fv	DW7/1	94.3	109.4	38.1	26.2
2018	Ch	Espérance	94.5	106.5	35.3	27.3	2018	Fv	Espérance	93.9	105.9	37.0	26.7
2018	Ch	Etamine	94.4	102.4	37.8	25.3	2018	Fv	Etamine	93.9	101.1	37.4	26.1
2018	Bg	Brown	94.0	103.1	37.2	26.9	2017	Fv	Brown	94.7	112.3	38.2	27.7
2018	Bg	BZ7/3	94.2	100.6	39.3	25.2	2017	Fv	BZ7/3	94.3	102.3	40.1	26.2
2018	Bg	CA119/3	93.9	103.5	36.3	27.8	2017	Fv	CA119/3	94.4	107.5	38.7	27.5
2018	Bg	CA98/1	94.2	122.3	36.9	28.4	2017	Fv	CA98/1	94.3	115.3	39.8	26.4
2018	Bg	CH25/1	94.7	93.9	42.3	24.2	2017	Fv	CH25/1	95.1	85.8	45.5	23.6
2018	Bg	CH7/1	94.3	100.5	41.9	22.8	2017	Fv	CH7/1	94.4	102.5	43.3	22.5
2018	Bg	CI114/2	94.3	98.0	40.1	23.9	2017	Fv	CI114/2	94.5	105.5	41.1	24.5
2018	Bg	CI2/3	94.5	94.7	42.0	23.4	2017	Fv	CI2/3	94.9	91.4	45.6	22.2
2018	Bg	CJ35/2	94.0	105.2	37.7	26.1	2017	Fv	CJ35/2	94.8	105.0	39.4	26.2
2018	Bg	CK17/1	94.5	96.0	38.1	25.0	2017	Fv	CK17/1	94.6	91.4	41.2	23.8
2018	Bg	DA1/2	94.3	75.8	38.6	22.8	2017	Fv	DA1/2	94.9	72.1	43.5	20.5
2018	Bg	DD84/3	94.2	112.8	37.8	26.7	2017	Fv	DD84/3	94.6	110.9	39.5	26.7
2018	Bg	DN107/1	94.4	92.6	38.2	22.7	2017	Fv	DN107/1	94.3	99.5	40.2	23.2
2018	Bg	DN76/3	94.1	79.3	38.4	22.0	2017	Fv	DN76/3	94.3	84.8	40.9	21.7
2018	Bg	DP32/1	94.7	77.4	41.4	24.2	2017	Fv	DP32/1	95.5	74.9	46.6	21.6
2018	Bg	DW7/1	94.4	102.1	38.8	24.5	2017	Fv	DW7/1	94.7	98.8	42.9	23.1
2018	Bg	Espérance	94.3	100.9	39.4	23.5	2017	Fv	Espérance	94.2	99.9	39.4	25.4
2018	Bg	Etamine	94.4	95.7	41.4	22.3	2017	Fv	Etamine	95.2	97.7	41.6	22.8

Table 4
Average values of fatty acids measured using NIR spectroscopy.

