



ISSN 1313 - 8820
Volume 8, Number 3
September 2016

AGRICULTURAL SCIENCE AND TECHNOLOGY

2016

An International Journal Published by Faculty of Agriculture,
Trakia University, Stara Zagora, Bulgaria

Editor-in-Chief

Georgi Petkov
Faculty of Agriculture
Trakia University, Stara Zagora
Bulgaria

Co-Editor-in-Chief

Dimitar Panayotov
Faculty of Agriculture
Trakia University, Stara Zagora
Bulgaria

Editors and Sections

Genetics and Breeding

Tsanko Yablanski (Bulgaria)
Atanas Atanasov (Bulgaria)
Nikolay Tsenov (Bulgaria)
Max Rothschild (USA)
Ihsan Soysal (Turkey)
Horia Grosu (Romania)
Bojin Bojinov (Bulgaria)
Stoicho Metodiev (Bulgaria)
Svetlana Georgieva (Bulgaria)

Nutrition and Physiology

Nikolai Todorov (Bulgaria)
Peter Surai (UK)
Zervas Georgios (Greece)
Ivan Varlyakov (Bulgaria)

Production Systems

Radoslav Slavov (Bulgaria)
Dimitar Pavlov (Bulgaria)
Bogdan Szostak (Poland)
Banko Banev (Bulgaria)
Georgy Zhelyazkov (Bulgaria)

Agriculture and Environment

Ramesh Kanwar (USA)
Martin Banov (Bulgaria)
Peter Cornish (Australia)

Product Quality and Safety

Marin Kabakchiev (Bulgaria)
Stefan Denev (Bulgaria)
Vasil Atanasov (Bulgaria)
Roumiana Tsenkova (Japan)

English Editor

Yanka Ivanova (Bulgaria)

Scope and policy of the journal

Agricultural Science and Technology /AST/ – an International Scientific Journal of Agricultural and Technology Sciences is published in English in one volume of 4 issues per year, as a printed journal and in electronic form. The policy of the journal is to publish original papers, reviews and short communications covering the aspects of agriculture related with life sciences and modern technologies. It will offer opportunities to address the global needs relating to food and environment, health, exploit the technology to provide innovative products and sustainable development. Papers will be considered in aspects of both fundamental and applied science in the areas of Genetics and Breeding, Nutrition and Physiology, Production Systems, Agriculture and Environment and Product Quality and Safety. Other categories closely related to the above topics could be considered by the editors. The detailed information of the journal is available at the website. Proceedings of scientific meetings and conference reports will be considered for special issues.

Submission of Manuscripts

All manuscripts written in English should be submitted as MS-Word file attachments via e-mail to editoffice@agriscitech.eu. Manuscripts must be prepared strictly in accordance with the detailed instructions for authors at the website

www.agriscitech.eu and the instructions on the last page of the journal. For each manuscript the signatures of all authors are needed confirming their consent to publish it and to nominate an author for correspondence.

They have to be presented by a submission letter signed by all authors. The form of the submission letter is available upon request from the Technical Assistance or could be downloaded from the website of the journal. Manuscripts submitted to this journal are considered if they have submitted only to it, they have not been published already, nor are they under consideration for publication in press elsewhere. All manuscripts are subject to editorial review and the editors reserve the right to improve style and return the paper

for rewriting to the authors, if necessary. The editorial board reserves rights to reject manuscripts based on priorities and space availability in the journal.

The journal is committed to respect high standards of ethics in the editing and reviewing process and malpractice statement. Commitments of authors related to authorship are also very important for a high standard of ethics and publishing. We follow closely the Committee on Publication Ethics (COPE), <http://publicationethics.org/resources/guidelines>

The articles appearing in this journal are indexed and abstracted in: DOI, EBSCO Publishing Inc. and AGRIS (FAO).

The journal is accepted to be indexed with the support of a project № BG051PO001-3.3.05-0001 "Science and business" financed by Operational Programme "Human Resources Development" of EU. The title has been suggested to be included in SCOPUS (Elsevier) and Electronic Journals Submission Form (Thomson Reuters).

