Scientific Papers. Series A. Agronomy, Vol. LXIV, No. 1, 2021
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

FIRST WINTER WHEAT VARIETY VARIABILITY BY PLANTS MORPHOLOGY FROM WHITE LUVIC SOIL CONDITIONS

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Abstract

The development of research to improve wheat began by creating local varieties with best possible yields, but also with increased adaptability) to the various crop conditions from us. The sufficiently wide genetic dowry obtained demonstrated that even in the conditions of white luvicsoil in the South, varieties with tolerance to aluminium ions can be obtained. The Albota variety obtained in 70th period and adapted under conditions have had proved new plant characteristics, required by the new intensification crop conditions. Compared to the Bezostaia 1 variety, some gains of morphological components were found, which contributed to the development over time of this new wheat breeding center. The study of morphological characters in newly created varieties), along with those of genetics and physiology, could be useful for the constant progress of wheat improvement. From the obtained data it was found that if the straw length of the two varieties was similar, its thickness at the base was higher for the Albota variety. The length of the spike/ear increased in Albota by 1.3 cm, the weight of the spike was by 0.4 g, and the number of spikelets in a spike was by 1.8. Instead, the Bezostaia 1 variety had an external glume and a slightly longer lower palea, and the number of grains in a spike was one unit longer (1 g). The grain sizes showed longer lengths and smaller thicknesses at Bezostaia 1. While the mass of one thousand grains (MTW) was larger at Albota. Positive correlations were obtained between the morphological characters, somewhat more obvious in the Albota variety. The data obtained demonstrate a progress of improving the morphological characteristics of the Albota variety, due to the gain of tolerance to the concentration of aluminium ions.

Key words*: Bezostaia 1 & Albota, grains, ear, variability, wheat.*

INTRODUCTION

Wheat [*Triticum aestivum* (L.) Thell ssp. *vulgare* (Will.) MK], (pro syn. *Triticum hybernum* L., *T. macha* Dekap. & Menab., *T. sativum* Lam., *T. sphaerococcum* Percival, *T. vulgare* Will., common wheat, bread wheat) is one of the most important crop (Balaj, 1990; Hancock, 2004; Olaf, 2009; Slafer et al., 1996). The name *Triticum* expresses the adaptation of the words *threshing* or *bruising* which means mechanical threshing, and *aestivum*, in summer, indicates the maturation of plants this season. The wheat that is threashed is also called *spelta*. By crossing with the species *Aegilops tauschii* were added to the wheat the resistance to cold, very important for cultivation in temperate climates and not only. The two researched varieties also contain the modern RHtB1b gene, which induces the short stalk/ straw, very important for more sustained fertilization and mechanized harvesting, elements necessary for their cultivation in intense conditions (Mohamed et al.,, 1990; Hoisington et al., 1999). In general, wheat has a terminal spike inflorescence (Balaj, 1990; Shewry, 2009), distich, 4-18 cm long, with sterile spikelets, caught solitary on the spike, zig-zagged. The spikelet is 10-25 mm long, being compressed laterally, it has two glume and flowers. The glume has the tip like a short, blunt tooth, but also a slightly smaller edge. Each flower has a palea and *lemma*. Depending on the variety, the lemma extends in the form of an edge, or as a hood. When the palea and the *lemma* adhere to the grain, it thus becomes dressed. The caryopsis- type bean has an ellipsoidal shape, with a central channel on one side. The grain is 4-11-14 mm long and 1.5-4.5 mm thick. The mass of one thousand grains (MTG) is between a minimum of 15 g and a maximum of 60-70 g. The plant generally forms stems with heights between 50(60) and 140(150) cm. Lower values are manifested in dwarf varieties. The researches carried out to observe the variation of some characters of wheat plants from the two varieties included: i) the stem by

the total length of the straw and the thickness of the basal internode, ii) the length and weight of the spike, iii) the number of spikelets/ spike, the length of the outer glume, the length of the lower glume (lemma) and the length of the awns, iv) the number of grains/ ear, their weight, the mass of the thousand grains (MTG) and the dimensions of the grains: length and thickness.

