UDC 633.11:581.16 https://doi.org/10.15407/biotech13.02.056

FATTY ACID COMPOSITION OF OIL FROM GRAIN OF SOME TETRAPLOID WHEAT SPECIES

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Received 28.12.2019
Revised 27.03.2020
Accepted 30.04.2020

Although wheat has never been considered an oil crop, oil from wheat germs and bran is valuable because it contains important bioactive compounds. Most of studies in this area were conducted with traditional commercial wheat varieties. At the same time, the interest of breeders, producers and consumers is going back to ancient and underutilized wheats species. In this respect, we set the purpose to evaluate tetraploid wheat species (*Triticum. dicoccoides* var. *pseudojordanicum, Triticum dicoccum, Triticum timofeevii, Triticum persicum var rubiginosum, Triticum durum* var. *falcatamelanopus, Triticum polonicum* var. *pseudocompactum* and *Triticum aethiopicum* var. *densimenelikii)* for fatty acid composition. Grain was harvested in 2015, 2016, 2017, 2018 and 2019. Fatty acid methyl esters were prepared by the modified Peisker method. Fatty acid composition was analyzed by gas chromatography. Six major fatty acids were found in grain of tetraploid wheat species, with linoleic acid being the most abundant. The ratio of unsaturated acids to saturated ones in grain of wild emmer *T. dicoccoides* var. *pseudojordanicum* was slightly lower than in the domestic emmer varieties. *T. timofeevii,* emmer varieties Holikovska and Romanivska and radium wheat variety Spadschina had the most beneficial unsaturated/saturated ratios. As conclusion there was no evidence of deterioration in the grain quality in terms of unsaturated fatty acid levels, and we observed no patterns in variability of fatty acid contents across the species under investigation.

Fatty acid composition was analyzed by gas chromatography. Six major fatty acids were found in grain of tetraploid wheat species, with linoleic acid being the most abundant. The ratio of unsaturated acids to saturated ones in grain of wild emmer *T. dicoccoides* var. *pseudojordanicum* was slightly lower than in the domestic emmer varieties. *T. timofeevii,* emmer varieties Holikovska and Romanivska and durum wheat variety Spadschina had the most beneficial unsaturated/saturated ratios.

There was no evidence of deterioration in the grain quality in terms of unsaturated fatty acid levels. We observed no patterns in variability of fatty acid contents across the species under investigation.

Key words: tetraploid wheat species, fatty acids, oil quality, gas chromatography.

The consumption of vegetable oils, including human and pet food production, numerous industrial uses, perfumery/cosmetic and pharmaceutical industries, fuel manufacturing, etc., has increased dramatically in the past century. Although wheat has never been considered an oil crop (oil from wheat germs makes up around 2.5% by weight of the kernel [1], oil from wheat germs and bran is valuable because it contains important bioactive compounds such as octacosanol [2], tocopherols [3], carotenoids [4] and unsaturated fatty acids [3]. Wheat germ oil is in demand in the cosmetics industry. Wheat bran oil contains carotenoids [5] and tocopherols [6]. Most of studies in this area are conducted on traditional commercial wheat varieties. However, there is an opinion that the value of wheat oil reduced in the course of domestication, in particular, domestication of emmer [7]. At the same time, the interest of breeders, producers and consumers in the

21st century is going back to ancient wheats, spelt, emmer, einkorn, as well as to domestic, but underutilized species [8]. They are valuable especially for resistance to fungal diseases, unpretentiousness to cultivation conditions and grain quality. Grain quality parameters are primarily the protein content and composition; contents of antioxidants, vitamins and minerals; and these wheat species often outperform commercial varieties by these parameters. In the literature, there is very little information on the quality of ancient wheat oil. It was found that the lipid content in einkorn grain was 50% higher than that in wheat bread grain (4.2 and 2.8 g/100 g of dry weight, respectively) [9].

It should be noted that this comparison cannot be considered quite correct, since ploidy of these wheat species is different (einkorn is diploid, and bread wheat is hexaploid), yet such a comparison can be valuable for evolutionists and producers. It was demonstrated that grain of *Triticum monococcum* L. ssp. *monococcum* was rich in polyunsaturated fatty acids [10]. Linoleic acid (polyunsaturated omega-6 fatty acid) was one of the predominant acids among 14 identified fatty acids in *T. monococcum* grain [11].

