

**LAPORAN KEMAJUAN
PROGRAM BEASISWA SANDWICH
DITJEN PENDIDIKAN TINGGI TAHUN 2009**



**IR. SUSWATI.MP
BP. 04 301 002**

ADVISOR: JOHN G.CARMAN PhD

**PROGRAM PASCASARJANA
UNIVERSITAS ANDALAS
PADANG
2010**

Abstrak

Program Sandwich Unand- Dikti TA 2009, dimulai dari 3 November 2009 - 1 Feb 2010. bertempat di Agriculture Faculty, Utah State University, USA. Advisor John G. Carman .PhD (Professor Plant Genetic). Pendalamam penelitian tentang': **Kajian molekuler gen-gen ketahanan tanaman pisang yang diintroduksi Fungi Mikoriza Arbuskular *Glomus clarum*.**

Kegiatan selama di USU dapat dibagi menjadi 3 bagian yaitu: 1. Kegiatan administrasi: pelaporan ke International Scholarship Officer; registrasi (ID Card, Akses internet kampus); pembayaran sewa apartement dan pengenalan berbagai fasilitas kampus. 2. Kegiatan kampus : Diskusi dengan advisor (pemantapan rencana penelitian), seat in (perkuliahan reguler dan seminar mingguan Agriculture Faculty) dan kegiatan 3. Penelitian di Research Green House, Caisson laboratory dan Biosystem laboratory.

Hasil kegiatan 1: diperoleh ID card atas nama **Suswati Suswati**, No ID Card visiting Scholar A01485855, akses internet gratis di dalam kampus USU dengan memanfaatkan Blue Zone area sedang di apartement menggunakan hotsite dengan kode akses **eh091509**. Kegiatan 2: Rencana penelitian terjadwal serta rincian bahan dan alat yang akan digunakan (pemesanan plantlet pisang kultivar Saba ke Agri-Star, Inc 1728 Kelly Park RD Apopka Florida 32712. Florida; *Glomus clarum* (AU402 B-13) International Culture Collection (INVAM), West Virginia University, Morgantown, WV, USA. Dapat diikuti 7 kali tatap muka perkuliahan reguler dan 6 kali kegiatan seminar mingguan di Agriculture Faculty, USU. Kegiatan 3. Rancangan penelitian yang digunakan Acak Lengkap dengan perlakuan *G. clarum*. Plantlet pisang diintroduksi dengan 10 gram inokulant *G. clarum* yang diaplikasi pada saat aklimatisasi menggunakan media tanam vermiculit: pasir steril 2:1(v/v). Tanaman dipelihara dalam rumah kaca selama 30 hari dengan kondisi : cahaya siang/malam 12/12 jam pada 30/28⁰C intensitas cahaya 300-315 $\mu\text{mol m}^{-2}\text{detik s}^{-1}$ dan RH 74. Parameter pengamatan pertumbuhan tanaman (tinggi dan jumlah daun), kolonisasi akar oleh FMA dan ekspresi 7 gen ketahanan tanaman pisang. Diperoleh hasil tanaman dengan introduksi *G. clarum* pertumbuhannya lebih baik, kolonisasi mencapai 29.41-39.29% dan keenam gen ketahanan jumlahnya meningkat dalam daun dan akar tanaman pisang yang diintroduksi *G. clarum* dibanding kontrol..

Kata kunci: Program Sandwich, Utah State University, Caisson Laboratory, Biosystem laboratory, Ekspresi gen ketahanan, plantlet pisang, *Glomus clarum*

Apartment address: Old Main Hill

**LAPORAN KEMAJUAN
PROGRAM BEASISWA SANDWICH
DITJEN PENDIDIKAN TINGGI TAHUN 2009**

A DATA PRIBADI		
1	Nama	Ir.Suswati.MP
2	Perguruan Tinggi Asal	Universitas Medan Area
3	Belajar di Program Pascasarjana (PPs danPT)	Program Pascasarjana Universitas Andalas Padang
4	Bidang Studi yang Diambil	Ilmu-Ilmu Pertanian
5	Semester	XI

B TEMPAT PROGRAM SANDWICH		
1	Program Studi dan PT tujuan program Sandwich di LN	Department Plant Soil & Climate, Agriculture Faculty, Utah State University (USU).
2	Negara Tempat Program Sandwich	United State of America (USA)
3	Waktu Kegiatan Sandwich	3 Nopember 2009-1 Februari 2010
4	Nama Host Supervisor/Advisor	Prof.Dr. John G.Carman Office : Telp. 435-797-2238 Fax : 435-797-3376