Address of Editorial office:

Agricultural Science and Technology
Faculty of Agriculture, Trakia University
Student's campus, 6000 Stara Zagora
Bulgaria

Telephone.: +359 42 699330
+359 42 699446

www.agriscitech.eu

Technical Assistance:

Nely Tsvetanova
Telephone.: +359 42 699446
E-mail: editoffice@agriscitech.eu

ISSN 1313 - 8820

Volume 8, Number 3
September 2016



*AGRICULTURAL
SCIENCE AND TECHNOLOGY*

2016

An International Journal Published by Faculty of Agriculture,
Trakia University, Stara Zagora, Bulgaria

Sensitivity of promising cherry hybrids and new cultivars to economically important fungal diseases

K. Vasileva¹, S. Malchev^{2*}, A. Zhivondov²

¹Agricultural University, 12 Mendeleev, 4000 Plovdiv, Bulgaria

²Fruit Growing Institute, 12 Ostromila, Plovdiv, Bulgaria

(Manuscript received 2 June 2016; accepted for publication 29 August 2016)

Abstract. As a result of years of developing the breeding programme for creating novel sweet cherry cultivars in the Fruit Growing Institute (FGI), Plovdiv, a reach hybrid fund from first and second hybrid generation is created. Of the selected and propagated hybrids at a more advanced stage of testing are 11 hybrids along with three new cultivars of the FGI Plovdiv ('Kossara', 'Rosalina' and 'Trakiiska hrushtyalka') grafted on three rootstocks were tested for sensitivity to causes of economically important fungal diseases in sweet cherry - cherry leaf spot (*Blumeriella jaapii* (Rehm) Arx), shothole blight (*Stigmata carpophila* (Lev.) Ellis) and brown rot (*Monilinia fructigena* (G. Wint) Honey). The degree of infestation under field conditions is reported by determining the index of attack on leaves and fruit, using the formula of McKinney. As the most sensitive elites are outlined elite El.17-31 (to cherry leaf spot) and elite El.17-136 (to shothole blight). The cultivars 'Kossara' and 'Trakiiska hrushtyalka' exhibit an average resistance to the three diseases, as the values for the index of infestation are lower or similar to those of standard cultivars 'Van' and 'Bing', while 'Rosalina' demonstrated sensitivity to shothole blight and brown rot. Interesting is the elite El.17-37 demonstrating the least infestation of *Blumeriella jaapii* - 7.33% and *Monilinia fructigena* - 6.67%. The same has a set of valuable qualities as late maturing date and very large fruits with excellent sensory profile, making it a potential candidate cultivar.

Keywords: *Prunus avium*, sweet cherry, hybrid, breeding, fungal diseases

Introduction

In a number of leading breeding centres in the world, as one of the main objectives set out in the programmes for creation of new sweet and sour cherry cultivars is the resistance to economically important diseases. Selection in this field is carried out in Germany (Schuster and Wolfram, 2005), Hungary (Apostol, 2005; Rozsnyay and Apostol, 2005), USA (Wharton and Iezzoni, 2005; Lang et al., 1998), Canada (Kappel, 2008), Romania (Budan, 2005; Grădinariu et al., 2008), Bulgaria (Christov et al., 2008), Estonia (Jänes et al., 2008), Sweden (Trajkovski, 1996), Switzerland (Theiler-Hedtrich, 1985), and according Sansavini and Lugli (2008) also in Lithuania, the Czech Republic, Italy, and England.

In laboratory conditions at the Institute in Dresden, Germany was conducted a study of 51 cultivars of sour cherries, 7 cultivars of sweet cherries and 11 wild species of the genus *Prunus* (Schuster, 2004) as 43 sour cherries and all of the tested sweet cherry cultivars showed sensitivity to *Blumeriella jaapii* Rehm. In the following years the laboratory results were confirmed by field experiments.

In a study of 6 rootstocks and 12 cherry cultivars in the Czech Republic, Blažková (2004) established that all tested seedling rootstocks are moderately susceptible to cherry leaf spot while clonal rootstocks range from moderately resistant to highly susceptible. As for the cultivars, resistance to the disease is observed only at variety 'Karešova'. Regarding the degree of attack by agents of brown rot, the most resistant were found 'Aranka' and 'Kordia', and the most sensitive 'Büttnerova kompakt', 'Horka' and 'Vilma'.

After a 3-year study in the four regions of the Italian province of Bari, was found that infestation severity of *Blumeriella jaapii* Rehm in

cherry leaves varies in the range of 23.6 to 39.7% (Frisullo and Ferrara, 1997).

Data on the influence of the rootstock on the severity of cherry leaf spot (*Blumeriella jaapii* (Rehm) Arx), fungal shothole blight (*Stigmata carpophila* (Lev.) Ellis) and brown rot (*Monilinia fructigena* (G. Wint) Honey) are scarce. The literature identified as resistant the clonal rootstock Gisela 6 interspecific hybrid of *P. cerasus* cv. 'Schattenmorelle' × *P. canescens*, and is recommended as a donor of resistance in breeding programmes (Holb, 2009; Schmidt and Gruppe, 1988). However, data is missing on its impact on the grafted variety.

