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Blueberry diseases survey in Estonia

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Abstract. In Estonian University of Life Sciences at the Department of Horticulture a blueberry-cultivation project was started in 1997. Nowadays blueberry cultivation is developing into a promising activity for small farms and efforts have been made to maintain blueberries in the different regions of the country. Surveys were conducted to determine the occurence of diseases in commercial blueberry fields at three farms of South Estonia. One plantation was located on peat (abandoned peat pits) soil and two plantations on mineral soil. Pesticides were not used in the blueberry plantations. Diseases were observed at the end of harvesting time (late August) in 2006. Several lowbush blueberry (*Vaccinium angustifolium* Ait.), highbush blueberry (*V. corymbosum* L.) and half-highbush blueberry (*V. corymbosum x V. angustifolium.*) cultivars were represented. In all plantations several plant diseases were found whereby *Pucciniastrum vaccinii* Wint. occured often. Lowbush blueberry plants were more disease-resistant than highbush and half-highbush blueberries. In the plantation located on peat soil the infection of diseases was lower.

Keywords: *Vaccinium corymbosum*, *Vaccinium angustifolium*, pathogen, infection, resistance

INTRODUCTION

Failure to produce good blueberry yields is often the result of the presence of disease (Scherm et al., 2001). There are a number of diseases that occur in both commercial and backyard plantings of blueberry every year. Disease problems are prevalent in all production areas in the word (Strik, 2005). The appearance of diseases is usually dependent on the environmental condition and the resistance of a cultivar.

The blueberry industry in Estonia has expanded considerably during the last decade (Värnik et al., 2004). Nowadays blueberry cultivation is developing into a promising horticultural crop for small farms and efforts have been made to maintain blueberries in the different regions of the country. Both lowbush blueberry (*Vaccinium angustifolium* Ait.) and half-highbush blueberry *(V. corymbosum* x *V. angustifolium*) grow very well in Estonian condition (Starast et al., 2005; Noormets, 2003). Some northern highbush blueberry (*V. corymbosum* L.) cultivars have shown good productivity.

In Estonian Agricultural University (now Estonian University of Life Sciences) blueberry-cultivation project was started in 1997. However blueberry diseases had not been studied earlier. The objective of this study was to determine the occurence of diseases in commercial blueberry fields at three farms of South Estonia.

MATERIALS AND METHODS

The blueberry diseases were observed in three different commercial plantations situated in Tartu County, South Estonia. Two areas located on mineral soil: Research Station of Estonian University of Life Sciences (Rõhu farm) (58°21' N, 26°31' E) and Metsa farm (58°13' N, 26°42' E). One plantation (Marjasoo farm) located on peat soil (58°13' N, 26°7' E). Blueberry plants were inspected for diseases in the end of harvesting time on 23 and 24 August, 2006. We identified the agents causing diseases. A hand lens and a knife were used for a diagnostician in the field. To assess plant disease severity we observed how many host units in the total area (leaf, stem, etc.) were diseased (%), i.e., harbor symptoms and/or signs of disease. We observed 5 plants in every three replication and then we calculated a mean disease rating for the cultivar.

The following lowbush blueberry (*Vaccinium angustifolium Ait*.), highbush blueberry (*V. corymbosum* L.) and half-highbush blueberry (*V. angustifolium* x *corymbosum*) taxa were observed in the plantation.

Metsa farm:
cv. Aino (half-highbush blueberry)
cv. Alvar (half-highbush blueberry)
cv. Northland (half-highbush blueberry)
cv. Northblue (half-highbush blueberry)
cv. Sine (half-highbush blueberry)
cv. Siro (half-highbush blueberry)
lowbush blueberry

Marjasoo farm:
cv. Aino (half-highbush blueberry)
cv. Alvar (half-highbush blueberry)
cv. Northland (half-highbush blueberry)
cv. Northblue (half-highbush blueberry)
lowbush blueberry

Rohu farm:
cv. Ama (highbush blueberry)
cv. Bluegold (highbush blueberry)
cv. Blue Rose (highbush blueberry)
cv. Bluecrop (highbush blueberry)
cv. Bluejay (highbush blueberry)
cv. Caroline Blue (highbush blueberry)
cv. Chandler (highbush blueberry)
cv. Denise Blue (highbush blueberry)
cv. Hardyblue (highbush blueberry)
cv. Olympia (highbush blueberry)
cv. Northblue (half-highbush blueberry)
cv. Northland (half-highbush blueberry)
cv. Nui (highbush blueberry)
cv. Puru (highbush blueberry)
cv. Bruni (highbush blueberry)
cv. Putte (half-highbush blueberry)
cv. Reka (highbush blueberry)
cv. Toro (highbush blueberry)
lowbush blueberry

Pesticides were not used in the blueberry plantations. Student's t-test was used for data analyses. To show statistically significant differences we calculated standard error and in figure it is marked like – I.