C KEGIATAN SANDWICH		
1	Tujuan Mengikuti Program Sandwich	<ol style="list-style-type: none"> 1. Studi perbandingan terhadap topik penelitian 2. Studi Kepustakaan terhadap topik penelitian S3 3. Pembimbingan dengan Advisor luar negeri 4. Melakukan penelitian tentang: “Kajian molekuler gen-gen ketahanan tanaman pisang yang diintroduksi Fungi Mikoriza Arbuskular <i>Glomus clarum</i>” (data yang akan diperoleh sangat mendukung 4 tahap penelitian disertai yang telah dilakukan di Unand,Padang).
2	Program Kegiatan Sandwich yang dilakukan	Lembar berikut di bawah

D	LAPORAN KEGIATAN SANDWICH MINGGU 1 (4 – 15 November 2009)	
1	Kegiatan yang dilakukan	Hasil yang dicapai
	<p>1. Persiapan keberangkatan</p> <p>2. Pengenalan kampus USU</p> <p>3. Registrasi peserta Sandwich di Graduate International Student Office. Aggies. USU</p> <p>4. Senin, 9 Nop 2009.</p> <ul style="list-style-type: none"> ❖ Pertemuan dengan Advisor dari Department Plant Soil & Climate ❖ Perkenalan dengan Dekan Agriculture Faculty, USU. ❖ Pengenalan berbagai laboratorium milik Agriculture Faculty. <p>5. Selasa, 10 Nop 2009</p> <ul style="list-style-type: none"> ❖ Perkenalan dengan Presiden Director International Scholarship. USU yang dihadiri oleh Direktur PPS Unand, PPS Nusa Cendana, Universitas Sumatera Utara dan para peserta Sandwich dari ketiga universitas tersebut. ❖ Penandatanganan MOU antara USU dengan Unand, Univ Sumatera Utara dan Nusa Cendana. 	<p>Pasport biru, tiket pesawat Padang-Jakarta-Salt Lake City (P/P) dari DIKTI dan Surat Tugas Belajar dari PPS Universitas Andalas Padang.</p> <p>Fasilitas –fasilitas yang dapat digunakan oleh peserta Sandwich: Pustaka, Laboratorium, Bus kampus.</p> <p>USU ID Card, Visiting Scholar A01485855, Suswati suswati</p> <p>Fasilitas laboratorium yang akan digunakan dalam pelaksanaan penelitian yang sudah setuju oleh advisor (sesuai dengan TOR).</p> <p>MOU antara USU dengan PPS Unand, Nusa Cendana Dan Univ. Sumatera Utara.</p>
2	Komentar dan Saran	Pelaksanaan program Sandwich di USU dan fasilitas laboratorium sangat mendukung dalam pelaksanaan dan penyelesaian rencana yang sudah disusun dalam TOR.

D LAPORAN KEGIATAN SANDWICH MINGGU 2 (16-22 November 2009)

I Senin, 16 Nop 2009

Presentasi rencana penelitian dihadapan 2 orang Advisor (Prof.DR.John G.Carman dan Prof. Dr. Jeanette Norton) di Conference Room Biotechnology Building

17 Nop- 22 Nop 2009

Studi terhadap bahan-bahan kepustakaan berasal dari pustaka dan internet/e-journal.

Mempelajari pustaka-pustaka yang berhubungan dengan topik rencana penelitian

Persiapan bahan dan alat yang akan digunakan dalam penelitian

Pemesanan plantlet pisang cv.Saba dari Ag

Rencana penelitian yang disetujui untuk dilaksanakan di Agriculture faculty, USU.

Berhasil diperoleh 500 jurnal dan 10 Thesis dan Disertasi yang relevan dengan topik penelitian .Beberapa diantaranya:

1. Host dependent differential spread of *Glomus intraradices* on various Ri T-DNA transformed roots *in vitro* (Pragati Tiwari and Alok Adholeya, Mycological Progress 2(3): 171–177, August 2003)
2. Regulation of arbuscular mycorrhization by apoplastic invertases: enhanced invertase activity in the leaf apoplast affects the symbiotic interaction (Sara Schaarschmidt , Joachim Kopka , Jutta Ludwig-Müller ³ and Bettina Hause ;Plant Journal, Vol 51,2007. Issue3.p-390-405)
3. A novel gene whose expression in *Medicago truncatula* roots is suppressed in response to colonization by vesicular-arbuscular mycorrhizal (VAM) fungi and to phosphate nutrition (Stephen H. Burleigh and Maria J. Harrison_ *Plant Molecular Biology* 34: 199–208, 1997. *Kluwer Academic Publishers. Printed in Belgium*).
4. Expression Patterns of Defense-Related Genes in Different Types of Arbuscular Mycorrhizal Development in Wild-Type and Mycorrhiza-Defective Mutant Tomato (Ling-Ling Gao, Wolfgang Knogge, Gabriele Delp, F. Andrew Smith, and Sally E.Smith;MPMI Vol. 1;7 No. 10, 2004, pp. 1103–1113. Publication no. M-2004-0813-01R. © 2004 The American Phytopathological Society)
- 5.Overlapping expression patterns and

