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Short Communication

INVESTIGATION OF *Botrytis cinerea* RISK FORECASTING MODEL OF STRAWBERRY IN LITHUANIA

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Grey mould, caused by Botrytis cinerea *Pers.:Fr. is one of the most important strawberry diseases in Lithuania, like in other countries, where strawberries are grown. The efficiency of different disease management systems were analyzed at the Institute of Horticulture in 2010–2011. The* B. cinerea *risk probability at various regions of Lithuania was analyzed according to iMETOS®sm grey mould risk forecasting model. Strawberry grey mould risk forecasting model indicates the risk of infection periods on the basis of the interaction between air temperature and leaf wetness duration. The model calculates how favourable is the period for the risk of infection. In periods where the risk is consistent (more than three days), higher than 60 points, a spray against grey mould should be applied. iMETOS®sm grey mould risk forecasting model gives the opportunity to optimize the usage of fungicides and reduce the number of applications and allows more efficient, ecologically and economically accepted control of strawberries grey mould.*

Key words: *grey mould risk, iMETOS®sm, leaf wetness, air temperature.*

Botrytis cinerea can seriously reduce strawberry yield and post-harvest quality (Miličevič *et al*., 2006; Shtienberg, 2007). Grey mould infects leaves, fruits, flowers, petioles, stems and often starts early as strawberry blossom blight. Flower infections are the main reason for latent infections leading to damages during the storage. Mostly pathogen remains invisible until ripening and then may cause fruit rot before or after harvest (Blanco *et al*., 2006; Williamson, 2007). *B. cinerea* cause the highest strawberry fruit and yield lost, it can be from 15% up to 50% (Blanco *et al*., 2006).

Conventionally grey mould is controlled by protecting flowers from infection by applications of fungicides every 7–14 days during strawberry flowering at 61–69 BBCH growth stages (Miličevič *et al*., 2006; Shtienberg, 2007). During the growing season in horticulture significant amounts of pesticides are consumed to control diseases. A large part of fungicides are used for preventative applications. Using disease forecasting models, applications of fungicides are made only when it is necessary (Shtienberg and Elad, 1997; Shtienberg, 2007).

The grey mould infection risk of the strawberry flowers mostly depends on temperature and humidity. Bulger *et al.* (1987) found resonance correlations for leaves wetness periods and temperature. If wetness periods last for 32 hours at 20 °C, the probability of grey mould infection is 60%. A forecasting model was used to calculate how favourable the periods are for the risk of infection for *B. cinerea* (Bulger *et al*., 1987).

Research on the efficiency of forecasting models for pests and diseases in horticultural plants under Lithuanian climate conditions using internet forecasting system iMETOS®sm (Pessl Instruments, Austria) was started at the Institute of Horticulture in 2007 (Valiuškaitė *et al*., 2008; Raudonis and Valiuškaitė, 2009). These studies were conducted under the long-term project "Establishment of warning models of horticultural plant diseases and pests and its implementation in Lithuania using warning equipment". One of the goals of this research was to investigate the *Botrytis cinerea* forecasting model for strawberries in Lithuanian conditions.

The two-year studies were carried out at the Institute of Horticulture in 2010–2011. Field trials were carried out in strawberries cv. 'Elkat' plantation. The control of strawberry grey mould was realised by different disease management systems: conventional plant protection system (conventional system) and iMETOS®sm *B. cinerea* risk forecasting model (forecasting model). For control of grey mould selected fungicide Switch 62.5 WG (a.i. Ciprodinil +

Fludioksonil 375 + 250 g/kg), rate 1.0 kg ha^{-1}. In order to evaluate the risk of infection records were compared of iMETOS®sm weather stations located in different agro-climatic regions of Lithuania: the first one was in the Central (Kaunas) region, the second one in the South (Alytus), and third one — in the North (Pasvalys) region.

iMETOS®sm *B. cinerea* risk forecasting model records leaf wetness, rainfall, air temperature and other parameters, also calculates the risk of infection every hour, the records are received on the internet http://www.fieldclimate.com/ (Valiuškaitė *et al*., 2008; Raudonis and Valiuškaitė, 2009). Strawberry iMETOS®sm *B. cinerea* risk forecasting model indicates the risk of infection periods on the basis of interaction between air temperature and duration of leaf wetness. Grey mould risk forecasting model calculates how favourable are periods for the risk of infection. According to the manufacturer guidelines, if iMETOS®sm grey mould risk forecasting model shows the infection risk periods more than 60% probability (which lasts longer than three days), a spray against grey mould should be applied.

