Proceedings of the 7th Congress on Plant Protection

Доклады 7-ого Конгресса по защите растений

Plant Protection Society of Serbia
Общество по защите растений Сербии

International Organization for Biological Control
-East Palearctic Regional Section (IOBC-EPRS)
-West Palearctic Regional Section (IOBC-WPRS)

Международная организация по биологической борьбе
- Восточно палеарктическая региональная секция (МОББ-ВПРС)
- Западно палеарктическая региональная секция (МОББ-ЗПРС)

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„Integrated Plant Protection – a Knowledge-Based Step towards Sustainable Agriculture, Forestry and Landscape Architecture“

(November 24-28, 2014, Zlatibor, Serbia)

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„Интегрированная защита растений - научно обоснованный шаг к устойчивому развитию сельского хозяйства, лесоводства и пейзажной архитектуры“

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PREFACE

The Plant Protection Society of Serbia (PPSS) and two regional sections of the International Organization for Biological and Integrated Control (IOBC-EPRS and IOBC-WPRS), on the occasion of the 60th anniversary of the PPSS organized VII Congress on Plant Protection with a motto: *"Integrated Plant Protection – a Knowledge-Based Step towards Sustainable Agriculture, Forestry and Landscape Architecture"* (November 24-28, 2014, Zlatibor, Serbia). The Congress enabled exchange of up-to-date scientific and technical information on plant protection in Agriculture, Forestry and Landscaping among researchers, teachers, experts in extension and public services and the business community, and promoted international cooperation. The Congress focused on basic knowledge and management practices established in plant protection, as well as on the development of alternative and innovative approaches. In addition, biological control as an important tool for the control of the harmful organisms with a minimal risk for ecosystems was discussed. A total of 209 contributions was presented - 8 keynote presentations, 28 oral presentations and 173 poster presentations - prepared by 467 authors from 26 countries. The Congress Proceedings comprise 65 contributions - 5 keynote presentations and 60 oral and poster presentations in six sessions, prepared by the authors from 18 countries (Algeria, Austria, Bosnia-Herzegovina, France, Georgia, Hungary, Italy, Kazakhstan, Montenegro, Poland, Russia, Rwanda, Serbia, Slovenia, Switzerland, Turkey, Uganda, USA). All contributions were reviewed by members of the Scientific Committee and other reviewers selected and invited by the editors of this publication.

Belgrade, November 2015 Editors

ПРЕДИСЛОВИЕ

Общество по защите растений Сербии (ОЗРС), Международная организация по биологической борьбе с вредными животными и растениями - Восточно палеарктическая региональная секция (МОББ-ВПРС) и Международная организациая по биологической борьбе и интегрированной системе защиты растений - Западно-палеарктическая региональная секция (МОББ-ЗПРС), по поводу 60-летия ОЗРС организировали VII Конгресс по защите растений, под девизом: *"Интегрированная защита растений - научно обоснованный шаг к устойчивому развитию сельского хозяйства, лесоводства и пейзажной архитектуры"* (24-28 ноября 2014 года, Златибор, Сербия). Цель Конгресса была обеспечение континуитета взаимообмена научно-техническими информациями, отвечающими современным требованиям защиты растений в сельском хозяйстве, лесоводстве и пейзажной архитектуре, которые представляют интерес для ученых, исследователей, преподавателей, экспертов-советников в области сельского хозяйства, лесоводства и пейзажной архитектуры, специалистов государственных и коммунальных служб, деловых кругов и средств массовой информации. Целью Конгресса является и продолжение содействия развитию и популяризации международного сотрудничества. Конгресс был концентрирован на основные знания и практический менаджмент в защите растений, а также на развитие алтернативних и новых подходов. Биологическая защита каторая представляет значительный способ для безопасной борьбы с вредними организмими была тоже рассмотривана. На конгрессе представлено 209 презентаций - 8 докладов по приглашению, 28 устных и 173 постер презентаций - которые подготовило 467 авторов из 26 стран. Сборник имеет 65 докладов - 5 докладов по приглашению и 60 устных и постер презентаций, распределенных в шести секциях. Авторы докладов приехали из 18 стран (Алжир, Австрия, Босния-Герцеговина, Франция, Грузия, Венгрия, Италия, Казахстан, Черногория, Польша, Россия, Руанда, Сербия, Словения, Швейцария, Турция, Уганда, США). Рецензенты всех опубликованных докладов в сборнике – члены Научного совета и другие рецензенты, выбранные редакторам этого издания.

