

THE ASSESSMENT OF GENETIC DIVERSITY OF STRAINS OF *Pseudomonas syringae* pv. *syringae* CAUSING BACTERIAL CANKER IN STONE FRUITS IN SOME NORTHERN PROVINCES OF IRAN*

V. ABBASI**, H. RAHIMIAN, M. A. TAJICK-GHANBARI and V. REZAIAN

(Received: 4. 2. 2010; Accepted: 21. 4. 2011)

Abstract

Pseudomonas syringae pv. *syringae* (*Pss*) is the causative agent of several bacterial diseases on a range of agricultural and horticultural crops that causes canker, leafspot and necrosis of the bark of stone fruit trees (peach, nectarine, apricot, plum and cherry). In this research samples were collected from various areas in Ardebil, Guilan, Mazandaran and Khorasane-Razavi provinces during 2007-2009. Bacterial strains identified as *Pss*, on the basis of LOPAT and GATTa were selected. Number of 70 bacterial isolates were compared based on their physiological and biochemical characteristics and total cellular protein profiles (SDS-PAGE). *Pss* isolates showed slight differences in phenotypic characteristics and protein profiles. To assess genetic diversity among the strains, genomic DNA was extracted from strains and used in ERIC and REP-PCR analysis. Strains formed 8 and 5 clusters in the ERIC-PCR and REP-PCR, at 75% similarity level, respectively and by the combination data set of both ERIC and REP-PCR, strains formed 9 clusters. The results demonstrated the existence of a considerable genetic diversity among *Pss* strains causing canker of stone fruit trees in the northern provinces of Iran.

Keywords: Bacterial canker, *Pseudomonas syringae* pv. *syringae*, Genetic diversity, Stone fruit trees.

See Persian text for figures and tables (Pages ۳۸۹ -۴۰۴).

*: A Part of MSc. Thesis of the First Author, Submitted to College of Agronomy Sciences, Sari Agricultural Sciences and Natural Resources University, Sari, Iran.

** : Corresponding Author, Email: valeh_abasi@yahoo.com

1. Former MSc. Student, Prof., Assis. Prof. and BSc. of Plant Pathology, Respectively, College of Agronomy Sciences, Sari Agricultural Sciences and Natural Resources University, Sari, Iran.

