

## **Incidence of fungal leaf diseases and phytophagous mites in different strawberry cultivars**

N. Uselis, A. Valiuškaitė and L. Raudonis

Lithuanian Institute of Horticulture, Babtai, Kaunas distr., LT-54333,  
Lithuania; e-mail: n.uselis@lsdi.lt

**Abstract.** The incidence of fungal leaf diseases, phytophagous mites and productivity of strawberry cultivars ‘Saulenė’, ‘Honeoye’, ‘Kent’, ‘Elkat’, ‘Polka’, ‘Dangė’, ‘Senga Sengana’, ‘Pegasus’, ‘Bogota’ and ‘Pandora’ was investigated in 2004–2005 under field conditions at the Lithuanian Institute of Horticulture.

The lowest incidence by common leaf spot (*Mycosphaerella fragariae* (Tul.) Sacc) was recorded on ‘Dangė’, ‘Elkat’ and ‘Pegasus’. Disease prevalence ranged on average from 43–46 % and disease intensity from 14–15.7%. The most common white leaf spot was on ‘Honeyoe’ and ‘Senga Sengana’. ‘Elkat’ and ‘Polka’ were the most damaged (disease prevalence was 68–69% and intensity 36–46%) by leaf scorch (*Marssonina potentillae* Desm. Magn.), while the lowest incidence of leaf scorch was recorded on ‘Bogota’. The incidence of diseases varied depending on meteorological conditions during 2004–2005.

The lowest infestation by strawberry mite (*Tarsonemus pallidus* Banks.) was recorded on ‘Bogota’ and ‘Kent’. Moderately infested were ‘Honeoye’, ‘Saulenė’, ‘Pandora’, ‘Senga Sengana’ and highly infested, ‘Pegasus’. Low infestation by two-spotted spider mites (*Tetranychus urticae* Koch) were ‘Bogota’, ‘Pandora’ and ‘Saulenė’, moderately – ‘Kent’ and ‘Honeoye’; the most common two-spotted spider mites were found on ‘Pegasus’.

The study showed that ‘Saulenė’, ‘Pandora’, ‘Senga Sengana’, ‘Honeoye’, ‘Polka’, ‘Elkat’ and ‘Dangė’ were highly productive, ranging from 11 to 17 t ha<sup>-1</sup>. The productivity of ‘Pegasus’ was 9 t ha<sup>-1</sup>. Cultivars ‘Bogota’ and ‘Kent’ were averagely productive (6–7 t ha<sup>-1</sup>).

**Key words:** *Mycosphaerella fragariae*, *Marssonina potentillae*, *Tarsonemus pallidus*, *Tetranychus urticae*, strawberry, cultivars, productivity

### **INTRODUCTION**

Several years ago the growing of strawberries for deep freezing and processing was developed in Lithuania. Initially, the most common strawberry cultivar for market was ‘Senga Sengana’. As the market for export continues to expand, it is very important to select only those productive strawberry cultivars which have berries of good quality and are suitable for transporting.

Many strawberry cultivars were investigated at the Lithuanian Institute of Horticulture during different periods. Sixteen (16) cultivars (‘Senga Sengana’, ‘Venta’, ‘Rubinovj kulon’, ‘Redgauntlet’, ‘Nida’, ‘Jaunė’, ‘Holiday’, ‘Rusanovka’, ‘Dukat’, ‘Induka’, ‘Korona’, ‘Polka’, ‘Tenira’, ‘Kama’, ‘Kent’, ‘Pandora’ were recommended for commercial growing (Uselis & Rašinskienė, 1997; Rašinskienė & Uselis, 2000; Uselis & Rašinskienė, 2000, 2001; Rugienius & Sasnauskas, 2005; Uselis, 2005).

Cultivars 'Elsanta', 'Senga Sengana', 'Dukat', 'Kama', 'Kokinskaja raniaja', 'Zefyr', 'Festivalnaja', 'Kulon', 'Tenira', 'Induka', 'Holiday', 'Bogota', 'Polka', 'Korona', 'Bounty' are the most often grown in neighbouring countries (Skriverle et al., 1998; Zurawicz et al., 2000; Libek, 2001).

The main factor restricting strawberry production in many countries is yield losses up to 15–92% - or even whole plantations - due to fungal diseases (Kapytowski & Bojarska, 2005). Pesticide use is restricted or not allowed at all because of high ecological risk. Thus, growing resistant varieties should become the main objective in strawberry disease management (Rugienius & Sasnauskas, 2005). Strawberry mite and the two-spotted spider mite are the key pests of strawberries, causing serious indirect damage to the crop in Lithuania (Raudonis, 2002). The resistance of strawberries to the phytophagous mites is a part of integrated pest management, however, the data of strawberry resistance to pests and diseases are very scarce. Resistance of varieties to two-spotted spider mite and some diseases were only tested in strawberries in Lithuania (Rašinskienė, 1997; Uselis & Rašinskienė, 2001).