Year	location	Name	C16:0.NIRS [%DM]	C18:0.NIRS [%DM]	C18:1.NIRS [%DM]	C18:2.NIRS [%DM]	C18:3.NIRS [%DM]	C20:1.NIRS [%DM]	C22:1.NIRS [%DM]	Year	Location	Name	C16:0.NIRS [%DM]	C18:0.NIRS [%DM]	C18:1.NIRS [%DM]	C18:2.NIRS [%DM]	C18:3.NIRS [%DM]	C20:1.NIRS [%DM]	C22:1.NIRS [%DM]
2018	Ch	Brown	1.2	0.5	6.8	8.2	4.5	4.3	7.8	2018	Fv	Brown	1.2	0.5	6.8	8.3	4.3	4.3	7.6
2018	Ch	BZ7/3	1.3	0.5	7.0	8.1	4.2	4.4	8.8	2018	Fv	BZ7/3	1.3	0.6	7.7	8.5	3.9	4.4	7.9
2018	Ch	CA119/3	1.4	0.6	7.7	9.5	4.4	4.1	5.8	2018	Fv	CA119/3	1.4	0.6	7.7	9.5	4.3	4.3	6.7
2018	Ch	CA98/1	1.4	0.6	8.2	9.5	4.3	4.2	5.1	2018	Fv	CA98/1	1.3	0.6	8.4	9.3	4.4	4.4	6.1
2018	Ch	CH25/1	1.3	0.4	4.8	7.3	4.7	5.2	16.6	2018	Fv	CH25/1	1.3	0.5	5.5	7.2	4.5	5.2	15.9
2018	Ch	CH7/1	1.1	0.5	4.6	6.9	4.7	5.1	15.2	2018	Fv	CH7/1	1.1	0.5	4.6	6.9	4.6	5.1	15.4
2018	Ch	CI114/2	1.2	0.6	8.6	9.1	5.0	4.9	8.0	2018	Fv	CI114/2	1.3	0.6	8.0	9.0	4.7	4.8	8.1
2018	Ch	CI2/3	1.4	0.5	5.5	7.3	4.9	5.3	15.3	2018	Fv	CI2/3	1.4	0.5	5.4	7.1	4.3	4.9	13.9
2018	Ch	CJ35/2	1.3	0.6	9.4	9.7	4.8	4.4	2.5	2018	Fv	CJ35/2	1.3	0.6	9.2	9.9	4.9	4.4	2.8
2018	Ch	CK17/1	1.5	0.7	11.5	11.4	5.2	4.4	-0.3	2018	Fv	CK17/1	1.5	0.7	11.2	11.3	5.1	4.4	0.0
2018	Ch	DA1/2	1.4	0.6	7.8	8.7	3.9	4.5	8.3	2018	Fv	DA1/2	1.4	0.6	8.7	9.1	4.1	4.8	8.4
2018	Ch	DD84/3	1.2	0.6	8.0	8.8	4.3	4.4	7.0	2018	Fv	DD84/3	1.2	0.5	8.0	8.6	4.2	4.3	6.9
2018	Ch	DN107/1	1.6	0.7	12.1	12.1	4.4	4.3	0.0	2018	Fv	DN107/1	1.6	0.8	12.8	11.8	4.1	4.4	0.0
2018	Ch	DN76/3	1.6	0.8	12.7	11.8	4.1	4.6	0.0	2018	Fv	DN76/3	1.5	0.8	12.6	11.6	4.2	4.6	0.3
2018	Ch	DP32/1	1.4	0.4	5.8	7.4	4.4	5.0	13.9	2018	Fv	DP32/1	1.4	0.5	5.8	7.5	4.1	4.7	13.2
2018	Ch	DW7/1	1.3	0.6	8.2	8.9	4.5	4.7	8.0	2018	Fv	DW7/1	1.3	0.6	7.6	8.6	4.3	4.7	8.5
2018	Ch	Espérance	1.3	0.6	8.5	8.8	3.7	4.3	5.3	2018	Fv	Espérance	1.2	0.6	8.9	8.9	3.8	4.5	5.7
2018	Ch	Etamine	1.3	0.6	8.0	8.6	4.5	4.5	7.4	2018	Fv	Etamine	1.3	0.6	7.6	8.5	4.3	4.5	8.4
2018	Bg	Brown	1.3	0.6	7.2	8.5	4.6	4.5	7.7	2017	Fv	Brown	1.1	0.5	7.9	8.1	4.8	4.7	7.8
2018	Bg	BZ7/3	1.3	0.6	7.9	8.3	4.5	4.9	9.2	2017	Fv	BZ7/3	1.2	0.6	8.5	8.3	4.4	5.1	9.3
2018	Bg	CA119/3	1.4	0.6	8.3	9.6	4.5	4.4	6.0	2017	Fv	CA119/3	1.3	0.6	9.0	9.0	4.6	4.8	6.4
2018	Bg	CA98/1	1.4	0.6	8.0	9.6	4.5	4.5	5.9	2017	Fv	CA98/1	1.3	0.6	9.3	9.1	4.7	5.0	6.5
2018	Bg	CH25/1	1.3	0.4	5.1	7.2	4.9	5.2	16.2	2017	Fv	CH25/1	1.2	0.5	5.8	6.9	4.9	5.8	18.1
2018	Bg	CH7/1	1.2	0.5	4.4	7.0	5.0	5.2	16.0	2017	Fv	CH7/1	1.1	0.5	5.2	6.7	4.7	5.6	16.0
2018	Bg	CI114/2	1.3	0.6	8.0	8.9	5.0	4.9	8.5	2017	Fv	CI114/2	1.2	0.6	8.7	8.8	5.1	5.2	8.0
2018	Bg	CI2/3	1.4	0.5	5.3	7.4	4.9	5.1	15.0	2017	Fv	CI2/3	1.2	0.5	6.0	7.1	5.0	5.7	16.6
2018	Bg	CJ35/2	1.3	0.6	8.9	9.8	5.0	4.6	3.7	2017	Fv	CJ35/2	1.3	0.6	9.7	9.8	5.5	4.9	3.8
2018	Bg	CK17/1	1.6	0.7	11.4	11.4	5.4	4.6	0.2	2017	Fv	CK17/1	1.5	0.8	12.8	11.6	5.4	5.2	0.3
2018	Bg	DA1/2	1.4	0.6	7.9	9.0	4.3	4.7	8.8	2017	Fv	DA1/2	1.4	0.6	9.1	9.1	4.6	5.5	10.3
2018	Bg	DD84/3	1.3	0.6	8.6	8.7	4.3	4.6	7.1	2017	Fv	DD84/3	1.1	0.6	8.8	8.7	4.5	4.9	7.9
2018	Bg	DN107/1	1.6	0.8	12.6	12.0	4.6	4.7	0.0	2017	Fv	DN107/1	1.5	0.8	13.9	12.1	4.9	5.0	0.0
2018	Bg	DN76/3	1.6	0.8	12.7	11.8	4.3	4.7	0.0	2017	Fv	DN76/3	1.5	0.8	14.1	12.2	4.5	5.1	0.0
2018	Bg	DP32/1	1.4	0.5	5.4	7.4	4.5	5.1	14.9	2017	Fv	DP32/1	1.2	0.5	6.1	7.2	4.8	5.8	17.8
2018	Bg	DW7/1	1.3	0.7	8.0	8.9	4.5	4.8	8.0	2017	Fv	DW7/1	1.2	0.6	9.4	9.0	4.8	5.4	9.6
2018	Bg	Espérance	1.3	0.7	9.7	9.6	4.2	4.9	5.3	2017	Fv	Espérance	1.3	0.7	10.1	9.4	3.9	5.0	4.8
2018	Bg	Etamine	1.4	0.6	8.2	9.0	4.7	5.0	8.9	2017	Fv	Etamine	1.3	0.7	8.9	8.7	4.5	5.2	8.1

Table 5
Average values of storage proteins measured after extraction and gel filtration analyses.