In Bulgaria the focus is mainly on *Blumeriella jaapii*, *Monilinia laxa* and *Monilinia fructigena* as they cause serious damage in year with unfavourable climatic conditions (Borovinova and Sredkov, 2006). Thirteen sweet cherry (*Prunus avium* L.) cultivars, grafted on *P. mahaleb*, were studied from 1997 to 2005 in the Institute of Agriculture in Kyustendil, Bulgaria. Elite '№ 5645' is only moderately susceptible to cherry leaf spot. 'Ranochnaya' had very low susceptibility to cherry leaf spot, whereas 'Sovetskaya', 'Merchant' and the standard 'Bing' were highly susceptible (Christov et al., 2008). Later on it was established that from all the evaluated cultivars, susceptible to cherry leaf spot - 'Royalton', 'Cherna Konyavska', 'Hebros', 'Starking Hardy Giant', and 'Sovremenica' are as susceptible as 'Van', whereas 'Pobeda', 'Rumanka', 'WhiteGold (NY 13688)', 'Merton Premier', 'Somerset' and '11-W 15-37' are more susceptible than 'Van' (Borovinova et al., 2014).

Borovinova et al. (2007) came to conclusion that all of the investigated cultivars are susceptible to the cherry leaf spot but the rate of attack is different. 'Patriotka Krimea', as early cultivar, is recommended for the sweet cherry breeding for its very weak susceptibility to the cherry leaf spot. The cultivars 'Sunburst',

* e-mail: svetoslav.m@live.com

'Sumerset', 'Royalton', 'Castor', 'Lapins' and 'NY 13791' are suitable for the Kyustendil region taking into consideration the mass of fruits, good resistance to late spring frosts and the medium susceptibility to the cherry leaf spot.

During a five-year experiment conducted in a cherry orchard located in the Hisar region, Bulgaria, Dimova and Titjnov (2013) established that *M. laxa* causes significant damages. Out of the three monitored cultivars, the most sensitive one is 'Oblachinska', for which the extent of the attack on untreated trees was about 50% up to 90% and in 2012. Another cultivar sensitive to the disease is 'Schattenmorelle' with damages of 22% up to 50% in the year 2012. 'Heimanns Rubin' was the cultivar less affected by the disease – 10% average with 20% and in the year 2012.

The program for the selection of new cherry cultivars in FGI was launched in 1987. Adding new breeding objectives to the program over the years is in line with market trends and the constantly changing preferences of consumers as this requires the creation of new cultivars and rootstocks with market-oriented qualities:

- very early and early cultivars with larger fruit;
- late cultivars ripening after the usual season;
- cultivars ripening after 'Bigarreau Burlat' - before 'Bing';
- self-fertile cultivars with intense red or light-coloured fruits;
- cultivars with a firm texture of the fruit, resistant to cracking;
- cultivars and rootstocks resistant to biotic and abiotic stress factors;
- cultivars and rootstocks with low and moderate growth;

In 25 years, a rich hybrid fund is built of first and second generation. By the year 2011, the total number of hybrids is more than 2600 plants derived from 58 populations, 31 of which are the result of controlled hybridization, 26 populations were obtained from open pollination of selected varieties and one includes seedlings of unknown origin. On the hybrid populations derived from uncontrolled crossings, mass selection was conducted in the early stages. After series of selection stages and assessments, depending on the time of beginning of fruit-bearing of the hybrids, among the selected 114 elites 4 cultivars were represented to and recognized by the Executive Agency for Variety Testing, Field Inspection and Seed Control (Zhivondov, 1994; Zhivondov et al., 2004; Zhivondov, 2005; 2008).

A final step, before placing the new selected hybrids (elites) as candidate cultivars for testing, is to study their sensitivity to agents of economically important fungal diseases. The aim of the study is to determine the sensitivity of 11 elite and three new cultivars of FGI-Plovdiv to the causers of cherry leaf spot (*Blumeriella jaapii* Rehm), shothole blight (*Stigmia carpophila* Lev. Ellis) and brown rot (*Monilinia fructigena* (G. Wint) Honey).

Materials and methods

Studies were conducted in experimental plantation (0.6 ha) within the FGI - Plovdiv. Observations were carried out on 11 selected hybrids, new cultivars 'Kossara', 'Rosalina', 'Trakiiska hrushtyalka' and standard cultivars 'Bigarreau Burlat', 'Bing' and 'Van', grafted on three rootstocks - clonal Gisela 5 and seedlings from wild cherry and mahaleb. Studies were conducted in two consecutive years 2011 and 2012, when weather conditions were in favour of the development of fungal diseases.

The severity of infection was scored by determining the index of an attack on the leaves and fruit, using the formula of McKinney (1923). Depending on the degree of contamination cultivars and

elites were grouped as:

- Immune - no attack 0.00%;
- Resistant - attack is from 0.01% to 5.00% (single stain);
- Average resistant - attacking from 5.01% to 20.00%;
- Sensitive - attacking from 20.1% to 40.00%;
- Highly sensitive - attack over 40.00%.

