

PHENOTYPIC AND GENOTYPIC DIVERSITY OF PECTOLYTIC ERWINIAS ISOLATED FROM ORNAMENTAL HOSTS IN SOME NORTHERN PARTS OF IRAN*

S. BAGHAE RAVARI¹, M. SHAMS-BAKSH^{1**}, H. RAHIMIAN² and N. SAFAEI¹

(Received : 12.10.2009; Accepted : 15.9.2010)

Abstract

A wide range of pectolytic bacteria inflict damages in ornamental plants. Accurate identification and determination phenotypic and genotypic variation in populations of these bacteria are necessary to implement effective control methods. Thirty-eight isolates of leaf and fleshy parts of ornamental plants from different greenhouses in Guilan, Golestan, East of Mazandaran and Mashhad were collected. The phenotypic features, electrophoretic pattern of cell proteins and DNA fingerprints of the isolates were studied. According to the differential phenotypic characteristics, the isolates were assigned to *Pectobacterium*, *Dickeya* and Intermediate species. In numerical analysis of biochemical and physiological features, the isolates were divided to 12 groups. The cell protein pattern of the isolates was diverse and was only useful for preliminary grouping of the isolates. Genomic DNA fragments of representative isolates and eleven references strains were amplified with ERIC, BOX and REP primers. According to the combined dendrogram of the rep-PCR electrophorograms, the isolates were clustered to several groups at a low level of similarity to the reference strains. It seems that rep-PCR is not a useful approach for differentiation of pectolytic erwinias at species or subspecies levels.

Keywords: Leaf spot, Soft rot, Ornamental plants, rep-PCR.

See persian text for figures and tables (Pages ۲۱۷-۲۳۳).

*: A Part of PhD. Thesis of the First Author Submitted to College of Agriculture, Tarbiat Modares University, Tehran, Iran.

** : Corresponding Author, Email: shamsbakhsh@modares.ac.ir

1. Former PhD. Student and Assoc. Prof.s of Pathology, Respectively, College of Agriculture, Tarbiat Modares University, Tehran, Iran.

