AS> Vol.3 No.3, May 2012

OPEN ACCESS

Isolation and pathogenicity of fungi associated to ambrosia borer (*Euplatypus segnis*) found injuring pecan (*Carya illinoensis*) wood

PDF (Size:384KB) PP. 405-416 DOI: 10.4236/as.2012.33048

Author(s)

Ramón Alvidrez-Villarreal, Francisco Daniel Hernández-Castillo, Oswaldo Garcia-Martínez, Rosalinda Mendoza-Villarreal, Raúl Rodríguez-Herrera, Cristóbal N. Aguilar

ABSTRACT

Euplatypus segnis is an insect pest of economic importance in pecan (*Carya illinoensis*) trees grown at Parras, General Cepeda and Torreón Coahuila, Mexico. The objectives in this study-were to identify the fungal strains associated to ambrosia borer body and diseased pecan wood and determine their pathogenicity. The results showed that the associated fungi to *Euplatypus segnis* and damaging the pecan wood were identified as: *Helminthosporium sp.*, *Aspergillus sp.*, *Penicillium sp.*, *Phoma sp.*, *Ascochyta sp.*, *Phaecylomices sp.*, *Umbeliopsis sp.*, *Torula sp.*, *Fusarium solani*, *Alternaria alternata*, *Fusarum oxysporum*, and *Lasiodiplodia theobromae*. The pathogenicity tests on healthy 3 year old pecan trees cv. western using *Fusarium oxysporum*, *Fusarium solani*, *Alternaria alternata* and *Lasiodiplodia theobromae* suspension conidia shown die back tree branches after 84 days inoculation. The insect in combination with the fungal invasion eventually cause the death of trees. Additionally, the insect contributes to the spread of fungi in pecan nut orchards.

KEYWORDS

Pathogenicity; Pecan Nut; *Euplatypus segnis*; Ambrosia Borer; *Carya illinoensis*

Cite this paper

Alvidrez-Villarreal, R. , Hernández-Castillo, F. , Garcia-Martínez, O. , Mendoza-Villarreal, R. , Rodríguez-Herrera, R. and Aguilar, C. (2012) Isolation and pathogenicity of fungi associated to ambrosia borer (*Euplatypus segnis*) found injuring pecan (*Carya illinoensis*) wood. *Agricultural Sciences*, 3, 405-416. doi: 10.4236/as.2012.33048.

References

[1] Equihua-Martínez, A. and Burgos-Solorio, A. (2007) Platypodidae y Scolytidae (Coleoptera) de Jalisco, México. Dugesiana, 14, 59-82.

[2] Galván, L.O.A. (2000) Euplatypus segnis (Chapuis): Fluctuación poblacional y magnitud de da?o a nogales en Parras, Coahuila. In: Vázquez, N.J.M., Ed., Memoria del II Curso de Actualización Fitosanitaria en Nogal. 10 y 11 de Marzo. Instituto Tecnológico de Estudios Superiores de Monterrey (ITESM), Torreón, 45-47.

[3] García, M.O. (1999) El barrenador ambrosia Euplatypus segnis (Chapuis) del tronco y ramas del nogal (Carya illinoensis). Memorias del Séptimo Simposium Internacional Nogalero NOGATEC. 23, 24 y 25 de septiembre. Instituto Tecnológico de Estudios Superiores de Monterrey, Torreón, 39-42.

[4] Cesaveco (2010) Comité estatal de sanidad vegetal del estado de Coahuila. Boletin, 86, 20.

[5] Atkinson, T.H., Fernández, E.M., Céspedes E.S. and Burgos, A.S. (1986) Scolytidae y platypodidae (coleoptera) asociados a selva baja y comunidades derivadas en el estado de Morelos, México. Folia Entomologica Mexicana, 69, 41-82

[6] Samaniego-Gaxiola, J.A., Ramírez-Delgado, M., Pedroza-Sandoval, A. and Nava-Camberos, U. (2008) Association between cotton root rot (Phymatotrichopsis omnivore) and borer insects of pecan tree (Carya illinoensis). Agricultura Técnica en México, 34, 21-32 (in Spanish).