In this respect, it is expedient to evaluate underutilized tetraploid wheat species for oil quality, in particular, to focus on breeding accessions of wild emmer *Triticum dicoccoides* var. *pseudojordanicum,* domestic emmer *Triticum dicoccum* as well as its tetraploid relatives: *Triticum timofeevii, Triticum persicum var rubiginosum, Triticum durum* var. *falcatamelanopus, Triticum polonicum* var. *pseudocompactum* and *Triticum aethiopicum* var. *densimenelikii.*

Purpose — to study the fatty acid composition of oil from grain of *T. dicoccoides* var. *pseudojordanicum*, *T. dicoccum*, *T. timofeevii, T. persicum* var *rubiginosum, T. durum* var. *falcatamelanopus, T. polonicum* var. *pseudocompactum* and *T. aethiopicum* var. *densimenelikii*, *T. dicoccum* var. *serbicum* and *T. dicoccum* var. *atratum.*

Materials and Methods

Domestic emmer (*T. dicoccum*) varieties were kindly provided by the Laboratory of Wheat Breeding and Physiology of the Plant Production Institute (PPI) named after V. Ya. Yuriev of the National Academy of Agrarian Sciences of Ukraine. Accessions of *T. dicoccoides* var. *pseudojordanicum* (IR00517, Israel), *T. timofeevii* (UA0300107, Georgia), *T. persicum* var *rubiginosum* (UA 0300066), *T. durum* var. *falcatamelanopus* (IR 00137, Syria), *T. polonicum* var. *pseudocompactum* (UA 0300337), *T. dicoccum* var. *serbicum* (UA0300183, Russia), *T. aethiopicum* Jakubz. var. *densimenelikii* (violet grain) (UA0300480), *T. dicoccum* var. *atratum* (UA0300485, Hungary), *T. dicoccum* var. *atratum* (UA0300214, USA), and *T. dicoccum* var. *atratum* (UA0300081, Poland) were kindly provided by the National Center for Plant Genetic Resources of Ukraine. Wheat was grown in the PPI's experimental plots in compliance with conventional farming techniques. Grain was harvested in 2015, 2016, 2017, 2018 and 2019. Two samples of freshly-harvested (to avoid the storage effect) grain were analyzed for each year. Whole kernels were milled on a laboratory mill LZM.

Fatty acid methyl esters were prepared by the modified Peisker method [12]. Chloroform (Thermo Fisher Scientific Inc., USA) — methanol (Honeywell Research Chemicals, Romania) — 96% sulfuric acid (Dneprochem, Ukraine) mixture in a ratio of 100:100:1 was used for methylation. 30–50 µl of lipid extract was placed in a glass ampoule; 2.5 ml of methylation mixture was added, and the ampoule was sealed. Ampoules were incubated in a thermostat at 105 °C for 3 hours. After methylation, ampoules were opened, the contents were transferred to test tubes, a pinch of powdered zinc sulfate (ChemElements, Ukraine) was added, and then 2 ml of distilled water and 2 ml of hexane (MOL Group, Hungary) were poured to extract methyl esters. After thoroughly stirring and settling, the hexane extracts were filtered and analyzed by gas chromatography [13].

Fatty acid composition was determined using a gas chromatograph Selmikhrom 1 (OAO SELMI, Ukraine) equipped with a flame ionization detector (FID). The stainless steel column, 2.5 m length×4 mm i.d., was packed with a stationary phase, Inerton AW-DMCS (0.16–0.20 mm) (Lachema, Czechia) processed with 10% diethylene glycol succinate (BOC Sciences, USA). 2 µl of hexane solution of fatty acid methyl esters was injected. Gas chromatography was operated under the following conditions: nitrogen flow 30 ml/min; hydrogen flow 30–35ml/min; air flow 300 ml/min; column temperature 180 °C; injector temperature 230 °C and FID temperature 220 °C. The fatty acids were identified by comparing the retention times of the peaks with those of reference fatty acid methyl esters (Sigma-Aldrich, USA).

The percentages of fatty acid methyl esters were calculated by internal normalization.

The data were statistically processed in STATGRAPHICS PLUS, using ANOVA method. The results in the Table are presented as mean ± standard deviation (SD) and reported to three significant figures. Graphs were plotted in Statistica 10.

