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EVALUATION OF GERMAN PLUM SELECTIONS IN LATVIA

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The aim of the study was to determine the suitability of growing plum cultivars and hybrids of German origin in Latvian conditions. In the trial the plum cultivars and hybrids were planted at the Latvia State Institute of Fruit Growing (now, Institute of Horticulture) in spring 2008. Six W. Hartmann genotypes (cultivars 'Tipala', 'Tegera' and 'Haganta', and hybrids H-5102, H-3753, and H-3690) from Hohenheim University were included in the study. Prunus cerasifera *was used as rootstock. The parameters evaluated were: beginning of flowering, ripening time, average yield (kg per tree), cumulative yield (kg), and average fruit weight from 2012 to 2016, and content of soluble solids from 2014 to 2016. In addition, self-fertility was evaluated in 2015 and 2016 for three cultivars and one hybrid. The winter of 2010/2011 was unfavourable, as plum orchards and most plum cultivars in Latvia suffered winter damage, but cultivars and hybrids in the trial were without damages. Significant damages were not observed in further years. Average flowering time in the four-year period for all cultivars and hybrids was the 1st or 2nd decade of May, harvest time was from the 1st decade of August to the 3rd decade of September. The earliest was hybrid H–3690, and the latest was cv.'Haganta'. The most productive was hybrid H–3690, which gave 42 kg in the 3rd year of yield and had the most rapid rise in yields. 'Haganta' had the biggest fruits (50 to 60 g) and highest content of soluble solids (17–18 Brix%). Self-fertility level was 40% for 'Tegera', 17.4% for 'Haganta', 14.5% for H–3690 and 0% for 'Tipala'. Evaluation of all analysed parameters showed that 'Tegera' could be recommended for Latvian growers thanks to good winter hardiness in the research period. 'Haganta' is recommended only for warmer regions in Latvia. Hybrid H-3690 will potentially be useful for Latvian growers.*

Key words: P. domestica *L., winter hardiness, productivity, fruit quality, self-fertility.*

INTRODUCTION

Plum production in northern latitudes, like in Latvia, is restricted by climatic factors. Introduction and adaptation of cultivars from the central and southern parts of Europe or Northern America are very difficult because of their unsatisfactory winter-hardiness, while winterhardy cultivars from Russia and Belarus are lacking in fruit quality. On the other hand, Latvian climatic conditions are favourable for growing of plums (Kaufmane *et al*., 2007).

The breeding and introduction objectives are general and specific. The general objectives include productivity, fruit quality (size, taste, appearance, stone adherence) and disease resistance, especially to Plum Pox Virus. The specific objectives are: late blooming and frost resistance of flower buds in the United Kingdom, Bulgaria, Moldova, and Belarus; winter hardiness and short vegetation period in Sweden and Latvia; good storage in Norway; extended ripening period in Bulgaria and Romania; and self-fertility in Latvia and Romania (Karklins *et al.*, 2007; Butac *et al*., 2013; Vangdal, 2007b). The fruits are of high benefit for human health. Fruits of *P. domestica* L. are mainly grown for fresh consumption, and additionally for processing. Plums are used to make jam, juice, canned goods, liquor and brandy, also for drying, baking and confectionary. Concentrated juices of plums and prunes are also used for medicinal purposes as a laxative. In different countries the traditional uses are different. For example, in Germany plums are mostly used for baking of plum cakes and distilling, in Romania, Hungary, Serbia, and Bulgaria for drying and distilling, and in Nordic countries and Latvia mostly for fresh consumption (Vangdal *et al*., 2007a; Hartmann and Neumüller, 2009; Kaufmane *et al.,* 2012; Botu *et al*., 2013).

Commercial plum growing in Latvia is constantly developing. However, despite long-term breeding efforts, the variety assortment of plums is still rather scarce. There is particularly a lack of plum cultivars suitable for sale at supermarkets, with large and tasty fruits, and satisfactory flesh firmness. The cultivated area of the six most popular plum cultivars is 69% of the total plum area. An extremely early maturing diploid cultivar is 'Kometa'. For commercial orchards, recommended cultivars are also 'Victoria', 'Julius', 'Experimentalfältets Sviskon', 'Perdrigon', 'Stanley'

and ‘Lase’ (Skrīvele *et al*., 2008). ‘Victoria’ and ‘Kometa’ have the most stable yields, yet for these cultivars fruitlet thinning is obligatory to achieve good fruit quality.