Statistical analysis of the data was performed by using the method developed by Duncan (1955) using the restated in 1960 in Air Force Base Wright-Patterson, critical values for the test (Harter, 1960). The software used in the study is R-3.1.3 and RStudio-0.98.

Isolation of the pathogens

Small pieces of infected tissues are cut from the border zone between the diseased and healthy part and then washed with running water. Isolations are made on potato dextrose agar (PDA). From pure cultures, sporulation is examined and pathogenicity tests are carried by inoculation of healthy cherry plants.

Pathogenicity tests

From 12-14 days old culture on PDA, a spore suspension of the pathogens is prepared and sprayed on leaves and immature fruitlets from healthy plants. Controls are sprayed with distilled water. All variants are placed at 25°C, RH 70% and periodically sprayed with water to maintain high humidity. If symptoms appear, reisolation and microscopic analysis are carried out.

Results and discussion

Table 1 shows the average data for the period 2011 – 2012, as the data for *Monilinia* is for 2012. In terms of the disease cherry leaf spot, the most resistant cultivars (elites) under field conditions with proven statistical difference are El.17-37, El.17-44 and 'Trakiiska hrushtyalka' in contrast to El.17-31 with highest percentage between 17.50% and 30.67% among the different rootstocks. Scion/rootstocks combinations, which fall within the group of resistant - up to 5% attack, are El.17-37/*P.mahaleb*, El.17-44/Gisela 5, 'Kossara'/*P.mahaleb*, 'Bing'/*P.mahaleb*, 'Bing'/Gisela 5 and El.17-37/Gisela 5.

As average for the three rootstocks, all cultivars and elites are defined as medium resistant, except for El.17-31. Susceptible are also the combinations 'Bigarreau Burlat'/Gisela 5, El.28-208/Gisela 5, El.17-136/Gisela 5, El.20-77/*P.mahaleb* and 'Bing'/*P.avium*. Elites with medium resistance, but without proven statistical difference to the sensitive group are El.17-90, El.17-136, El.28-208, El.20-77 and 'Bigarreau Burlat' cultivar.

Determinant of the sensitivity to *Blumeriella jaapii* is the cultivar (elite), but the influence of the rootstock is significant, especially in elites El.17-37, El.17-44, El.20-47, El.28-208, El.28-209 and cultivars 'Bing', 'Van' and 'Kossara'.

The degree of attack by agents of fungal shothole blight range from 55.00% in scion-rootstock combination El.17-136/Gisela 5 up to 0.00% in El.17-44/*P.mahaleb*. There is a strong influence of the rootstock to the sensitivity, as the most severe damages were observed on clonal rootstock Gisela 5. The only exception is El.8-65 grafted on Gisela 5 - 12.00% compared to 20.48% - *P.mahaleb* and 23.00% - *P.avium*.

The heavy rainfall in 2012, coinciding with the mass cherry fruit ripening period, allowed the determination of the sensitivity to the causers of brown rot (*Monilinia fructigena* (G. Wint) Honey) under favourable for their development climate conditions. Variations in the

Table 1. Degree of infestation (%) of cherry hybrids (elites) and cultivars on tree rootstocks