Results and Discussion

As we had expected, 6 major fatty acids were detected in all wheat species. They are listed in order of decreasing amounts as follows: linoleic (C18:2) > oleic (C18:1) >palmitic (C16:0) > linolenic (C18:3) > stearic (C18:0) > palmitoleic (C16:1). This distribution did not vary from year to year and is slightly different from the ranking reported by Narducci V. et al for durum wheat [14]: linoleic (C18:2) > palmitic (C16:0) ≈ oleic (C18:1) > linolenic (C18:3) > stearic (C18:0) > palmitoleic (C16:1). We also detected trace amounts of 3 minor fatty acids: eicosanoic acid (C20:0), eicosenoic acid (C20:1) and behenic acid (C22:1). Their contents were 0.1% in most of the species under investigation (below 0.5% in all the species) and characterized by wide variability. At the same time, the palmitoleic oleic acid content was much less variable in most of the species under investigation, although it never exceeded 1% and was 0.1%, too, in many cases. Fig. 1 shows a typical chromatogram of one of the best (in terms of unsaturated fatty acid content) wheat accessions.

Bottari et al. [15] obtained more than 60 peaks by gas chromatography and mass spectrometry and identified fatty acids with even numbers of carbon atoms from C12 to C30 as well as with odd numbers of carbon atoms C15 and C17. The database of the United States Department of Agriculture (USDA) also reports small levels of C14:0 in durum wheat kernels (0.003 g/100 g fresh matter). There are also publications reporting minor fatty acids (C17, C20, C22 and C24) both in kernels [16] and in germ oil [17, 18]. Myristic acid (C14:0) was present in negligibly small amounts and irrelevant for calculation of fatty acid percentages. We detected no other minor fatty acids, as they were below limit of quantification for our method. Only C16:0, C18:0, C18:1, C18:2 and C18:3 accounting for around 90% of the total fatty acid content in durum wheat grain are constantly reported by all researchers and considered as the most important ones in durum wheat, while others amount to approximately 1–2% in total [19].

Wheat and other cereals lack Δ^6desaturase, the enzyme responsible for catalytic conversion of linoleic acid to γ-linolenic acid [20] and conversion of α-linolenic acid to stearidonic acid (C18:4). Therefore, we expectedly found no stearidonic acid, and all the linolenic acid in our samples should be considered as α-linolenic acid.

There is an idea that some parameters of grain quality can deteriorate during domestication. For example, Chatzav et al. reported that domestic emmer was inferior to its wild ancestor in terms of protein, iron and zinc contents [21]. Unsaturated fatty acid levels are obviously not the case, since the ratio of unsaturated acids to saturated ones in grain of wild emmer *T. dicoccoides* var. *pseudojordanicum* is even slightly lower than in the domestic emmer varieties bred at the PPI (Table).

It is noteworthy that there were no significant differences for 4 (palmitic, linoleic, oleic and palmitoleic) of 6 major fatty acids between *T. dicoccoides* var. *pseudojordanicum* and *T. dicoccum* var. *serbicum,* which is considered to have not been crossed with other tetraploid species and have undergone the least changes in the breeding process. On the other hand, *T. dicoccum* var. *atratum* accessions from different locations, which are morphologically very close, in many cases differ one from another in contents of 5 of 6 major fatty acids (except palmitoleic acid).

Increased unsaturated fatty acid contents is known to be associated with cold tolerance and considered as a general biological pattern. However, there are data that increased unsaturated fatty acid contents are due rather to cold hardening than to genetic differences between cold hardy and less hardy varieties, as the fatty acid profiles did not differ between the varieties under investigation [22]. For oil crops, Chernova et al. [23] reported that winter-type rapeseed seeds contained triglycerides with a lower degree of saturation, while in spring-type rapeseed highly saturated lipids were the most abundant. We found that the unsaturated/saturated ratio in grain was not associated with growth habit (winter vs. spring).

