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GENETIC RECOURSES: EVALUATION OF THE VALUE OF SOME OLD LATVIAN FLAX ACCESSIONS

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Abstract. *In the resent years evaluation and conservation of genetic recourses becomes of great importance. Some of the genotypes could be lost when un-sufficient attention is given to them. Some old (created before WWII) Latvian flax accessions have been investigated at the collection nursery at the Upytė Experimental Station of the Lithuanian Research Centre for Agriculture and Forestry in 2007-2010. Phenological phases, plant height, flower colour, stem, seed and long fibre yield, fibre content and quality (flexibility, strength, quality number), duration of vegetation period, resistance to lodging, etc., have been investigated. The most valuable genotypes have been suggested to be used in further breeding programs.*

Keywords: *breeding, genetic recourses, flax, fibre, Latvian origin.*

Introduction

Latvians and Lithuanians have similar language, and being close neighbours have more or less similar pedoclimatical conditions to develop agriculture, so both countries (among many others) have been involved in flax growing long ago.

Before the World War II flax production was very important in Baltic countries [1; 2].

Fibre flax breeding in Lithuania has been carried out since 1922. Since 1922 to 2005 eighteen fibre flax varieties have been developed in our country, and in 2009 three new varieties have been registered [3].

Flax breeding in Latvia was started in 1923. After World War II, flax growing was not considered as an important task for the region, and, therefore, the flax area in the country was gradually reduced. In 1970, flax breeding in Latvia was cancelled [4]. Fibre flax breeding was started in Latvia again since 1992 [5], linseed (oil flax) growing and breeding has been started there in 1993 [6]. The repatriation and investigation of the Latvian flax genetic resources become a very actual task [1].

Several accessions of the Latvian origin, created and collected before the Second World War were repatriated from the N.I. Vavilov Institute of Plant Industry (Russia), Flax Research Institute of Russia, the Institute of Plant Genetics and Crop Plant Research (Germany) and Polish Seed Gene Bank [7].

Many authors report that plant genetic resources have a national value for each country [8; 9; 10; 11; 12; 13; 14]. Collection, storage and investigation of plant genetic resources have become a very important task in many countries [15; 16; 17; 9; 10; 12; 13].

Different local and foreign varieties, accessions, and breeding lines serve as a solid basis for the development of new plant varieties [9; 14; 15; 18]. The main targets when creating flax varieties are yielding capacity, fibre quality, good adaptability to local climatic and soil conditions, resistance to lodging and diseases [19; 20; 21; 22].

The task of the present study was to evaluate valuable characters of investigated fibre flax accessions with aim to include the best of them into fibre flax breeding programs as well as to confirm the value of genetic resources tested and to save them for coming generations.

Materials and methods

The investigation was carried out over the period 2007-2010 at the Upytė Experimental Station of the Lithuanian Research Centre for Agriculture and Forestry. Flax was grown on a

sandy loam Endocalcari-Endohypogleic Cambisol [23]. The main agrochemical parameters of the arable soil layer were following: pH_{KCl} – 6.7-7.5, humus content – 2.0-3.62 %, available P_2O_5 – 202-245 mg kg^{-1}, available K_2O – 122-152 mg kg^{-1}.

Flax was sown after winter wheat. Conventional cultivation practices were used.

In the collection flax was sown in a 1 m wide band with 10 cm interrows, without replications. The area of the plot was 1 m^2 and seed rate – 22-25 million of viable seeds per hectare.

Flax varieties for investigation were obtained from Agriculture Science Centre of Latgale (Director dr. V. Stramkale). The set of following flax accessions was investigated: 1. Altgauzen 3*19; 2. Altgauzen 5*30; 3. Altgauzen 12*80; 4. Altgauzen 16*90; 5. Altgauzen 17*93; 6. Altgauzen 23*112; 7. Dolgunec N 32; 8. Dolgunec N 115; 9. Dolgunec N 101; 10. Dolgunec N 116; 11. Dolgunec N 143; 12. Mestnyj belocvetkovyj N 580; 13. Mestnyj N 1; 14. Mestnyj N 3; 15. Mestnyj N 4; 16. Mestnyj N 6; 17. N 2; 18. N 5; 19 N 7. Accessions 7-12 were included to the list of VIR collection (obtained from Stendes breeding station) in 1930, and accessions 13-19 – in 1939, so they were developed many years ago. All the investigated varieties were compared to the standard fibre flax variety 'Kastyčiai' (productive, medium late, lodging resistant, distinguishing by good fibre quality) at present registered in Lithuania.