Cultivar / Hybrid (Elite)	Degree of infestation, %								
	Gisela 5		<i>P. avium</i>		<i>P. mahaleb</i>		Average for all rootstocks		
<i>Cherry leaf spot (Blumeriella jaapii (Rehm) Arx)</i>									
El.8-65	11.33	a	10.00	a	9.26	a	10.20	b	Medium resistant
El.17-31	30.67	a	30.04	a	17.50	a	26.07	a	Susceptible
El.17-37	4.00	a	18.00	a	0.00	a	7.33	b	Medium resistant
El.17-44	2.00	a	12.00	a	8.00	a	7.33	b	Medium resistant
El.17-90	18.00	a	18.00	a	19.00	a	18.33	ab	Medium resistant
El.17-136	23.00	a	13.00	a	19.38	a	18.46	ab	Medium resistant
El.20-31	15.92	a	8.65	a	6.00	a	10.19	b	Medium resistant
El.20-47	15.14	a	5.33	a	NA*		10.23	b	Medium resistant
El.20-77	15.33	a	10.50	a	21.89	a	15.91	ab	Medium resistant
El.28-208	24.59	a	14.00	a	13.00	a	17.20	ab	Medium resistant
El.28-209	7.52	a	9.50	a	15.50	a	10.84	b	Medium resistant
'Bigarreau Burlat'	28.92	a	NA*		6.50	a	17.71	ab	Medium resistant
'Bing'	4.00	a	20.35	a	3.00	a	9.12	b	Medium resistant
'Van'	6.94	a	19.00	a	12.00	a	12.65	b	Medium resistant
'Kossara'	20.00	a	15.33	a	2.00	a	12.44	b	Medium resistant
'Rosalina'	11.44	a	11.13	a	8.00	a	10.19	b	Medium resistant
'Trakiiska hrushtyalka'	9.00	a	10.00	a	6.00	a	8.33	b	Medium resistant
<i>Shothole blight (Stigmia carpophila (Lev.) Ellis)</i>									
El.8-65	12.00	b	23.00	a	20.48	ab	18.49	bc	Medium resistant
El.17-31	40.67	ab	29.01	a	34.00	ab	34.56	ab	Susceptible
El.17-37	21.00	ab	37.00	a	21.50	ab	26.50	abc	Susceptible
El.17-44	24.00	ab	8.00	a	0.00	b	10.67	c	Medium resistant
El.17-90	46.67	ab	11.62	a	22.67	ab	26.98	abc	Susceptible
El.17-136	55.00	a	26.00	a	43.00	a	41.33	a	Highly susceptible
El.20-31	38.59	ab	7.77	a	28.00	ab	24.79	abc	Susceptible
El.20-47	14.76	b	18.67	a	NA*		16.72	bc	Medium resistant
El.20-77	15.00	b	21.00	a	17.26	ab	17.75	bc	Medium resistant
El.28-208	32.87	ab	16.00	a	16.00	ab	21.62	abc	Susceptible
El.28-209	21.38	ab	25.00	a	30.00	ab	25.46	abc	Susceptible
'Bigarreau Burlat'	43.83	ab	NA*		23.00	ab	33.42	ab	Susceptible
'Bing'	12.00	b	7.85	a	12.00	ab	10.62	c	Medium resistant
'Van'	22.50	ab	18.00	a	10.00	ab	16.83	bc	Medium resistant
'Kossara'	27.00	ab	19.00	a	6.00	ab	17.33	bc	Medium resistant
'Rosalina'	36.33	ab	11.85	a	38.00	a	28.73	abc	Susceptible
'Trakiiska hrushtyalka'	31.78	ab	18.00	a	10.00	ab	19.93	bc	Medium resistant
<i>Brown rot (Monilinia fructigena (G. Wint) Honey)</i>									
El.8-65	70.00	a	70.00	b	70.00	bc	70.00	ab	Highly susceptible
El.17-31	15.00	d	70.00	b	70.00	bc	51.67	abc	Highly susceptible
El.17-37	10.00	d	5.00	f	5.00	f	6.67	d	Medium resistant
El.17-44	70.00	a	50.00	cd	20.00	ef	46.67	abcd	Highly susceptible
El.17-90	5.00	d	10.00	f	60.00	c	25.00	cd	Susceptible
El.17-136	15.00	d	15.00	f	70.00	bc	33.33	bcd	Susceptible
El.20-31	35.00	bc	35.00	de	35.00	de	35.00	bcd	Susceptible
El.20-47	5.00	d	60.00	bc	NA*		32.50	bcd	Susceptible
El.20-77	70.00	a	90.00	a	90.00	a	83.33	a	Highly susceptible
El.28-208	5.00	d	45.00	cd	40.00	d	30.00	bcd	Susceptible
El.28-209	6.00	d	10.00	f	10.00	f	8.67	cd	Medium resistant
'Bigarreau Burlat'	60.00	ab	NA*		40.00	d	50.00	abcd	Highly susceptible
'Bing'	40.00	b	35.00	de	70.00	bc	48.33	abcd	Highly susceptible
'Van'	20.00	cd	20.00	ef	60.00	c	33.33	bcd	Susceptible
'Kossara'	10.00	d	15.00	f	10.00	f	11.67	cd	Medium resistant
'Rosalina'	NA*		20.00	ef	80.00	ab	50.00	abcd	Highly susceptible
'Trakiiska hrushtyalka'	10.00	d	20.00	ef	30.00	de	20.00	cd	Medium resistant

* NA - not available (no data)

influence of the rootstock are observed only in the seedling *P.mahaleb*, the results obtained by Gisela 5 and *P.avium* are very close. Most susceptible are El.8-65 and El.20-77 and large number elites and the cultivars 'Bigarreau Burlat', 'Bing' and 'Rosalina' fall in the highly susceptible category. Resistant to medium resistant are El.17-37, El.28-209, 'Kossara' and 'Trakiiska hrushtyalka'.