The oil value is primarily determined by unsaturated fatty acids. In this respect, *T. timofeevii* seems the most promising species for crossing with other tetraploid species to improve wheat oil quality via breeding. Nevertheless, the emmer varieties bred at the PPI, Holikovska and Romanivska, and durum wheat variety Spadschina, also

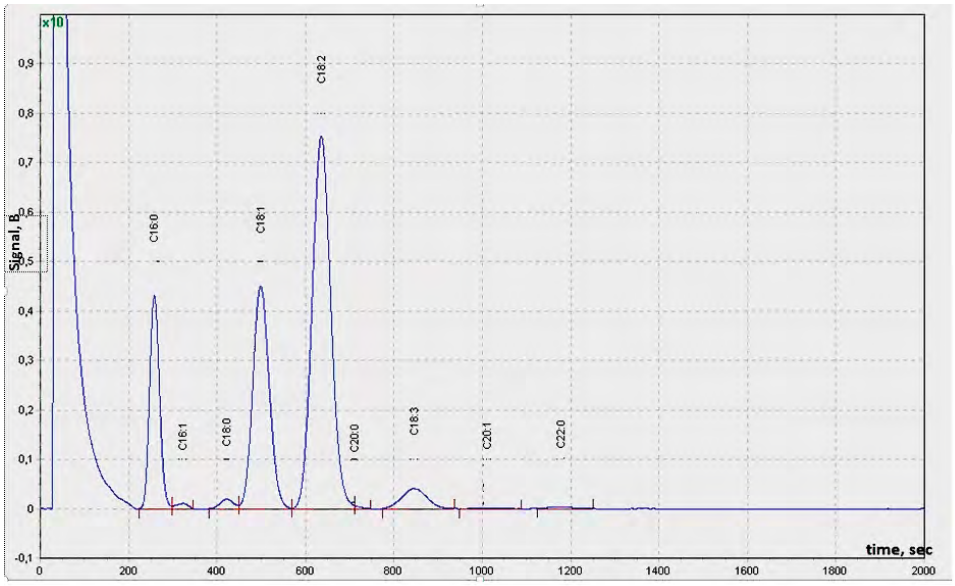

Fig. 1. **Typical chromatogram of fatty acid methyl esters extracted from *T. timofeevii* grain**

developed by the PPI, boast rather high unsaturated/saturated ratios (4.5, 4.7, and 5.1, respectively). These values are higher than those registered for durum wheat in USDA and Italian National Institute for Research on Food and Nutrition (IINRAN) databases (3.0 and 3.5, respectively) and also higher than the average ratio obtained by Narducci et al. for Italian durum wheat varieties [14].

Interspecies comparison showed that among emmer species *T. timofeevii* and emmer varieties Holikovska and Romanivska had the best unsaturated/saturated ratios (see above). This is attributed rather to the sum of unsaturated fatty acids than to an increased content of one component. Linoleic acid content in oil from *T. timofeevii* grain was significantly higher than in oil from *T. dicoccoides* var. *pseudojordanicum, T. dicoccum* var. *atratum* (Poland), *T. dicoccum* var. *atratum* (USA) and *T. dicoccum* var. *serbicum*. Linolenic acid content in oil from *T. timofeevii* grain was significantly lower than in oil from *T. dicoccoides* var. *pseudojordanicum,* but higher than in oil from *T. dicoccum* var. *atratum* (USA) and *T. dicoccum* var. *atratum* (Poland). Oleic acid content in oil from *T. timofeevii* grain was significantly lower than in oil from *T. dicoccoides* var. *pseudojordanicum, T. dicoccum* var. *atratum* (Poland) and *T. dicoccum* var. *serbicum,* but significantly higher than in oil from *T. dicoccum* var. *atratum* (Hungary). Palmitoleic acid content in oil from *T. timofeevii* grain was significantly higher than in oil from *T. dicoccoides* var. *pseudojordanicum, T. dicoccum* var. *atratum* (Poland), *T. dicoccum* var. *atratum* (USA), *T. dicoccum* var. *atratum* (Hungary) and *T. dicoccum* var. *serbicum*. As to domestic emmer, linoleic acid content in oil from varieties Holikovska and Romanivska was significantly higher than in oil from *T. dicoccoides* var. *pseudojordanicum, T. dicoccum* var. *atratum* (Poland), *T. dicoccum* var. *atratum* (USA), *T. dicoccum* var. *atratum* (Hungary) and *T. dicoccum* var. *serbicum*. Linolenic acid content in oil from varieties Holikovska and Romanivska was significantly lower than in oil from *T. dicoccoides* var. *pseudojordanicum,* but higher than in oil from *T. dicoccum* var. *atratum* (Poland) and *T. dicoccum* var. *atratum* (USA). Oleic acid content in oil from varieties Holikovska and Romanivska was significantly lower than in oil from *T. dicoccoides* var. *pseudojordanicum, T. dicoccum* var. *serbicum, T. dicoccum* var. *atratum* (Poland) and *T. dicoccum* var. *atratum* (Hungary). Palmitoleic acid content in oil from varieties Holikovska and Romanivska was significantly higher than in oil from *T. dicoccoides* var. *pseudojordanicum, T. dicoccum* var. *atratum* (Poland), *T. dicoccum* var. *atratum* (USA), *T. dicoccum* var. *atratum* (Hungary) and *T. dicoccum* var. *serbicum*. No differences between Holikovska and Romanivska are explained by their close origin in the breeding process.

