




UNIVERSITAS
GADJAH MADA

DETEKSI DAN IDENTIFIKASI FITOPLASMA YANG BERASOSIASI DENGAN PISANG MENGGUNAKAN METODE NESTED-PCR

SAURMA MONA ASTRID S, Prof. Dr. Ir. Siti Subandiyah, M.Agr.Sc., Dr. Tri Joko, S.P. M.P.

Universitas Gadjah Mada, 2018 | Diunduh dari <http://etd.repository.ugm.ac.id/>

- Adhikari S, Chattopadhyay SK, Ghosh PD. 2012. A simplified high yielding genomic DNA extraction protocol for three chemotypically different plant species. *Ind J Biotech.* 11:337–340.
- Agrios, G. N. 2005. *Plant Pathology.* Elsevier Academic Press. USA.
- Alhudaib, K and Rezk, A. A. 2014. Molecular Characterization Of Phytoplasma-Associated Disease In Tomato (*Lycopersicum esculentum L.*) In Saudi Arabia. *International Journal Of Virology* 10 (3) : 10-191.
- Aliaga, F., Hopp, E., Alvarez, E., and L.A. Becerra Lopez-Lavalle, L.A. 2018. First report of a *Candidatus phytoplasma asteris* isolate associated with banana elephantiasis disease in Colombia. *New Disease Reports* 37, 12.
- Al-Saleh, M. A. and Amer, M. A. 2014. Molecular Characterization Of The 16SR II Group Of Phytoplasma Associated With Faba Bean (*Vicia faba L.*) In Saudi Arabia. *The Journal Of Animal & Plant Sciences*, 24(1) : 221-228.
- Astawan, M. 2009. Pisang Buah Kehidupan. <http://www.depkes.go.id/index.php?option=articles&task=viewarticle&artid=232&Itemid=3>. Diakses pada tanggal 25 November 2017.
- Bai, X.D., Zhang, J.H., Ewing, A., Miller, S.A., Radek, A.J., Shevchenko, D.V., Tsukerman, K., Walunas, T., Lapidus, A., Campbell, J.W. and Hogenhout, S.A. 2006. Living with genome instability, the adaptation of phytoplasmas to diverse environment of their insect and plant hosts. *Journal of Bacteriology.* 188:3682-3696.
- Beattie, G.A. 2006. Survei, molecular phylogeny, genomics and recent advances. Di dalam Gnanamanickam SS, editor. *Plant-Associated Bacteria.* Netherlands (NL). Springer. hlm 1-56.
- Bertaccini A. 2007. Phytoplasmas: diversity, taxonomy, and epidemiology. *Front Biosci.* 12(2):673–689. DOI: <https://doi.org/10.2741/2092>.

Bertaccini, A., Duduk, B., Paltrinieri, S. and Contaldo, N. 2014. Phytoplasmas and phytoplasma
 **DETEKSI DAN IDENTIFIKASI FITOPLASMA YANG BERASOSIASI DENGAN PISANG MENGGUNAKAN METODE NESTED-PCR**
SAURMA MONA ASTRID S, Prof. Dr. Ir. Siti Subandiyah, M.Agr.Sc., Dr. Tri Joko, S.P. M.P.
Universitas Gadjah Mada, 2018 | Diunduh dari <http://etd.repository.ugm.ac.id/>
Scientific Research 3: 1763-1768.

Bertacini, A. and Duduk, B. 2009. Phytoplasma and Phytoplasma Diseases : A Review of Recent Research. *Phytopathologia Mediterranea*, 48 : 355-378.

Budiman, L. 2009. Pisang. <<http://www.situshijau.co.id/tanaman/buah/p.htm>>. Diakses pada tanggal 15 Januari 2018.

Budyarto dan Mutaqin, K.H. 2012. TEMUAN PENYAKIT BARU : Sapu pada Kacang Hias (*Arachis pinto*) : Penyakit Baru yang Berasosiasi dengan Fitoplasma. *Jurnal Fitopatologi Indonesia* Vol. 8 (3) : 844-88.

Blomquist, C.L., Barbara, D.J., Davies, D.L., Clark, M.F. and Kirkpatrick, B.C. 2001. An Immunodominant Membrane Protein Gene from the Western X-Disease Phytoplasma Is Distinct from Those of Other Phytoplasmas. *Microbiology*, 147: 571-580.