References

- ALDAGHI, M., MOHAMMADI, M., RAHIMIAN, H. and SHARIFI TEHRANI, A. 2000. Serological and molecular comparison of *Pseudomonas syringae* pv. *syringae* strains isolated from stone fruit trees, wheat and barley. **Proc. 14th Plant Protect. Cong., Isfahan, Iran.** (Abst.). 179.
- ALDAGHI, M., RAHIMIAN, H. and MOHAMMADI, M. 2009. Comparison of phenotypic, serological and biochemical characteristics of *Pseudomonas syringae* pv. *syringae* strains, the causal agent of bacterial canker of stone fruits and blight of cereals. **Iran. J. Plant Pathol.** 45: 317-336. (In Farsi with English Summary).
- AGRIOS, G. N. 2005. **Plant Pathology.** 5th ed., Elsevier Academic Press, London, UK.
- ARABI, F., NICKRAVESH, Z., BABAIZAD, V., REZAEIAN, V. and RAHIMIAN, H. 2006. The occurrence of bacterial blight of beet caused by *Pseudomonas syringae* pv. *aptata* in Iran. **Iran. J. Plant Pathol.** 42: 471-655. (In Farsi with English Summary).
- BAHAR, M., MOCHTAHEDI, H. and AKHIANI, A. 1985. Bacterial canker of apricot in Esfahan. **Iran. J. Plant Pathol.** 18: 58-68. (In Farsi with English Summary).
- BANAPOOR, A., ZAKIEE, Z. and AMANI, G. 1990. The isolation of *Pseudomonas syringae* pv. *syringae* of sweet cherry in Tehran province. **Iran. J. Plant Pathol.** 26: 67-72. (In Farsi with English Summary).
- DE BRUIJN, F. J. 1992. Use of repetitive (repetitive extragenic palindromic and enterobacterial repetitive intergenic consensus) sequences and the polymerase chain reaction to fingerprint the genomes of *Rhizobium meliloti* isolates and other soil bacteria. **Appl. Environ. Microbiol.** 58: 2180-2187.
- DE BRUIJN, F.J., RADEMARKER, J., SCHNEIDER, M., ROSSBACH, U. and LOUWS, F. J. 1996. Rep-PCR Genomic Fingerprinting of plant-Associated Bacteria and Computer-Assisted Phylogenetic Analysis. Pp. 497-502. *In*: Grey, S., Beth, M. nad Peter, M. G (Eds.), **Biology of Plant-Microbe Interaction.** Vol. 1, APS Press, USA.
- FARIIS, J. S. 1969. On the cophenetic correlation coefficient. **Sys. Zool.** 18: 279-285.
- HAYWARD, A. C. 1996. Molecular biology in systematic and diagnosis of phytopathogenic prokaryotes. **Phytopathology** 24: 271-274.
- HIRANO, S. S. and UPPER, C. D. 2000. Bacteria in the leaf ecosystem eith emphasis on *Pseudomonas syringae*: a pathogen, ice nucleus and epiphyte. **Microbiol. Mol. Bio. Rev.** 64: 624-653.
- JONES, A. A. 1971. Bacterial canker of sweet cherry in Michigan. **Plant Dis.** 55: 961-965.
- KLEMENT, Z., FARKAS, G. L. and LOVERKOVICH, L. 1974. Hypersensitive reaction induced by phytopathogenic bacteria in the tobacco leaf. **Phytopathology** 64: 474-477.
- KOVACS, N. 1956. Identification of *Pseudomonas solanacearum* by the oxidase reaction. **Nature** 178: 703.
- LAEMMLI, U. K. 1970. Cleavage of structural proteins during the assembly of the head of bacteriophage. **Nature** 227: 680-685.
- LILLEY, A. K., BAILEY, M. J. and FRY, J. C. 1996. Diversity of mercury resistance plasmid obtained by exogenous isolation from the bacteria of sugar beet in three successive seasons. **FEMS. Microbiol. Ecol.** 20: 211-227.
- LITTLE, E. L., BOSTOCK, R. M. and KIRKPATRIC, B. C. 1998. Genetic characterization of *Pseudomonas syringae* pv. *syringae* from stone fruits in California. **Appl. Environ. Microbiol.** 64: 3818-3823.
- LITTLE, E. L. and GILBERTSON, R. L. 1997. Phenotypic and genotypic characters support placement of *Pseudomonas syringae* strains from tomato, celery and cauliflower into distinct pathovars. **Plant Pathol.** 9: 542-547.
- LOUWS, F. G., FULBRGHT, D. W., STEPHANS, C. T. and BRUIJN, F. G. 1994. Specific genomic fingerprinting of phytopathogenic *Xanthomonas* and *Pseudomonas* pathovars and strains generated whit repetitive sequences and PCR. **Appl. Environ. Microbiol.** 60: 2286-2299.
- LOUWS, F. G., RADEMARKER, J. L. W. and BRUIJN, F. J. 1999. The three Ds of PCR-Base genomic analysis of phytobacterial diversity, detection and diagnosis. **Annu. Rev. Phytopathol.** 37: 81-125.
- LUPSKI, J. R. and WEINSTOCK, G. M. 1992. Short, interspersed repetitive DNA sequences in prokaryotic genomes. **J. Bacteriol.** 174: 4525-4529.