As to durum wheat and related species, variety Spadschina has the best unsaturated/saturated ratio. The ratios for *T. persicum* var. *rubiginosum, T. durum* var. *falcatamelanopus,*

Fatty acid composition of tetraploid wheat grain oil (relative content,%)

Source	Palmitic C16:0	Palmitoleic C16:1	Stearic C18:0	Oleic C18:1	Linoleic C18:2	Linolenic C18:3	Eicosanoic C20:0	Eicosenoic C20:1	Behenic C22:0	Ratio Unsaturated/ Saturated
USDA	23.9	0.51	1.02	19.3	52.8	2.54	Not mentioned	Not mentioned	Not mentioned	3.0
INRAN	21.1	0.41	1.24	16.5	56.2	4.55	Not mentioned	Not mentioned	Not mentioned	3.5
Narducci et al. [14]	19.1 ± 3.18	0.40 ± 0.08	1.23 ± 0.38	19.1 ± 5.58	54.0 ± 12.7	6.35 ± 1.59	Not detected	Not detected	Not detected	3.8
Our data Species or variety/Growth habit										
T. dicoccoides var. *pseudojordanicum* / winter	17.7 ± 0.28	0.08 ± 0.01	0.77 ± 0.09	27.5 ± 0.05	47.9 ± 0.14	5.48 ± 0.14	0.08 ± 0.001	0.10 ± 0.01	0.39 ± 0.03	4.3
T. dicoccum var. *atratum* (Hungary)/ winter	18.9 ± 0.14	0.08 ± 0.03	0.91 ± 0.02	24.2 ± 0.19	51.4 ± 0.42	4.01 ± 0.02	0.10 ± 0.01	0.10 ± 0.01	0.33 ± 0.04	3.9
T. dicoccum var. *atratum* (Poland)/winter	18.0 ± 0.16	0.10 ± 0.01	1.17 ± 0.06	27.7 ± 0.27	48.8 ± 0.49	3.60 ± 0.06	0.09 ± 0.02	0.11 ± 0.01	0.41 ± 0.09	4.1
T. dicoccum var. *atratum* (USA)/winter	18.8 ± 1.02	0.11 ± 0.05	1.30 ± 0.17	26.6 ± 0.53	49.1 ± 1.53	3.52 ± 0.19	0.10 ± 0.02	0.12 ± 0.04	0.36 ± 0.03	3.9
T. dicoccum var. *serbicum*/ spring	16.7 ± 0.32	0.09 ± 0.01	1.38 ± 0.11	27.4 ± 0.21	49.4 ± 0.54	4.42 ± 0.12	0.11 ± 0.01	0.11 ± 0.01	0.44 ± 0.02	4.3
T. timofeevii/ spring	15.4 ± 0.15	0.68 ± 0.04	0.96 ± 0.07	25.7 ± 1.31	52.7 ± 1.32	3.99 ± 0.27	0.13 ± 0.05	0.10 ± 0.02	0.29 ± 0.08	5.0
T. persicum var.*rubiginosum*/spring	19.0 ± 0.66	0.85 ± 0.13	1.05 ± 0.04	19.1 ± 0.73	52.8 ± 0.65	6.60 ± 0.60	0.14 ± 0.04	0.12 ± 0.08	0.30 ± 0.06	3.9
T. durum var. *falcatamelanopus*/spring	17.3 ± 0.71	0.61 ± 0.08	1.19 ± 0.10	20.9 ± 1.48	54.9 ± 0.81	4.59 ± 0.23	0.12 ± 0.05	0.08 ± 0.02	0.29 ± 0.07	4.3
T. polonicum var. *pseudocom pactum*/ spring	18.4 ± 0.16	0.64 ± 0.08	1.05 ± 0.07	21.1 ± 1.02	53.4 ± 0.81	4.84 ± 0.41	0.10 ± 0.04	0.09 ± 0.04	0.32 ± 0.08	4.0
T. aethiopicum var. *densime nelikii* (violet grain)/spring	19.1 ± 0.66	0.64 ± 0.11	0.95 ± 0.12	16.5 ± 0.30	55.9 ± 0.35	6.46 ± 0.43	0.11 ± 0.01	0.07 ± 0.02	0.29 ± 0.03	3.9
Emmer Romanivska/spring	16.0 ± 0.42	0.30 ± 0.13	1.23 ± 0.12	24.3 ± 0.69	53.3 ± 0.78	4.40 ± 0.13	0.14 ± 0.04	0.08 ± 0.02	0.20 ± 0.08	4.7
Emmer Holikovska/ spring	17.1 ± 0.94	0.39 ± 0.09	0.98 ± 0.09	24.2 ± 0.46	52.9 ± 0.35	4.39 ± 0.12	0.17 ± 0.05	0.08 ± 0.03	0.18 ± 0.10	4.5
Durum wheat Spadschina (reference variety)/spring	14.9 ± 0.39	0.42 ± 0.09	1.21 ± 0.11	24.4 ± 0.33	54.3 ± 0.45	4.32 ± 0.16	0.13 ± 0.04	0.12 ± 0.04	0.30 ± 0.10	5.1