For Latvian consumers and farmers, German breeding material is interesting as it has high fruit quality, good yield and high sugar content. Although Sharka (Plum Pox Virus) has not caused major losses for Latvia plum growers so far, resistance of German breeding material to Plum Pox Vrus is important, especially in changing climatic conditions.

As reported by German researchers, both extreme high and extreme low temperatures influence plant productivity and length of the vegetation period. In the maturation period, extreme temperatures may reduce the yield by up to 40% (Tromp and Wertheim, 2005). In Latvia, weather conditions can be highly variable between different regions and winters are colder than in Germany.

One of the important conditions for development of plum growing is obtaining a regular harvest for which the guarantee is suitable pollinator selection. To obtain a quality harvest, it is necessary to determine the self-compatibility of cultivars. As mentioned by some researchers, after cross-pollination, fruit set can be higher and may reach more than 50%. Especially in case of bad weather conditions during flowering, cross-pollination resulted in higher fruit set even for self-fertile cultivars (Hartmann and Neumüller, 2009; Wertheim and Schmidt, 2005).

The aim of the study was to determine the suitability of growing plum cultivars and hybrids of German origin in Latvian conditions.

MATERIALS AND METHODS

The study was conducted at the Latvia State Institute of Fruit-Growing, which is situated in the southern part of Latvia, latitude 56° 36.633` and longitude 23°17.888`. Three W. Hartmann cultivars (‘Tipala’, ‘Tegera’, ‘Haganta’) and three hybrids (H-5102, H-3753, H-3690), grafted on seedlings of *P. cerasifera*, were planted in 2008 at distances of 3 × 5 m. The cultivar ''Victoria’ was used as a control. Evaluation of flowering and yield parameters was conducted during 2012 to 2016. Soil of the experimental plot was VKt (Kārkliņš, 2009); Hypopisocalcic Luvisol (Hypereutric) (Anonymous, 2006), sandy loam, organic matter content — 32 $g \cdot kg^{-1}$ (Tyurin method), pH — 6.5 (in 1 M KCl). Plant available P_2O_5 was 170 $mg \cdot kg^{-1}$ and K_2O — 233 $mg \cdot kg^{-1}$ (DL).

The parameters evaluated for the three cultivars and three hybrids were:

– winter damages of the tree (0–5 points): 0 point — tree without winter damage; 1 point — flowers without stigma, woody parts without damage; 2 points — 30% of flowering buds with damage, some flowers without stigma, woody parts without damage; 3 points — 60% of flowering buds damaged, visible woody part damage, injured and dying fruit spurs; 4 points — tree with significant damage, gradually dies; 5 points — the tree is dead;

– beginning of flowering time;

– intensity of flowering (scored on a scale of 0 (no flowers) — 5 (abundant flowering);

– time of ripening, when 50% of fruits have reached harvest maturity;

– crown density (easy of pruning the tree crown);

– average yield (kg per tree);

– cumulative yield from 2012 to 2016 (kg);

– fruit quality: average fruit weight (g) was determined by weighing 50–100 fruits in an unsorted sample; for weighing an Electronic Compact Scale SF–400A with accuracy from 1 g to 10 kg was used;

– content of soluble solids (Brix%) in fresh fruits (ISO 2173:2003) was measured at 20 °C with a digital refractometer ATAGO N20 (measurement error ± 0.1%) according to the standard BS EN 12147 (1 July 2001). Measurements were made in 20 replications.

For evaluation of self-fertility, in 2015 and 2016, agro-plastic isolators were placed on branches before flowering to ensure pollination of each cultivar and hybrid with its own pollen. Later fruits were counted and number of fruits as % of pollinated flowers was calculated. Level of self-fertility was compared with open pollination.

