Study of the relationship between the conductive system of the internodes in spring bread wheat with lodging resistance and yield traits

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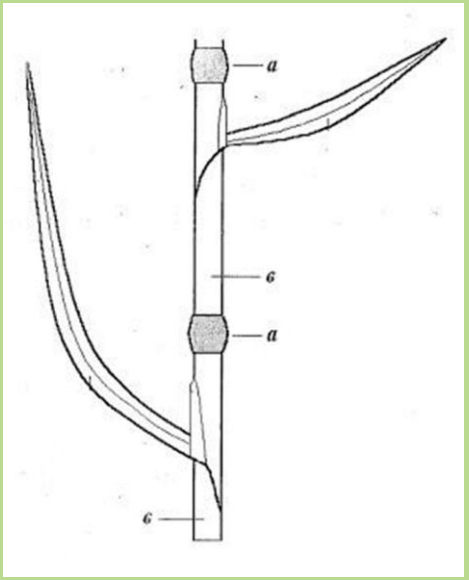

Figure 1. The structure of the stem.

a- node; in - internodes.

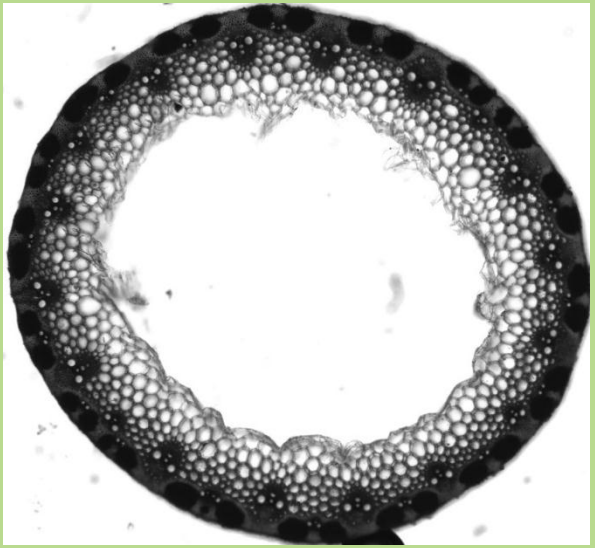

Figure 2. Cross-section of the centre of the internode. ID – internode diameter, LD – lumen diameter, MLT – mechanical layer thickness, SWT – stem wall thickness.

The aim of the work is to study the anatomo-morphological parameters of the stem in Russian varieties of bread wheat.

Materials

The material for research served 11 varieties of Russian breeding, presented in Table 1. Plants grown on the experimental field SibNIIRS – Branch of the Institute of Cytology and genetics SB RAS in 2018.

Particular attention in the study of the internal structures of the stem of spring bread wheat in the internodes EN1 and EN2 in the studied varieties given to the stem diameter, the thickness of the primary cortex, the number and diameter of the vascular parenchyma bundles.

Table 1 – The research material

№	Sample name	Originator
1	Novosibirskaya 15	ICG SB RAS
2	Novosibirskaya 29	ICG SB RAS
3	Bel	ICG SB RAS
4	Chernyava 13	RESEARCH INSTITUTE OF AGRICULTURE NORTHERN TRANSURALS
5	Saratovskaya 29	ARISER
6	Obskaya 2	ICG SB RAS
7	Novosibirskaya 18	ICG SB RAS
8	Trizo	DEUTSCHE SAATVEREDELUNG AG
9	Novosibirskaya 31	ICG SB RAS
10	Novosibirskaya 16	ICG SB RAS
11	Velut	ICG SB RAS

Methods

In the study of the anatomical structure of the stem was used the method to assess the level of development of the conductive system of the ear's internode, which developed at the All-Russian Research Institute of Grain Crops name I.G. Kalinichenko (2009). Counting of internodes was carried out according to the proposed by Lazarevich S.V. (1999) sequences - from under internode under the ear to to internodes of the lower part of the stem. Internode under the ear noted as EN1 (entre-noeud), the second from the top - EN2 and etc.

Resistance to lodging was evaluated in points on a five-point conventional technique. During statistical processing were used the methods of correlation and analysis of variance (Dospekhov, 1985). The factor analysis was carried out with the use the program Statistica 8, Past 3.

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Figure 3. Cross section the internodes under of ear spring bread wheat colored Safranin O.