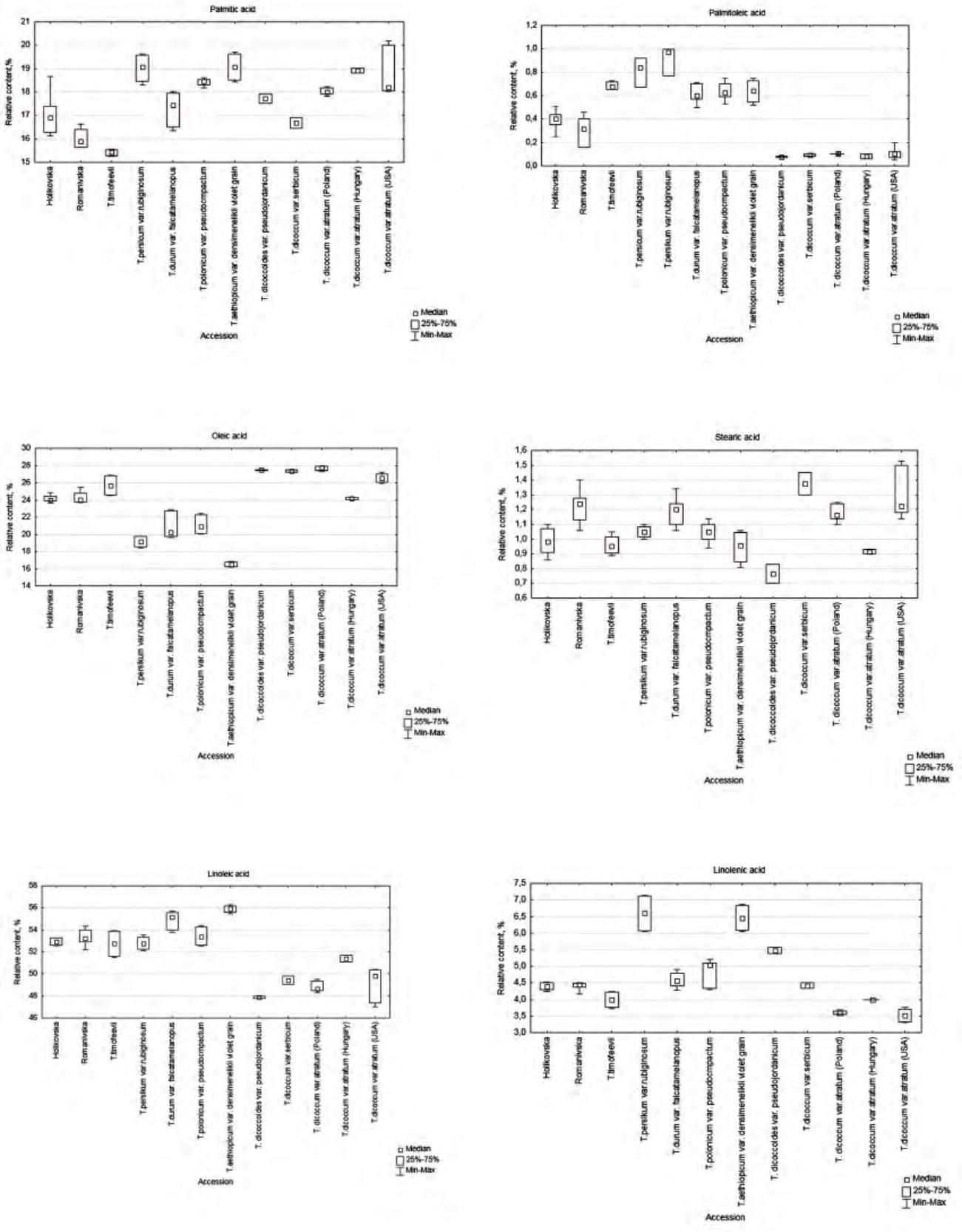

Fig. 2. **'Box-and-whiskers' plots of fatty acid content in grain of tetraploid wheat species grown in the same location for three consecutive years**

T. polonicum var. *pseudocompactum* and *T. aethiopicum* var. *densimenelikii* were less beneficial (Table). Thus, these species are unadvisable to use in crossings for improvement oil quality. The highest level of linoleic acid was recorded for *T. aethiopicum* var. *densimenelikii* (though there was no significant difference in comparison with *T. durum* var. *falcatamelanopus);* however this species had the lowest level of oleic acid (Table). The oleic acid levels in oil from *T. persicum* var.*rubiginosum, T. durum* var. *falcatamelanopus* and *T. polonicum* var. *pseudocompactum* did not differ. The highest levels of linolenic acid were observed in oil from *T. aethiopicum* var. *densimenelikii* and *T. persicum* var.*rubiginosum* grain (6.46 ± 0.43% and 6.60 ± 0.60%, respectively, vs. 4.84 ± 0.41% and 4.59 ± 0.23%, respectively, for *T. polonicum* var. *pseudocompactum* and *T. durum* var. *falcatamelanopus* oil). The highest level of palmitoleic acid was determined in oil from *T. persicum* var. *rubiginosum* (0.85 ± 0.13% vs. 0.61 ± 0.08%, 0.64 ± 0.08% and 0.64 ± 0.11% for *T. durum* var. *falcatamelanopus, T. polonicum* var. *pseudocompactum* and *T. aethiopicum* var. *densimenelikii* oil, respectively).

The greatest variability was intrinsic to fatty acids, contents of which were below 1%: the peak variation coefficients amounted to 48.8% for palmitoleic acid in *T. dicoccum* var. *atratum* (USA) and 67.7% for eicosenoic acid in *T. persicum* var. *rubiginosum*. In Fig. 2, box and whisker plots are presented.