Insecticides were sprayed against flax flea beetles and herbicides were used to control weeds.

During flax growth period the phenological observations were conducted; before harvesting the resistance to lodging was assessed. Flax was pulled at the stage of early yellow ripeness, threshed by a MS thresher, the stems were retted in a warm (33-37˚C) water, then were scuthched by machine tool SMT-200, fibre was hackled with special combs. Quality number of long fibre was determined in the laboratory, flexibility – by a device G-2, strength of fibre – by a device DK-60. All field trials were conducted (with a few modifications) in compliance with published methodology [24; 25].

Over investigation years (2007-2010) meteorological conditions were diverse. The years 2007, 2008 and 2010 were less or more favourable for flax growing, but in 2009 we discarded the Collection nursery because of uneven germination, developing and ripening of flax plants. Of course, the meteorological conditions during flax growing period had influence on all tested parameters, but all the tested accessions were sown close each other, so they have similar pedoclimatical conditions.

Results and discussion

The average date from 2007, 2008 and 2010 are presented in the graphs. The tallest plants (besides of the standard 'Kastyčiai') in the field were that of the accession Dolgunec N 32 (76.2 cm) (Fig. 1). Very close to this mean was the height of plants of accessions Dolgunec N 101 (75.5 cm), Dolgunec N 116 (75.8 cm), Dolgunec N 143 (75.3 cm) and Mestnyj N 6 (74.9 cm). The shortest were plants of accessions N 7 (57.3 cm), Mestnyj N 4 (61.8 cm), Mestnyj belocvetkovyj N 580 (62.5 cm).

Plants of all tested accessions ripped earlier than that of standard variety 'Kastyčiai' (Fig. 2). The shortest growing period (from full germination to early yellow ripening stage) had plants from the set of Altgauzen accessions – 79-80 days. Those accessions could serve as the donors for the earliness.

Tested accessions were less resistant to lodging than the standard 'Kastyčiai' (Fig. 3). The most resistant to lodging were plants of Mestnyj belocvetkovyj N 580 (8.8 points), and plants of N 5 (6.3 points) and N 7 (6.5 points) were the most sensitive to lodging.

Old Latvian flax accessions were less productive than modern variety, and it is justifiable. The highest stem yield was produced by plants of accession N 2 (0.547 kg m^{-2}, or 5.47 t ha^{-1}) (Fig. 4).