Climatic conditions during the period of evaluation. Evaluation of climatic conditions was made during 2010 to 2016. Evaluation of first yield was made only in 2013 because:

– in 2010, the vegetation period was significantly longer and moister, after abundant rainfall from July to September vegetative shoots did not mature — possibly this was one of the reasons for winter injury to flower buds in the next year. During the winter of 2010/2011, in December the snow cover was about 40–50 cm, the soil under snow was not frozen, and at the end of December a thick ice crust developed causing severe damage to tree trunks for a second successive season;

– in 2011, after a prolonged thaw, in the 2nd decade of February, the temperature fell even to –24 °C. The condition of tree trunk wood significantly worsened, and plum flowering was very weak. The weather conditions during summer were favourable for the development of generative buds, but, in autumn precipitation was too high — the trees could not mature properly and enter physiological dormancy. Plum orchards and most plum cultivars in Latvia had winter damages, but cultivars and hybrids in the trial were without damage.

– in 2012, winter cold started only in the 2nd half of January, when the majority of cultivars either had not developed

sufficient resistance to low temperatures or had already lost it. The flower buds had formed in abundance, but bud damage was observed in spring — buds were without stigma. As a result of the winter conditions, branches exhibited signs of drying, and flower buds and fruitlets fell off.

– in 2013, March was unfavourable due to sharp day and night temperature fluctuations, with –15 °C at night and up to +10 °C during the day. The spring was very late; in the 1st decade of April the average air temperature was only –0.3 °C. Plum vegetative growth started in the 3rd decade of April (for the latest cultivars — in the 1st decade of May), but already in the 2nd decade of May, when plum flowering begun (May 10 to 20), air temperature had increased up to +30 °C. During flowering of late-blossoming cultivars, very intense rainfall and wind destroyed part of the flowers, and washed away pollen, thus causing problems with fertilisation. In August the temperature increased to +34 °C. Some of the cultivars had small fruits with high acidity and increased stone adherence to flesh.

From 2014 to 2015, significant tree damage was not detected. Spring frosts occurred in 2014 and 2016, but flower fertilisation did not decrease significantly.

The beginning of 2016 was unfavourable for plum growing. After prolonged warmth in February, March, and April were cold. Fruit twigs with frost damage were observed during spring, and some of the cultivars had flowers without stigma. For the first time in the evaluation period, significant frost damage to flower buds and fruit twigs was observed.

Mathematical processing of data. Differences in yield, fruit average mass, as well as differences of other plant parameters between cultivars and measurement replications were analysed using basic indices of descriptive statistics. Ranging and grouping of results into significantly differing groups was done by the use of the Tukey test, indicating significantly different groups with letters *a, b, c, d, e, f, g, h*, where *a* always means the smallest value.

For the evaluation of fruit qualitative traits in homogenous systems, analysis of variance was used (level of significance $p = 0.05$) and, in addition, also the Tukey test.

RESULTS

For evaluation of German origin genotypes (obtained in southern Germany where the winters are much milder than in Latvia), one of the main indices showing adaptation ability to our climate is winter-hardiness. Description of winter damage during the period from 2012 to 2016 is presented in Table 1. Significant differences during the evaluation period were observed both between years and between genotypes. Significantly lower winter damage occurred in 2014 and 2015. Statistically non-significant differences were found between years 2013 and 2016, when frost damaged flower buds and fruit spurs were observed. Among genotypes, significantly lower frost damage was found for hybrid H-3690 (average of all years only 0.5 points), and significantly higher for hybrid H-5102 (average of all years 2.6 points).

Table 2 provides a summary of data on beginning and intensity of flowering, and beginning of ripening, from 2012 to 2016. Flowering in Latvia is usually from the 1st to the 3rd decade of May (Table 2). In some years, spring frosts occur at this time and later flowering is beneficial for cultivars. Of the evaluated material during the evaluation period, the earliest flowering was observed for hybrid H–3690, and the latest for cultivar 'Haganta'. The flowering season in 2014 was earlier and with good flowering intensity, but very short with negative influence on fertilisation and yield was low. The opposite conditions were observed in 2015, when the flowering period was very long (approximately two weeks for all cultivars). Flowering intensity was significantly different among genotypes and years. Significantly lower flowering intensity was observed for genotypes 'Tegera' (1 point) and H-5102 (1.1 point), while higher flowering intensity without significantly differences for genotypes 'Victoria' (3.2 points), 'Tipala' (3.5 points) and H-3690 (4.2 points). The lowest flowering intensity was in