Bressan, E., Rossi, M.L., Gerald, L.T.S., and Figuera, A. 2014. Extraction of high quality DNA from ethanol preserved tropical plant tissues. *BioMed Central Research*. 7:268.

Brown D, Whitcomb RF, Bradbury JM. 2007. Revised minimal standar for description of new spesies of the class Mollicutes (division Tenericutes). *International Journal of Systematic and Evolutionary Microbiology*. 57:2703-2719.

Constable, F.E., Gibb, K.S. and Symons, R.H. 2003. Seasonal Distribution of Phytoplasma In Australian grapevines. *Plant Pathol*. 52 : 267-276.

Davis, R.I., P. Kokoa, L.M. Jones, J. Mackie, F.E., Constable, B.C., Rodoni, T.G., Gunua, and J.B. Rossel. 2012. A New Wilt Diseases of Banana Plants Associated With Phytoplasmas in Papua New Guinea (PNG). *Australian Plant Dis. Notes*, 7 : 91-97.

Davis, R.I., J. Henderson, L.M. Jones, A.R. McTaggart, C.O'Dwyer, F. Tsatsia, C. Fanai and J.B. Rossel. 2015. First Record of A Wilt Diseases of Banana Plants Associated With Phytoplasmas in Solomon Islands. *Australian Plant Dis. Notes* 10 : 14.

Dellaporta SL, Wood J, Hicks JB. 1983. A plant DNA minipreparation: Version II. *Plant Molecular Biology Reporter*. 1:19-21. DOI: 10.1007/BF02712670



DETEKSI DAN IDENTIFIKASI FITOPLASMA YANG BERASOSIASI DENGAN PISANG MENGGUNAKAN METODE NESTED-PCR

ANITA MURNI ASTRI D. S., Prof. Dr. Ir. Siti Subandiyah, M.Agr.Sc., Dr. Tri Joko, S.P., M.P.

Universitas Gadjah Mada, 2018 | Diunduh dari <http://etd.repository.ugm.ac.id>

Nonculturable Phytoplasmas. *Journal of Microbiological Methods*, 14 : 53-61.

Deng, S. and Hiruki, C. 1991. Application of PCR to the detection of phytoplasmas. *Journal of Microbiological Methods*, 14 : 53-61.

Doi, Y., Teranaka, M., Yora, K., and Asuyama, H. 1967. Mycoplasma, or PLT group-like microorganisms, found in the phloem elements of plant infected with mulberry dwarf, potato witch's broom, aster yellows, or Paulownia witch's broom. *Ann. Phytopath. Soc. Japan* 33: 259-266.

Dickinson, M., Tuffen, M. and Hodgetts, J. 2013. The Phytoplasmas : An Introduction. Di dalam Dickinson M, Hodgetts J, editor. *Phytoplasma Methods and Protocols*. New York (USA): Humana Press. hlm 1-14.

Duduk, B. 2009. Molecular characterization of phytoplasmas detected in Agronomically Relevant Crops in Serbia [Disertasi]. Bologna (IT): Universita di Bologna.

Duduk, B., Paltrinieri, S., Lee, I.M. and Bertaccini, A. 2013. Nested-PCR and RFLP Analysis Based on The 16S rRNA Gene. Di Dalam Dickinson, M., Hodgetts, J., editor. *Phytoplasma Methods and Protocols*. New York (USA) : Humana Press. Hlm 159-172.

Firrao, G., Conci, L., and Locci, R. 2007. Molecular Identification and Diversity of Phytoplasma. Di dalam: Punja ZK, De Boer SH, Sanfacon H, editor. *Biotechnology and Plant Disease Management*. London (UK): Biddles Ltd. hlm 250- 276.

Gundersen, D.E., Lee, I.M., 1996. Ultrasensitive detection of phytoplasmas by nested PCR assays using two universal primer pairs. *Phytopathol Mediterranea*. 35:144-151.

Gibb, K., and Padovan, A. 1994. A DNA Method that Allows Reliable PCR Amplification of MLO DNA from Difficult Plant Host Species. *PCR Method & Appl.* 4 : 56-58.