- Open Special Issues
- Published Special Issues
- Special Issues Guideline

AS Subscription

Most popular papers in AS

About AS News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

[7] Rondon, A. and Guevara, Y. (1984) Algunos aspectos relacionados con la muerte regresiva del aguacate (Persea Americana Mill). Agronomía Tropical, 34, 119-129.

[8] Kok, L.T. and Norris, D.M.J. (1972) Symbiotic interrelationships between microbes and ambrosia beetles. VI Amino-acid composition of ectosymbiotic fungi of Xyleborus ferrugineus. Annals of the Entomological Society of America, 65, 598-602

[9] Brignola, C., Lacroix B., Lieutier F., Sauvard D., Drouet A., Claudot, C., Yart, A., Berryman, A. and Christiansen, E. (1995) Induced Responses in phenolic metabolism in two norway spruce Inoculations with Ophiostoma polonicumand bark beetle-associated fungus. Plant Physiology, 109, 821-827.

[10] Morales, R.J.A., Rojas, M.G., Bhatkar, H.S. and Salda?a, G. (2000) Symbiotic relationships between Hypothenemus hampei (coleoptera: scolytidae) and Fusarium solani (moniliales: tubercula riaseae). Annals of the Entomological Society of America, 93, 541-547. doi:10.1603/0013-8746(2000)093[0541:SRBHHC]2.0.CO;2

[11] Kuroda, K. (2001) Responses of Quercus sapwood to infection with the pathogenic fungus of a new wilt disease vectored by the ambrosia beetle Platypus quercivorus. Japan Wood Society, 47, 425-429.

[12] Peterson, W.S., Pérez, E.J., Vega, F. and Infante, F. (2003) Brocae Penicillium, a new species associated coffee berry borer with the in Chiapas, Mexico. Mycologia, 95, 141-147. doi:10.2307/3761973

[13] Alfaro, R. (2003) El taladrillo grande de los forestales, Platypus mutatus (=sulcatus): Importante plaga de la populicultura Argentina. Forestal, 28, 17.

[14] Rosas, R.E., Avila, G.M.R. and Cano, R.P. (2004) El metodo Laguna tecnica para conbatir el barrenador del tronco del nogal (Euplatypus segnis Chapuis). Memorias de la XVI Semana Internacional de Agronomia FAZ-UJED. Gomez Palacios, del 6-10 de Septiembre 2004.

[15] Barnett, H.L. and Hunter, B.B. (2006) Illustrated genera of imperfect fungi. 4th Edition, The American Phytopatological Society, St. Paul Minnesota.

[16] Hanlin, R.T. (1990) Illustrated genera of ascomycetes I. APS Press, Saint Paul.

[17] Booth, C. (1971) The genus Fusarium. Common-wealth Mycological, Kew.

[18] Rotem, J. (1988) The genus Alternaria, biology, epidemiology and pathogenicity. APS Press, St. Paul.

[19] Neergaard, P. (1977) Seed pathology. The McMillan Press Ltd., Surrey.

[20] Sutton, B.C. (1980) The fungi imperfecti with pycnidia coellomycetes, acervuli and stromata. Commonwealth Mycological Institute, Surrey.

[21] Wei, R.R., Sorger, P.K. and Harrison, S.C. (2005) Molecular organization of the Ndc80 complex, an essential kinetochore component. Proceedings of the National Academy of Sciences, 102, 5363-5367. doi:10.1073/pnas.0501168102

[22] Punithalingam, E. (1976) Botryodiplodia theobromae. CMI description of pathogenic fungi and bacteria No. 519. Commonwealth Mycological Institute, Surrey.