Table 1

EVOLUATION OF WINTER HARDINESS IN THE PERIOD FROM 2012 TO 2016

Cultivars and hybrids	Winter hardiness damage (0–5 points) (0 – tree without damage; 5 – tree died)					Average level of damage among cultivars
	2012	2013	2014	2015	2016	
Tegera	2.1 ± 1.5	2.1 ± 0.4	0	1.6 ± 0.5	2.8.± 0.2	1.7^{c}
Tipala	1.8 ± 0.8	2.2 ± 0.8	2.0 ± 0.1	0.8 ± 0.8	3.0 ± 0.5	2.0^{cd}
Haganta	2.4 ± 0.6	2.3 ± 0.4	1.0 ± 0.1	0.8 ± 0.2	2.2 ± 0.8	1.7^{c}
H-5102	2.3 ± 0.8	3.3 ± 0.3	2.5 ± 0.2	1.8 ± 0.4	3.4 ± 0.2	2.6^{d}
H-3753	2.1 ± 0.5	3.2 ± 0.7	1.5 ± 0.1	0.6 ± 0.5	2.2 ± 0.4	1.9^{cd}
H-3690	0.5 ± 0.1	1.0 ± 0.2	0	0	1.0 ± 0.1	0.5^{a}
Victoria	0.4 ± 0.2	1.4 ± 0.4	0	0.1±0.1	3.5 ± 0.5	1.1^{b}
Average level of damages among years	1.7^{b}	2.2^{c}	1.0^{a}	0.8^{a}	2.6^{cd}	
p-value: year	< 0.05					
p-value: cultivars	< 0.05					

Table 2

FLOWERING PARAMATERS OF ANALYSED CULTIVARS AND HYBRIDS

Parameter	Cultivars and hybrids	2012	2013	2014	2015	2016	Average flowering intensity among cultivars
Flowering intensity (0–5)	Tegera	1.0	0.5	1.0	1.5	1.0	1.0^{a}
	Tipala	3.5	2.5	3.0	5.0	3.5	3.5^{c}
	Haganta	2.0	1.0	2.0	4.5	1.5	2.2^{b}
	H-5102	1.5	0.5	1.0	2.5	0.1	1.1^{a}
	H-3753	2.0	1.0	2.0	3.5	2.0	2.1^{b}
	H-3690	4.0	3.0	5.0	5.0	4.0	4.2^{cd}
	Victoria	3.5	2.5	5.0	5.0	0.1	3.2^{c}
Average flowering intensity among years		2.5^{b}	1.6^{a}	2.7^{b}	3.9^{c}	1.7^{a}	
p-value: years	< 0.05						
p-value: cultivars	< 0.05						
Beginning of flowering	Tegera	07.05	13.05	01.05	06.05	16.05	
	Tipala	05.05	10.05	25.04	02.05	04.05	
	Haganta	07.05	16.05	05.05	06.05	08.05	
	H-5102	07.05	13.05	27.04	06.05	06.05	
	H-3753	05.05	13.05	27.04	06.05	06.05	
	H-3690	06.05	13.05	27.04	06.05	05.05	
	Victoria	05.05	10.05	25.04	02.05	07.05	
Beginning of ripening	Tegera	21.08	09.08	12.08	21.08	12.08	
	Tipala	21.08	09.08	1808	14.08	03.08	
	Haganta	24.09	09.09	17.09	02.10	12.08	
	H-5102	–	09.08	12.08	17.08	06.08	
	H-3753	–	02.09	22.08	21.08	25.08	
	H-3690	–	10.08	10.08	17.08	18.08	
	Victoria	27.08	28.08	28.08	14.08	25.08	

2013 (1.6 points) and 2016 (1.7 points), characterised by unfavourable weather in winter and spring. Significantly higher flowering intensity occurred in 2015. As a result, crop yields were significantly higher. Ripening time for the earlier cultivars 'Tipala' and 'Tegera' was the first decade of August, which is early for Latvian condition. The latest cultivar was 'Haganta', which usually produced fruit at the end of September. However, in 2015, this cultivar was harvested at the beginning of October, when the overnight temperature was –8 °C for seven days. This indicates that this cultivar is suitable only for growing in warmer regions in Latvia.

In addition, we evaluated the crown density and how many times were needed to prune and to form the tree of each perspective genotype. Cultivar's 'Tegera' crown is vigorous and upright, but young branches need spreading. 'Haganta' has a vigorous and semi-open crown, and there are no problems with pruning. Hybrid H-3690 has a crown which is medium vigorous and semi-open, very amenable to pruning.