The aim of this work was to evaluate the productivity and resistance of the different strawberry cultivars to the common leaf spot (*Mycosphaerella fragariae* (Tul.) Sacc), leaf scorch (*Marssonina potentillae* Desm. Magn.), two-spotted spider mite (*Tetranychus urticae* Koch) and strawberry mite (*Tarsonemus pallidus* Banks).

## MATERIALS AND METHODS

The incidence of fungal leaf diseases, phytophagous mites and productivity of strawberry cultivars 'Saulenė', 'Honeoye', 'Kent', 'Elkat', 'Polka', 'Dangė', 'Senga Sengana', 'Pegasus', 'Bogota' and 'Pandora' was evaluated in 2004–2005 under field conditions at the Lithuanian Institute of Horticulture. The strawberries were planted at a spacing of 0.8 x 0.3 m. The experiments were arranged in well-fertilized soil of light loam on hard loam. The treatment was repeated four times at random plot distribution; each replicate consisted of 12 m<sup>2</sup>.

In order to estimate the number of two-spotted spider mites per leaf and strawberry mites per plant assessments were made on 10 leaves and plants in each plot. Leaf diseases were estimated after harvest. Disease intensity was estimated by six points: 0–healthy leaves; 1–single spots; 2–spotted leaf surface up to 10%; 3–spotted leaf surface up to 30%; 4–spotted leaf surface up to 50%, 5–spotted leaf surface over 50%.

Experimental data were subjected to analysis of variance. For mean separation Duncan's test at  $P = 0.05$  was used. Data were analyzed by ANOVA statistical program.

## RESULTS AND DISCUSSION

White leaf spot is the most harmful strawberry leaf disease in Lithuania (Rašinskienė, 1997; Uselis & Rašinskienė, 2001). The lowest incidence of common leaf spot (*M. fragariae*) was recorded on cultivars 'Dangė', 'Elkat' and 'Pegasus' during both experimental years. On average, disease prevalence ranged - from 43-46 % and disease intensity from 14-15.7% (Table 1).

**Table 1.** Incidence of *Mycosphaerella fragariae* in different strawberry cultivars.

Cultivars	Common leaf spot, %					
	Disease incidence			Disease intensity		
	2004	2005	average	2004	2005	average
‘Sulenė’,	80.0 d	33.0ab	56.5	46.2b	8.7ab	27.4
‘Honeyoe’	92.0ef	48.0c	70.0	45.0b	14.2d	29.6
‘Kent’	66.0bc	36.0abc	51.0	25.0a	9.7abc	17.3
‘Dangė’	58.0ab	29.0a	43.5	21.0a	7.7a	14.3
‘Elkat’	55.0a	32.0ab	43.5	20.0a	8.0a	14.0
‘Bogota’	96.0 f	37.0abc	66.5	69.2d	14.0bc	38.6
‘Senga’	91.0ef	43.0bc	70.0	65.5d	11.7bcd	58.5
Sengana’						
‘Pegasus’	62.0ab	30.0a	46.0	24.2a	7.5a	15.7
‘Pandora’	92.0ef	43.0bc	67.0	49.9b	13.5cd	31.7
‘Polka’	73.0cd	62.0d	67.5	36.7e	20.0e	28.3

Note: means followed by the same letter are not significantly different according to Duncan’s multiple range test ( $P = 0.05$ )

**Table 2.** Incidence of *Marssonina potentillae* in different strawberry cultivars.

Cultivars	Leaf scorch, %					
	Disease incidence			Disease intensity		
	2004	2005	average	2004	2005	average
‘Saulenė’	85.0cde	29.0c	57.0	63.4e	7.7b	35.6
‘Honeyoe’	93.0e	28.0bc	60.5	63.0e	8.2bc	35.6
‘Kent’	82.0c	45.0e	63.5	76.7f	15.7ef	46.2
‘Dangė’	88.0cde	36.0d	62.0	36.7b	10.5cd	23.6
‘Elkat’	93.0de	44.0e	68.5	48.7cd	13.0de	30.8
‘Bogota’	36.0a	14.0a	25.0	11.0a	4.0a	7.5
‘Senga’	67.0b	22.0b	44.5	37.7b	6.0ab	21.8
Sengana’						
‘Pegasus’	64.0b	40.0de	52.0	48.7cd	18.2fgh	33.4
‘Pandora’	83.0cde	28.0bc	55.5	46.5c	7.0b	26.7
‘Polka’	85.0cde	53.0f	69.0	54.2d	19.7h	36.9