differential transcript levels of phosphate transporter genes in arbuscular mycorrhizal, Pi-fertilised and phytohormone-treated *Medicago truncatula* roots (Ulf Grunwald · Wenbing Guo · Kerstin Fischer · Stanislav Isayenkov · Jutta Ludwig-Müller · Bettina Hause · Xiaolong Yan · Helge Küster · Philipp Franken ; *Planta* (2009) 229:1023–1034)

6. The *Medicago truncatula* Sucrose Synthase Gene *MtSucS1* Is Activated Both in the Infected Region of Root Nodules and in the Cortex of Roots Colonized by Arbuscular Mycorrhizal Fungi (Natalija Hohnjec, Andreas M. Perlick, Alfred Pühler, and Helge Küster; *MPMI* Vol. 16, No. 10, 2003, pp. 903–915)
7. Arbuscular mycorrhizal symbiosis is accompanied by local and systemic alterations in gene expression and an increase in disease resistance in the shoots (Jinyuan Liu, Ignacio Maldonado-Mendoza, Melina Lopez-Meyer, Foo Cheung, Christopher D. Town and Maria J. Harrison; *The Plant Journal* (2007) 50, 529–544)
8. Arbuscular Mycorrhiza-Specific Signaling in Rice Transcends the Common Symbiosis Signaling Pathway (Caroline Gutjahr, Mari Banba, Vincent Croset, Kyungsook An, Akio Miyao, Gynheung An, Hirohiko Hirochika, Haruko Imaizumi-Anraku, and Uta Paszkowska; *The Plant Cell*, Vol. 20: 2989–3005, November 2008)
9. Arbuscular Mycorrhiza (Vivienne Gianinazzi-Pearson, Ignacio Maldonado-Mendoza, Melina Lopez-Meyer, Stéphanie Weidmann and Maria J. Harrison; *Medicago truncatula* handbook version November 2006)
10. Transcriptome Profiling of *Lotus japonicus* Roots During Arbuscular

Mycorrhiza Development and Comparison with that of Nodulation (Yuichi Deguchi, Mari Banba, Yoshikazu Shimoda, Svetlana A. Chechetka, Ryota Suzuri, Yasuhiro Okusako, Yasuhiro Ooki, Koichi Toyokura, Akihiro Suzuki, Toshiki Uchiumi, Shiro Higashi, Mikiko Abe, Hiroshi Kouchi, Katsura Izui, and Shingo Hata; DNA RESEARCH 14, 117–133, (2007).

11. Molecular and cell biology of arbuscular mycorrhizal symbiosis (Bettina Hause, Thomas Fester; *Planta* (2005) 221: 184–196).
12. Gene Expression Profile Changes in Cotton Root and Hypocotyl Tissues in Response to Infection with *Fusarium oxysporum* f. sp. *Vasinfectorum* (Caitriona Dowd, Iain W. Wilson, and Helen McFadden; *MPMI* Vol. 17, No. 6, 2004, pp. 654–667).
13. Pathogen-associated molecular pattern recognition rather than development of tissue necrosis contributes to bacterial induction of systemic acquired resistance in *Arabidopsis* (Tatiana E. Mishina and Jürgen Zeier, Julius-von-Sachs-Institute of Biological Sciences, University of Würzburg, Julius-von-Sachs-Platz 3, D-97082 Würzburg, Germany; *The Plant Journal* (2007) 50, 500–513).
14. Accumulation of secondary compounds in barley and wheat roots in response to inoculation with an arbuscular mycorrhizal fungus and co-inoculation with rhizosphere bacteria (Thomas Fester, Walter Maier, Dieter Strack; *Mycorrhiza* (1999) 8 :241–246).
15. Arbuscular Mycorrhiza-Specific Signaling in Rice Transcends the Common Symbiosis Signaling Pathway, Caroline Gutjahr, Mari Banba, Vincent Croset, Kyungsook An, Aki Miyao, Gynheung An, Hirohiko Hirochika, Haruko Imaizumi-Anraku, and Uta Paszkowska; *The Plant Cell*,