The plots show no patterns in variability of fatty acid contents across the species under investigation. The same species (for example, *T. persicum* var. *rubiginosum* with variation coefficients of 15.5% and 4.19% for palmitoleic and stearic acids, respectively*)* can be characterized by a wide variability in one fatty acid and by a narrow range for another. At the same time, the same fatty acid (for example, palmitic acid) can be very variable within one species (*T. dicoccum* var. *atratum* (USA) and variety Holikovska; variation coefficient = 5.45% and 5.49%, respectively) and demonstrate a relatively stable content in another (*T. dicoccum* var. *atratum* (Hungary)*;* variation coefficient = 0.75%).

Thus, we can conclude that 1) six major fatty acids were found in tetraploid wheat species, with linoleic acid being the most abundant; 2) there was no evidence of deterioration in the grain quality in terms of unsaturated fatty acid levels, since the ratio of unsaturated acids to saturated ones in grain of wild emmer *T. dicoccoides* var. *pseudojordanicum* was even slightly lower than in the domestic emmer varieties; 3) *T. timofeevii,* emmer varieties Holikovska and Romanivska and durum wheat variety Spadschina had the most beneficial unsaturated/saturated ratios; 4) we observed no patterns in variability of fatty acid contents across the species under investigation, since same species can be characterized by a wide variability in one fatty acid and by a narrow range for another, and, at the same time, the same fatty acid can be very variable within one species.