2. Prof. of Plant Pathology, Sari Agricultural Sciences and Natural Resources University, Sari, Iran.

References

- AHMADVAND, R. and RAHIMIAN, H. 2005. Study on phenotypic and electrophoretic diversity of *Pectobacterium* species infecting corn in Mazandaran. **Iran. J. Plant Pathol.** 41: 271-289. (In Farsi With English Summary).
- ALIPPI, A. M. and LOPEZ, A. C. 2009. First Report of *Pectobacterium carotovorum* subsp. *carotovorum* on *Spathiphyllum wallisii* in Argentina. **Plant Dis.** 93:842.
- AMANI, B. 1969. Rotting of ornamental plants and vegetables. **Iran. J. Plant Pathol.** 4:10-13. (In Farsi With English Summary).
- ARAB, A. M. and RAHIMIAN, H. 1989. Bacterial stem rot of dieffenbachia in north of Iran. **Proc. 9th Iran. Plant Protec. Cong., Mashhad, Iran.** 151 (Abst.).
- ARABI, F., NIKRAVESH, Z., BABAEE ZAD, V., REZAEAN, V. and RAHIMIAN, H. 2006. Occurrence of bacterial leaf spot of garden beet caused by *Pseudomonas syringae* pv. *aptata* in Iran. **Iran. J. Plant Pathol.** 42: 655-671. (In Farsi with English Summary).
- ARIAS, R. S., MURAKAMI, P. K. and ALVAREZ, A. M. 1998. Rapid detection of pectolytic *Erwinia* sp. in *Aglaonema* sp. **Hort. Technol.** 8: 602–605.
- BARRAS, F., VAN GIJSEGEM, F. and CHATTERJEE, A. K. 1984. Extracellular enzymes and pathogenesis of soft-rot *Erwinia*. **Ann. Rev. Phytopathol.** 32:201-234.
- BOCCARA, M., VEDAL, R. LALO, D. LEBRUM, M. H. and LAFAY, J.F. 1991. Genetic diversity and host range in strains of *Erwinia chrysanthemi*. **Mol. Plant Microbe Interac.** 4: 293-299.
- BOYRAZ, N., BASTAS, K. K., Maden, S. and Yasar, A. 2006. Bacterial Leaf and Peduncle Soft Rot Caused by *Pectobacterium carotovorum* on Tulips in Konya, Turkey. **Phytoparasitica** 34:272-280.
- CHAO, Y. C., FENG, C. T. and HO, W.C. First report of *Aglaonema* bacterial blight caused by *Erwinia chrysanthemi* in Taiwan. **Plant Dis.** 90: 1358.
- CZAJKOWSKI, R., GRABE, G. J. and VAN DER WOLF, J. M. 2009. Distribution of *Dickeya* spp. and *Pectobacterium carotovorum* subsp. *carotovorum* in naturally infected seed potatoes. **Eur. J. Plant Pathol.** 125: 263-275.
- DE BRUJIN, F. J. 1992. Use of repetitive (Repetitive Extragenic Palindromic and Enterobacterial Repetitive Intergeneric 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.
- FIORI, M. and SCHIAFINO, A. 2004. Bacterial stem rot in Greenhouse pepper (*Capsicum annuum* L.) in Sardinia (Italy): Occurrence of *Erwinia carotovora* subsp. *carotovora*. **Phytopathology** 152: 28–33.
- GARDAN, L., GOUY, C., CHRISTEN, R. and SAMSON, R. 2003. Elevation of three subspecies of *Pectobacterium carotovorum* to species level: *Pectobacterium atrosepticum* sp. nov., *Pectobacterium betavascularum* sp. nov. and *Pectobacterium wasabiae* sp. nov. **Intl. J. Sys. Evol. Microbiol.** 53: 381–391.
- GILLINGS, M. and M. HOLLEY. 1997. Repetitive element PCR fingerprinting (rep-PCR) using enterobacterial repetitive intergenic consensus (ERIC) primers is not necessarily directed at ERIC elements. **Lett. Appl. Microbiol.** 25:17–21.
- HASANZADEH, N. 1995. The occurrence of bacterial soft rot disease on dieffenbachia. **Proc. 12th Iran Plant Protec. Cong., Karaj, Iran.** 275 (Abst.).
- HAUBEN, L., VAN GIJSEGEM, F. and SWINGS, J. 2006. Genus XXIV *Pectobacterium* Waldee 1945, 469 ^{AL}emend. Hauben, Moore, Vauterin, Steenackers, Mergaert, Verdonck and Swigns 1999a. Pp. 721-730. In: G.M., Brenner, D.J., Krieg, N. and Staley, J. (Eds.), **Bergey's Manual of Systematic Bacteriology**, Springer Pub., USA.
- HEDJAROOD, G. 1967. Soft rot of cyclamen in Iran. **Iran. J. Plant Pathol.** 4: 19-23. (In Farsi With English Summary).
- KHADEMLOU, E., TAGHINASAB, M., TAHERI, A. and RAHIMIAN, H. 2006. Bacterial leaf spot of aglaonema caused by strains resembling *Pectobacterium carotovorum* subsp. *odoriferum*. **Proc. 17th Iran Plant Protec. Cong., Karaj, Iran.** 384 (Abst.).