[23] Burgess, T.I., Barber, P.A., Mohali, S., Pegg, G., De Beer W. and Wingfield, M.J. (2006) Three new Lasi-odiplodia spp. Fromthe tropics, based on DNA sequence recognized comparisons and morphology. Mycologia, 98, 423-435. doi:10.3852/mycologia.98.3.423

[24] Ahrens, U. and Seemüller, E. (1992) Detection of DNA of plant pathogenic mycoplasmalike organisms by polymerase chain reaction amplifying a sequence of 16S rRNA gene. Phytopathology, 82, 828-832. doi:10.1094/Phyto-82-828

[25] Kirkendall, L.R. (1983) The evolution of mating system in bark and ambrosia beetles (Co-leoptera: Scolytidae and Platypodidae). Zoological Journal of the Linnean Society, 77, 293-352. doi:10.1111/j.1096-3642.1983.tb00858.x

[26] Wood, S.L. (1982) The bark and ambrosia beetles of north and central America (Coleoptera: Scolytidae), a taxonomic monograph. Great Basin Naturalist Memoirs, 6, 1359.

[27] Ulloa, M. (1991) Illustrated dictionary of mycology. UNAM, Mexico.

[28] Flechtmann, C.A.H. (1995) Scolytidae em refloresta- mentos com pinheiros tropicais. IPEF, Piracicaba.

[29] Harrington, C.T. (2005) Ecology and evolution of mycophagous bark beetles and their fungal partners. In: Vega, F.E. and Blackwell, M., Eds., Ecological and Evolutionary Advances in Insect-Fungal Associations, Oxford University Press, Oxford, 257-291.

[30] Beaver, R.A. (1989) Insect-fungus in the bark relationships and ambrosia beetles. Academic Blackwell, London.

[31] Kok, L.T, Norris, D.M and Chu, H.M. (1970) Sterol metabolism as a basis for a mutualistic symbiosis. Nature, 225, 661-662. doi:10.1038/225661b0

[32] Norris, D.M. (1979) The mutualistic fungi of xyleborine beetles. Halsted Press, Chichester. http://www.ncbi.nlm.nih.gov

[33] French, J.R.J. and Roeper, R.A. (1972) Interactions of the ambrosia beetle Xyleborus dispar (Coleoptera: Scolytidae) with STI symbiotic fungus, Am-brosiella hartigii (Fungi Imperfecti). Canadian Entomologist, 104, 1635-1641. doi:10.4039/Ent1041635-10

[34] Kingsolver, J.G. and Norris, D.M. (1977) External morphology of Xyleborus ferrugineus (Fabr.) (Coleoptera: Scolytidae) I. Head and prothorax of adult male and female. Journal of Morphology, 154, 147-156. doi:10.1002/jmor.1051540110

[35] Roeper, R.A, Treeful, L.M., O ' Brien, K.M., Foote, R.A. and Bunce, M.A. (1980) Life history of the ambrosia beetle Xyleborus affinis (Coleoptera: Sco-lytidae) from in vitro culture. Great Lakes Entomologist, 13, 141-144.

[36] Borden, J.H. (1988) The striped ambrosia beetles. In: Berryman, A.A., Ed., Dynamics of Forest Insect Populations, Plenum, New York.

[37] Batra, L.R. (1966) Ambrosia fungi: Extent of specificity to ambrosia beetles. Science, 153, 193-195. doi:10.1126/science.153.3732.193

[38] Haanstad, J.O. and Norris, D.M. (1985) Microbial symbionts of the ambrosia beetle Xyloterinus politus. Microbial Ecology, 11, 267-276. doi:10.1007/BF02010605

[39] Norris, D.M. (1965) The complex of fungi essential to growth and development of Xyleborus sharpie in wood. Material und Organismen Beiheft, 1, 523-529.

[40] Baker, J.M. (1963) Ambrosia beetles and their fungi, with particular reference to Platypus cylindricus Fab. Symposium of the Society for General Microbiology, 13, 232- 265.

[41] Gebhardt, M., Bergerow, D. and Oberwinkler, F. (2004) Identification of the ambrosia fungus of Xyleborus mono- graphus and X. dryographus (Curculionidae, Scolytinae). Mycologia, 3, 95-102.

[42] Kinuura H. (1995) Symbiotic fungi associated with ambrosia beetles. Japan Agricultural Research Quarterly, 29, 57-63.