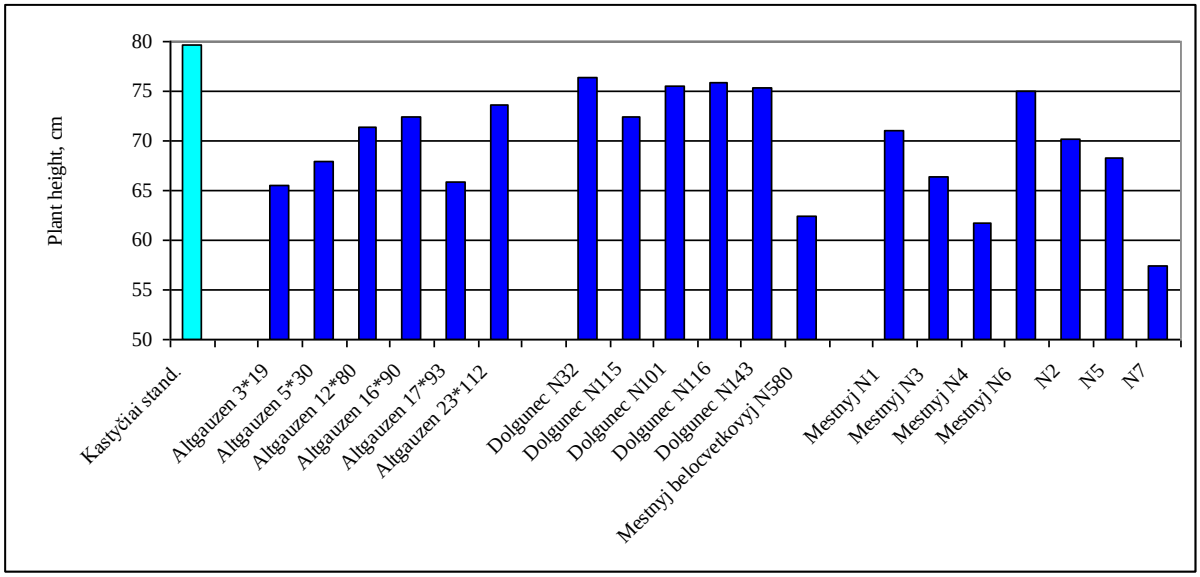

Fig. 1. **Plant height of tested accessions**

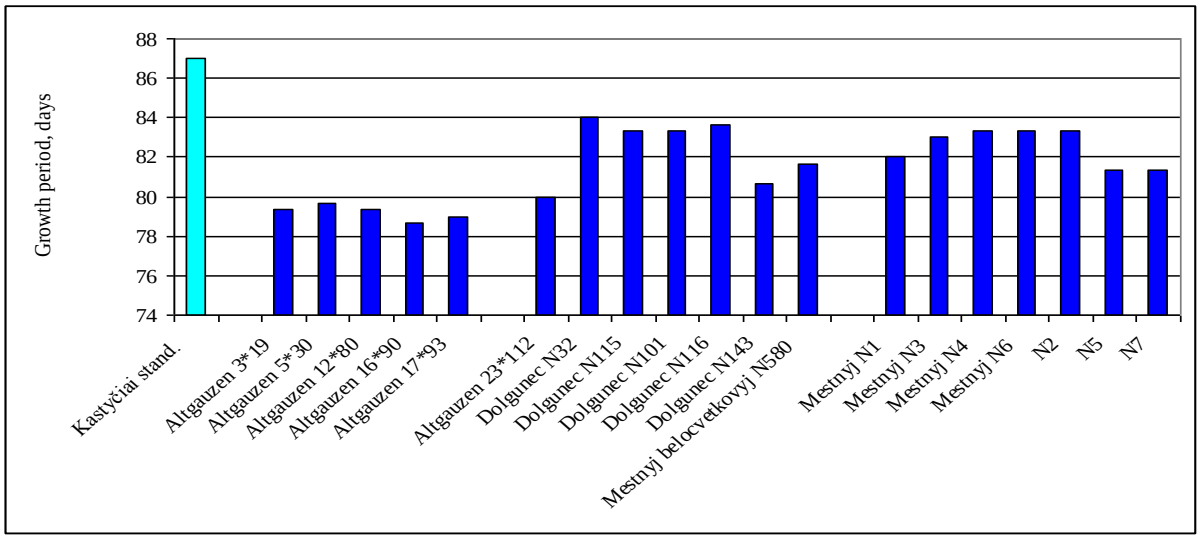

Fig. 2. **Growth period of tested accessions**

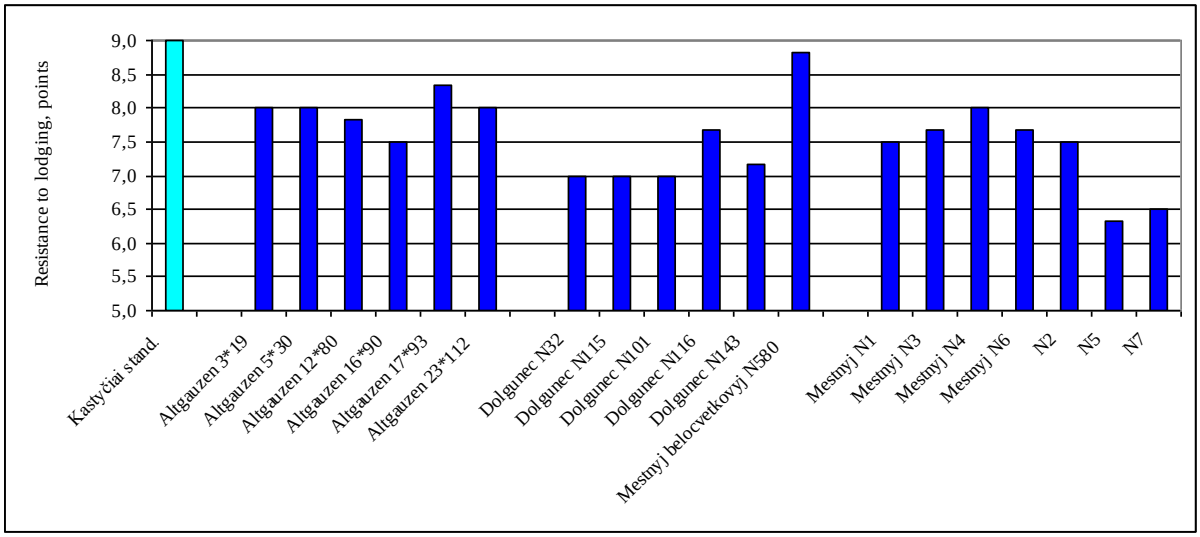

Fig. 3. **Resistance of tested accessions to lodging**

Very close results showed accessions Dolgunec N 116 (0.526 kg m^{-2}) and Mestnyj N 6 (0.525 kg m^{-2}). The highest seed yield was obtained from plants of accessions Dolgunec N 115 (0.087 kg m^{-2}, or 0.87 t ha^{-1}), Mestnyj N 4 and Mestnyj N 6 (0.081 kg m^{-2}, or 0.81 t ha^{-1}).

Long fibre yield (and fibre content in the stems) of tested accessions was rather lower than average yield of 'Kastyčiai' plants (782 kg ha^{-1} and 14.8 %, respectively) (Fig. 5). From tested accessions Dolgunec N 116 (496 kg ha^{-1}) and Mestnyj N 6 (431 kg ha^{-1}) gave the highest long fibre yield. Other accessions were less productive. Similar tendency could be noted for the fibre content data.

Very important character of the variety is fibre quality – flexibility, breaking tenacity (strength), divisibility (fineness), thus new varieties should be not only high yielding but also should have good fibre quality [26; 27; 28]. The data of evaluation of fibre quality are delighting. Variety 'Kastyčiai' is characterized as flax owning