- KIM, J. H., JOEN, Y. H., KIM, S. G. and KIM, Y. H. 2007. First Report on Bacterial soft rot of graft-cactus *Chamaecereus silvestrii* caused by *Pectobacterium carotovorum* subsp. *carotovorum* in Korea. **Plant Pathol.** 23: 314-317
- KNAUSS, J. F. and C. WEHLBURG. 1969. The distribution and pathogenicity of *Erwinia chrysanthemi* Burkholder et al. to *Syngonium podophyllum* Schott. **Proc. Fla. State Hortic. Soc.** 82:370-373.
- KNAUSS, J. F. and MILLER, J. W. 1974. Etiological aspects of bacterial blight of *Philodendron selloum* caused by *Erwinia chrysanthemi*. **Phytopathology** 64: 1526-1528.
- LAEMMLI, U.K. 1970. Cleavage of Structural proteins during the assembly of the head of bacteriophage T₄. **Nature** 227: 680-685.
- LEE, Y.N. and YU, C.P. 2006. A differential medium for the isolation and rapid identification of a plant soft rot pathogen, *Erwinia chrysanthemi*. **J. Microbiol. Methods.** 64: 200-206.
- LOUWS, F. G., FULBRIGHT, D.W., STEPHANS, C.T. and BRUIJN, F.J. 1994. Specific genomic fingerprints of phytopathogenic *Xanthomonas* and *Pseudomonas* pathovars and strains generated with repetitive sequences and PCR. **Appl. Environ. Microbiol.** 60: 2286-2295.
- MAHMOODI, E., SOLEIMANI, M.J., TAGHAVI, M. and AKBARI, A. 2006. Occurrence of bacterial corn soft rot on crown imperial. **Proc. 17th Iran Plant Protec. Cong., Karaj, Iran.** 379 (Abst.).
- MARTIN, B., HUMBERT, O., CAMARA, M., GUENZI, E., WALKER, J. and MITCHELL, T. 1992. A highly conserved repeated DNA element located in the chromosome of *Streptococcus pneumoniae*. **Nucleic Acids Res.** 20:3479-3483.
- MCFADDEN, L. A. 1961. Bacterial stem and leaf rot of *Dieffenbachia* in Florida. **Phytopathology** 51: 663-668.
- MCFADDEN, L. A. 1969. *Aglaonema pictum*, a new host for *Erwinia chrysanthemi*. **Plant Dis. Rep.** 53: 253-254.
- NIEVES-BRUM, C. 1985. Infection of roots of *Dieffenbachia maculata* by the foliar blight and soft rot pathogen, *Erwinia chrysanthemi*. **Plant Pathol.** 34: 139-145.
- RAHIMIAN, H. and TALEI, D. 1995. Bacterial leaf spot of iris incited by *Erwinia carotovora* subsp. *carotovora*. **Proc. 12th Iran Plant Protec. Cong., Karaj, Iran.** 279 (Abst.).
- RAZI NATAJ, M. RAHIMIAN, H. and BEIKI, F. 2008a. Pathogenicity of four species of bacteria with bacterial leaf spot on *Dieffenbachia*. **Proc. 18th Iran Plant Protec. Cong., Hamadan, Iran.** 444 (Abst.).
- RAZI NATAJ, M. RAHIMIAN, H. and BEIKI, F. 2008b. Isolation of three species of pathogenic bacteria from bacterial leaf spot and soft rot of *Aglaonema*. **Proc. 18th Iran Plant Protec. Cong., Hamadan, Iran.** 445 (Abst.).
- RADEMAKER, J. L. W., HOSTE, B., LOUWS, F. J., KERSTERS, K., SWINGS, J., VAUTERIN, L., VAUTERIN, 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. Sys. Evol. Microbiol.** 50: 665-677.
- SAALTINKAND, G. J. and KAMERMAN, W. 2005. *Begonia bertinii*, a new host of *Erwinia chrysanthemi*. **Eur. J. Plant Pathol.** 77: 25-29.
- SAMSON, R., LEGENDRE, J. B., CHRISTEN, R., SAUX, M. F. L. ACHOUAK, W. and GARDAN, L. 2005. Transfer of *Pectobacterium chrysanthemi* (Burkholder et al. 1953) Brenner et al. 1973 and *Brenneria paradisiaca* to the genus *Dickeya* gen. nov. as *Dickeya chrysanthemi* comb. nov. and *Dickeya paradisiaca* comb. nov. and delineation of four novel species: *Dickeya dadantii* sp. nov., *Dickeya dianthicola* sp. nov., *Dickeya dieffenbachiae* sp. nov. and *Dickeya zae* sp. nov. **Int. J. Syst. Evol. Microbiol.** 55:1415-1427.
- SCHAAD, N. W., JONES, J. B. and CHUN, W. 2001. **Laboratory Guide for Identification of Plant Pathogenic Bacteria.** Amer. Phytopathol. Soc. St. Paul, Minnesota. 373pp.
- SLAWIAK, M., VAN BECKHOVEN, JOSE R. C. M., SPEKSNIJDER, ADRIANUS G. C. L., CZAJKOWSKI, R., GRABE, G. and VAN DER WOLF, J. M. 2009. Biochemical and genetical analysis reveal a new clade of biovar 3 *Dickeya* spp. strains isolated from potato in Europe. **Eur. J. Plant Pathol.** 125: 245-261.