Analysis of records of iMETOS®sm grey mould risk forecasting model in the Central region showed dissimilar *B. cinerea* occurrence in both years of investigation (Fig. 1). The risk of infection was greater than 60% and lasted for 15 days in May and 14 days in June of 2010. Meanwhile, in 2011 there was no risk of infection in May and only two days in June (Fig. 1). Therefore, observing meteorological conditions in plots treated according to the forecasting model only two applications were performed in 2010 while by the conventional system four applications were performed in both years of investigation. Comparison of different disease management system advisable experiments showed that the first and the second application time in 2010 coincided, but other application times differed. The first application under the conventional system in 2010 was performed on May 16 and under the forecasting model on May 15. At that time strawberries were at 61–65 BBCH growth stages. The second application depending on the conventional system was on May 23 and by the forecasting model on May 21 of 2010. Other application times in 2010 differed, since the risk of infection was lower than 60% or the risk reached 60% at the strawberry harvesting time, when application is impossible. Weather conditions during strawberry flowering in 2011 were exceptional comparing to year 2010. The year was dry and there was no need of us-

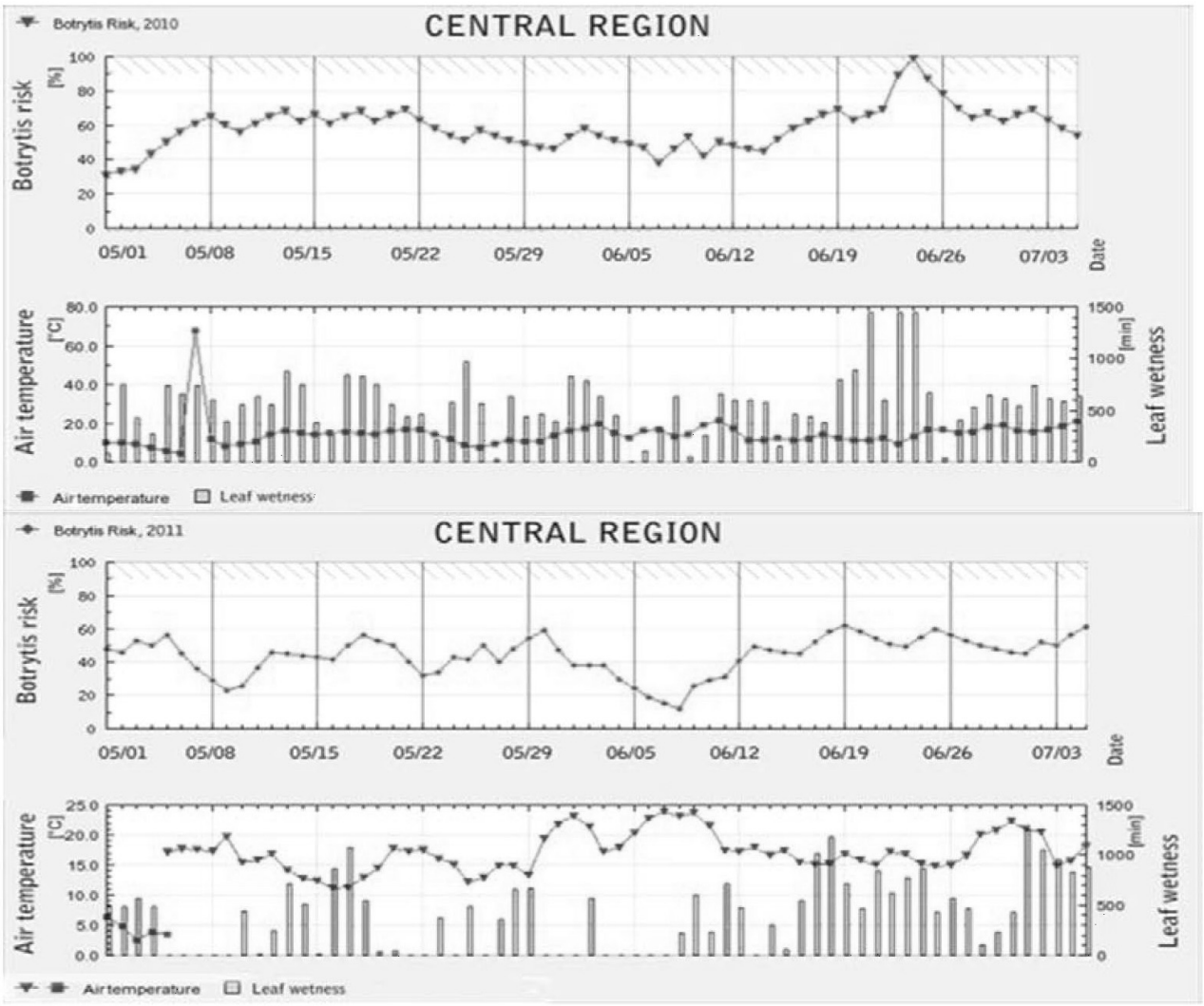

Fig. 1. Strawberry grey mould risk dynamics according to iMETOS®sm forecasting model. Central region, 2010–2011.

Table 1

INFLUENCE OF DISEASE MANAGEMENT SYSTEMS IN CENTRAL REGION OF LITHUANIA, 2010–2011

Disease management system	Strawberry fruits, %*				Efficiency of systems, %	
	healthy	rotten	healthy	rotten		