good fibre quality, but the majority of tested accessions prevailed over our standard variety. The most flexible fibre was obtained from flax of accessions N 2 (61.1 mm), Mestnyj N 1 (59.3 mm), Mestnyj belocvetkovyj N 580 (58.4 mm) and Altgauzen 17*93 (58.0 mm) (Fig. 6). The best results of fibre strength were shown by flax of accession Altgauzen 16*90 (16.2 kg F). Strong fibre was obtained from flax of accessions Altgauzen 23*112 (14.5 kg F) and Altgauzen 3*19 (14.4 kg F). The highest (from tested old Latvian accessions) long fibre quality number (Nb 11.0) was established for fibre of accessions Dolgunec N 115, Dolgunec N 101 and N 2 (Fig 7).

Also we investigated 1000 seed weight. Seeds of tested accessions were rather smaller than that of modern variety 'Kastyčiai' (5.24 g) (Fig. 8). Plants of accession Dolgunec N 101 produced largest seeds (1000 seed weight – 4.58 g) from all tested accessions.

In this context it would be fair to say, that the most valuable accessions from the tested set were Altgauzen 3*19, Altgauzen 5*30, Altgauzen 12*80, Altgauzen 16*90, Altgauzen 17*93, Altgauzen 23*112, Mestnyj belocvetkovyj N 580, Dolgunec N 32, Dolgunec N 101, Dolgunec N 116, N 2, Mestnyj N 6, Mestnyj N 1. Those varieties could be recommended to be included into fibre flax breeding programmes.