Conclusions

The analysis of the data collected in this current study reveals that the susceptibility to the investigated diseases is in relation not only to the cultivar used, but rather to the scion/rootstock combination and the interaction between the two components. Determinant of the sensitivity to *Blumeriella jaapii* is the cultivar (elite), but the influence of the rootstock is significant, especially in elites El.17-37, El.17-44, El.20-47, El.28-208, El.28-209 and cultivars 'Bing', 'Van' and 'Kossara'. As average for the three rootstocks, all cultivars and elites are defined as medium resistant, except for El.17-31. There is a strong influence of the rootstock to the sensitivity to *Stigmia carpophila*, as the most severe damages were observed on clonal rootstock Gisela 5. Interesting is the elite El.17-37 demonstrating the least infestation of *Blumeriella jaapii* - 7.33% and *Monilinia fructigena* - 6.67%. The same has a set of valuable qualities as late maturing date and very large fruits with excellent sensory profile, making it a potential candidate cultivar.

References

- Apostol J**, 2005. New sweet cherry varieties and selections in Hungary. *Acta Horticulturae* (ISHS), 667, 59-64.
- Blažková J**, 2004. Resistance to abiotic and biotic stressors in sweet cherry rootstocks and cultivars from the Czech Republic. *Journal of Fruit and Ornamental Plant Research*, 12, 303-311.
- Borovinova M, Christov N, Borisova A and Maneva S**, 2014. Evaluation of some biological properties and susceptibility to *Blumeriella jaapii* of sweet cherry cultivars in Kyustendil region, Bulgaria. *Acta Horticulturae* (ISHS), 1020, 131-136.
- Borovinova M, Christov N and Nyéki J**, 2007. Some biological properties of new sweet cherry cultivars in Bulgaria and their susceptibility to *Blumeriella jaapii*. *International Journal of Horticultural Science*, 13, 95-97.
- Borovinova M and Sredkov I**, 2006. Comparison of integrated and conventional plant protection of cherry orchards. *Notulae Botanicae Horti Agrobotanici*, XXXI, 93-99.
- Budan S**, 2005. Breeding sour cherry for resistance to leaf spot: new promising selections. *Acta Horticulturae* (ISHS), 667, 141-144.
- Christov N, Borovinova M and Borisova A.**, 2008. Results of the study of new sweet cherry cultivars and elites in Kyustendil region, Bulgaria. *Acta Horticulturae* (ISHS), 795, 97-102.
- Dimova M and Titjnov M**, 2013. Control of early brown rot - blossom blight in sour cherry caused by *Monilia laxa*. *Book of Proceedings "Fourth International Scientific Symposium „Agrosym 2013“*, 573-577.
- Frisullo S and Ferrara G**, 1997. Indagine sui micromiceti del ciliegio in puglia. *Atti del Convegno Nazionale del Ciliegio*, Valenzano (Ba), 515-519.
- Grădinaru G, Istrate M, Budan S, Petre L, Corneanu G, Corneanu M and Popescu A**, 2008. New cherry cultivars and hybrids created at IASI fruit research station, Romania. *Acta Horticulturae* (ISHS), 795, 137-140.
- Holb IJ**, 2009. Some biological features of cherry leaf spot (*Blumeriella jaapii*) with special reference to cultivar susceptibility. *International Journal of Horticultural Science*, 15, 91-93.
- Jänes H, Klaas L and Kahu K**, 2008. Sweet cherry cultivars in Estonia. *Acta Horticulturae* (ISHS), 795, 103-108.
- Kappel F**, 2008. Breeding cherries in the 'New World'. *Acta Hort (ISHS)* 795: 59-69
- Lang G, Ophardt D and Olmstead J**, 1998. Sweet cherry breeding at Washington state university. *Acta Horticulturae* (ISHS), 468, 97-104.
- McKinney HH**, 1923. Influence of soil temperature and moisture on infection on wheat seedling by *Helmintosporium sativum*. *Journal of Agricultural Research*, 26, 195-217.
- Rozsnyay ZS and Apostol J**, 2005. Breeding for sweet and sour cherry disease resistance in Hungary. *Acta Horticulturae* (ISHS), 667, 117-122.
- Sansavini S and Lugli S**, 2008. Sweet cherry breeding programs in Europe and Asia. *Acta Horticulturae* (ISHS), 795, 41-57.
- Schmidt H and Gruppe W**, 1988. Breeding dwarfing rootstocks for sweet cherries. *HortScience*, 23, 112-114.
- Schuster M**, 2004. Investigation on resistance to leaf spot disease, (*Blumeriella jaapii*), in cherries. *Journal of Fruit and Ornamental Plant Research*, 12, 275-279.
- Schuster M and Wolfram B**, 2005. Sour cherry breeding at Dresden-Pillnitz. *Acta Horticulturae* (ISHS), 667, 127-130
- Theiler-Hedtrich R**, 1985. Sweet cherry breeding programme at the Swiss Federal Research Station I. Results of fruit characters and flowering period inheritance. *Acta Horticulturae* (ISHS), 169, 51-62.
- Trajkovski V**, 1996. A review of the cherry breeding program in Sweden. *Acta Horticulturae* (ISHS), 410, 387-388.
- Wharton P and lezzoni A**, 2005. Development of a protocol for screening cherry germplasm for resistance to cherry leaf spot. *Acta Horticulturae* (ISHS), 667, 509-514.
- Zhivondov A**, 1994. Genetic fund and breeding activities in stone fruit species at the Fruit-Growing Institute, Plovdiv. *Agricultural Science and Production*, 32, 54-56.
- Zhivondov A**, 2005. Inheritance of some characteristics in F1 hybrid generation obtained by open pollination of sweet cherry cultivar Stella. *Vočarstvo Journal of Pomology*, 39, 179-185.
- Zhivondov A**, 2008. Some Results of Using 'Van' to Improve the Range of Sweet Cherry Cultivars in Bulgaria. *Acta Horticulturae* (ISHS), 795, 93-96.
- Zhivondov A, Gercheva P and Djouvinov V**, 2004. Some Results of a Sweet Cherry Breeding Programme in Bulgaria. *Acta Horticulturae* (ISHS), 663, 739-741.