	2010		2011		2010	2011
Unsprayed	91,83	8.17	93.85	6.15	-	-
Conventional plant protection system	97.50	2.5	98.06	1.94	69.40	68.46
iMETOS®sm risk forecasting model	98.00	2,0	97.80	2.20	75.52	64.23

* sample 1000 fruit

ing fungicides, because the risk of infection was minimal. The application time in 2011 according to the conventional system was similar as in 2010.

Comparison of different protection systems showed that both disease management systems reduced the spread of grey mould in strawberries (Table 1). 8.17 and 6.15 % of strawberries were rotten in unsprayed plots in 2010 and 2011, respectively. According to the conventional plant protection system, in 2010 there were 2.5% rotten strawberries and in 2011 — 1.94%. Similar results were in plots treated according to the forecasting model — 2.0 (2010) and 2.20% (2011).

By evaluating and comparing the records under the forecasting model in different agro-climatic regions of Lithuania diverse results were obtained (Fig. 2). According to the data of the iMETOS®sm grey mould risk forecasting model, the risk of infection was lower than 60% and there was no need for use of fungicides in South and North regions in May 2010–2011 and in North region in June 2010. Whereas the risk of infection was greater than 60% in South and North region for five days in June of 2010 and in South region for three days in June of 2011. The risk of infection in both regions was unfavourable or minimal, thus there was no need to use fungicides.

The iMETOS®sm grey mould risk forecasting model analysis shows that disease forecasting allows applying fungicides precisely then it is needed, which leads to environmentally friendly plant protection. Spraying fungicides according to the conventional plant protection system was