Data on the evaluated average yield per tree in the trial is shown in Table 3. Significant differences were found among years and among cultivars ($p < 0.05$, credibility 95%). In 2012, some of cultivars lacked a plum yield. Highly varying weather in winter and spring caused fluctuation of yield. The best yield after a very long flowering season for all cultivars was in 2015. In 2016, after unfavourable winter–spring weather, some fruit twigs perished during fruit swelling. As a result the yield was very low. Differences among years within cultivars were significant for all cultivars. Comparing cumulative yield among cultivars, the most productive were 'Victoria' (74.5 kg) and hybrid H-3690 (76.5). Slightly lower cumulative yield was observed for cultivar 'Tegera' (62.0 kg). For other genotypes, cumulative yield was significantly lower.

Fruit weight varied significantly among cultivars and hybrids, but it was not clearly correlated with yield. Average fruit weight differed significantly among cultivars, but not significantly among years for all cultivars. Genotypes 'Tegera', 'H-3753 and 'Victoria' showed no significant differences in fruit weight between years. The cultivar 'Haganta' had significantly higher fruit weight (39.9–57.7 g), and the smallest fruits were observed for hybrid H-5102 (21.3–36.7 g). As Latvian consumers mainly consume plums as dessert fruits, cultivars with small fruits are not desirable.

Soluble solid content (SSC) was determined starting with year 2014. SSC varied from 11.4 Brix% to 18.3 Brix% depending on genotype and climatic conditions. The cultivar 'Haganta' had a higher Brix% (up to 18.3 Brix%), except in 2015, when soluble solid content was only 13.1 Brix% be-

Table 3

EVALUATION OF YIELD PARAMETERS (AVERAGE YIELD (KG PER TREE), CUMULATIVE YIELD, AVERAGE FRUIT WEIGHT (G)) AND SOLUBLE SOLID CONTENT (BRIX%)

Cultivars and hybrids	Year	AY	CY	AFW	Soluble solids Brix%
Tegera	2012	0^{a}	62.0	–	–
	2013	8.7^{b}		23.0^{a}	NA
	2014	13.9^{bc}		35.4^{ab}	13.9 ± 0.11
	2015	20.8^{c}		28.8^{a}	15.1 ± 0.06
	2016	16.6^{c}		24.2^{a}	12.6 ± 0.02
p-value among years within cultivar		< 0.05	–	> 0.05	< 0.05
Tipala	2012	0^{a}	25.4	–	–
	2013	0.4^{a}		34.0^{b}	NA
	2014	4.7^{b}		36.2^{b}	12.5 ± 0.10
	2015	17.9^{c}		27.0^{a}	14.4 ± 0.07
	2016	2.4^{b}		24.8^{a}	14.3 ± 0.09
p-value among years within cultivar		< 0.05	–	< 0.05	>0.05
Haganta	2012	0^{a}	30.6	–	–
	2013	1.1^{b}		57.7^{d}	NA
	2014	7.6^{c}		48.9^{c}	17.6 ± 0.08
	2015	15.6^{d}		30.9^{a}	13.1 ± 0.03
	2016	6.3^{c}		41.2^{b}	18.3 ± 0.05
p-value among years within cultivar		< 0.05	–	< 0.05	< 0.05
H-5102	2012	0^{a}	13.4	–	–
	2013	1.3^{b}		36.7^{c}	17.4 ± 0.03
	2014	0.8^{ab}		24.5^{ab}	14.6 ± 0.04
	2015	9.8^{c}		26.3^{ab}	15.3 ± 0.06
	2016	1.5^{b}		21.3^{a}	13.9 ± 0.1
p-value among years within cultivar		< 0.05	–	< 0.05	< 0.05
H-3753	2012	0^{a}	33.0	–	–
	2013	2.3^{b}		31.3^{a}	NA
	2014	13.4^{c}		41.0^{b}	12.3 ± 0.04
	2015	13.3^{c}		36.1^{ab}	13.7 ± 0.06
	2016	4.0^{b}		38.2^{ab}	14.9 ± 0.04
p-value among years within cultivar		< 0.05	–	> 0.05	< 0.05
H-3690	2012	2.0^{a}	76.5	36.3^{b}	NA
	2013	1.0^{a}		19.5^{a}	NA
	2014	13.6^{b}		48.6^{c}	12.7 ± 0.04
	2015	42.0^{c}		29.7^{b}	14.6 ± 0.08
	2016	17.9^{b}		32.0^{b}	11.4 ± 0.05
p-value among years within cultivar		< 0.05	–	< 0.05	< 0.05
Victoria	2012	3.4^{ab}	74.5	36.6^{ab}	NA
	2013	9.0^{ab}		40.3^{bc}	NA
	2014	20.5^{c}		37.3^{b}	14.8 ± 0.1
	2015	41.6^{d}		25.8^{a}	15.2 ± 0.05
	2016	$< 00^{a}$		–	–
p-value among years within cultivar		< 0.05	–	> 0.05	< 0.05
p-value: cultivars		< 0.05	–	< 0.05	> 0.05
p-value: years		< 0.05	–	> 0.05	< .05