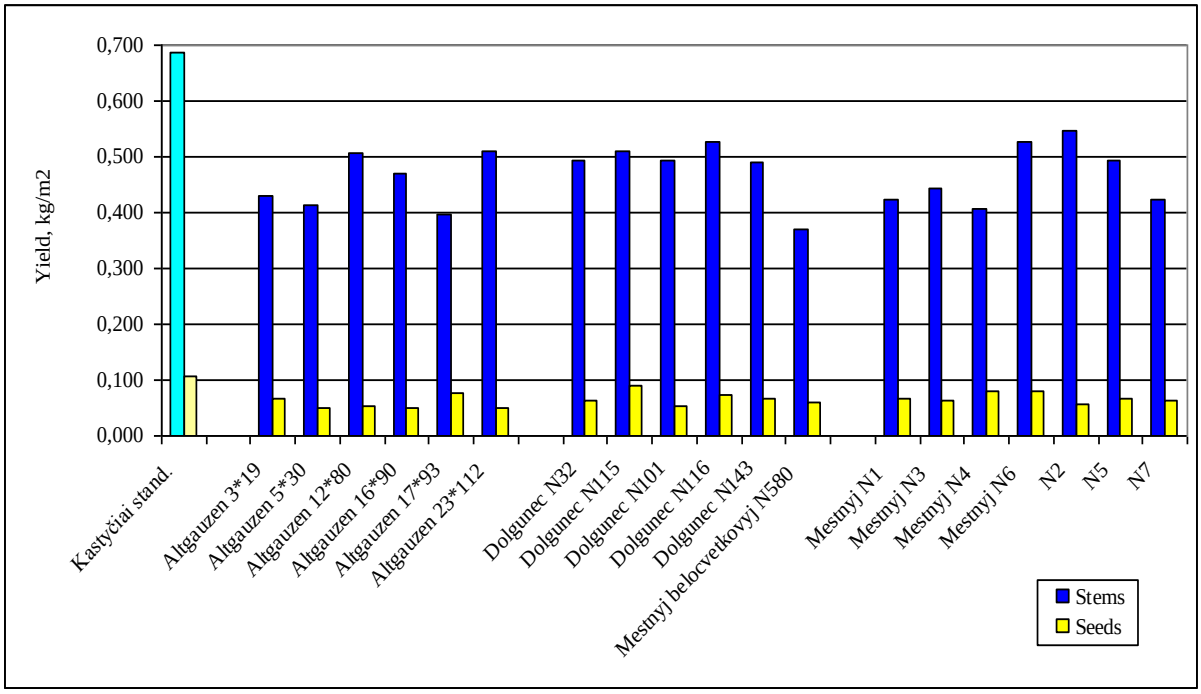

Fig. 4. **Stem and seed yield of tested accessions**

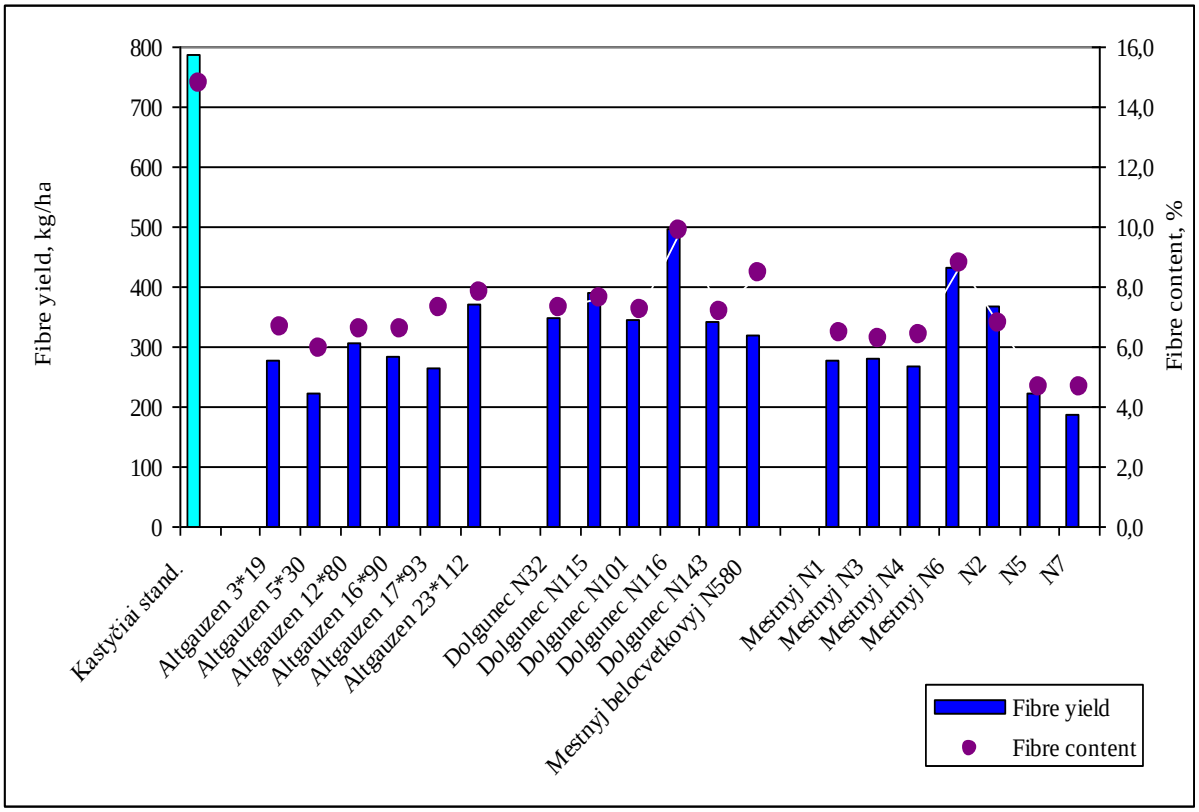

Fig. 5. **Long fibre yield and fibre content of tested accessions**

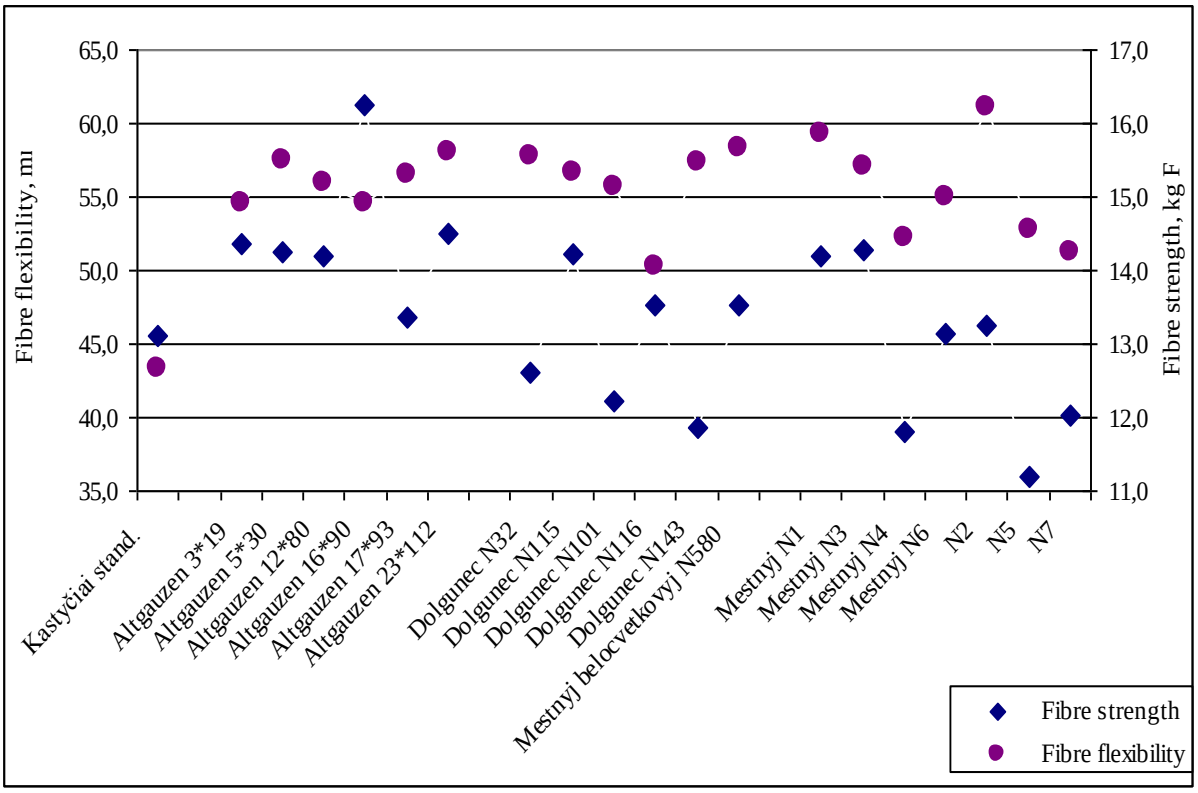

Fig. 6. **Long fibre flexibility and strength of tested accessions**

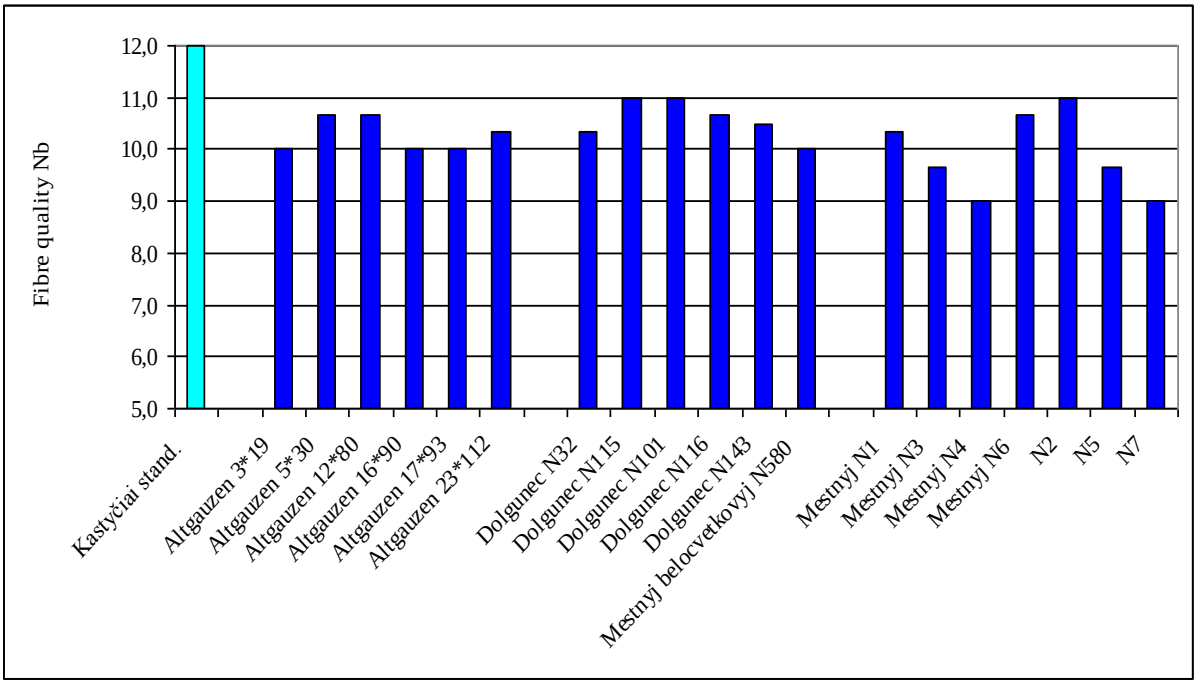

Fig. 7. **Long fibre quality number of tested accessions**

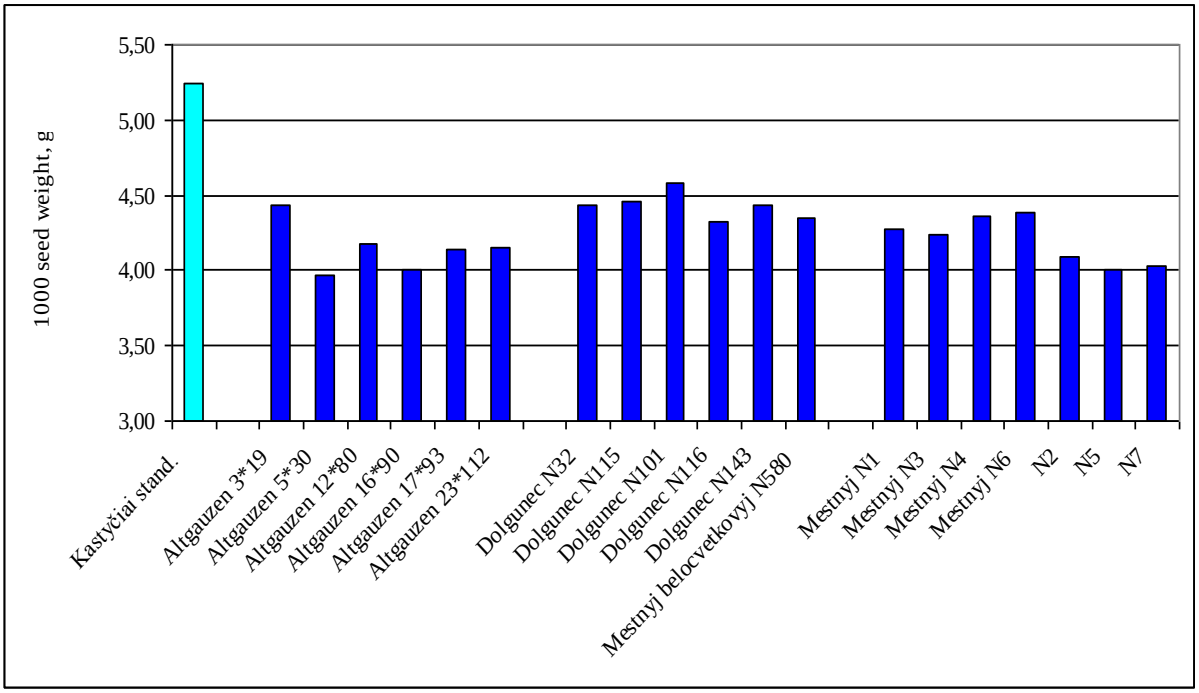

Fig. 8. **1000 seed weight of tested accessions**

Conclusions

The tallest plants (besides of the standard 'Kastyčiai') in the field were that of the accession Dolgunec N 32 (76.2 cm). The shortest growing period had plants from the set of Altgauzen accessions – 79-80 days. Tested accessions were