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Basic chemical components, smoking and taste qualities of tobacco varieties grown in different regions of Bulgaria

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Abstract

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Bulgarian oriental tobacco is characterized by the unique combination of strong pleasant aroma, beneficial substances and balanced chemical composition forming high-quality content. The aim of this study is to find the quality indicators determining the smoking and taste properties of oriental tobacco varieties cultivated in typical or untypical environmental conditions. The study was conducted with Bulgarian varieties of oriental tobaccos of Ustina ecotype and Dupnitsa ecotype. The tobaccos were grown in the typical and in the untypical regions for the varieties. The content of nicotine and sugars was determined as well as nicotine/sugars balance ratio, which is indicator for balanced tobacco smoke. Tobaccos grown in typical areas are characterized by typical for oriental tobacco content of nicotine and sugars and balanced tobacco smoke. The content of nicotine and sugars in tobacco varieties, grown in untypical region varied in wide ranges, which show a great difference in taste and physiological sensation of tobacco smoke. In order to show the full potential of the variety and its quality properties, it is necessary to cultivate the variety in the regions suitable for it.

Keywords: tobacco; quality characteristics; regions

Introduction

The various ecological, climatic and soil conditions in Bulgaria are a prerequisite for a creation a wide range of oriental tobacco varieties with specific quality parameters defining their smoking and taste properties. They are formed under specific ecological conditions characterized by poor skeletal soils, sloped terrains, low soil and air humidity and abundant sunshine (Dimanov & Masheva, 2011; Masheva & Kasheva, 2011).

Bulgarian oriental tobacco is characterized by the unique combination of strong pleasant aroma, beneficial substances and balanced chemical composition forming high-quality content (Chuman, 1977; Masheva & Kasheva, 2016). Due to these properties, Bulgarian oriental tobacco is used worldwide in cigarette production and is an essential ingredient in all quality cigarette brands (Otmar & Dimitrios, 2007).

Genotype plays a key role for the quality of oriental tobacco, and secondly, environmental conditions and the way of cultivation are important (Dimitreski et al., 1992). Because of this, tobacco production in Bulgaria is structured in 6 regions. Widespread cultivation of a limited number of commercial high-yielding varieties outside the typical regions is a reason for low quality of tobacco as a product of consumption and loss of its typical smoking characteristics (Dimanov & Vitanova, 2011; Kasheva et al., 2014; Tahsin et al., 2014).

The aim of this study is to define the quality indicators determining the smoking and taste properties of oriental tobacco varieties cultivated in typical or untypical environmental conditions.

Materials and Methods

The study was conducted with Bulgarian varieties of oriental tobacco of two ecotypes (Table 1):

• Ecotype Ustina – variety Plovdiv 7, Plovdiv 187, Plovdiv 380 and Kozarsko 339, grown in the typical for the ecotype region – the Plovdiv tobacco region;

• Ecotype Dupnitsa – variety Dupnitsa 160, Dupnitsa 733 and Rila 89, grown in the typical of the varieties region (Struma-Mesta tobacco region) and in the untypical region of the varieties (Plovdiv tobacco region).

Tobaccos were grown in the Experimental field of the village Kozarsko (Plovdiv tobacco region) and Experimental station in the town Rila (Struma-Mesta tobacco region) to the Tobacco and Tobacco Products Institute under vegetation period.

The experiments are based on the block method with 4 reps with a plot size of 30 m^2. Tobaccos are grown according to the ecotype-approved technology.

Each tobacco sample was divided into two groups – I class and II class. The nicotine and sugars (reducing carbohydrates) content of all groups was determined in the laboratory complex for testing in the TTPI, Markovo. The content of nicotine and sugars was performed according to international standardized methods.

The coordinates and the altitude of the areas are presented in Table 2.

Nicotine content was determined with auto analyser Technicon II according ISO15152:2003. The principle of the method consists in rifting cleaving the pyridine group from the nicotine molecule with cyanogen bromide. Further reaction with aniline in a buffered solution is in the formation of a yellow-coloured compound which is measured colourmetrically at 460 nm.

The content of sugars was checked by using auto analyser Technicon II following the ISO 15154:2003. The content of reducing carbohydrates is based on their ability to reduce potassium ferricyanide to potassium ferrocyanide, whereby the intensity of ferrocyanide staining is reduced. This colour decrease in colour at 420 nm is directly proportional to the amount of sugars.

Analysis of each sample was performed in triplicate. All results presented were the mean ± SD of at least three independent experiments. Statistical analysis (ANOVA) was carried out with SPSS 16.0 for Windows.