- TAGHINASAB, M. and RAHIMIAN, H. 2008. Isolation of *Dickeya* spp. causal agent of *Dracaena* sp. leaf spot from Mazandaran Province. **Proc. 18th Iran Plant Protec. Cong., Hamadan, Iran.** 466 (Abst.).
- TAGHINASAB, M., KHADEMLOU, E. and RAHIMIAN, H. 2006a. Diversity of *Pectobacterium* spp. causing philodendron leaf spot. **Proc. 17th Iran Plant Protec. Cong., Karaj, Iran.** 385 (Abst.).
- TAGHINASAB, M., KHADEMLOU, E. and RAHIMIAN, H. 2006b. Isolation of *Dickeya* spp. and *Pectobacterium* spp. from pandanus leaf spot in Mahallat greenhouses. **Proc. 17th Iran Plant Protec. Cong., Karaj, Iran.** 405 (Abst.).
- TAGHINASAB, M., KHADEMLOU, E. and RAHIMIAN, H. 2008. Identification of *Pectobacterium carotovorum* casual agent of gladiolus bulb and stalk rot in Mahallat greenhouses. **Proc. 18th Iran Plant Protec. Cong., Hamadan, Iran.** 465 (Abst.).
- TAGHINASAB, M., MAHMOODI, H., ARABKHANI, M. and RAHIMIAN, H. 2008. Identification of *Dickeya* sp. causal agent of cactus soft rot in Mahallat. **Proc. 18th Iran Plant Protec. Cong., Hamadan, Iran.** 413 (Abst.).
- TOTH, I. K., L. HYMAN, J. and J. R. WOOD. 1999. A one-step PCR-based method for the detection of economically important soft rot *Erwinia* species on micropropagated potato plants. **J. Appl. Microbiol.** 87:158–166.
- TSROR, W. L., ERLICH, O., LEBIUSH, S., HAZANOVSKY, M., ZIG, U., SLAWIAK, M., GRABE, G., VAN DER WOLF, J. M. and VAN DER HARR, J. J. 2009. Assessment of recent outbreaks of *Dickeya* sp. (syn. *Erwinia chrysanthemi*) slow wilt in potato crops in Israel. **Eur. J. Plant Pathol.** 123:311–320.
- VERSALOVIC, J., SCHNEIDER, M., DE BRUIJN, F.J. and LUPSKI, J. R. 1994. Genomic fingerprinting of bacteria using repetitive sequence-based polymerase chain reaction. **Methods in Mol. Cell Biol.** 5: 25–40.
- VERSALOVIC, J., T. KOEUTH and J. R. LUPSKI. 1991. Distribution of repetitive DNA sequences in eubacteria and application to fingerprinting of bacterial genomes. **Nucleic Acids Res.** 19:6823–6831.
- WEINGART, H. and VOLKSCH, B. 1997. Genetic fingerprinting of *Pseudomonas syringae* pathovars using ERIC-, REP- and IS50-PCR. **Phytopathology** 145: 339-345.
- WILSON, L. A. and SHARP, P. M. 2006. Enterobacterial repetitive intergenic consensus (ERIC) sequences in *Escherichia coli*: Evolution and implications for ERIC-PCR. **Mol. Biol. Evol.** 23:1156–1168.