RESULTS AND DISCUSSION

In Metsa farm 11 pathogens were detected (Table 1). The 'Northlue' plants were significantly more infected. Three pathogens were found on the plants and the average disease rate was the highest. *Mycosphaerella vaccina* (Cooke) Schröt. infected blueberry plants of two cultivars. Other pathogens were performed on one cultivar.

In the plantation from Marjasoo farm nine different pathogens were found (Table 2.). the following pathogens infected more than one cultivar: *Mycosphaerella vaccina* (Cooke) Schröt., *Phyllosticta rhododendricola* Brun., *Pucciniastrum vaccinii* (G. Wint.) Karst. The 'Alvar' plants were the most infected compared to other cultivars.

Altogether, 10 pathogens were identified in Rohu plantation (Table 3.). Infection was larger on 'Putte' plants and the largest disease cases were found on cv. 'Blue Rose' plants. Highbush blueberry cultivars Bluecrop, Bluejay, Denise Blue, Hardyblue, Nui, Puru, Toro, half- higbush blueberry cv. Northblue and lowbush blueberry showed good disease resistance the plants were not infected with pathogens.

Table 1. Plant pathogens and disease severity (%) depending on blueberry taxon in Metsa farm.

Host	Pathogen	Severity (%)
'Aino'	*Mycosphaerella vaccina* (Cooke) Schröt.	0.3
'Alvar'	*Diplodia vaccinii* Barl. et Roum.	0.3
	Phyllosticta rhododendricola Brun.	0.6
'Northland'	Mosaic virus	12.5
'Northblue'	*Mycosphaerella eriophila* (Niessl.) Migula	15.0
	Fusicoccum aesculi Corda	7.0
	Phytophthora cinnamomi Rands.	84.0
'Sine'	*Ascochyta vaccinii* Jacz.	2.5
	Mycosphaerella vaccina (Cooke) Schröt.	20.3
'Siro'	*Glomerella cingulata* (Stoneman) Spauld	18.5
Lowbush blueberry	*Discosia artocreas* (Tode) Fr.	1.5
	Coniothyrium phyllogenum Sacc.	7.0

Table 2. Plant pathogens and disease severity (%) depending on blueberry taxon in Marjasoo farm.

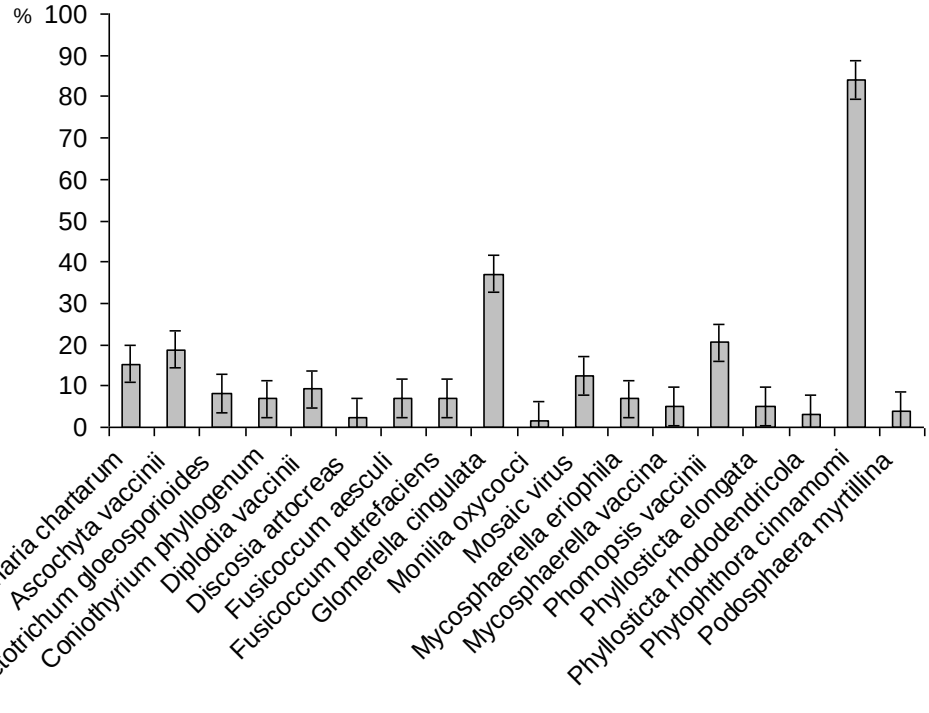
Host	Pathogen	Severity (%)
'Aino'	*Pucciniastrum vaccinii* (G. Wint.) Karst.	1.8
	Mycosphaerella vaccina (Cooke) Schröt.	1.5
'Alvar'	*Diplodia vaccinii* Barl. et Roum.	18.0
	Phyllosticta rhododendricola Brun.	5.5
'Arne'	*Colletotrichum gloeosporioides* Penz.	3.0
	Mycosphaerella vaccina (Cooke) Schröt.	2.2
	Phyllosticta rhododendricola Brun.	3.0
'Northblue'	*Pucciniastrum vaccinii* (G. Wint.) Karst.	5.0
	Mycosphaerella eriophila (Niessl.) Migula	2.5
Lowbush blueberry	*Phyllosticta elongata* Weid.	2.9
	Discosia artocreas (Tode) Fr.	3.5
	Coniothyrium phyllogenum Sacc.	6.7