Hogenhout, S.A., and Music, M.S. 2010. Phytoplasma Genomics, From Sequencing to Comparative and Functional Genomics. Di dalam: Weintraub, P.G., Jones, P., editor. *Phytoplasma: Genomes, Plant Hosts and Vectors*. London (UK): CAB International. hlm 19-36.

Hogenhout, S.A., Oshima, K., Ammar, D., Kakizawa, S., Kingdom, H.N., and Namba, S. 2008. Phytoplasma, Bacteria That Manipulate Plants and Insect. *Molecular Plant Pathology*. 9(4):403-423. DOI: 10.1111/J.1364-3703.2008.00472.x.

Hodgents J, Dickinson M. 2010. Phytoplasma phylogeny and detection based on genes
DETEKSI DAN IDENTIFIKASI FITOPLASMA YANG BERASOSIASI DENGAN PISANG MENGGUNAKAN METODE NESTED-PCR
SAURMA MONA ASTRID S, P167, Dr. Ir. Saiful Bahriyan, M. Ag. Sc., Dr. T. Joko S. P., editor.
Universitas Gadjah Mada, 2018 | Diunduh dari <http://etd.repository.ugm.ac.id/>
Phytoplasmas: Genomes, Plant Hosts and Vectors. Wallingford (UK): CAB International. hlm 108–128.



- Hong, Y., D.L. Davies, R.V. Wezel, B.E. Ellerker, A. Morton and D. Barbara, 2001. Expression of the immunodominant membrane protein of chlorantie-aster yellows phytoplasma in *Nicotiana benthamiana* from a potato virus X-based vector. *Acta Horticulturae* 550, 409–415.
- Irfan Martiansyah S.Si. 2008. Petunjuk Teknis Budidaya Pisang Asal Kultur In Vitro dengan Teknologi Pusat Penelitian Bioteknologi dan Bioindustri (PPBBI). PT Riset Perkebunan Nusantara.
- Jha, U.K. 2011. Analysis of The Nutritional Value Of Banana For Human Health. *Indian Journal of Research* (5) : p. 79-82.
- Jumari dan Pudjoarinto, A. 2000. Keekerabatan Fenetik Kultivar Pisang di Jawa. *Biologi Vol. 2* (9) : 531-542.
- Kirkpatrick, B.C., Smart, C.D., Gardner, S.L., Ahrens, U. Ma'urer, R., Schneider, B., Lorenz, K.H.m Seemuller, E., Harrison, N.A., Namba, S., and Daire, X. 1994. Phylogenetic Relationships of Plant Pathogenetic MLOs Established by 16/23S rDNA Spacer Sequences. *IOM Letter*, 3 : 228-229.
- Kumar, S., Stecher, G. and Tamura, K. 2016. MEGA7 : Molecular Evolutionary Genetics Analysis Version 7.0 for Bigger Data Sets. *Molecular Biology and Evolution* 33 : 1870-1874.
- Lee, I.M., Gundersen-Rindal, D., Davis, R.E., and Bartoszyk, I.M. 1998. Revised Classification Scheme of Phytoplasma Based on RFLP Analysis of 16S rRNA and Ribosomal Protein Gene Sequences. *International Journal of Systematic Bacteriology*, 48 : 1153-1169.
- Lee, I.M., Davis, R.E., Gundersen, D.E., and Rindal. 2000. Fitoplasma, Phytopathogenic Mollicutes. *Annual Review of Microbiology*.54:221-225.
- Lee, I.M., Zhao, Y., and Davis, R.E. 2010. Prospects Of Multiple Gene-based Systems For Differentiation and Classification of Fitoplasma. Di dalam: Weintraub, P.G., Jones, P., editor. *Phytoplasma: Genomes, Plant Hosts and Vectors*. Wallingford (UK): CAB International. hlm 66-78.