less resistant to lodging than the standard 'Kastyčiai'. Old Latvian flax accessions were less productive than modern variety. The highest stem yield was produced by plants of accession N 2 (0.547 kg m^{-2}, or 5.47 t ha^{-1}). The highest seed yield was obtained from plants of accessions Dolgunec N 115 (0.087 kg m^{-2}, or 0.87 t ha^{-1}), Mestnyj N 4 and Mestnyj N 6 (0.081 kg m^{-2}, or 0.81 t ha^{-1}). From tested accessions Dolgunec N 116 (496 kg ha^{-1}) and Mestnyj N 6 (431 kg ha^{-1}) gave the highest long

fibre yield. The most flexible fibre was obtained from flax of accessions N 2 (61.1 mm), Mestnyj N 1 (59.3 mm), Mestnyj belocvetkovyj N 580 (58.4 mm) and Altgauzen 17*93 (58.0 mm). The best results of fibre strength were shown by flax of accession Altgauzen 16*90 (16.2 kg F). Plants of accession Dolgunec N 101 produced largest seeds (1000 seed weight – 4.58 g) from all tested accessions.

The most valuable accessions (Altgauzen 3*19, Altgauzen 5*30, Altgauzen 12*80, Altgauzen 16*90, Altgauzen 17*93, Altgauzen 23*112, Mestnyj belocvetkovyj N 580, Dolgunec N 32, Dolgunec N 101, Dolgunec N 116, N 2, Mestnyj N 6, Mestnyj N 1) from the tested set could be recommended to be included into fibre flax breeding programmes.

Summary

Before the World War II flax production was very important in Baltic countries. Fibre flax in Lithuania breeding has been carried out since 1922. Flax breeding in Latvia was started in 1923. In 1970, flax breeding in Latvia was cancelled and was started in Latvia again since 1992. The repatriation and investigation of the Latvian flax genetic resources become a very actual task. The task of the present study was to evaluate valuable characters of some old fibre flax accessions with aim to include the best of them into fibre flax breeding programs as well as to confirm the value of genetic resources tested and to save them for coming generations. The most valuable accessions (Altgauzen 3*19, Altgauzen 5*30, Altgauzen 12*80, Altgauzen 16*90, Altgauzen 17*93, Altgauzen 23*112, Mestnyj belocvetkovyj N 580, Dolgunec N 32, Dolgunec N 101, Dolgunec N 116, N 2, Mestnyj N 6, Mestnyj N 1) from the tested set could be recommended to be included into fibre flax breeding programmes.

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