Pucciniastrum vaccinii (G. Wint.) Karst. was frequently noticed in the plantation. The plants from five cultivars had damages of this pathogen. In the case of two cultivars *Colletotrichum gloeosporioides* Penz., *Glomerella cingulata* (Stoneman) Spauld, and *Mycosphaerella vaccina* (Cooke) Schröt were registered.

18 different pathogens were found from three plantations (Fig. 1). *Pucciniastrum vaccinii* (G. Wint.) Karst. infected plants most often: this pathogen was identified six times (Tables 1, 2, 3). However average severity of the pathogen was not very high – 3.9%. Strik (2005) has reviewed a serious problem with various leaf diseases and rusts (*Pucciniastrum vaccinii*) particularly in Florida and Mexico. Fungi *Pucciniastrum vaccinii* have been found to have impact on the leaf coverage of natural *V. myrtillus* L. (Aamlid, 2000) and *V.* oxycoccus L. plants (Mulenkoa, 1994). *Mycosphaerella vaccina* (Cooke) Schröt. often damaged plants, but severity was low – only 5.1% (Fig. 1). In Estonia *Mycosphaerella* funguses were determined on cereals (Lõiveke et al., 2004) and pine (Hanso & Drenkhan, 2007). *Glomerella cingulata* (Stoneman) Spauld caused a larger severity of the disease (37.1%). However this pathogen was seldom identified (Fig. 1).

Table 3. Plant pathogens and disease severity (%) depending on blueberry taxon in Rõhu farm.

Host	Pathogen	Severity (%)
'Ama'	*Colletotrichum gloeosporioides* Penz.	14.7
	Mycosphaerella eriophila (Niessl.) Migula	3.0
'Bluegold'	*Pucciniastrum vaccinii* (G. Wint.) Karst.	6.0
'Blue Rose'	*Glomerella cingulata* (Stoneman) Spauld *Alternaria*	85.0
	chartarum Preuss.	15.3
	*Pucciniastrum vaccinii (*G. Wint.) Karst.	3.0
'Bluecrop'	-	0
'Bluejay'	-	0
'Caroline Blue'	*Colletotrichum gloeosporioides* Penz.	7.0
	Glomerella cingulata (Stoneman) Spauld	7.8
'Chandler'	*Fusicoccum putrefaciens* Shear	7.0
	Podosphaera myrtillina (Fr.) Kunze et Schmidt	4.0
'Denise Blue'	-	0
'Hardyblue'	-	0
'Olympia'	*Pucciniastrum vaccinii* (G. Wint.) Karst.	3.2
	Mycosphaerella vaccina (Cooke) Schröt.	1.4
'Northblue'	-	0
'Northland'	*Pucciniastrum vaccinii* (G. Wint.) Karst.	5.6
'Nui'	-	0
'Puru'	-	0
'Bruni'	*Pucciniastrum vaccinii* (G. Wint.) Karst.	3.0
'Putte'	*Ascochyta vaccinii* Jacz.	35.0
	Mycosphaerella vaccina (Cooke) Schröt.	5.0
'Reka'	*Phyllosticta accine* Weid.	7.0
	Monilia oxycocci Wor.	1.5
'Toro'	-	0
Lowbush blueberry	-	0



I – standard error

Fig. 1. Average disease severity (%) of three plantations.

Glomerella cingulata causes anthrachnose and blight in agricultural important hosts inclueding blueberry (Smith et al., 1996; Yoshida & Tsukiboshi, 2002).
Disease severity caused by *Phytophthora cinnamomi* Rands. was very large – 84.0% (Fig. 1). Concurrently this pathogen was observed only once (cv. 'Northblue' in Metsa farm). The fungus causes severe root rot on many woody plant species including blueberries (Milholland, 1975) and cranberries (Caruso, 1989). Phytophthora root rot is a serious disease of highbush blueberry which is more susceptible than rabbiteye blueberry (*V. ashei* Reade) (Smith, 2002).