Note: means followed by the same letter are not significantly different according to Duncan’s multiple range test ( $P = 0.05$ )

The most damaged (disease incidence 70%) were ‘Honeyoe’, and ‘Senga Sengana’, meanwhile cultivars ‘Kent’, ‘Saulenė’, ‘Bogota’, ‘Polka’, ‘Pandora’ were damaged by 51–68%. ‘Elkat’ and ‘Polka’ were the most damaged (disease prevalence was 68–69% and intensity 36–46%) by leaf scorch (*M. potentillae*); the lowest incidence of leaf scorch was recorded on ‘Bogota’ (Table 2). Other authors stated that cultivars ‘Elkat’, ‘Elsanta’, ‘Dukat’ were the most resistant to leaf spot and ‘Elkat’, ‘Dukat’, ‘Heros’, ‘Filon’ to leaf scorch (Rugienius & Sasnauskas, 2005).

The incidence of diseases varied depending on meteorological conditions during 2004–2005. The incidence of leaf diseases was twice as high in 2004, due to comparatively cold and wet weather conditions, as in 2005. Previous field tests showed that the most favorable conditions for development of common leaf spot are a wet flowering period and a late strawberry season (Uselis & Rašinskienė, 2001).

**Table 3.** Incidence of two-spotted spider mites (*T. urticae*) and strawberry mites (*T. pallidus*) in different strawberry cultivars.

Cultivars	Infested plant leaves/plants, %			Mean number of mites per leaf/plant		
	2004	2005	2004–2005	2004	2005	2004–2005
<b>Two-spotted spider mite (<i>T. urticae</i>)</b>						
‘Senga Sengana’	19.9d	15.0c	17.5d	1.0e	0.6cd	0.8d
‘Bogota’	8.5a	8.9a	8.7a	0.2a	0.3a	0.3a
‘Kent’	14.8c	14.5b	14.7c	0.4cd	0.6de	0.5bc
‘Pandora’	9.0a	11.0b	10.0b	0.25ab	0.35ab	0.3a
‘Pegasus’	25.9e	29.7d	27.8e	1.7f	1.5f	1.6e
‘Saulenè’	11.1b	9.1a	10.1b	0.35bc	0.45bc	0.4ab
‘Honeoye’	15.0c	16.2c	15.6c	0.5d	0.7e	0.6c
<b>Strawberry mites (<i>T. pallidus</i>)</b>						
‘Senga Sengana’	18.0d	16.0c	17.0c	1.0b	1.0cde	1.0b
‘Bogota’	7.0a	9.0a	8.0a	0.2a	0.3a	0.3a
‘Kent’	6.0a	8.0a	7.0a	0.2a	0.4ab	0.3a
‘Pandora’	15.5c	18.5d	17.0c	0.5a	0.7bc	0.6ab
‘Pegasus’	47.5e	42.5e	45.0e	1.7c	1.3e	1.5c
‘Saulenè’	18.0d	16.0c	17.0c	1.0b	1.0cde	1.0b
‘Honeoye’	13.5b	10.5b	12.0b	0.9b	1.1de	1.0b

Note: means followed by the same letter are not significantly different according to Duncan’s multiple range test ( $p = 0.05$ )

**Table 4.** The yield of strawberries in 2004–2005.

Cultivars	2004	2005	Average
‘Saulenè’	13,81	7,49	10,65
‘Honeoye’	18,32	11,42	14,87
‘Kent’	12,46	1,85	7,16
‘Elkat’	16,38	14,30	15,34
‘Polka’	19,62	10,60	15,11
‘Dangé’	19,37	15,65	17,51
‘Senga Sengana’	19,10	8,93	14,02
‘Pegasus’	10,70	7,35	9,02
‘Bogota’	10,81	1,62	6,22
‘Pandora’	16,98	10,84	13,91
LSD <sub>05</sub>	2,481	2,186	1,820

Table 3 describes the incidence of two-spotted spider mites (*Tetranychus urticae* Koch) and strawberry mites (*Tarsonemus pallidus* Banks.) in different strawberry cultivars. The lowest infestation by strawberry mite was recorded in ‘Bogota’ and ‘Kent’ strawberry cultivars, medium infestation – in ‘Honeoye’, ‘Saulenè’, ‘Pandora’, ‘Senga Sengana’ and high – in cultivar ‘Pegasus’. The least infestations by two-spotted spider mite were recorded in ‘Bogota’, ‘Pandora’, ‘Saulenè’, medium – ‘Kent’, ‘Honeoye’ and the most common two-spotted spider mites were on cultivar ‘Pegasus’.