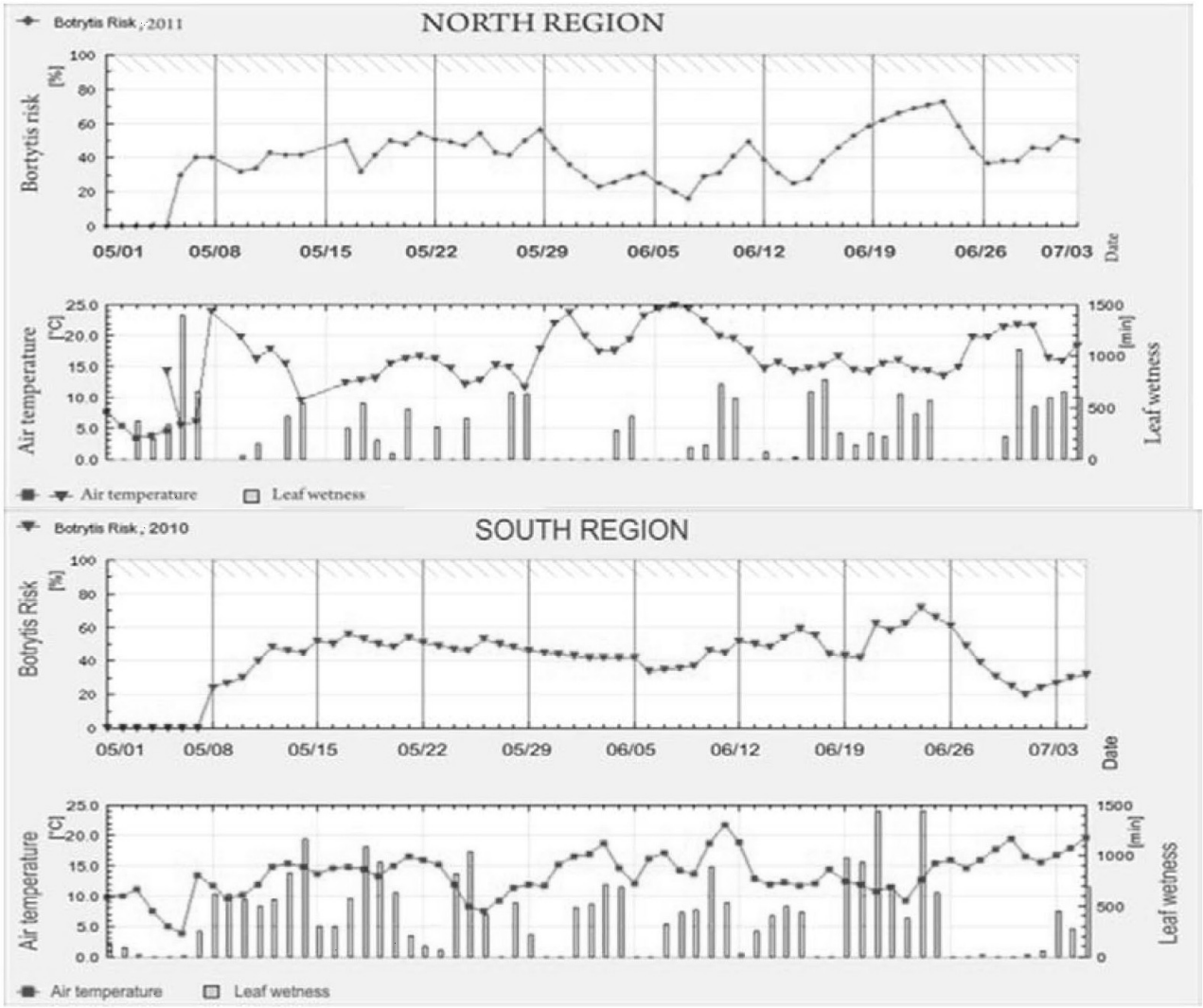

Fig. 2. Strawberry grey mould risk dynamic according to iMETOS®sm forecasting model. North (2011) and South (2010) regions.

effective, on average, 68.93%, and spraying according to the forecasting model — 68.38 %, compared with unsprayed strawberries.

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Botrytis cinerea RISKA PROGNOZĒŠANAS MODEĻA ZEMENĒM IZPĒTE LIETUVĀ

Pelēkā puve, ko izraisa *Botrytis cinerea* Pers: Fr., ir viena no svarīgākajām zemeņu slimībām gan Lietuvā, gan arī citās valstīs, kur zemenes tiek audzētas. Pētījumi par prognozēšanas modeļu efektivitāti dārzkopības augu kaitēkļiem un slimībām Lietuvas klimatiskajos apstākļos, izmantojot interneta prognozēšanas sistēmu iMETOS ® cm (*Pessl* instrumenti, Austrija), tika uzsākti Dārzkopības institūtā 2007. gadā. Šajā pētījumā veikti novērojumi par zemeņu iMETOS ® sm pelēkās puves riska prognozēšanas modeļiem 2010.–2011. gadā. Darba mērķis bija analizēt *B. cinerea* slimības riska iespējamību dažādos agroklimatiskajos apstākļos dažādos Lietuvas reģionos. Zemeņu pelēkās puves riska prognozēšanas modelis norāda inficēšanās risku, pamatojoties uz mijiedarbību starp gaisa temperatūru un lapu samitrinājuma ilgumu. Modelis aprēķina, kāds inficēšanās risks ir konkrētajā periodā. Periodos, kad risks ir konsekventi (vairāk nekā trīs dienas) lielāks nekā 60 punkti, pret pelēko puvi jāpielieto smidzinājumi. iMETOS ® cm pelēkās puves riska prognozēšanas modelis dod iespēju optimizēt fungicīdu izmantošanu un samazināt pielietojumu skaitu, tādējādi ļaujot daudz efektīvāk, videi draudzīgāk un ekonomiski pamatotāk kontrolēt zemeņu pelēko puvi.