- Lou, B., X. Bai, Y. Bai, C. Deng, M.R. Chowdhury, C. Chen, & Y. Song. 2013. **DETEKSI DAN IDENTIFIKASI FITOPLASMA YANG BERASOSIASI DENGAN PISANG MENGGUNAKAN METODE NESTED-PCR**. *SAURMA MONA* 4(1):1-8. Prof. Dr. H. Siti Subandiyah, M. Ag. Sc., Dr. Triandono, Universitas Gadjah Mada, 2018 | Diunduh dari <http://etd.repository.ugm.ac.id/>
- Phytoplasma Associated with Ring Spot-Like Symptoms in China. *Journal of Phytopathology* 162(6):387-395.
- Mahfud, T. Joko, dan Daryono, B.S. 2016. Molecular Characterization of Odontoglossum Ring Spot Virus (ORSV) in Java and Bali, Indonesia. *Asian Journal of Plant Pathology* 10 : 9-14.
- Maixner, M. 2010. Phytoplasma Epidemiological Systems With Multiple Plant Hosts. Di dalam: Weintraub PG, Jones P, editor. *Phytoplasma: Genomes, Plant Hosts and Vectors*. London (UK): CAB International. hlm 213-232.
- Marcone C. 2010. Movement of fitoplasma and the development of disease in plant. Di dalam: Weintraub PG, Jones P, editor. *Phytoplasma: Genomes, Plant Hosts and Vectors*. London (UK): CAB International. hlm 114-131.
- Marcone C. 2014. Molecular biology and pathogenicity of phytoplasma. *Annals of Applied Biology*. 165:199-221.
- Maust, B.E., Espadas, C.F., Talavera, M. Aguilar, J.M., Santamaría and Oropeza, C. 2003. Changes in Carbohydrate Metabolism in Coconut Palms Infected with The Lethal Yellowing Phytoplasma. *Phytopathology* 93, 976–981.
- Mehle N, Nikolic P, Rupar M, Boben J, Ravnikar M, Dermastia M. 2013. Automated DNA extraction for large number of plant samples. Di dalam: Dickinson M, Hodgetts J, editor. *Phytoplasma: Methods and Protocols, Methods in Molecular Biology*. New York (USA): Humana press. hlm 139-146.
- Murray, R.G.E., Brenner, D.J., Colwell, R.R., de Vos P, Goodfellow, M., Grimont P.A.D., Pfenning, N., Stackebrandt, E., Zavarzin, G.A. 1990. Report of the ad Hoccommittee on Approaches To Taxonomy Within The Proteobacteria. *International Journal of Systematic Bacteriology*. 40:213-215.
- Musetti, R. 2010. Biochemical changes in plant infected by phytoplasma. Di dalam: Weintraub PG, Jones P, editor. *Phytoplasmas: Genomes, Plant Hosts and Vectors*. Wallingford (UK): CAB International. hlm 132–146.
- Nejat, N., Sijam, K., Amdullah, S.N.A, Vadamalai, G.M. 2009. Molecular characterization of a phytoplasma associated with cococnut yellow decline (CYD) in Malaysia. *American Journal of Applied Sciences*. 6(7):1331-1340.
- Nishida, H. 2013. Phylogenetic analysis of phytoplasmas based on whole genome comparison. Di dalam Dickinson M, Hodgetts J, editor. *Phytoplasma Methods and Protocols*. New York (USA): Humana Press. hlm 319-328.

Prasetyo, A.E., Mutaqin, K.H., dan Giyanto. 2017. Deteksi dan Identifikasi fitoplasma yang berasosiasi dengan pisang menggunakan metode nested-PCR. *SAURMA MONASTRID'S*, Prof. Dr. Ir. Sri Subandiyah, M.Agr.Sc., Dr. Tri Joko, S.P. M.P. Universitas Gadjah Mada, 2018 | Diunduh dari <http://eud.repository.ugm.ac.id/>
Timur, Jurnal Fitopatologi Indonesia Vol. 13 (3) : 89-97.