[43] Francke-Grosmann, H. (1967) Wood-inhabiting ectosym- biosis in insects. Academic, New York.

[44] Morelet, M. (1998) Une nouvelle raffaelea spec, isolee cylindrus platypus, coleoptera des chenes xylomyceto-phage. Extr. Annales de la Societe des Sciences Naturelles, 50, 185-193.

[45] Fernandez-Marin, H., Zimmerman, J.K. and Wcislo, W.T. (2004) Ecological traits and evolutionary sequences of nest establishment in fungus growing ants (Hymenoptera, Formicidae, Attini). Biological Journal of the Linnean Society, 81, 39-48.

[46] Jones, K.G. and Blackwell, M. (1998) Phylogenetic analysis of ambrosia species in the genus Raffaelea based on 18S rDNA sequences. Mycological Research, 102, 661-665. doi:10.1017/S0953756296003437

[47] Rollins, F., Jones, K.G., Krokene, P., Solheim, H. and Blackwell, M. (2001) Phylogeny of asexual fungi associated with bark beetles and ambrosia. Mycologia, 93, 991- 996. doi:10.2307/3761761

[48] Nicholson, P. (2001) Molecular Assays as aids in the detection, diagnosis and Quantification of Fusarium species in plants. APS Press, St. Paul, 176-192.

[49] Carrillo, L. (1990) Micotoxinas de Fusarium spp en frutos deteriorados de Cucurbita ficifolia. Revista Argentina de Microbiología, 22, 212-215.

[50] Doohan, F.M., Brennan, J. and Cooke, B.M. (2003) Influence of climatic factors on Fusarium species

pathogenic to cereals. European Journal of Plant Pathology, 109, 755-768.

[51] Cooke, R. (1977) Mutualistic symbioses with insects. John Wiley & Sons, London.

[52] Gil, P.Z.N., Bustillo, P.A.E., Gómez, D.D.S. and Marín, M.P. (2004) Corthylus novo sp. (Coleoptera: Scolytidae), plaga del aliso en la cuenca del rio Blanco en Colombia. Revista Colombiana de Entomología, 30, 171-178.

[53] Bonello, R., McNee, W.R., Storer, A.J., Wood, D.L. and Gordon, T.L. (2001) The role of olfactory stimuli in the location of weakened hosts by twiginfesting Pityophthorus sp. Ecological Entomology, 26, 8-15. doi:10.1046/j.1365-2311.2001.00288.x

[54] Tisserat, N., Cranshaw, W., Leatherman, D., Utley, C. and Alexander, K. (2009) Mortality in colorado black walnut caused by the walnut twig beetle and thousand cankers disease. Plant Health Progress. doi:10.1094/PHP-2009-0811-01-RS

[55] Morales-Ramos, J.A., Rojas, M.G. and Harrington, T. (1999) Association between the coffee berry borer, Hypothenemus hampei (Coleoptera: Scolytidae) and Fusarium solani (Moniliales: Tubercula-riaceae). Annals of the Entomological Society of America, 92, 98-100.

[56] Morales-Ramos, J.A., Rojas, M.G., Sittertz-Bhatkar, H. and Salda?a, G., (2000) Symbiotic relationship between Hypothenemus hampei (Coleoptera: Scolytidae) and Fusarium solani (Moniliales: Tubercularia-ceae). Annals of the Entomological Society of America, 93, 541-547. doi:10.1603/0013-8746(2000)093[0541:SRBHHC]2.0.CO;2

[57] Norris, D.M. and Baker, J.K. (1967) Symbiosis effects of a mutualistic fungus upon the growth and reproduction of Xyle-borus ferrugineus. Science, 156, 1120-1122. doi:10.1126/science.156.3778.1120

[58] Norris, D.M. and Chu, H.M. (1971) Maternal Xyleborus ferrugineus transmission of sterol or sterol-dependent metabolites necessary for progeny pupation. Journal of Insect Physiology, 17, 1741-1745. doi:10.1016/0022-1910(71)90071-0

[59] Norris, D.M., Baker, J.K. and Chu, H.M. (1969) Symbiotic interrelationships between microbes and ambrosia beetles. III. Ergosterol as the source of sterol to the insect. Annals of the Entomological Society of America, 62, 413- 414.