Results and Discussion

Table 3 presents the average monthly temperature and rainfall in the studied regions. There are no significant climate differences in the studied regions (http://www.meteo.bg/). The high temperature and average rainfall in 2017 are favourable for the cultivation of quality tobacco raw material. May and June are characterized by relatively high rainfall – average 64 l/m^2. This presupposes the good start of vegetative processes of tobacco cultivation in the field. In dry August (an average of 33 l/m^2) there are very good conditions for tobacco reaching technical maturity.

Chemical values, smoking and taste qualities of oriental tobacco varieties of the Ustina ecotype, cultivated in typical regions

All studied tobacco varieties of the Ustina ecotype are cultivated in their typical region (Plovdiv tobacco region). Tobaccos of the Ustina ecotype are distinguished by their strong aroma, which is at the top of oriental tobaccos in the world (Gyuzelev, 1983; Tso, 1990; Layten & Nielson, 1999).

Table 1. Production of recommended varieties tobacco in different regions in Bulgaria

Oriental tobacco	Variety, harvest 2017	Tobacco region
Ecotype Ustina	Plovdiv 7, Plovdiv 187, Plovdiv 380, Kozarsko 339	Plovdiv
Ecotype Dupnitsa	Dupnitsa 160, Dupnitsa 733, Rila 89	Struma-Mesta

Table 2. Coordinates and altitude of the places

Tobacco region	Place	Altitude, m	N	E
Strumsko-Mesta	Rila	593	42°12′680″	23°13′070″
Plovdiv	Kozarsko	250	42°05′916″	24°41′667″

Table 3. Average monthly temperature and rainfall, 2017

Place	May		June		July		August		September	
	t°C	Rain-fall, l/m^2	t°C	Rain-fall, l/m^2	t°C	Rain-fall, l/m^2	t°C	Rain-fall, l/m^2	t°C	Rain-fall, l/m^2
Rila	15.9	57	19.3	64	21.7	49	21.4	30	17.4	32
Kozarsko	16.9	72	20.6	58	22.9	51	22.5	36	18.2	38

Table 4. Content of nicotine, sugars and balance ratio sugars/nicotine in variety tobaccos from ecotype Ustina, grown in a typical region for varieties

Tobacco variety	Plovdiv tobacco region	Class	Chemical components, %		Balance ratio
			Nicotine	Sugars	Sugars/nicotine
Plovdiv 7	Kozarsko	I	1.70±0.05	17.05±0.68	10.03
		II	3.23±0.09	10.50±0.42	3.25
Plovdiv 380	Kozarsko	I	1.71±0.05	20.96±0.83	10.56
		II	2.64±0.08	15.78±0.63	5.98
Plovdiv 187	Kozarsko	I	1.81±0.05	19.13±0.76	10.57
		II	3.08±0.09	14.82±0.59	4.81
Kozarsko 339	Kozarsko	I	2.10±0.06	20.98±0.84	9.99
		II	2.71±0.08	15.83±0.63	5.98

Table 4 presents nicotine and sugar content in studied tobacco varieties as well as their balance ratio. Nicotine content in class I varies from 1.70±0.05% (Plovdiv 7) to 2.10±0.06% (Kozarsko 339) as expected (1.5-2%) for oriental tobacco according to market requirements established in recent years. Sugar content is higher than the typical for oriental tobacco content of 8-14% and varies from 17.05±0.68% (Plovdiv 7) to 20.98±0.84% (Kozarsko 339). Tobacco of class II has higher nicotine content – from 2.64±0.08% – Plovdiv 380 to 3.23±0.09% – Plovdiv 7 and lower sugar content – from 10.5±0.42% Plovdiv 7 to 15.83±0.63% Kozarsko 339 in comparison with first class. The results obtained are corresponds with our previous research (Dimanov & Masheva, 2011; Masheva et al., 2014).

The product from tobacco consumption is tobacco smoke whose chemical composition is conditioned by the chemical composition of tobacco leaves. The chemical properties contained in tobacco smoke affect the chemoreceptors in the oral cavity and respiratory tract by causing certain sensations and chemical irritation. In general, it is appropriate to state that the more pleasant smoking sensations tobacco causes, the better tobacco quality is. Scientific research has proven that quantity ratio between sugar and nicotine gives an idea of the fullness and taste of tobacco smoke as well as of burning and sharpness. With values lower than 6.0, smoking taste is definitely sharp and rough. With coefficient values over 10.0, taste of tobacco smoke is insufficiently full, with some degree of lightness and well-presented burning (Gyuzelev, 1983).