Белград, Ноября 2015 Редакторы

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RACE DIFFERENTIATION WITHIN STRAINS OF *Xanthomonas euvesicatoria* CAUSAL AGENT OF BACTERIAL SPOT OF PEPPER IN SERBIA

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ABSTRACT

Bacterial spot of pepper, caused by *Xanthomonas euvesicatoria* regularly causes losses in pepper production in Serbia. During 2008, 2009 and 2010 samples of diseased pepper leaves with bacterial spot symptoms were collected from different localities in Serbia. Total of 116 strains of bacteria were obtained by isolation from infected leaves. Within the world population of the pathogen 11 physiological races are distinguished on the basis of reaction on pepper variety ECW and their isogenic lines known as ECW10R (*Bs1* gene), ECW20R (*Bs2* gene), ECW30R (*Bs3* gene) and PI 235047 (*Capsicum pubescens*). Race differentiation of Serbian *X. euvesicatoria* strains was carried out based on the reaction of differential plants. Our studies showed that the population of *X. euvesicatoria* was heterogeneous, consisting of four physiological races: P1, P3, P7 and P8. The most common was the pepper race P8, followed by P7, P1 and P3 represented by the 93, 17, 5 and 1 strain, respectively.

Key words: pepper race, bacterial spot, *Xanthomonas euvesicatoria*

INTRODUCTION

According to the latest classification, bacterial spot (BS) of pepper could be caused by three species of Gram-negative bacteria belonging to the genus *Xanthomonas*: *X. euvesicatoria*, *X. vesicatoria* and *X. gardneri* (Vauterin *et al*., 1995; Stall *et al*., 1994; Jones *et al*., 2004; Obradović *et al*., 2004; Bull *et al*., 2010). The pathogen is seed-borne, but from season to season it can persist in the field on weeds, volunteer plants and debris of infected plants (Jones *et al*., 1986; Obradović *et al*., 2008). Under humid and warm weather conditions, bacterial spot of pepper, caused by *Xanthomonas euvesicatoria* regularly causes losses in pepper production in Serbia (Obradović *et al*. 2000a, 2004; Ignjatov *et al*. 2010). Susceptibility of pepper varieties grown in Serbia certainly contributes to frequent occurrence of bacterial spot. Currently, 11 physiological races of *X. euvesicatoria* are distinguished based on the reaction on pepper variety ECW and its isogenic lines ECW10R (*Bs1* gene), ECW20R (*Bs2* gene), ECW30R (*Bs3* gene) and PI 235047 (*Capsicum pubescens*) (Stall *et al*., 2009) (tab. 1). The aim of this study was to differentiate races within strains of *X. euvesicatoria* collected from different pepper production regions in Serbia.

MATERIAL AND METHOD

A three-year survey (2008-2010) of pepper fields resulted in isolation of numerous bacterial strains. After obtaining pure cultures 116 strains were chosen for

further study. Pepper plants of Early Calwonder (ECW), and differential isogenic lines were grown for 3-4 weeks in a growth chamber until the fourth true leaf was fully expanded. Infiltration of a leaf is accomplished by gently forcing the bacterial suspension (10^8CFU/ml) into the underside of the leaf using a sterile needless syringe. Plants were incubated in the laboratory at 22-24 °C. Rapid collapse of the infiltrated area, followed by necrosis within 24h, was considered hypersensitive reaction (HR). Development of water-soaked lesions after 3-5 days indicated a susceptible reaction (C).

RESULTS

According to the reaction of differential isogenic lines, our studies showed that the population of *X. euvesicatoria* was heterogeneous with four physiological races present: P1, P3, P7 and P8. The most common was the pepper race P8, followed by P7, P1 and P3 represented by the 93, 17, 5 and 1 strain, respectively. The pepper isogenic line ECW-20R, carrying *Bs2* resistant gene, reacted hypersensitively to all investigated strains. Race composition of pepper strains and presence of four races (P1, P3, P7, P8) indicated that introduction of *Bs2* gene in commercial varieties would control resistance to majority of the strains included in this study. Susceptible reaction appeared 3-5 days after infiltration as chlorotic, water soaked tissue within the infiltrated area (Fig. 1a). Resistant reaction can vary in appearance from bleached white with a dark border to uniformly dark brown color throughout the infiltrated, collapsed area (Fig. 1b).