MATERIALS AND METHODS

In the last two years, the two varieties have been cultivated: *Bezostaia 1* (Moon, 2008) and *Albota* using the technology recommended by the resort. The experiments were set up according to the block method, with variants of 25 m^2 each in 4 replicates. At full maturity, 25 plants (stems) from each repetition were randomly selected (zig-zag method), which meant a total of 100. These stems were cut from the ground and brought to the laboratory. The following were measured and determined for the 100 stems: straw length, basal internode diameter, spike length and weight, number of spikelets in spike, length of glume and lemma, number of grains in an ear and their weight, mass of one thousand grains (MTG), as well as grain sizes: length and thickness. These morphological characters (Slafer et al., 1996; Slafer & Satorre, 1999) of the wheat plants obtained were then analyzed by histogram method. Both class intervals and absolute values were used in their expression. Each histogram was established according to the specific sequence of values obtained. Following the establishment of the respective intervals, the modal values (with the highest frequencies), the limits of the variability intervals of the studied characters and the specificity of each character of the two cultivated wheat varieties resulted. The correlations between the analyzed characters were also established, with the help of which their tendencies within the studied ecotypes could be observed. Excel was used to express values. The significance of the correlation coefficients was obtained by comparing with the r_{max} values for the levels of 5%, 1% and 0.1% of the transgression probabilities. The statistical calculation was also performed, which was based on the analysis of variance (Anova test), namely on the variation strings. Statistical indices were obtained using the formulas: $\bar{a} = \frac{\Sigma x}{n}$, where $\bar{a}$ = mean of determinations, and x = the values, S^2 (variance) $= \frac{1}{n-1}\left[\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right]$, S (standard error) = $\sqrt{S^2}$, and S % (variation coefficient) = $\frac{S}{\bar{a}}100$.

RESULTS AND DISCUSSIONS

Variability in wheat straw size. The wheat stalk or straw is segmented by several internodes (5-7) with lengths towards the ear. Straw length is between 40-50(60) cm for intensive varieties and up to 130-150 cm for extensive varieties. At the harvest maturity, the straw has a vertical position, being suitable for mechanized harvesting. The measurements showed that the straw of the two varieties of wheat was between 43 and 76 cm. A relative similarity was found between the varieties (Figure 1). The straw frequency was 58-61 cm (22-23%), followed by those with 64 cm (16%). The diameter (thickness) of the straw at the base was differentiated between the two varieties. In the *Bezostaia 1* variety, the straw was between 2.0 and 3.4 mm, and in *Albota* in the range of 2.2-4.0 mm (Figure 2). They dominated the segments with 2.6 mm in the first variety (29%) and respectively with 3.0-3.2 in the second variety (30-35%). From these data it appears that the Albota variety, having a slightly thicker straw, could represent a gain in increasing the plant's favorability (Bonjean & Angus, 2001; Evans, 1993; Willcox & Willcox, 2006) to the degree of crop intensification (Săulescu et al., 2006).

Variability of wheat ears. The appearance and size of the ear of the two varieties had different characteristics. Thus, the length of the ear ranged between 6 and 10 cm for the *Bezostaia 1* wheat variety and between 6 and 11.5 cm for the *Albota* variety. The lengths of 8 cm (28%) for the first variety of wheat and those of 9 cm (20%) for the second variety (Figure 3) dominated. And in the case of the length of the ears, there is an increase in the length of the ear in the *Albota* variety.