Results

The correlations of anatomical and morphological characteristics with the yield, grain quality and resistance to lodging has been found. In the studied genotypes yield varied from 3.51 (Bel) to 5.83 t/ha (Obskaya 2). The most productive varieties originated from mid-ripening (Novosibirskaya 18 and Obskaya 2) and mid-late ripening groups (Triso). The yield of early-maturing varieties was estimated at the level of the average value, which indicates their high potential in the prevailing environments. Three varieties (Velut, Bel and Obskaya 2) had an excess in number of vascular bundles of the parenchymal layer. The Obskaya 2, Velut and Novosibirskaya 18 prevailed over the other wheat varieties in the mechanical layer thickness. It was shown that diameter of the under-ear internode was more than 2 mm. The largest diameter EN1 was recorded in varieties Novosibirskaya 16 (3.02 mm), Velut (2.74 mm) and Novosibirskaya 31 (2.91 mm). EN2 diameter varied from 2.45 to 4.07 mm. Novosibirskaya 16 was characterized as the thickest among the studied varieties; the diameter of EN2 was 4.07 mm. In general, most of the varieties had good indicators of gluten and protein content. The highest gluten content were shown for the early ripening varieties Novosibirskaya 15 and Novosibirskaya 16 (32.4 and 33.4%, respectively).

Conclusions

Analysis of the relationship between anatomical and morphological traits, yield, and grain protein content revealed parameters that correlate with lodging resistance (thickness of the straw and mechanical layer thickness). Obtained results also point to correlation between number of conductive bundles and mechanical layer thickness and the traits that can cause high ear productivity.

Table 2 - Morphological stem indicators of spring bread wheat

WHEAT VARIETY	ID EN1	MLT EN1	SWT EN1	NVB EN1	ID EN2	MLT EN2	SWT EN2	NVB EN2
Novosibirskaya 18	4.07	0.19	0.55	21.64	5.73	0.15	0.79	29.27
Novosibirskaya 31	5.10	0.20	0.60	16.00	6.51	0.10	0.73	22.64
Triso	3.32	0.10	0.58	18.18	4.28	0.10	0.82	24.64
Obskaya 2	4.56	0.20	0.60	24.20	6.45	0.17	0.76	28.73
Novosibirskaya 16	5.28	0.11	0.60	19.73	7.12	0.14	0.82	24.70
Novosibirskaya 15	3.72	0.15	0.54	19.20	5.45	0.16	0.72	26.36
Novosibirskaya 29	3.26	0.10	0.38	17.45	5.10	0.10	0.65	25.64
Bel	4.26	0.14	0.51	19.33	5.84	0.12	0.76	28.89
Velut	4.80	0.18	0.59	22.18	6.45	0.13	0.93	33.82
Chernyava 13	3.90	0.15	0.57	20.73	5.51	0.10	0.72	26.09
Saratovskaya 29	3.85	0.19	0.67	18.82	5.22	0.10	0.74	26.00
$LSD_{0.05}$	0.2	0.03	0.07	2.4	0.4	0.01	0.08	2.6

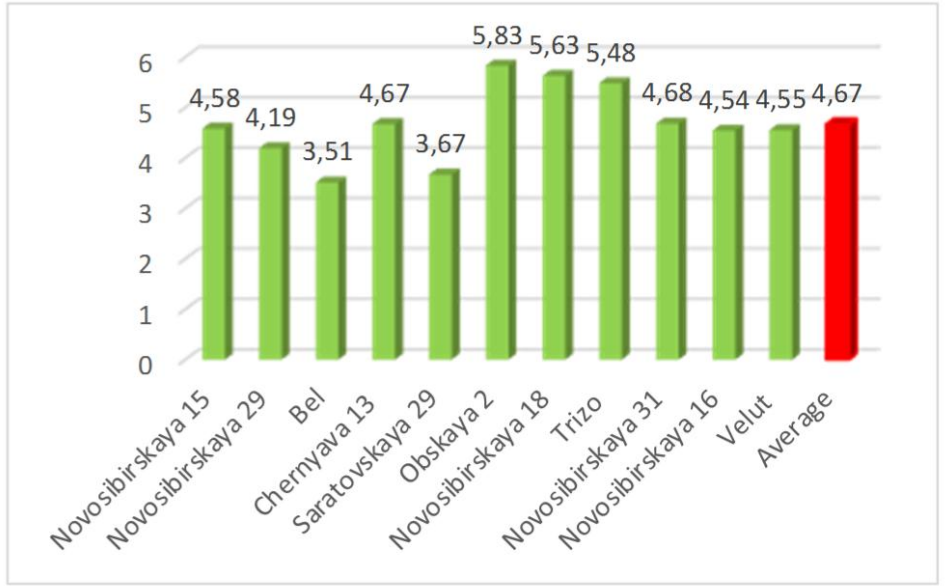

Figure 4. Average yield, t / ha

Thank you for attention!