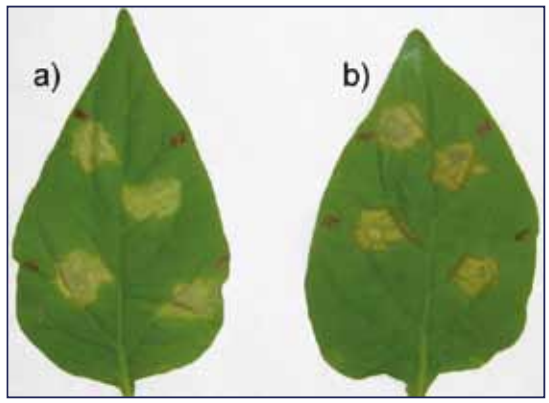

Fig. 1. Reaction of differential pepper lines: a) compatible (susceptible) reaction (C) on pepper cv. ECW; b) resistant reaction (HR) on pepper cv. ECW20

DISCUSSION

Bacterial spot of pepper caused by *X. euvesicatoria* occurs regularly in Serbia, causing significant losses due to reduction of leaf area, defoliation and fruit scab (Obradović *et al*., 1999, 2000b; Ignjatov *et al*., 2010; Gašić *et al*., 2011). Breeding programmes for BS-resistance are considered as one of the most effective strategies for controlling the disease. However, the development of resistance has been limited by the high degree of genetic and phenotypic diversity within the *Xanthomonas* species complex. Over the last 20 years, the pathogen distribution and diversity was observed in Serbia and the presence of pepper races 1, 3, 7 and 8 was already reported (Obradović *et al*., 2000a, 2004).

Table 1. Differentiation of *X. euvesicatoria* races using known resistance genes in pepper (Stall *et al*., 2009)

Races	Funcional avirulence gene (*avr*)	Pepper diferential lines				
		ECW	ECW-10 *Bs1*	ECW-20 *Bs2*	ECW-30 *Bs3*	PI235047 *Bs4*
P0	*avrBs1*, *avrBs2*, *avrBs3*, *avrBs4*	C	HR	HR	HR	HR
P1	*avrBs2*, *avrBs3*, *avrBs4*	C	S	HR	HR	HR
P2	*avrBs1*, *avrBs2*	C	HR	HR	C	C
P3	*avrBs2*, *avrBs4*	C	C	HR	C	HR
P4	*avrBs3*, *avrBs4*	C	C	C	HR	HR
P5	*avrBs1*	C	HR	C	C	C
P6	*avrBs4*	C	C	C	C	HR
P7	*avrBs2*, *avrBs3*	C	C	HR	HR	C
P8	*avrBs2*	C	C	HR	C	C
P9	*avrBs3*	C	C	C	HR	C
P10	nema	C	C	C	C	C

ECW - Early Calwonder (No R gene); C – compatible (susceptible) reaction; HR - hypersensitive (resistant) reaction; PI235047-*Capsicum pubescens*

First, the pepper races P1 and P3 were reported (Obradović *et al*., 2008), later after *Bs4* gene were identified in *Capsicum pubescens* as PI235047 (Sahin i Miller, 1998), new pepper races of *X. c.* pv. *vesicatoria* (P7, P8) were differentiated in Serbia (Obradović *et al*. 2004). Results of the pepper differential cultivars presented in this study showed that the population of Serbian strains of *X. euvesicatoria* still consists of four races: P1, P3, P7 and P8. The results indicated that the race P8 was predominant in Serbia during all three years of survey. The pepper isogenic line ECW-20R, with *Bs2* resistant gene, reacted hypersensitively to all investigated strains. As source of resistance to race 8 mostly present in Serbia, introduction of *Bs2* into commercial pepper genotypes would provide better control of the pathogen. Since pepper is intensivly grown in Eastern Europe and in Mediterranean countries, we can not ignore the possibility of introduction of new races.

In Europe the different pepper races were determined in Italy, Hungary, Romania and in Eastern Meditarrean region of Turkey (Bouzar *et al*. 1994; Buonaurio *et al*., 1994; Sahin, 2001). Mitrev and Kovačević (2006) reported that pepper races P0 and P2 were predominant in Republic of Macedonia. Selection pressure created by entering the resistance genes in commercial genotypes often results in the appearance of strains able to overcome resistance (Pernezny and Collins, 1997). Therefore, determination of the genetic diversity of local pepper affecting *Xanthomonas* population is a prerequisite for the development of durable resistance to BS (Stall *et al*. 2009).

CONCLUSION

Race composition of *X. euvesicatoria* strains and presence of four races (1, 3, 7, 8), with prevailing race P8, indicate that introduction of *Bs2* gene would be effective against the majority of strains found in this study. In conclusion, the results presented here defined the target for breeding programs and creating resistant lines and varieties of pepper. Host-plant resistance is an effective method for plant disease management.

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