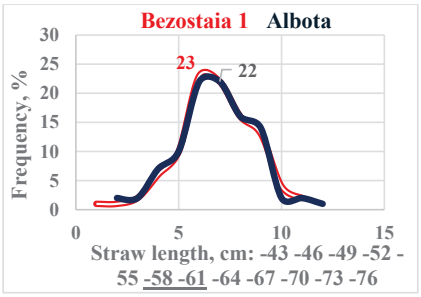

Figure 1. Frequencies of straw length

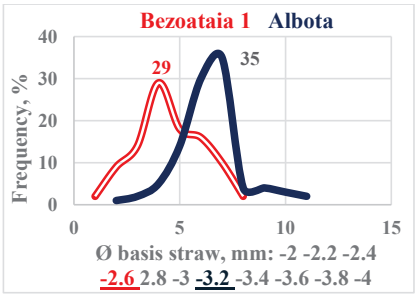

Figure 2. Frequencies of straw thickness

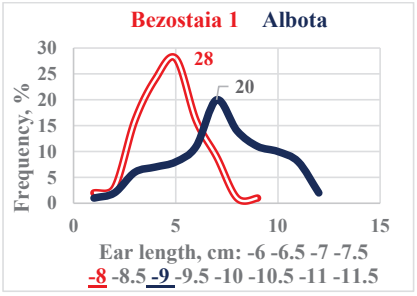

Figure 3. Frequencies of ear length

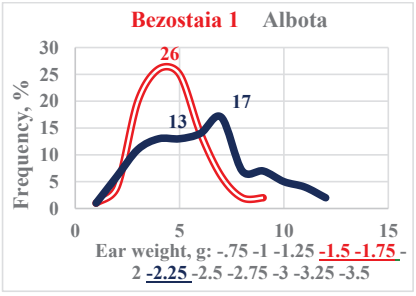

Figure 4. Frequencies of ear weight

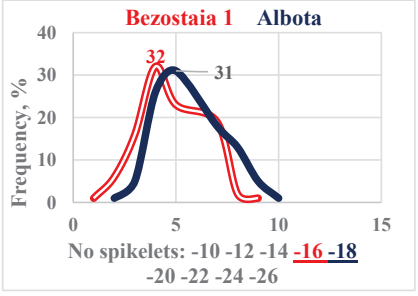

Figure 5. Frequencies of no. spikelets/ear

The weight of the ears was between 0.75 g and 2.75 g for the first variety and between 0.75 g and 3.5 g for the second variety (Figure 4). They dominated th ears whose weights were between 1.5-1.75 g in the *Bezostaia 1* variety (25-26%) and 2.25 g in *Albota* (17%). The most obviuos tendency to improve the morphology of the ear was found in the case of the total weight of the ear, which in *Albota* was increasing. The number of spikelets in one spike ranged from 10 to 28 for both varieties (Figure 5). They dominated the ears with 15-16 spikelets (32%) in the first variety (the reference one) and those with17-18 spikelets in the second variety (31%). The glume of the spikelets had different lengths. These were between 6 and 11 mm (Figure 6). In the case of *Bezostaia 1* wheat, 8 mm long (56%) glumes from the 7-11 mm range dominated, while in the *Albota* variety, 8 mm (38%) glumes from the 6-10 mm range also dominated. In general, the *Bezostaia 1* variety had noticeably longer membranes than *Albota*. The lower palea (lemma) was generally between 7 and 12 mm long. Both varieties has sizes between 7 and 12 mm, with a frequency of 40% for the first and 562% for the second wheat variety, respectively (Figure 7). And in this case the *Bezostaia 1* variety had grouped values at significantly larger dimensions than the *Albota* variety.

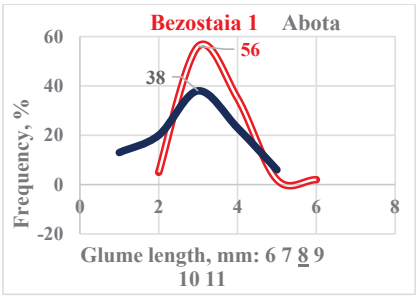

Figure 6. Frequencies of glume length

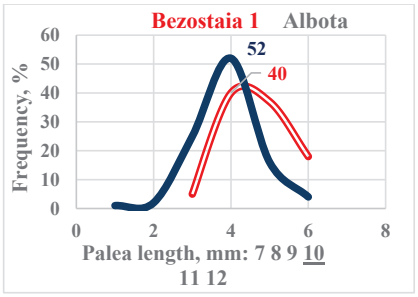

Figure 7. Frequencies of palea length

Wheat grain variability. Research has shown that each variety has characteristic aspects related to grains. In the case of the number of ears in an ear, the values were between 15 and 51. In both varieties, the ears with 28-31 grains had the highest frequency (29% in *Bezostaia 1* and 24% in the *Albota* variety), without finds obvious differences (Figure 8). The weight of the grains formed in an ear had corresponding values between 0.3 g and 2.3 g. The highest frequency was obtained at weights of 1.3 g (26%) for the *Bezostaia 1* variety and at the same weights, 1.3 g (19%) at *Albota* variety (Figure 9). The size of the grains also had some characteristics. Thus, the grain length was in the range of 5.5-8 mm, with a maximum of 7 mm (57%) in *Bezostaia 1* and in the range of 4-8 mm, with a maximum of 6.5 mm (29%) in *Albota* (Figure 10). The grain thickness was between 2.4 and 3.4 mm, with the modal value at 3 mm (45%) in the case of the first variety and between 2-3.8 mm with the dominant range of 2.9-3 mm (37%) in the case of the *Albota* variety (Figure 11).