AY, average yield per tree (kg); CY, cumulative yield from 2012 to 2016; AFW, average fruit weight (g); NA, not analysed

cause the harvest time was very late and fruits were not sufficiently ripe. SSC is an important index also for determining the fruit suitability for drying. Most of the Latvian plum cultivars are juicy, and for this reason they are not suitable for drying, but cultivar 'Tegera' had a very high quality dried product.

Table 4 shows the results of self-pollination and open- pollination. The level of self-pollination was higher in 2015 because weather conditions were better. 'Tegera' and 'Haganta' had a higher level of both self- pollination and also open pollination in both years of evaluation.

Table 4

RESULTS OF SELF-FERTILITY AND OPEN POLLINATION

Cultivars and hybrids	Year	Self-fertility, %	Open pollination, %
Tegera	2015	40.0	72.7
	2016	37.0	28.6
Haganta	2015	17.4	35.4
	2016	7.1	10.5
Tipala	2015	0	30.2
	2016	0	1.5
H-3690	2015	14.5	1.6
	2016	4.0	12.3
H-3753	2015	3.0	2.9
	2016	1.2	5.1

DISCUSSION

The vegetation period is shorter and sum of active temperatures is lower in Northern Europe, including in Latvia, than in other European countries. The winters can also be a limiting factor for performance of plum cultivars. Productive plum cultivars with high quality fruits are urgently needed for the Latvian market. In addition to breeding efforts, introduction of suitable cultivars can also be of high importance.

The results of this study show that low yields were observed in years with thaw periods during winter and spring. This corresponds to the reports of German researchers that frost damage of flower buds was observed when a warm period in January was followed by very low temperatures in February (Hartman and Neumüller, 2009). For example, intensive flowering was observed for the cultivar 'Tipala' in all years, but high yield was only observed in 2015. The low yield was a consequence of a lacking stigma in the majority of flower buds, and only partial development of the fruitlets, which were prematurely shed.

In comparison with the main plum production regions, flowering and fruiting times are considerably later in Latvia. For example, flowering time for the cultivar 'Tegera' in Bulgaria is one month earlier than when grown in Latvian conditions, and ripening time is approximately half a month earlier than in Latvia (Dragoyski *et al*., 2010). In Serbia, the flowering time for the cultivar 'Victoria' is at the beginning of April (in Latvia flowering occurs one month later), but ripening time is middle of August (in Latvia at the end of August). In Germany, the ripening time for the cultivar 'Haganta' is in the middle of September (Hartman *et al.,* 2012), while in Latvia ripening is at the end of September – beginning of October, which is the latest time for plum harvesting.

The highest yields were obtained from hybrid H-3690, with average yield per tree (15.3 kg) surpassing yield of the control variety 'Victoria' (14.9 kg). The cultivar 'Victoria' was also reported to have an average yield per tree of 14.0 kg in Serbia (Miloševič *et al*., 2012), and high average yield per tree was also observed for the cultivar 'Tegera' (12.4 kg).

In northern Europe, soluble solid content of fruits is lower than in Germany and the southern part of Europe. The cultivar 'Tegera' was reported to have 20.6 Brix% in Bulgaria (Dragoyski *et al*., 2010). Previous studies in Latvia reported a soluble solid content of 14.9 Brix% for the cultivar 'Victoria' (Skrīvele *et al.,* 1998). In this study, the cultivars 'Tegera' and 'Victoria' had a soluble solid content of 13.9 Brix% and 15.0 Brix%, on average.