Year	Location	Name	12S.GF [%DM]	2S.GF [%DM]	ratio 12S/2S	Year	Location	Name	12S.GF [%DM]	2S.GF [%DM]	ratio 12S/2S
2018	Ch	Brown	6.0	7.4	0.81	2018	Fv	Brown	5.2	6.1	0.86
2018	Ch	BZ7/3	6.4	7.7	0.84	2018	Fv	BZ7/3	5.9	7.2	0.82
2018	Ch	CA119/3	6.1	7.3	0.83	2018	Fv	CA119/3	5.0	5.8	0.85
2018	Ch	CA98/1	5.6	7.0	0.80	2018	Fv	CA98/1	4.8	6.0	0.80
2018	Ch	CH25/1	4.1	7.0	0.58	2018	Fv	CH25/1	3.6	6.6	0.54
2018	Ch	CH7/1	5.1	7.2	0.71	2018	Fv	CH7/1	5.3	7.3	0.73
2018	Ch	CI114/2	4.7	6.3	0.74	2018	Fv	CI114/2	4.9	7.0	0.70
2018	Ch	CI2/3	5.0	7.5	0.66	2018	Fv	CI2/3	3.5	5.7	0.62
2018	Ch	CJ35/2	6.5	8.5	0.77	2018	Fv	CJ35/2	5.8	8.1	0.73
2018	Ch	CK17/1	5.5	8.5	0.65	2018	Fv	CK17/1	3.2	4.9	0.64
2018	Ch	DA1/2	5.1	6.5	0.78	2018	Fv	DA1/2	3.0	4.1	0.72
2018	Ch	DD84/3	6.6	7.0	0.94	2018	Fv	DD84/3	5.8	7.0	0.82
2018	Ch	DN107/1	5.5	7.1	0.78	2018	Fv	DN107/1	4.7	6.9	0.68
2018	Ch	DN76/3	5.3	6.4	0.83	2018	Fv	DN76/3	3.2	4.3	0.74
2018	Ch	DP32/1	4.9	6.7	0.73	2018	Fv	DP32/1	3.3	4.7	0.70
2018	Ch	DW7/1	5.0	7.3	0.69	2018	Fv	DW7/1	4.3	6.0	0.71
2018	Ch	Espérance	4.7	6.7	0.70	2018	Fv	Espérance	4.9	7.2	0.67
2018	Ch	Etamine	5.1	6.9	0.74	2018	Fv	Etamine	4.7	6.6	0.71
2018	Bg	Brown	5.3	6.0	0.89	2017	Fv	Brown	5.2	6.3	0.83
2018	Bg	BZ7/3	5.0	6.8	0.73	2017	Fv	BZ7/3	4.4	5.3	0.83
2018	Bg	CA119/3	5.8	7.2	0.80	2017	Fv	CA119/3	6.1	7.4	0.82
2018	Bg	CA98/1	6.3	7.8	0.81	2017	Fv	CA98/1	5.2	6.2	0.83
2018	Bg	CH25/1	4.1	6.0	0.68	2017	Fv	CH25/1	3.2	5.1	0.63
2018	Bg	CH7/1	4.0	6.1	0.66	2017	Fv	CH7/1	3.5	5.3	0.65
2018	Bg	CI114/2	6.3	8.5	0.75	2017	Fv	CI114/2	4.5	4.4	1.02
2018	Bg	CI2/3	4.5	6.5	0.69	2017	Fv	CI2/3	4.3	6.8	0.63
2018	Bg	CJ35/2	7.2	9.4	0.76	2017	Fv	CJ35/2	6.0	7.2	0.83
2018	Bg	CK17/1	5.6	8.4	0.67	2017	Fv	CK17/1	4.7	7.3	0.65
2018	Bg	DA1/2	5.2	6.9	0.75	2017	Fv	DA1/2	4.5	6.3	0.72
2018	Bg	DD84/3	6.6	7.7	0.86	2017	Fv	DD84/3	5.7	6.1	0.96
2018	Bg	DN107/1	5.1	7.5	0.68	2017	Fv	DN107/1	4.3	6.4	0.67
2018	Bg	DN76/3	5.6	7.2	0.78	2017	Fv	DN76/3	4.6	6.0	0.77
2018	Bg	DP32/1	4.7	6.4	0.74	2017	Fv	DP32/1	3.6	5.5	0.67
2018	Bg	DW7/1	3.3	4.0	0.82	2017	Fv	DW7/1	4.4	6.8	0.66
2018	Bg	Espérance	4.4	6.7	0.66	2017	Fv	Espérance	4.9	6.8	0.72
2018	Bg	Etamine	4.2	6.0	0.70	2017	Fv	Etamine	4.5	6.1	0.73

Table 6
Average values of cell wall polysaccharides: total amount (PS) and amount of each monosaccharide subunit of PS (Rha: rhamnose; Ara: arabinose; Xyl: xylose; Man: mannose; Gal: galactose; Glc: glucose; UA: uronic acids).