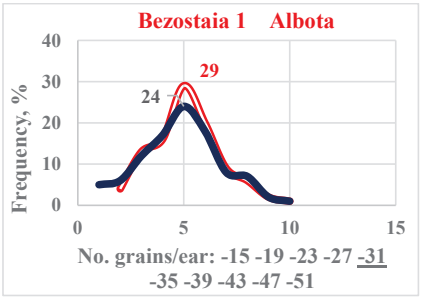

Figure 8. Frequencies of no. grains/ear

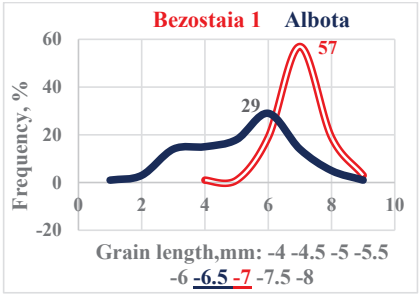

Figure 10. Frequencies of grain length

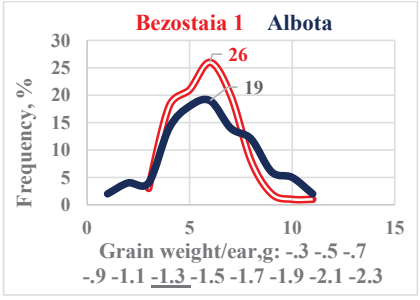

Figure 9. Frequencies of grain weight/ear

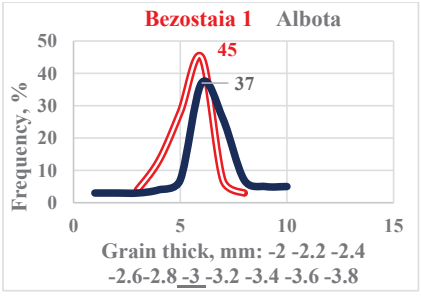

Figure 11. Frequencies of grain thick

The mass of a thousand grains (MTG) demonstrated several differences. The extremes of this character were between under 29 and 56 g. The range of variability in the first variety was 32-50 g, with the modal value at 39-41 g (38%). For the second variety, the range was between 29 and 56 g with the modal value also at 39-41 g (22%) (Figure 12). The characteristics of the

Albota variety plants are presented in figure 13. The aspects of the grains of Bezostaia 1 and Albota varioeties are presented in Figures 14 and 15.

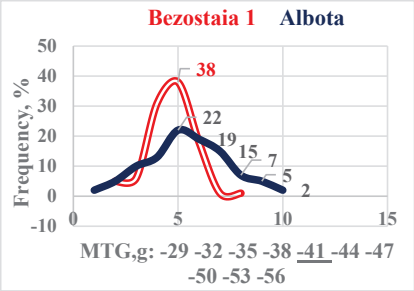

Figure 12. Frequencies of grains MTG

Figure 13. Wheat *Albota* variety

Figure 14. Wheat *Bezostaia 1* grains

Figure 15. Wheat *Albota* grains

Correlations between the main morphological characteristics of wheat plants. If we analyze the whole set of correlations between all the characters analyzed for the two varieties of winter wheat, we find specific situations. Thus, in wheat *Bezostaia 1* variety were obtained statistically assured correlations in most cases. Of these, the positive correlations betwen the weight of the ear and the other characters were noted. The grain length correlated insignificantly with some of the other characters. The mass of a thousand grains correlated very significantly positively with the thickness of the grains. A positive correlation was found between the number of grains in the spike with the grain length and an insignificant correlation between the number of spikelets in an ear with MTG (Table 1). In the *Albota* wheat variety, most correlations were statistically ensured at tighter levels than the first variety. One explanation would be that this variety has a more obvious adaptation to the ecology of white luvicsoils.