Review

- Honey bees and their products as indicators of environmental pollution: A review** 175
D. Salkova, M. Panayotova-Pencheva

Genetics and Breeding

- Characterization of the Bulgarian sunflower hybrid Valin** 183
G. Georgiev

- Evaluation of the combining ability of mutant maize lines** 189
V. Valkova, N. Petrovska

- Evaluation of small size fruit peppers *Capsicum annum* spp. *microcarpum* with cluster and factor analysis** 193
V. Kuneva, M. Nikolova

- Sensitivity of promising cherry hybrids and new cultivars to economically important fungal diseases** 197
K. Vasileva, S. Malchev, A. Zhivondov

Nutrition and Physiology

- Lysozyme levels in haemolymph of worker bees (*Apis mellifera* L.) from bee colonies with different degree of expression of hygienic behaviour** 201
S. Lazarov, I. Zhelyazkova, D. Salkova, R. Shumkova, S. Takova

Production Systems

- Study on energy flows of renewable sources for producing hot water on dairy farms** 205
R. Georgiev, K. Peychev, D. Georgiev, R. Slavov, S. Apostolov, J. Ellingsen, J. Tønnesen

- Loose smut of barley grown in three types of farming** 209
T. Nedelcheva, V. Maneva

- Efficacy and timing of some new products against pear psylla (*Cacopsylla pyri* L.) (Hemiptera: Psyllidae): I. Spirotetramat** 213
V. Arnaudov

- Influence of year's characteristics and the different fertilization levels on the structural elements of wheat yield** 217
V. Kuneva, R. Bazitov, A. Stoyanova

Grain combines productivity according to various unloading methods – in the field and at the edge of the field	221
N. Delchev, K. Trendafilov, G. Tihanov, Y. Stoyanov	
 Agriculture and Environment	
Effect of some herbicides on weeds and vines in mother plantation of Cabernet sauvignon	227
N. Prodanova – Marinova	
Influence of foliar herbicides treatment on malting barley (<i>Hordeum vulgare</i> L.) productivity of Emon, Vanessa and Vicky varieties	232
D. Atanasova, V. Maneva	
Selectivity and stability of herbicides and herbicide combinations for the grain yield of maize (<i>Zea Mays</i> L.)	237
G. Delchev, T. Barakova	
Effect of some soil herbicides on vegetative habits of almond trees of 'Nonpareil' cultivar grown in a second-year nursery field	242
Z. Rankova, M. Tityanov	
Phytosanitary conditions of the organic field and boundary	245
D. Atanasova, V. Maneva, N. Grozeva	
 Product Quality and Safety	
Quality traits of eggs from autosexing Easter eggers	249
H. Lukanov, A. Genchev, A. Pavlov, I. Penchev	
Amino acid composition of lamb meat from the North East Bulgarian fine fleece breed and its crossbreds from internal breeding	256
R. Slavov, G. Mihaylova, St. Ribarski, D. Panayotov, D. Pamukova, D. Dragnev	
Some results of evaluation of new-introduced apricot cultivars under conditions of Plovdiv region	262
V. Bozhkova, M. Nesheva	

Instruction for authors

Preparation of papers

Papers shall be submitted at the editorial office typed on standard typing pages (A4, 30 lines per page, 62 characters per line). The editors recommend up to 15 pages for full research paper (including abstract references, tables, figures and other appendices)

The manuscript should be structured as follows: Title, Names of authors and affiliation address, Abstract, List of keywords, Introduction, Material and methods, Results, Discussion, Conclusion, Acknowledgements (if any), References, Tables, Figures.

The title needs to be as concise and informative about the nature of research. It should be written with small letter /bold, 14/ without any abbreviations.