The work was supported by the National Academy of Agrarian Sciences project 24.01.03.01.Ф. (State Registration Number 0116U001070). The authors declare that they have no conflicts of interest.

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ЖИРНОКИСЛОТНИЙ СКЛАД ОЛІЇ ІЗ ЗЕРНА ДЕЯКИХ ВИДІВ ТЕТРАПЛОЇДНОЇ ПШЕНИЦІ

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Незважаючи на те, що пшениця ніколи не належала до олійних культур, олію з пшеничних зародків та висівок вважають цінною, оскільки вона містить важливі біоактивні сполуки. Більшість досліджень у цій галузі проводять на традиційних комерційних сортах пшениці. Водночас інтерес селекціонерів, виробників та споживачів повертається до давніх та малопоширених видів пшениці. З огляду на вищезазначене ми поставили за мету оцінити тетраплоїдні види пшениці (*Triticum. dicoccoides* var. *pseudojordanicum, Triticum dicoccum, Triticum timofeevii, Triticum persicum* var *rubiginosum, Triticum durum* var. *falcatamelanopus, Triticum polonicum* var. *pseudocompactum* і *Triticum aethiopicum* var. *densimenelikii)* за показниками жирнокислотного складу. Для оцінювання використовували зерно врожаю 2015, 2016, 2017, 2018 та 2019 рр. Метилові ефіри жирних кислот готували за модифікованим методом Пейскера. Жирнокислотний склад аналізували методом газової хроматографії.

У зерні видів тетраплоїдної пшениці було знайдено шість основних жирних кислот, і найвищим був рівень лінолевої кислоти. Співвідношення ненасичених кислот до насичених у зерні дикорослої полби *T. dicoccoides* var. *pseudojordanicum* було дещо нижчим, ніж у зерні сортів культурної полби. *T. timofeevii,* сорти полби Голіковська і Романівська, а також сорт твердої пшениці Спадщина мали найкращі співвідношення ненасичені/насичені жирні кислоти.

Не отримано доказів погіршення якості зерна за показником рівнів ненасичених жирних кислот. Ми не спостерігали закономірностей у варіабельності вмісту жирних кислот у зерні досліджених видів.

Ключові слова: види тетраплоїдної пшениці, жирні кислоти, якість олії, газова хроматографія.

ЖИРНОКИСЛОТНЫЙ СОСТАВ МАСЛА ИЗ ЗЕРНА НЕКОТОРЫХ ВИДОВ ТЕТРАПЛОИДНОЙ ПШЕНИЦЫ

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Несмотря на то, что пшеница никогда не относилась к масличным культурам, масло из пшеничных зародышей и отрубей считают ценным, поскольку оно содержит биологически активные соединения. Большинство исследований в этой области проводят на традиционных коммерческих сортах пшеницы. В то же время интерес селекционеров, производителей и потребителей возвращается к древним и малоиспользуемым видам пшеницы. Учитывая вышеизложенное, мы поставили цель оценить тетраплоидные виды пшеницы (*Triticum. dicoccoides* var. *pseudojordanicum, Triticum dicoccum, Triticum timofeevii, Triticum persicum* var *rubiginosum, Triticum durum* var. *falcatamelanopus, Triticum polonicum* var. *pseudocompactum* и *Triticum aethiopicum* var. *densimenelikii)* по показателям жирнокислотного состава. Зерно собирали в 2015, 2016, 2017, 2018 и 2019 гг. Метиловые эфиры жирных кислот готовили по модифицированному методу Пейскера. Жирнокислотный состав анализировали методом газовой хроматографии.

В зерне видов тетраплоидной пшеницы было обнаружено шесть основных жирных кислот, и наиболее высоким был уровень линолевой кислоты. Соотношение ненасыщенных кислот к насыщенным в зерне дикой полбы *T. dicoccoides* var. *pseudojordanicum* было несколько ниже, чем в зерне сортов культурной полбы. *T. timofeevii,* сорта полбы Голиковська и Романивська, а также сорт твердой пшеницы Спадщина характеризовались наилучшими соотношениями ненасыщенные/насыщенные жирные кислоты.

Не получено доказательств ухудшения качества зерна по показателю уровней ненасыщенных жирных кислот. Мы не наблюдали закономерностей в вариабельности состава жирных кислот в зерне исследованных видов.

Ключевые слова: виды тетраплоидной пшеницы, жирные кислоты, качество масла, газовая хроматография.