Statistical analysis of the variability of morphological characters in wheat. The results obtained in the morphological analysis of some characters for the two varieties of winter wheat, showed specific aspects. Thus, by comparing the *Bezostaia 1* and *Albota* varieties, the straw length measured on average 59.6 cm compared to 59.4 cm. The diameter of the straw at the base was a few millimeters more în *Albota*. The length of the ears was 7.7 cm in *Bezostaia 1* compared to 9.00 cm at the *Albota* variety. The weight of spikes was in the same comparison of 1.54 g compared to 1.90 g. The number of spikelets/ spike was on the one hand 16.2 compared to 18.0 (Table 2). The weight of the ear had greater variability in both varieties. Between the two varieties of wheat, the length of the glume was 8.4 mm compared to 7.6 mm, and that of the palea 10.7 mm compared to 9.7 mm. In the same order, the number of grains formed in an ear was 30.1 to 29.2. the weight of the grains in an ear was 1.18 g to 1.21 g. Tha grains had average dimensions of 6.9/2.8 mm compared to 6.0/3.0 mm. The mass of one thousand grains was 38.9 g in *Bezostaia 1* compared to 40.2 g in the *Albota* variety (Table 3). Greater variability was found in the number of grains in an ear and in the weight of the grains in both varieties.

Table 1. Correlations between the main morphological characters of the two varieties analyzed

Winter wheat, Bezostaia 1 variety												
Indices	**Ø stem. mm**	**Ear length. cm**	**Ear weight, g**	**No. spikelets**	**Glume mm**	**Palea mm**	**Awns cm**	**No. grains/ ear**	**Grains weight, g**	**Grain length, mm**	**Grain thick, mm**	**MTG, g**
Straw, cm	**.332**	.099	**.396**	.171	.166	**.192**	.060	**.293**	**.393**	.175	**.208**	**.586**
Ø stem mm	**1**	**.501**	**.427**	**.403**	.158	.046	.024	**.471**	**.459**	.165	**.224**	.181
Spike, cm		**1**	**.603**	**.756**	**.324**	.124	.044	**.703**	**.592**	**.244**	.067	-.030
Spike weight, g			**1**	**.789**	**.361**	**.336**	.091	**.905**	**.977**	**.357**	**.233**	**.415**
No. spikelets				**1**	**.302**	**.217**	.149	**.838**	**.775**	**.322**	.084	.077
Glume, mm					**1**	**.233**	-.156	**.379**	**.341**	.157	-.030	.072
Palea, mm						**1**	-.009	**.345**	**.320**	.095	.024	.080
Awn, cm							**1**	.057	.057	-.032	-.130	.024
No. grains								**1**	**.898**	**.297**	.091	.117
Grain weight, g									**1**	**.355**	**.250**	**.437**
Grain length, mm										**1**	.182	.164
Grain thick, mm											**1**	**.377**
MTG, g												**1**
Winter wheat, Albota variety												
Straw, cm	.094	**.260**	**.375**	.045	.134	.069	**.303**	**.291**	**.365**	**-.316**	.077	**.343**
Ø stem mm	**1**	**.311**	**.279**	**.244**	**.309**	**.277**	**.237**	**.288**	**.246**	**.319**	**.379**	.109
Spike, cm		**1**	**.691**	**.752**	**.206**	**.299**	**.528**	**.618**	**.549**	.078	.114	**.255**
Spike weight, g			**1**	**.600**	.160	**.379**	**.648**	**.873**	**.943**	.020	**.253**	**.705**
No. spikelets				**1**	**.194**	**.190**	**.518**	**.587**	**.492**	.036	-.032	.182
Glume, mm					**1**	**.426**	**.213**	.179	.127	**.529**	**.217**	-.024
Palea, mm						**1**	**.246**	**.333**	**.376**	**.409**	**.272**	**.313**
Awn, cm							**1**	**.494**	**.547**	.059	.166	**.385**
No. grains								**1**	**.909**	.064	.147	**.497**
Grain weight, g									**1**	.047	**.267**	**.792**
Grain length, mm										**1**	**.585**	.002
Grain thick, mm											**1**	**.370**
MTG, g												**1**
LSD 5 % = 0.19 DL 1 % + 0.25 DL 0.1 % = 0.32												