Monilinia funguses are serious diseases in most blueberry (*Vaccinium* spp.) production regions of North America (Batra, 1983; Hildebrand et al., 1995; Scherm & Copes, 1999; Annis & Stubbs, 2004) and Europe (Gosch, 2006). *Monilia oxycocci* Wor. infected blueberry plants in our experiment also, but disease severity was not high.

CONCLUSIONS

The plant diseases survey showed several pathogens, colonized cultivated in blueberry plants, and disease severity was rather large already. On an average lowbush blueberry plants were more disease-resistant than highbush and half-highbush blueberries. In the plantation, located on peat soil, the infection of diseases was lower.

In future more attention is to be paid to monitor blueberry plants in plantations and how to control disease agents. In addition visual observation and molecular analyses are needed for the identification of diseases.

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REFERENCES

Aamlid, D. 2000. Infections of *Valdensinia heterodoxa* and *Pucciniastrum vaccinii* on bilberry (*Vaccinium myrtillus*). *Forest Pathology* **30**(3), 135–139.

Annis, S.L. & Stubbs, C.S. 2004. Stem and Leaf Diseases and Their Effects on Yield in Maine Lowbush Blueberry Fields. *Small Fruits Review* **3**(1/2), 159–167.

Batra, L.R. 1983. *Monilinia vaccinii-corymbosi* (*Sclerotiniaceae*): its biology on blueberry and comparison with related species. *Mycologia* **75,** 131–152.

Caruso, F.L. 1989. Phytophthora root rot of the cultivated cranberry in Massachusetts (*Vaccinium macrocarpon* Ait.). *Acta Hort.* **241**, 307–311.

Gosch, C. 2006. Mummy berry disease (*Monilinia vaccinii-corymbosi*) on highbush blueberries in Europe. *Acta Hort*. **715**, 469–472.

Hanso, M. & Drenkhan, R. 2007. Punavöötaud on jõudnud Eestisse! *Eesti Loodus*, 2007/7 (in Estonian).

Hildebrand, P.D., Milholland, R.D. & Stretch, A.W. 1995. Mummy berry. In Caruso, F.L. & Ramsdell, D.C. (eds): *Compendium of Blueberry and Cranberry Disease*. American Phytopathological Society, St. Paul, MN, pp. 11–12.

Lõiveke, H., Ilumäe, E. & Toome, M. 2004. Toxigenic microfungi in cereals. *Agronomy 2004*. *Transactions of EAU* **219**, 163–165.

Milholland, R. D. 1975. Pathogenicity and histopathology of *Phytophthora cinnamomi* on highbush and rabbiteye blueberry. *Phytopathology* **65**, 789–93.

Mulenkoa, W.1994. Notes on some rare and unusual species of parasitic fungi collected from natural plant communities in Poland. *Mycologist* **8**(2), 71–75.

Noormets, M., Karp, K. & Paal, T. 2003. Recultivation of opencast peat pits with *Vaccinium* culture in Estonia. *Ecosystems and Sustainable Development IV*, eds. E. Tiezzi, & C.A., Brebbia, Wessex Institute of Technology, UK and J-L. USO, Universitat Jaume I, Spain, **2**, pp, 584.

Scherm, H. & Copes, W.E. 1999.Evaluation of methods to detect fruit infected by *Monilinia vaccinii-corymbosi* in mechanically harvested rabbiteye blueberry. *Plant Dis*. **83**, 799–805.

Scherm, H., Horton, D.L., Nesmith, D.S. & Krewer, G. 2001. A survey of horticultural and pest management practices of the Georgia blueberry industry. *Small Fruits Rev*. **1**(4), 17–28.

Smith, B. J., Magee, J. B. & Gupton, C. L. 1996. Susceptibility of rabbiteye blueberry cultivars to postharvest diseases. *Plant Dis*. **80**, 215–218.

Smith, B.J. 2002. Susceptibility of southern highbush blueberry cultivars to Phytophthora root rot. *Acta Hort.* **574**, 75–79.

Starast, M., Karp, K., Vool, E. & Moor, U. 2005. The cultivation of half-highbush blueberry under organic farming condition. *Egipt. J.Agric. Res*. **83**(1), 155–168.

Strik, B. 2005. Blueberry: An Expanding World Berry Crop. *Chronica Hort.* **45**(1), 7–12.

Värnik, R., Ohvril, T. & Starast, M. Blueberry growing efficiency and marketing in Estonia. Report on 8th International Symposium on *Vaccinium* Culture. 3rd-8th May, 2004, Oeiras/Portugal; Seville/Spain.

Yoshida, S. & Tsukiboshi, T. 2002. Shoot blight and leaf spot of. blueberry caused by *Colletotrichum acutatum. Journal of. General Plant Path.* **68**, 246–8.