Year	Location	Name	PS.GC [%DM]	Rha.GC [%DM]	Ara.GC [%DM]	Xyl.GC [%DM]	Man.GC [%DM]	Gal.GC [%DM]	Glc.GC [%DM]	UA.GC [%DM]	Year	Location	Name	PS.GC [%DM]	Rha.GC [%DM]	Ara.GC [%DM]	Xyl.GC [%DM]	Man.GC [%DM]	Gal.GC [%DM]	Glc.GC [%DM]	UA.GC [%DM]
2018	Ch	Brown	16.5	0.2	3.2	1.1	0.4	1.8	4.9	4.9	2018	Fv	Brown	15.4	0.3	3.0	1.1	0.4	1.7	4.8	4.0
2018	Ch	BZ7/3	18.4	0.3	3.3	1.2	0.4	2.1	5.7	5.3	2018	Fv	BZ7/3	13.1	0.2	2.6	0.9	0.4	1.5	3.9	3.6
2018	Ch	CA119/3	15.7	0.3	3.3	1.2	0.4	1.5	4.3	4.7	2018	Fv	CA119/3	13.0	0.2	2.7	0.9	0.4	1.4	3.9	3.4
2018	Ch	CA98/1	17.7	0.3	3.3	1.2	0.4	2.2	5.3	5.0	2018	Fv	CA98/1	13.0	0.2	2.6	0.9	0.4	1.5	3.8	3.5
2018	Ch	CH25/1	16.2	0.3	3.6	1.3	0.4	1.7	4.5	4.2	2018	Fv	CH25/1	13.0	0.2	3.0	1.0	0.3	1.4	3.8	3.2
2018	Ch	CH7/1	14.2	0.1	2.9	0.9	0.3	1.4	3.8	4.8	2018	Fv	CH7/1	12.9	0.2	2.7	0.9	0.4	1.4	3.7	3.6
2018	Ch	CI114/2	17.3	0.3	3.6	1.3	0.4	1.9	5.1	4.6	2018	Fv	CI114/2	13.9	0.3	2.8	1.0	0.5	1.5	4.2	3.5
2018	Ch	CI2/3	14.1	0.3	3.2	1.1	0.2	1.3	4.0	4.0	2018	Fv	CI2/3	11.1	0.2	2.5	0.8	0.3	1.2	3.2	2.9
2018	Ch	CJ35/2	21.4	0.4	4.8	1.6	0.6	2.6	6.1	5.2	2018	Fv	CJ35/2	14.0	0.3	3.0	1.1	0.4	1.7	4.1	3.5
2018	Ch	CK17/1	16.8	0.2	3.4	1.1	0.4	1.7	4.9	5.1	2018	Fv	CK17/1	14.0	0.3	3.1	1.1	0.4	1.4	4.1	3.6
2018	Ch	DA1/2	17.4	0.3	3.7	1.2	0.4	1.8	4.9	5.1	2018	Fv	DA1/2	14.3	0.3	3.2	1.0	0.3	1.6	4.2	3.6
2018	Ch	DD84/3	15.9	0.3	3.1	1.2	0.4	1.7	4.7	4.5	2018	Fv	DD84/3	14.2	0.3	2.9	1.0	0.4	1.5	4.4	3.7
2018	Ch	DN107/1	17.7	0.3	3.4	1.2	0.4	1.9	5.2	5.3	2018	Fv	DN107/1	16.1	0.3	3.4	1.2	0.5	1.7	4.8	4.2
2018	Ch	DN76/3	19.0	0.3	3.8	1.3	0.4	2.0	5.6	5.5	2018	Fv	DN76/3	15.8	0.3	3.4	1.2	0.4	1.7	4.6	4.1
2018	Ch	DP32/1	14.8	0.3	3.3	1.1	0.3	1.5	4.4	3.9	2018	Fv	DP32/1	12.6	0.3	2.8	0.9	0.3	1.3	3.7	3.2
2018	Ch	DW7/1	16.4	0.5	3.4	1.3	0.1	1.5	5.1	4.5	2018	Fv	DW7/1	13.3	0.3	2.8	0.9	0.4	1.6	3.9	3.4
2018	Ch	Espérance	18.6	0.2	3.5	1.2	0.4	2.1	5.5	5.6	2018	Fv	Espérance	15.4	0.2	3.1	1.1	0.5	1.7	4.5	4.2
2018	Ch	Etamine	17.3	0.2	3.5	1.1	0.3	1.8	5.1	5.3	2018	Fv	Etamine	12.3	0.2	2.6	0.8	0.3	1.3	3.7	3.4
2018	Bg	Brown	16.7	0.3	3.2	1.2	0.4	2.0	5.4	4.1	2017	Fv	Brown	15.1	0.3	3.1	1.1	0.5	1.6	4.7	3.7
2018	Bg	BZ7/3	16.0	0.3	3.0	1.2	0.4	1.9	5.4	3.8	2017	Fv	BZ7/3	13.5	0.2	2.8	1.1	0.4	1.5	4.1	3.3
2018	Bg	CA119/3	14.4	0.2	2.9	1.1	0.4	1.5	4.3	3.9	2017	Fv	CA119/3	13.3	0.2	2.8	1.0	0.4	1.5	4.0	3.2
2018	Bg	CA98/1	15.4	0.2	2.9	1.1	0.4	1.8	5.0	3.9	2017	Fv	CA98/1	12.9	0.2	2.7	1.0	0.4	1.5	3.9	3.2
2018	Bg	CH25/1	14.7	0.2	3.1	1.1	0.3	1.7	4.5	3.8	2017	Fv	CH25/1	12.9	0.3	2.8	1.0	0.4	1.4	3.8	3.2
2018	Bg	CH7/1	15.4	0.3	3.0	1.0	0.4	1.6	4.9	4.0	2017	Fv	CH7/1	13.0	0.2	2.9	1.0	0.3	1.4	3.9	3.1
2018	Bg	CI114/2	14.7	0.3	3.2	1.1	0.3	1.7	4.3	3.6	2017	Fv	CI114/2	14.6	0.3	3.1	1.1	0.5	1.6	4.4	3.5
2018	Bg	CI2/3	13.0	0.2	2.9	0.9	0.3	1.4	3.8	3.5	2017	Fv	CI2/3	11.7	0.2	2.7	0.9	0.3	1.2	3.6	2.9
2018	Bg	CJ35/2	15.3	0.3	3.3	1.2	0.4	1.8	4.4	3.8	2017	Fv	CJ35/2	14.3	0.2	3.1	1.1	0.5	1.7	4.2	3.4
2018	Bg	CK17/1	14.8	0.2	3.3	1.2	0.4	1.6	4.5	3.8	2017	Fv	CK17/1	15.2	0.3	3.3	1.2	0.5	1.7	4.7	3.6
2018	Bg	DA1/2	18.0	0.4	4.0	1.3	0.4	1.9	5.4	4.5	2017	Fv	DA1/2	16.4	0.4	3.7	1.2	0.4	1.7	4.9	4.0
2018	Bg	DD84/3	16.4	0.3	3.4	1.2	0.4	1.8	5.0	4.3	2017	Fv	DD84/3	14.6	0.2	3.1	1.1	0.5	1.6	4.4	3.6
2018	Bg	DN107/1	16.8	0.3	3.8	1.4	0.4	1.9	5.0	4.0	2017	Fv	DN107/1	15.1	0.3	3.3	1.2	0.5	1.6	4.4	3.7
2018	Bg	DN76/3	17.5	0.3	3.7	1.3	0.4	1.8	5.4	4.4	2017	Fv	DN76/3	16.4	0.3	3.5	1.2	0.6	1.8	5.0	4.0
2018	Bg	DP32/1	14.0	0.2	3.0	1.0	0.3	1.6	4.4	3.5	2017	Fv	DP32/1	12.2	0.2	2.8	0.9	0.4	1.2	3.7	2.9
2018	Bg	DW7/1	15.6	0.2	3.3	1.1	0.3	1.7	4.6	4.2	2017	Fv	DW7/1	14.3	0.3	3.1	1.1	0.5	1.7	4.2	3.4
2018	Bg	Espérance	16.6	0.6	3.7	1.1	0.5	1.8	4.8	4.2	2017	Fv	Espérance	16.2	0.3	3.4	1.2	0.5	1.9	4.8	4.1
2018	Bg	Etamine	14.7	0.2	3.1	1.1	0.3	1.5	4.4	4.1	2017	Fv	Etamine	14.5	0.2	3.0	1.0	0.4	1.5	4.6	3.8