Names and affiliation of authors

The names of the authors should be presented from the initials of first names followed by the family names. The complete address and name of the institution should be stated next. The affiliation of authors are designated by different signs. For the author who is going to be corresponding by the editorial board and readers, an E-mail address and telephone number should be presented as footnote on the first page. Corresponding author is indicated with *.

Abstract should be not more than 350 words. It should be clearly stated what new findings have been made in the course of research. Abbreviations and references to authors are inadmissible in the summary. It should be understandable without having read the paper and should be in one paragraph.

Keywords: Up to maximum of 5 keywords should be selected not repeating the title but giving the essence of study.

The introduction must answer the following questions: What is known and what is new on the studied issue? What necessitated the research problem, described in the paper? What is your hypothesis and goal?

Material and methods: The objects of research, organization of experiments, chemical analyses, statistical and other methods and conditions applied for the experiments should be described in detail. A criterion of sufficient information is to be possible for others to repeat the experiment in order to verify results.

Results are presented in understandable

tables and figures, accompanied by the statistical parameters needed for the evaluation. Data from tables and figures should not be repeated in the text.

Tables should be as simple and as few as possible. Each table should have its own explanatory title and to be typed on a separate page. They should be outside the main body of the text and an indication should be given where it should be inserted.

Figures should be sharp with good contrast and rendition. Graphic materials should be preferred. Photographs to be appropriate for printing. Illustrations are supplied in colour as an exception after special agreement with the editorial board and possible payment of extra costs. The figures are to be each in a single file and their location should be given within the text.

Discussion: The objective of this section is to indicate the scientific significance of the study. By comparing the results and conclusions of other scientists the contribution of the study for expanding or modifying existing knowledge is pointed out clearly and convincingly to the reader.

Conclusion: The most important consequences for the science and practice resulting from the conducted research should be summarized in a few sentences. The conclusions shouldn't be numbered and no new paragraphs be used. Contributions are the core of conclusions.

References:

In the text, references should be cited as follows: single author: Sandberg (2002); two authors: Andersson and Georges (2004); more than two authors: Andersson et al. (2003). When several references are cited simultaneously, they should be ranked by chronological order e.g.: (Sandberg, 2002; Andersson et al., 2003; Andersson and Georges, 2004).

References are arranged alphabetically by the name of the first author. If an author is cited more than once, first his individual publications are given ranked by year, then come publications with one co-author, two co-authors, etc. The names of authors, article and journal titles in the Cyrillic or alphabet different from Latin, should be transliterated into Latin and article titles should be translated into English. The original language of articles and books translated into English is indicated in parenthesis after the bibliographic reference (Bulgarian = Bg, Russian = Ru, Serbian = Sr, if in the Cyrillic, Mongolian =

Mo, Greek = Gr, Georgian = Geor., Japanese = Ja, Chinese = Ch, Arabic = Ar, etc.)

The following order in the reference list is recommended:

Journal articles: Author(s) surname and initials, year. Title. Full title of the journal, volume, pages. Example:

Simm G, Lewis RM, Grundy B and Dingwall WS, 2002. Responses to selection for lean growth in sheep. *Animal Science*, 74, 39-50

Books: Author(s) surname and initials, year. Title. Edition, name of publisher, place of publication. Example:

Oldenbroek JK, 1999. Genebanks and the conservation of farm animal genetic resources, Second edition. DLO Institute for Animal Science and Health, Netherlands.

Book chapter or conference proceedings:

Author(s) surname and initials, year. Title. In: Title of the book or of the proceedings followed by the editor(s), volume, pages. Name of publisher, place of publication. Example:

Mauff G, Pulverer G, Operkuch W, Hummel K and Hidden C, 1995. C3-variants and diverse phenotypes of unconverted and converted C3. In: Provides of the Biological Fluids (ed. H. Peters), vol. 22, 143-165, Pergamon Press. Oxford, UK.

Todorov N and Mitev J, 1995. Effect of level of feeding during dry period, and body condition score on reproductive performance in dairy cows. IXth International Conference on Production Diseases in Farm Animals, September 11-14, Berlin, Germany.

Thesis:

Hristova D, 2013. Investigation on genetic diversity in local sheep breeds using DNA markers. Thesis for PhD, Trakia University, Stara Zagora, Bulgaria, (Bg).

The Editorial Board of the Journal is not responsible for incorrect quotes of reference sources and the relevant violations of copyrights.

Animal welfare

Studies performed on experimental animals should be carried out according to internationally recognized guidelines for animal welfare. That should be clearly described in the respective section "Material and methods".

AGRICULTURAL SCIENCE AND TECHNOLOGY

Volume 8, Number 3
September 2016



Journal web site:
www.agriscitech.eu


Publisher:
www.alfamarket.biz