The yield and resistance to frost as well as low susceptibility to the diseases are the major factors influencing the production of strawberries (Kapytowski & Bojarska, 2005). The disease incidence and pest infestation had an impact on the yield of

different cultivars of strawberries (Table 4). The data shows that cultivars 'Honeoye', 'Saulenè', 'Dangè' and 'Polka' were the most productive in 2004. The lowest yield was obtained from 'Bogota', 'Pegasus' and 'Kent'. In 2005 the most productive were 'Dangè' and 'Elkat', while a statistically lower yield was obtained from 'Polka', 'Pandora' and 'Honeoye' strawberries.

The study indicated that 'Saulenè', 'Pandora', 'Senga Sengana', 'Honeoye', 'Polka', 'Elkat' and 'Dangè' strawberry cultivars were highly productive during 2004–2005. The productivity ranged from 11 to 17 t ha<sup>-1</sup>. The productivity of 'Pegasus' was 9 t ha<sup>-1</sup> and cultivars of 'Bogota' and 'Kent' had medium productivity (6–7 t ha<sup>-1</sup>).

## CONCLUSIONS

The lowest incidence of common leaf spot (*M. fragariae*) was recorded on strawberries 'Dangè', 'Elkat' and 'Pegasus'. The most common white leaf spot was on cultivars 'Honeyoe' and 'Senga Sengana'. 'Elkat' and 'Polka' were the most damaged by leaf scorch (*M. potentillae*). The lowest incidence of leaf scorch was recorded on 'Bogota'. The lowest infestation by strawberry mite (*Tarsonemus pallidus* Banks.) was recorded on cultivars 'Bogota' and 'Kent'; highly infested was 'Pegasus'. 'Bogota', 'Pandora', 'Saulenè' cultivars had the low infestation by the two-spotted spider mite (*Tetranychus urticae* Koch). The highest infestation was recorded on cultivar 'Pegasus'.

The study showed that cultivars 'Saulenè', 'Pandora', 'Senga Sengana', 'Honeoye', 'Polka', 'Elkat' and 'Dangè' were highly productive. Lower productivity was obtained from cultivars 'Pegasus', 'Bogota' and 'Kent'.

## REFERENCES

- Kapytowski, J. & Bojarska, J.E. 2005. Current status and trends in production of strawberries in Poland. *Belsád fruit-growing* **17**(2), 310–313.
- Libek, A. 2001. Investigation of strawberry cultivars in Estonia. *Horticulture and Vegetable Growing* **20**(3), 245–251.
- Rašinskienė, A. 1997. Pathogens of strawberry diseases and some protection means against them. *Agricultural Science* **4**, 53–56 (in Lithuanian).
- Rašinskienė, A. & Uselis, N. 2000. Estimation of biological and economic properties of 16 strawberry varieties. *Horticulture and Vegetable Growing* **19**(2), 11–22 (in Lithuanian).
- Raudonis, L. 2002. Monitoring of harmful insects and mites of strawberries. *Horticulture and Vegetable Growing* **21**(4), 102–110 (in Lithuanian).
- Rugienius, R. & Sasnauskas, A. 2005. Investigation of strawberry cultivars and hybrid clones. *Horticulture and Vegetable Growing* **24**(1), 34–41 (in Lithuanian).
- Skrivele, A., Ikase, L. & Kaufmane, E. 1998. Horticulture in Latvia. In Makosza, E. (ed.): *Sadownictwo w krajach Środkowo – Wschodniej Europy*. Lublin, pp. 205–212.
- Uselis, N. & Rašinskienė, A. 2000. Assessment of biological and economic properties of 9 strawberry varieties. *Fruit production and fruit breeding* **207**, 188–194.
- Uselis, N. & Rašinskienė, A. 2001. Assessment of biological and economic properties of strawberry varieties. *Horticulture and Vegetable Growing* **20**(2), 18–31 (in Lithuanian).
- Uselis, N. 2005. Investigation of strawberry cultivars for commercial growing in Lithuania. *Belsád fruit-growing* **17**(2), 314–319.
- Zurawicz, E., Pluta, S. & Danek, J. 2000. Small fruit breeding at the research institute of Pomology and Floriculture in Skierniewice. *Acta Horticulture* **538**, 457–462.