Table 7
Average of *flow in Bostwick consistometer of grinded seeds soaked in verjuice-like solution over a period of 30s then 60s*

Year	Location	Name	Rheo.30sec [cm]	Rheo.60sec [cm]	Year	Location	Name	Rheo.30sec [cm]	Rheo.60sec [cm]
2018	Ch	Brown	10.3	10.5	2018	Fv	Brown	7.8	8.3
2018	Ch	BZ7/3	13.5	14.0	2018	Fv	BZ7/3	11.0	11.8
2018	Ch	CA119/3	11.5	12.0	2018	Fv	CA119/3	11.0	11.3
2018	Ch	CA98/1	13.3	12.0	2018	Fv	CA98/1	16.8	17.5
2018	Ch	CH25/1	23.0	24.0	2018	Fv	CH25/1	23.0	23.8
2018	Ch	CH7/1	24.0	24.0	2018	Fv	CH7/1	24.0	24.0
2018	Ch	CI114/2	11.8	12.3	2018	Fv	CI114/2	11.8	12.3
2018	Ch	CI2/3	24.0	24.0	2018	Fv	CI2/3	22.8	23.8
2018	Ch	CJ35/2	18.0	19.0	2018	Fv	CJ35/2	18.8	19.3
2018	Ch	CK17/1	17.0	17.5	2018	Fv	CK17/1	13.8	14.3
2018	Ch	DA1/2	14.5	13.3	2018	Fv	DA1/2	13.8	14.3
2018	Ch	DD84/3	12.8	13.3	2018	Fv	DD84/3	8.8	9.3
2018	Ch	DN107/1	19.0	20.3	2018	Fv	DN107/1	14.8	15.3
2018	Ch	DN76/3	13.5	14.0	2018	Fv	DN76/3	10.8	11.3
2018	Ch	DP32/1	21.3	22.8	2018	Fv	DP32/1	13.8	14.5
2018	Ch	DW7/1	17.3	18.0	2018	Fv	DW7/1	15.5	16.0
2018	Ch	Espérance	12.0	12.5	2018	Fv	Espérance	10.0	10.5
2018	Ch	Etamine	20.8	22.3	2018	Fv	Etamine	16.5	17.3
2018	Bg	Brown	11.5	12.0	2017	Fv	Brown	10.8	11.3
2018	Bg	BZ7/3	15.5	16.3	2017	Fv	BZ7/3	16.8	17.3
2018	Bg	CA119/3	13.8	14.3	2017	Fv	CA119/3	18.8	19.8
2018	Bg	CA98/1	16.0	16.5	2017	Fv	CA98/1	19.3	20.3
2018	Bg	CH25/1	21.3	22.8	2017	Fv	CH25/1	23.5	24.0
2018	Bg	CH7/1	23.8	24.0	2017	Fv	CH7/1	24.0	24.0
2018	Bg	CI114/2	15.0	15.5	2017	Fv	CI114/2	12.5	13.0
2018	Bg	CI2/3	23.8	24.0	2017	Fv	CI2/3	24.0	24.0
2018	Bg	CJ35/2	21.0	22.0	2017	Fv	CJ35/2	21.0	22.3
2018	Bg	CK17/1	17.0	18.0	2017	Fv	CK17/1	16.8	17.5
2018	Bg	DA1/2	15.0	15.8	2017	Fv	DA1/2	17.3	18.5
2018	Bg	DD84/3	11.0	11.3	2017	Fv	DD84/3	13.8	14.3
2018	Bg	DN107/1	19.0	20.0	2017	Fv	DN107/1	19.5	21.0
2018	Bg	DN76/3	14.5	15.0	2017	Fv	DN76/3	14.8	15.5
2018	Bg	DP32/1	19.5	21.0	2017	Fv	DP32/1	24.0	24.0
2018	Bg	DW7/1	15.5	16.5	2017	Fv	DW7/1	20.3	21.0
2018	Bg	Espérance	12.5	13.0	2017	Fv	Espérance	12.3	12.8
2018	Bg	Etamine	22.5	23.5	2017	Fv	Etamine	19.5	20.8

Table 8
Average values of granulometric parameters: D(v0,1), D(v0,5), D(v0,9) mean particle diameter in µm of 10%, 50% and 90% population and proportion of grinded seeds whose size is less than 150 µm.