[60] Chu, H.M., Norris, D.M. and Kok, L.T. (1970) Pupation requirement of the beetle, Xyleborus ferrugineus: Sterols other than cholesterol. Journal of Insect Physiology, 16, 1379-1387. doi:10.1016/0022-1910(70)90137-X

[61] Kok, L.T. (1979) Lipids of ambrosia fungi and the life of mutualistic beetles. In: Batra, L.R., Ed., Insect-Fungus Symbiosis, Halsted Press, Sus-sex.

[62] Milholland, R.D. (1970) Histology of Botryosphaeria canker of highbush blueberries susceptible and resistant. Phytopathology, 60, 70-74. doi:10.1094/Phyto-60-70

[63] Riva, R. (1996) Tecnología del cultivo de camu camu en la Amazonía Peruana. INIA, Pucallpa-Perú.

[64] Umezurike, G.M. (1969) Cellulolytic activities of Botryodiplodia theobromae pat. Annals of Botany, 33, 451- 462

[65] Rajput, K.S. and Rao, K.S. (2007) Death and decay in the trees of Mango (Mangifera indica L.). Microbiological Research, 162, 229-237. doi:10.1016/j.micres.2004.07.003

[66] Flores, T.V., Crespo, R.G. and Cabezas, G.F. (2010) Plagas y enfermedades en plantaciones de Teca (Tectona grandis L.F) en la zona de Balzar, Provincia del Guayas. Ciencia y Tecnología, 3, 15-22.

[67] Masood, A., Saeed, S., Silveira, S.F., Akem, C.N., Hussain, N. and Farooq, A.M. (2011) Of mango quick decline In Pakistan: survey and pathogenicity of fungi isolated from bark beetle and mango tree. Pakistan Journal of Botany, 43, 1793-1798.

[68] Andersen, B., Kr?ger, E. and Rodney G.R. (2001) Chemical and morphological segregation of Alternaria alternata, A. gaisen and A. longipes. Mycological Research, 105, 291-299. doi:10.1017/S0953756201003446

[69] Armengol, J., Sales, R., Garcia-Jimenez, J. and Alfaro-Lassala, F. (2000) First report of Alternariabrown spot of citrus in Spain. Plant Disease, 84, 1044. doi:10.1094/PDIS.2000.84.9.1044B

[70] Negron, J.F., Wit-cosky, J.J., Cain, R.J., LaBonte, J.R., Duerr, D.A., McElwey, S.J., Lee, J.C. and Seybold,

S.J. (2005) The banded elm bark beetle: A new threat to elms in North America. American Entomologist, 51, 84-94.

[71] Capurro, M. and Reyes, S. (2007) Fungi, insect borers Association present in samples of wood entered into the regional laboratory of the agricultural and livestock service. Bachelor Thesis, Universidad Austral de Chile.

[72] Chan-Cupul, W., Ruiz-Sánchez, E., Cristóbal-Alejo, J., Pérez-Gutiérrez, A., Munguía-Rosales, R. and Lara- Reyna, J. (2010) In vitro development of four Paecilomyces Fumosoroseus isolates and their pathogenicity on immature whitefly. Agrociencia, 44, 587-597.

[73] Gemma, J.N., Hartmann, G.C. and Wasti, S.S. (1984) Interaction between inhibitory Ceratocystis ulmi and several species of entomogenous fungi. Mycologia, 76, 256-260. doi:10.2307/3793101

[74] Moraes, A.M.L. Junqueira, A.C.V., Costa, G.L., Celano, V., Oliveira, P.C. and Coura, J.R. (2000) Fungal flora of the digestive tract of triatomines of 5 species vectors of Trypanosoma cruzi, Chagas 1909. Mycopathologia, 151, 41-48. doi:10.1023/A:1010905420001