- MARTIN, F. N. and ENGLISH, J. T. 1997. Population genetics of soil born fungal plant pathogens. **Phytopathology** 87: 446-447.
- MOHAMMADI, M., GHASEMI, A. and RAHIMIAN, H. 2001. Phenotypic characterization of Iranian strains of *Pseudomonas syringae* pv. *syringae* Van Hall, the causal agent of bacterial canker disease of 135tone fruit trees. **J. Agric. Sci. Technol.** 3: 51-65.
- MOSIVAND, M., RAHIMIAN, H. and SHAMS-BAKHS, M. 2009. Phenotypic and genotypic relatedness among *Pseudomonas syringae* pv. *syringae* strains isolates from sugarcane, stone fruits and wheat. **Iran. J. Plant Pathol.** 45: 75-85. (In Farsi with English Summary).
- NAJAFIPOUR, G. and TAGHAVI, S. M. 2011. Comparison of *Pseudomonas syringae* pv. *syringae* from different hosts based on pathogenicity and BOX-PCR in Iran. **J. Agric. Sci. Technol.** 13: 431-442.
- PALLERONI, N. J. 1984. Genus I. *Pseudomonas* (Migula 1984), Pp. 141-199. In. J. G. Holt and N. R. Kreig (Eds.), **Bergey's Manual of Systematic Bacteriology**. The Williams and Wilkins, Co., Baltimore.
- RADEMARKER, J. W., HOSTE, B., LOUWS, F. J., KERSTERS, K., SWINGS, J., VAUTERINE, L., VAUTERINE, P. and DE BRUIJN, F. J. 2000. Comparison of AFLP and rep-PCR genomic fingerprinting with DNA-DNA homology studies: *Xanthomonas* as a model system. **Intl. J. Syst. Evo. Microbiol.** 50: 665-677.
- RAHIMIAN, H. 1994. The occurrence of bacterial red streak of sugarcane caused by *Pseudomonas syringae* pv. *syringae* in Iran. **J. Phytopathol** 143: 321-324.
- RAHIMIAN, H. 1989. The occurrence of bacterial blight of wheat introduced in Kerman. Proc. **11th Plant Protec. Cong. Guilan, Iran.** 146. (AbSt.).
- RAHIMIAN, H., NICKRAVESH, Z., ARABI, F. and REZAEIAN, V. 2004. The interference of *Xanthomonas arboricola* pv. *pruni* in blossom blast of peach in Mazandaran. **Proc. 16th Plant Protec. Cong. Tabriz, Iran.** P 424.
- ROHLF, F. J. 1990. NTSYS-pc. Numerical Taxonomy and Multivariat Analysis System, Version 2.02. Exeter Software, New York.
- ROOS, I. M. and HATTINGH, M. J. 1987. Systemic invasion of plum leaves and shoot by *Pseudomonas syringae* pv. *syringae* introduced into petioles. **Phytopathology** 77: 1253-1257.
- SANDS, D. C., SCHORTH, M. N. and HILDEBRAND, D. C. 1970. Taxonomy of phytopathogenic *Pseudomonas*. **J. Bacteriol.** 101: 9-23.
- SCHAAD, N. W., JONES, J. B. and CHUN, W. 2001. **Laboratory Guide for Identification of Plant Pathogenic Bacteria**. 3rd ed., APS Press. St Paul, Minnesota, USA. 373p.
- SNEATH, P. H. and SOKAL, R. R. 1973. **The Principles and Practice of Numerical Classification**. Numerical Taxonomy. W. H. Freeman Co. San Francisco.
- SOKAL, R. and ROHLF, F. J. 1962. The comparisons of dendrograms by objective methods. **Taxon** 11: 33-40.
- SULIKOWSKA, M. and SOBICZEWSKI, P. 2008. *Pseudomonas* spp. Isolated from stone fruit trees in Poland. **Zemdirbyste-Agriculture** 95: 166-170.
- THOMIDIS, T., TSIPOURIDIS, C., EXADAKTYLOU, E. and DROGOUDI, P. 2005. Comparison of three laboratory methods to evaluate the pathogenicity and virulence of ten *Pseudomonas syringae* pv. *syringae* strains on apple, pear, cherry and peach trees. **Phytopathology** 33: 137-140.
- VERSALOVIC, J., SCHEIDER, M., DE BRUIJN, F. J. and LUPSKI, J. R. 1994. Genomic fingerprinting of bacteria using repetitive sequence based polymerase chain reaction. **Meth. Mol. Cell. Biol.** 5: 25-40.
- ZHAO, Y., DAMICONE, J. P., DOMEZAS, D. H., RANGASWAMY, V. and BENDER, C. L. 2000. Bacterial leaf spot diseases of leafy crucifers in Oklahoma caused by *Pseudomonas syringae* pv. *maculicola*. **Plant Dis.** 84: 1015-1020.