Year	Location	Name	LG.D(v0,1) [µm]	LG.D(v0,5) [µm]	LG.D(v0,9) [µm]	LG.%< 150 µm [%]	Year	Location	Name	LG.D(v0,1) [µm]	LG.D(v0,5) [µm]	LG.D(v0,9) [µm]	LG.%< 150 µm [%]
2018	Ch	Brown	42.8	520.3	1067.6	23.6	2018	Fv	Brown	41.4	506.9	1051.0	25.5
2018	Ch	BZ7/3	41.3	522.7	1084.4	24.4	2018	Fv	BZ7/3	42.2	496.5	1115.9	29.3
2018	Ch	CA119/3	38.5	491.1	1080.9	26.6	2018	Fv	CA119/3	40.3	498.7	1106.6	26.7
2018	Ch	CA98/1	37.5	513.9	1083.4	26.4	2018	Fv	CA98/1	41.3	540.6	1079.8	23.6
2018	Ch	CH25/1	38.7	511.3	1087.8	26.1	2018	Fv	CH25/1	42.0	476.4	1009.5	26.7
2018	Ch	CH7/1	37.5	424.3	972.8	29.7	2018	Fv	CH7/1	42.1	542.2	1077.5	25.3
2018	Ch	CI114/2	43.8	494.9	1025.8	24.6	2018	Fv	CI114/2	43.1	525.9	1097.2	25.1
2018	Ch	CI2/3	40.0	490.2	995.9	26.1	2018	Fv	CI2/3	41.4	506.6	1061.4	25.1
2018	Ch	CJ35/2	40.0	476.8	1070.4	27.8	2018	Fv	CJ35/2	44.0	597.5	1166.0	22.4
2018	Ch	CK17/1	39.5	485.5	1043.0	25.0	2018	Fv	CK17/1	45.5	580.4	1135.7	22.9
2018	Ch	DA1/2	42.2	528.8	1133.1	25.0	2018	Fv	DA1/2	40.6	507.5	1082.0	27.2
2018	Ch	DD84/3	45.0	542.7	1100.2	22.7	2018	Fv	DD84/3	44.8	549.9	1116.3	20.7
2018	Ch	DN107/1	45.4	621.3	1185.2	20.5	2018	Fv	DN107/1	43.3	573.4	1165.0	23.5
2018	Ch	DN76/3	40.5	522.9	1111.2	26.5	2018	Fv	DN76/3	44.6	583.3	1177.9	24.2
2018	Ch	DP32/1	45.7	454.4	982.9	26.1	2018	Fv	DP32/1	43.1	485.7	1066.3	25.8
2018	Ch	DW7/1	44.2	542.5	1066.6	22.4	2018	Fv	DW7/1	42.1	466.8	1023.5	30.5
2018	Ch	Espérance	44.5	567.3	1120.7	21.5	2018	Fv	Espérance	39.0	504.4	1090.1	26.3
2018	Ch	Etamine	42.8	545.9	1088.7	22.4	2018	Fv	Etamine	43.9	527.6	1056.8	23.9
2018	Bg	Brown	45.7	582.8	1141.8	21.5	2017	Fv	Brown	51.4	692.6	1077.2	21.0
2018	Bg	BZ7/3	42.4	521.3	1102.2	27.4	2017	Fv	BZ7/3	47.2	563.6	1224.1	27.4
2018	Bg	CA119/3	43.3	565.4	1162.9	23.2	2017	Fv	CA119/3	48.9	608.7	1296.1	25.9
2018	Bg	CA98/1	39.8	521.8	1125.0	27.9	2017	Fv	CA98/1	45.7	507.7	1205.2	30.6
2018	Bg	CH25/1	39.4	530.9	1072.8	26.1	2017	Fv	CH25/1	40.7	505.6	1130.9	29.6
2018	Bg	CH7/1	37.9	461.1	977.6	28.9	2017	Fv	CH7/1	39.8	477.5	1085.9	31.0
2018	Bg	CI114/2	41.6	515.3	1068.1	25.6	2017	Fv	CI114/2	47.9	536.3	1183.4	28.3
2018	Bg	CI2/3	44.2	546.8	1097.8	23.3	2017	Fv	CI2/3	47.2	462.1	1110.7	29.7
2018	Bg	CJ35/2	40.2	534.1	1095.8	25.7	2017	Fv	CJ35/2	44.5	547.6	1177.2	28.8
2018	Bg	CK17/1	43.6	548.2	1116.0	24.6	2017	Fv	CK17/1	47.2	591.2	1180.8	24.3
2018	Bg	DA1/2	41.5	544.1	1141.1	24.8	2017	Fv	DA1/2	43.0	500.9	1156.7	29.9
2018	Bg	DD84/3	44.5	540.1	1086.8	23.9	2017	Fv	DD84/3	46.1	533.1	1165.7	28.4
2018	Bg	DN107/1	43.0	613.5	1189.3	23.6	2017	Fv	DN107/1	47.8	543.5	1253.5	30.0
2018	Bg	DN76/3	40.2	590.1	1208.9	24.4	2017	Fv	DN76/3	48.5	608.1	1261.9	25.3
2018	Bg	DP32/1	43.1	506.2	1067.3	24.6	2017	Fv	DP32/1	45.4	486.9	1075.2	29.7
2018	Bg	DW7/1	40.6	536.3	1079.2	24.4	2017	Fv	DW7/1	47.2	532.1	1101.8	30.7
2018	Bg	Espérance	39.6	536.8	1103.7	23.8	2017	Fv	Espérance	49.4	614.4	1210.5	21.1
2018	Bg	Etamine	43.4	468.9	1005.8	29.5	2017	Fv	Etamine	51.8	607.9	1243.1	22.4

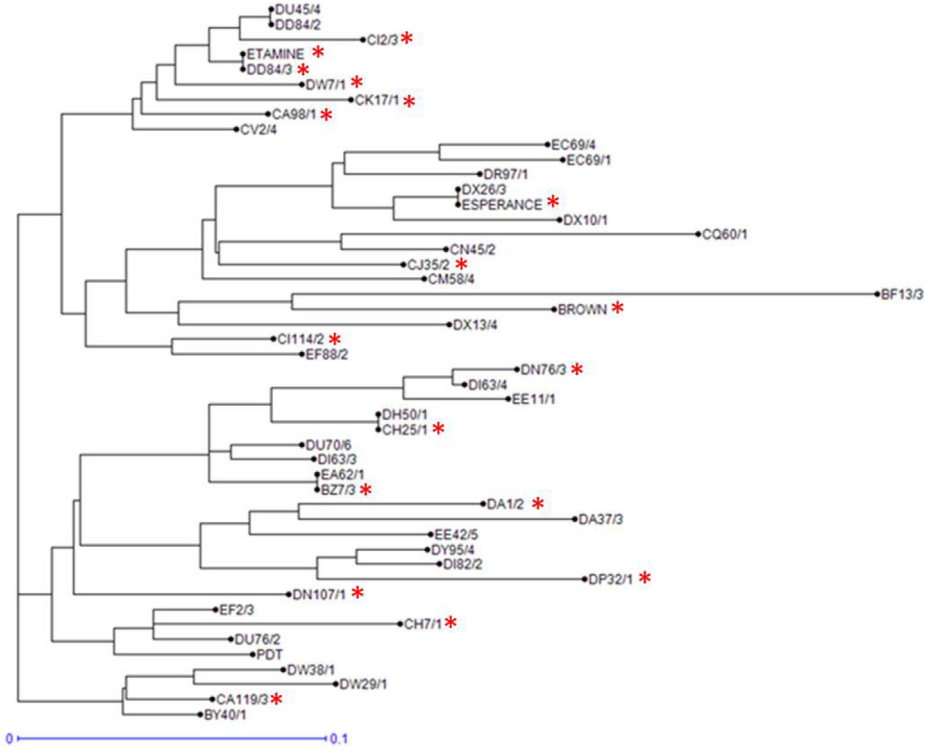

Fig. 1. Dendrogram of the genetic diversity within the 48 genotypes. The 18 selected genotypes for further biochemical and rheological characterization were indicated by a red asterisk. Darwin software, unpondered Neighbor joining method.