Table 5. Content of nicotine, sugars and balance ratio sugars/nicotine in variety tobaccos from ecotype Dupnitsa, grown in a typical and untypical regions for varieties

Tobacco variety	Region	Class	Chemical components, %		Balance ratio
			Nicotine	Sugars	Sugars/nicotine
Dupnitsa 733*	Rila	I	1.98±0.06	18.40±0.74	9.30
		II	1.65±0.05	12.43±0.50	7.53
Dupnitsa 733**	Kozarsko	I	0.70±0.02	26.33±1.05	37.61
		II	0.60±0.02	24.63±0.99	41.05
Dupnitsa 160*	Rila	I	1.33±0.04	22.86±0.91	17.19
		II	1.69±0.05	14.80±0.59	8.75
Dupnitsa 160**	Kozarsko	I	1.78±0.05	19.72±0.79	11.07
		II	1.80±0.05	16.26±0.65	9.03
Rila 89*	Rila	I	1.35±0.04	17.07±0.68	12.64
		II	2.16±0.06	11.05±0.44	5.11
Rila 89**	Kozarsko	I	1.58±0.05	19.66±0.79	12.44
		II	0.76±0.02	18.41±0.74	24.22

* – typical region for cultivation of tobacco varieties from the ecotype Dupnitsa – Strumsko-Mesta tobacco region

** – untypical region for cultivation of varieties of tobacco from the ecotype of Dupnitza – Plovdiv tobacco region

Sugar/nicotine balance ratio of studied tobacco class I varieties is close to or a little over the upper limit of optimum values of 6-10 which is typical of tobacco with good smoking qualities; it varies from 9.99 (Kozarsko 339) to 10.57 (Plovdiv 187). For class II tobacco, balance ratio is close to the lower limit of 5.98. These values confirm the well balanced chemical composition of tobacco that is in turn present in its smoking properties. As an exception, the Plovdiv 187 class II and Plovdiv 7 class II varieties show balance ratio below reference values which results in certain sharpness and roughness of tobacco smoke.

Chemical values, smoking and taste properties of oriental tobacco varieties of the Dupnitsa ecotype, cultivated in typical and untypical regions

Tobaccos of the Dupnitsa ecotype are characterized with good taste and less pronounced flavour compared with tobaccos of the Ustina ecotype (Gyuzelev, 1983; Tso, 1990; Layten & Nielson, 1999).

Nicotine and sugar content in tobacco varieties of the Dupnitsa ecotype cultivated in typical and untypical regions and their balance ratio are presented in Table 5.

Significant differences are observed in nicotine and sugar content in the Dupnitsa 733 variety cultivated in different regions. Nicotine content is within the normal range (1.65±0.05% – class II and 1.98±0.06% – class I) only at the region of cultivation typical for this variety (Rila). Sugar content is a little higher than normal; however, sugar/nicotine balance ratio is within the optimum values of 6 – 10. The results obtained correspond with our previous research (Masheva & Kasheva, 2016). Nicotine content in the Dupnitsa 733 variety cultivated under untypical conditions (Kozarsko) is two times lower (0.6±0.02% – 0.7±0.02%), and sugar content – two times higher (24.63±0.99% – 26.33±1.05%) than that of the same variety cultivated in the typical regions (Rila). The relatively low nicotine content combined with the high sugar content presupposes a high balance assessment – 37-41, which shows highly imbalanced tobacco smoke (Table 5).

Nicotine content in the Dupnitsa 160 variety cultivated in regions typical or untypical for the variety is approximately equal (an average of 1.76%). An exception is the Dupnitsa 160 variety, class I, Rila, with lower nicotine content – 1.33±0.04%. There is a wide variation in nicotine content in the Rila 89 variety – from 0.76±0.02% (Kozarsko) to 2.16±0.06% (Rila) (Table 5).

Sugar content in tested tobacco samples of the Dupnitsa 160 and Rila 89 varieties varies broadly – from 11.05±0.44% (Rila 89 variety, class II, Rila) to 19.72±0.79% (Dupnitsa 160 variety, class I Kozarsko). Sugar/nicotine balance ratio for the Dupnitsa 160 and Rila 89 varieties is between 8.75 (Dupnitsa 160, class II, Rila) and 24.22 (Rila 89, class II, Kozarsko), which shows a great difference in taste and physiological sensation of tobacco smoke.

Conclusions

Tobacco is a plant showing relative flexibility to environmental conditions. The study was conducted with Bulgarian varieties of oriental tobacco, grown in the typical and untypical regions for the varieties. Tobacco varieties Plovdiv 7, Plovdiv 380, Plovdiv 187, Kozarsko 339, Dupnitsa 733, Dupnitsa 160 and Rila 89 grown in typical areas are characterized by typical for oriental tobacco content of nicotine and sugars and balanced tobacco smoke. The content of nicotine and sugars in tobaccos grown in untypical region (Dupnitsa 733, Dupnitsa 160 and Rila 89) varied in wide ranges, which show a great difference in taste and physiological sensation of tobacco smoke. Dupnitsa 733 variety shows its full potential only under the typical conditions. This variety is insufficiently flexible and its cultivation in different regions yields low-quality raw material. The Dupnitsa 160 and Rila 89 varieties show some flexibility.

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