Table 2. Statistical indices of winter wheat straw and spike

Winter wheat Bezostaia 1 variety								
Indices	**High , cm**	**Internode 3, cm**	**Internode 2, cm**	**Internode 1, cm**	**Basis diameter, mm**	**Ear length cm**	**Ear weight g**	**No. spikelets**
Mean, ā	**59.57**	**11.63**	**16.46**	**20.78**	**2.668**	**7.652**	**1.5351**	**16.21**
Variance, s^2	29.025	1.533	3.867	17.769	.0982	.592	.163	6.612
Std. deviation, s	5.387	1.238	1.966	4.215	.313	.727	.404	2.571
Var. coef,. s%	**9.04**	**10.65**	**11.95**	**20.29**	**11.73**	**9.51**	**26.32**	**15.86**
Winter wheat Albota variety								
Mean, ā	**59.40**	**8.94**	**14.92**	**22.78**	**3.046**	**8.953**	**1.895**	**17.97**
Variance, s^2	31.07	2.208	5.216	15.042	0.096	1.104	0.430	7.464
Std. deviation, s	5.574	1.486	2.284	3.878	0.310	1.0505	0.6559	2.732
Var. coef,. s%	**9.38**	**16.62**	**15.31**	**17.03**	**10.16**	**11.73**	**34.61**	**15.20**

Table 3. Statistical indices winter wheat ear components

Winter wheat Bezostaia 1 variety								
Indicii	**Glume length, mm**	**Palea length, mm**	**Awn length, cm**	**No. grains/ ear**	**Grains weight g**	**Grain length mm**	**Grain thick mm**	**MTG, g**
Mean, ā	**8.40**	**10.68**	**1.89**	**30.11**	**1.1775**	**6.859**	**2.846**	**38.893**
Variance, s^2	5.50	.684	.483	47.28	.106	.1527	.0564	10.914
Std. deviation, s	2.357	.827	.695	6.876	.3258	.391	.2376	3.304
Var. coef,. s%	**28.06**	**7.74**	**36.77**	**22.84**	**27.67**	**5.70**	**8.35**	**8.49**
Winter wheat Albota variety								
Mean, ā	**7.60**	**9.67**	**6.51**	**29.15**	**1.211**	**5.961**	**3.007**	**40.218**
Variance, s^2	0.919	0.772	1.750	57.40	0.196	0.780	0.144	87.96
Std. deviation, s	0.9585	0.879	1.323	7.576	0.443	0.883	0.380	9.379
Var. coef,. s%	**12.61**	**9.09**	**20.32**	**25.99**	**36.60**	**14.82**	**12.63**	**23.32**

CONCLUSIONS

The morphological characteristics of winter wheat, studied in comparison to the two varieties, had specific aspects. The choice of the two wheat varieties was made due to the relatively close morphological similarity. The *Albota* variety has benefited from some new genetic improvements since the first period of breeding activity. It has a clear tolerance to soil acidity induced by aluminium ions, but also high production capacity, different tolerances.

By comparison between the two varieties, the stem/ straw had average lengths of both at 59 cm. The values obtained show the existence of low waist in both plants, a condition increasingly induced in the improvement of winter wheat to maximize crop yields (Acevedo et al., 1991).
The spike was 7.7 cm long in the first variety and 9.0 cm in the second variety, and weighted 1.5 to 1.9 g at Bezostaia 1. The number of spikelets was 16 to 18 in the same order. The spikelet pieces: glumes and paleas were quite sensible long for *Bezostaia 1*.
The number of grains in an ear was 30 to 29, weighting 1.18 g to 1.21 g, the mass of one thousand grains was from 39 g în *Bezostaia 1*, compared to 40 g in *Albota*. The grains were 7 to 6 mm in length and 2.9 to 3.0 mm in thickness. Through these results, the Albota variety demonstrated improved characteristics by the thickness at the base of the straw, the larger and heavier spike, but with low dimensions of the spikelet membranes (outer glume and lower glume) and relatively smaller grains.
Simple correlations were established between all the studied characters, with some small defferentiations. Thus, both between characters of the straw and those between the elements of productivity, mostly positive and significant correlations were obtained, closer to *Albota*. Very close positive links have been established between the components of the ear, which demonstrates the great productive possibilities that the two varieties of wheat have in the analyzed area.

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