GENTYANE Genotyping and Sequencing platform (Clermond-Ferrand, France). Electrophoregrams (Fig. 1) were analyzed with the Gene-Mapper software (Applied Biosytems).

4. Near Infra-Red Spectroscopy Analysis

The quantitative mustard seeds biochemical parameters such as dry matter, fat (total lipids), proteins, Fatty Acids and Glucosinolates (*i.e.* sinigrin) were predicted using Near-infrared Spectroscopy (NIRSystems 6500-FOSS©). The mustard seeds were introduced in ¼ cup cell. The values were calculated on an average of 32 scans.

The validation of the instrument measurement was done using calibrated mustard seed samples. The references values of these calibrated samples were analyzed with a reference laboratory method: Dry Matter (desiccation 4 h/103 °C), Protein (N, Kjeldahl method, NF EN ISO 5983-2), Fat (Soxhlet extraction method, NF V03 908), Fatty Acids (ISO/ Total FAT (NF EN ISO 12966-2/12966-4), Glucosinolates (NF V03 918-3).

5. Sample Preparations

Prior to biochemical analyses, 10 g of each cultivars were milled with an IKA M20 grinding system (IKA®-Werke GmbH & Co., KG, Germany) during 2 * 10 s. Then, each mill was dried

at 40 °C overnight under vacuum over P2O5, weighted and defatted using an accelerated solvent extractor (ASE™350, Thermo Scientific™ Dionex™). Briefly, 1 g of dried mill per 22 mL stainless steel cell was flushed with hexane during 3 min at 20 °C (flow 2 mL.min-1). Partially defatted mill was recovered, dried and ground into fine powder using FastPrep-24 instrument (MP Biochemicals, CA) at a speed of 6.5 m/s for 60 s. Partially dried defatted mill was transferred in 22 mL stainless steel cell of the ASE® 350, weighted and flushed with hexane during 3 min at room temperature (flow 2 mL.min-1). Lipids content were determined as the yield of extraction using initial and final dry weight. Defatted mills were gridding before biochemical analyses (seed storage protein and cell wall polysaccharides composition).

6. Biochemical Analyses

6.1. Seed storage protein composition

Seed storage proteins were extracted from deffated mill in Tris buffer 50 mM pH 8.5 containing NaCl 750 mM, EDTA 5 mM, sodium bisulfite 15 mM (ratio 1/10 w/w). Pigments were removed by desalting chromatography (PD Miditrap G-25, GE Healthcare). Depigmented extracts were injected onto size exclusion chromatography (Superdex75 Increase, GE Healthcare) with refractometer detection. The column was calibrated with increasing quantity of 12S and 2S standards produced as previously described [4]. Quantification of 12S and 2S was calculated from linear regression between peak area and standard quantity for each protein. The 12S and 2S contents were determined in triplicates in independent experiments.

6.2. Cell wall polysaccharides composition

Cell wall polysaccharides were extracted as Alcohol Insoluble Residues (AIRs) using the ASE® 350 (Thermo Scientific™ Dionex™). Approximately 200 mg of defatted dried mill prepared as described above were transferred in 22 mL cells of the ASE® 350, weighted and AIRs were extracted using 80% ethanol at 100 °C during 15 min (flow 2 mL.min-1). Cells of the ASE® 350 containing AIRs were dried at 40 °C overnight under vacuum over P2O5 before weighing in order to determine the yield of extraction. AIRs were grinded before compositional analyses.

Identification and quantification of cell wall sugars were performed by gas-liquid chromatography (GC) or using the metahydroxydiphenyl colorimetric method after sulfuric acid degradation as described previously [5].

7. Rheological Measurements

30 g of seeds were mixed 10 pulses in 15 s in a coffee grinder KRUPS F203 or in Tube Mill control IKA grinding system (IKA®-Werke GmbH & Co., KG, Germany) during 30 s at 14,000 rpm. Then, the grind was soaked 24 h in 70 mL of a verjuice-like solution containing 8% Salt NaCl and 2% acetic acid (Fig. 2). The totality of the mixture (100 mL) is transferred in a Bostwick Consistometer (Endecotts) to measure the distance (cm) of the sample flowing at 30 s and 60 s.

8. Particle Size Distribution

The particle size distribution of the grinded seeds for rheological measurements was determined by laser diffraction using a particle size analyzer Partica LA960 (Horiba). The refractive index used was 1.473 with water as dispersant. Each sample was measured in duplicate. The volume-weighted particle size distribution was calculated using the Mie theory by the LA960