- Purnomo, B. 2006. Dasar-Dasar Perlindungan Tanaman : Penggolongan Penyakit dan Patogen Tumbuhan 19.
www.geocities.ws/bpurnomo51/das_files/das2.pdf. Diakses pada tanggal 18 Mei 2018.
- Quaglino, F., Kube, M., Jawhari, M., Abou-Jawdah, Y., Siewert, C., Choueiri, E., Sobh, H., Casati, P., Tedeschi, R., Lova, M.M., Alma, A. and Bianco, P.A. 2015. 'Candidatus Phytoplasma phoenicium' Associated with Almond Witches'-broom Disease : From Draft Genome to Genetic Diversity Among Strain Population. *BMC Microbiology*, 15 : 148.
- Schneider, B., Seemuller, E., Smart, C.D. and Kirkpatrick, B.C. 1995. Phylogenetic Classification of Plant Pathogenic Mycoplasma-like Organisms or Phytoplasmas. In: *Molecular and Diagnostic Procedures in Mycoplasmaology*, pp. 369-380. Ed. S. Razin and J.G.Tully. San Diego, CA: Academic Press.
- Semangun, H. 2007. Penyakit-Penyakit Tanaman Hortikultura di Indonesia. UGM Press. Yogyakarta.
- Singh, H.P., S. Uma, R. Selvarajan and J.L. Karihaloo. 2011. Micropropagation for Production of Quality Banana Planting Material in Asia-Pacific. Asia-Pacific Consortium on Agricultural Biotechnology (APCoAB), New Delhi. p 92.
- Suhartanto, R., Sobir dan Harti, H. 2012. Teknologi Sehat Budidaya Pisang. Pusat Kajian Hortikultura Tropika, LPPM-IPB. Bogor.
- Suyanti dan Supriyadi, A. 2008. Pisang, Budidaya, Pengolahan, dan Prospek Pasar. Penebar Swadaya. Depok. 132 hal.
- Suwandi. 2016. Outlook Komoditas Pisang. Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian. 53 hal.
- Tim Penyusun Jurusan HPT. 2007. Buku Penuntun Praktikum Dasar-Dasar Perlindungan Tanaman. FP UB. Malang.

Tamura, K., Nei, M. and Kumar, S. 2004. Prospects for Inferring Very Large Phylogenies. *Journal of Molecular Evolution*. 59: 21-32.

UNIVERSITAS GADJAH MADA

DETEKSI DAN IDENTIFIKASI FITOPLASMA YANG BERASOSIASI DENGAN PISANG MENGGUNAKAN METODE NESTED-PCR
SAURMA MONA ASTRID S, Prof. Dr. Ir. Siti Subandiyah, M.Agr.Sc., Dr. Tri Joko, S.P. M.P.
Universitas Gadjah Mada, 2018 | Diunduh dari <http://eudl.repository.ugm.ac.id/>

Academy of Science. (USA) 101 : 11030-11035.

Tran-Nguyen, L.T., Kube, M., Schneider, B., Reinhardt, R., Gibb, K.S. 2008. Comparative Genome Analysis of 'Candidatus *Phytoplasma australiense*' (subgroup *tuf*-Australia I; *rp-A*) and 'Ca. *Phytoplasma asteris*' Strains OYM and AY-WB. *Journal Bacteriology*. 190: 3979-3991.

Utomo, C.Y.H. 2018. Deteksi Dan Identifikasi Fitoplasma Pada Tanaman Tebu di Sulawesi Selatan. Tesis. Fakultas Pertanian, Universitas Hasaddin Makasar. 74 hlm.

Warokka, J.S., Jones, P., and Dickson, M.J. 2006. Detection of Phytoplasma Associated with Kalimantan wilt Disease of Coconut by The Polymerase Chain Reaction. *J. Littri*. 12(4):154–160.

Wei W, Davis RE, Lee IM, Zhao Y. 2007. Computer-simulated RFLP analysis of 16S rRNA genes: identification of ten new phytoplasma groups. *Int J Syst Evol Microbiol*. 57:1855–1867. DOI: <https://doi.org/10.1099/ijs.0.65000-0>.

Yuwono, T. 2006. Teori dan Aplikasi Polymerase Chain Reaction (PCR); Panduan Eksperimen PCR untuk Memecahkan Masalah Biologi Terkini. Andi Offset, Yogyakarta. 239 hal.

Zhao, Y., Wei, W., Davis, R.E., Lee, I.M. 2010. Recent Advances in 16SrRNA Genebased Phytoplasma Differentiation, Classification, and Taxonomy. Di dalam Weintraub PG, Jones P, editor. *Phytoplasma: Genomes, Plant Hots and Vectors*. London (UK): CAB International. hlm 65-9