Self-pollination was scored quantitatively, as recommended by researchers from the Netherlands. They analysed self-fertility and pollination level before and after the June drop of different cultivars. The best result was reported to be 25% fruit set from 100 pollinated flowers. The pollination results are evaluated as good, if fruit set is 10–24%, as moderate if 5–9%, and as low if 0–4% (Wertheim, 1996; Koskela *et al*., 2010). According to results from this study, the cultivar 'Tegera' had a significantly higher level of self-fertility for both years (40.0% in 2015; 37.0% in 2016). The cultivars 'Haganta' had a medium level of self-fertility (17.4% in 2015; 7.1% in 2016), and a similar level was observed for the hybrid H-3690 (14.5% in 2015; 4.0% in 2016). A low level of self-fertility was observed in both years for the hybrid H-3753, while the cultivar 'Tipala' is self-sterile.

CONCLUSIONS

After evaluation of all analysed parameters 'Tegera' can be recommended for Latvian growers because of good winter hardiness in the research period. The crown is strong and upright, but young branches need spreading. The cultivar has medium flowering and yielding intensity, and regular yields. Initial observations indicate that all fruits mature at the same time and are suitable for drying.

'Haganta' had very good fruit quality and yield. The crown is strong and semi-open, and there is no problems with pruning. Because of late fruit maturing, the cultivar is recommended only for warmer regions in Latvia.

Hybrid H-3690 had good and regular yield, and good fruit quality. Density of the crown is semi strong and semi-open, very amenable to pruning. So far no significant frost damage has been observed. It will potentially be useful for Latvian growers.

The cultivar 'Tipala', and the hybrids H–5102, H–3753 were demonstrated to be unsatisfactory for Latvian growers and consumers.

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VĀCIJAS PLŪMJU SELEKCIJAS IZVĒRTĒJUMS LATVIJĀ

Pētījuma mērķis bija noteikt Vācijas izcelsmes plūmju piemērotību audzēšanai Latvijas klimatiskajos apstākļos. Izmēģinājums ierīkots Latvijas Valsts augļkopības institūtā (tagad Dārzkopības institūts) 2008. gada pavasarī ar sešiem V. Hartmana genotipiem: šķirnēm ('Tipala', 'Tegera', 'Haganta') un hibrīdiem (H-5102, H-3753, H-3690). Kā potcelms izmantota *Prunus cerasifera*. Vērtētie parametri bija: ziedēšanas sākums, ienākšanās laiks, vidējā raža (kg no koka) un kumulatīvā raža no 2012. līdz 2016. gadam; augļu svars un šķīstošās sausnas saturs. Papildus 2015. gadā tika vērtēta triju šķirņu un viena hibrīda pašauglības pakāpe. 2010./2011. gada ziema bija ļoti nelabvēlīga plūmju stādījumiem, un lielākajai daļai Latvijā audzēto šķirņu tika novēroti sala bojājumi, bet pētījumā iekļautās šķirnes šajā ziemā necieta. Arī turpmākajos gados būtiski bojājumi tām netika novēroti. Četru gadu periodā vidējais ziedēšanas laiks visām šķirnēm un hibrīdiem bija maija 1. vai 2. dekāde, augļu ienākšanās laiks — no augusta 1. dekādes līdz septembra 3. dekādei. Visagrīnākais bija hibrīds H-3690. vēlākā — šķirne 'Haganta'. Visražīgākais bija H-3690, no kura 3. ražas gadā tika ievākti 42 kg augļu un kura uzrādīja visstraujāko ražas pieaugumu. Šķirnei 'Haganta' bija vislielākie augļi (50 to 60 g) un augstākais šķīstošās sausnas saturs augļos (17–18 Brix%). Pašauglības pakāpe tika konstatēta: 'Tegera' — 40%, 'Haganta' — 17.4%, H–3690 — 14.5% un 'Tipala' — 0%. Pēc visu parametru kopējās analīzes Latvijas audzētājiem tiek rekomendēta šķirne 'Tegera', jo tā ir uzrādījusi labu ziemcietību visa pētījumu periodā. 'Haganta' tiek rekomendēta tikai Latvijas siltākajiem reģioniem. Hibrīds H-3690, iespējams, būs perspektīvs Latvijas plūmju audzētājiem.