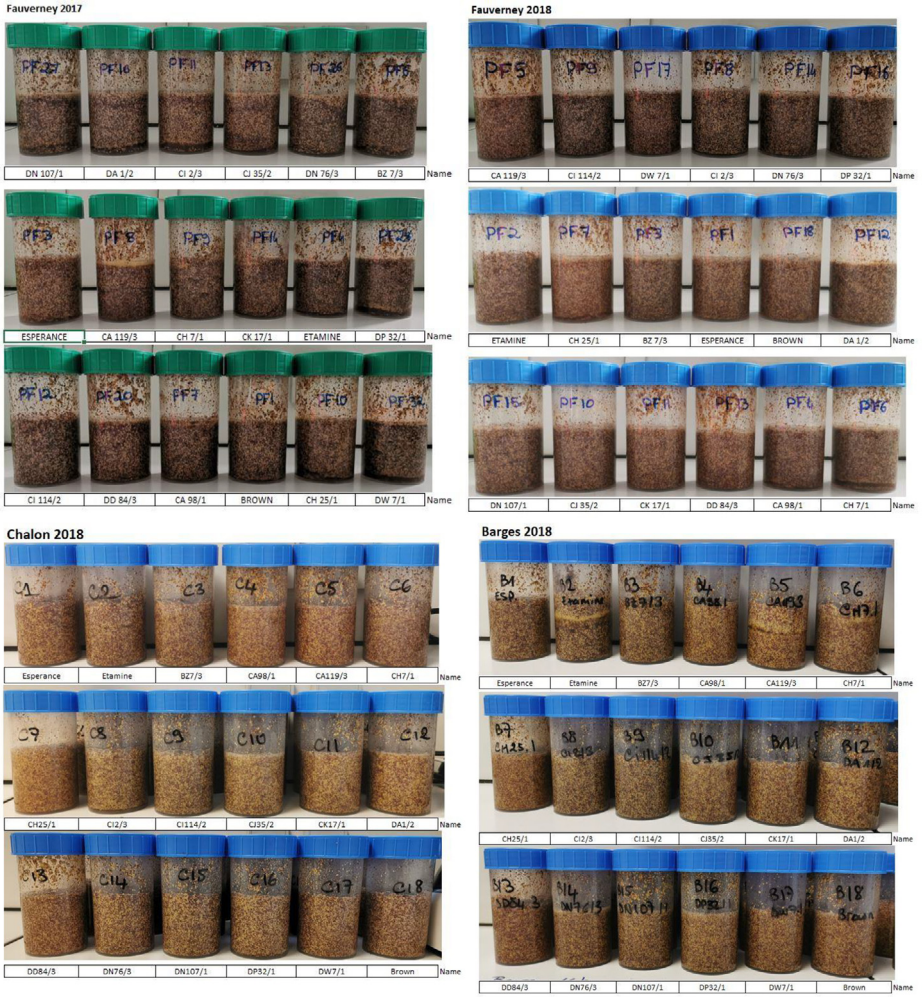

Fig. 2. Appearance of grinded seeds soaked in verjuice-like solution for each location (Fauverney, Chalon, Barges) and year (2017, 2018).

Horiba analytical software. To compare the distribution of each accession, the D10, D50 and D90 values were used and the population proportion under 150 µm.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT Author Statement

Sophie Le Gall: Methodology, Validation, Formal analysis, Supervision, Data curation, Writing – original draft, Writing – review & editing; **Véronique Sole-Jamault:** Methodology, Validation,

Formal analysis, Writing – original draft, Supervision; **Marine Nars-Chasseray:** Methodology, Investigation, Writing – original draft; **Aude Le Goff:** Investigation; **Lucie Le Bot:** Investigation; **Thierry Guinet:** Resources; **Christelle Renaud:** Investigation, Writing – original draft; **Jérôme Gervais:** Resources; **Stéphane Bansard:** Data curation; **Laure Ohleyer:** Project administration, Funding acquisition; **Sylvain Jeandroz:** Conceptualization, Writing – original draft, Funding acquisition.

Acknowledgments

These data were acquired within the project FEADER operation 16.1 “moutarde de Bourgogne, les défis pour pérenniser une association locale pour un marché international” n° OSIRIS : RBO160118CR0260008.

The authors thank Catherine Loisel for providing the bostwic equipment.

Supplementary Materials

Supplementary material [6] associated with this article can be found in the online version at doi:10.15454/YJ33JC.

References

[1] B.K. Singh, D.C. Mishra, S. Yadav, S. Ambawat, E. Vaidya, K.U. Tribhuvan, A. Kumar, S. Kumar, S. Kumar, K.K. Chaturvedi, R. Rani, P. Yadav, A. Rai, P.K. Rai, V.V. Singh, D. Singh, Identification, characterization, validation and cross-species amplification of genic-SSRs in Indian mustard (Brassica juncea), J. Plant Biochem. Biotechnol. 25 (2016) 410–420, doi:10.1007/s13562-016-0353-y.

[2] S. Chen, Z. Wan, M.N. Nelson, J.S. Chauhan, R. Redden, W.A. Burton, P. Lin, P.A. Salisbury, T. Fu, W.A. Cowling, Evidence from genome-wide simple sequence repeat markers for a polyphyletic origin and secondary centers of genetic diversity of *Brassica juncea* in China and India, J. Hered. 104 (3) (2013) 416–427, doi:10.1093/jhered/est015.

[3] J. Sudan, P. Khajuria, S.K Gupta, R. Singh, Analysis of molecular diversity in Indian and exotic genotypes of Brassica juncea using SSR markers, Indian J. Genet. 76 (3) (2016) 361–364, doi:10.5958/0975-6906.2016.00054.7.

[4] S. Bérot, J.P. Compoint, C. Larré, C. Malabat, J. Guéguen, Large scale purification of rapeseed proteins (Brassica napus L.), J. Chromatogr. B Anal. Technol. Biomed. Life Sci. 818 (1) (2005) 35–42, doi:10.1016/j.jchromb.2004.08.001.

[5] M. Lahaye, X. Falourd, B. Laillet, S.Le Gall, Cellulose, pectin and water in cell walls determine apple flesh viscoelastic mechanical properties, Carbohydr. Polym. 232 (2020) 115768, doi:10.1016/j.carbpol.2019.115768.

[6] S. Le Gall, V. Sole-Jamault, M. Nars-Chasseray, A. Le Goff, L. Le Bot, T. Guinet, C. Renaud, J. Gervais, S. Bansard, L. Ohleyer, S. Jeandroz, Data on agronomic traits, biochemical composition of lipids, proteins and polysaccharides and rheological measurement in a brown mustard seed collection, Portail Data INRAE 1 (2021), doi:10.15454/YJ33JC.