	<p>Vol. 20: 2989–3005, November 2008).</p> <p>16. Differential Gene Expression in Ripening Banana Fruit, Stephanie K. Clendennen and Gregory D. May; <i>Plant Physiol.</i> 1997, 115: 463-469)</p> <p>17. Induction of systemic resistance in banana (<i>Musa spp.</i>) against Banana bunchy top virus (BBTV) by combining chitin with root-colonizing <i>Pseudomonas fluorescens</i> strain CHA0 (Mathiyazhagan Kavino, Sankarasubramanian Harish, Neelakandan, Duraisamy Saravanakumar, Ramasamy Samiyappan; <i>Eur J Plant Pathol</i> (2008) 120:353–362</p> <p>18. Molecular cloning, characterization and expression of phenylalanine ammonia-lyase gene from <i>Ginkgo biloba</i> (Feng Xu1, Rong Cai, Shuiyuan Cheng, Hewei Du, Yan Wang and Shuhan Cheng; <i>African Journal of Biotechnology</i> Vol. 7 (6), pp. 721-729, 18 March, 2008</p> <p>19. Microarray gene expression profiling of developmental transitions in Sitka spruce (<i>Picea sitchensis</i>) apical shoots (Michael Friedmann, Steven G. Ralph, Dana Aeschliman, Jun Zhuang, Kermit Ritland, Brian E. Ellis, Joerg Bohlmann, and Carl J. Douglas; <i>Journal of Experimental Botany</i>, Vol. 58, No. 3, pp. 593–614, 2007</p> <p>20. Induction of systemic resistance in banana (<i>Musa spp.</i>) against Banana bunchy top virus (BBTV) by combining chitin with root-colonizing <i>Pseudomonas fluorescens</i> strain CHA0 (Mathiyazhagan Kavino & Sankarasubramanian Harish & Neelakandan Kumar & Duraisamy Saravanakumar & Ramasamy Samiyappan ; <i>Eur J Plant Pathol</i> (2008) 120:353–362).</p>
<p>19 Nov 2009 Mengikuti training Laboratory Safety Initial di ECOB #127 Building</p>	<p>Penguasaan kemampuan penyelamatan kerja di Laboratorium</p> <p>Sertifikat laboratory Safety Initial dari USU</p>

Mengikuti kegiatan perkuliahan Propagation dan seminar mingguan di Agriculture Faculty.USU dengan mahasiswa S1.	Berhasil diikuti sebanyak 7 kali tatap muka hingga akhir semester. Berhasil diikuti 6 kali pertemuan seminar
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D LAPORAN KEGIATAN SANDWICH MINGGU 3 (23 Nop-29 Nop 2009)

Kegiatan yang dilakukan	Hasil yang dicapai
<p>Persiapan bahan dan alat penelitian: EKSPRESI BERBAGAI GEN KETAHANAN TANAMAN PISANG (<i>Musa sp.</i>) SETELAH DIINDUKSI OLEH FUNGI MIKORIZA ARBUSKULAR</p> <ul style="list-style-type: none"> ❖ Pemesanan plantlet pisang kultivar Saba sebanyak 24 ke Agri-Star, Inc 1728 Kelly Park RD Apopka Florida 32712. ❖ Pemesanan mikoriza <i>Glomus .clarum</i> (AU402 B-13) sebanyak 200 cc ke International Culture Collection (INVAM), West Virginia University, Morgantown, WV, USA. <p>Mengidentifikasi PCR primer 6 gen pertahanan tanaman pisang dan 18S rRNA menurut Altschul <i>et al.</i>, 1997 dari http://www.ncbi.nlm.nih.gov/BLAST.</p>	<p>24 plantlet pisang kultivar Saba</p> <p>200 cc inokulant <i>G.clarum</i></p> <p>Diperoleh PCR primer 7 gen ketahanan tanaman pisang:</p> <ol style="list-style-type: none"> 1. Catalase gen 2. Pectin 3. Pathogenesis-related protein 4. EndoChitinase1 5. Ubiquitin 6. 26S rRNA 7. 18S rRNA (house keeping gen) <p>Hasil sequencing dapat dilihat pada halaman berikut.</p>

D LAPORAN KEGIATAN SANDWICH MINGGU 4 (30 Nop- 5 des 2009)

Kegiatan yang dilakukan	Hasil yang dicapai
<p>Merancang 7 gen primer pertahanan tanaman pisang menggunakan alat design Primer3 Primer (Rozen & Skaletsky, 2000, http://frodo.wi.mit.edu/cgi-bin/primer3/primer3.cgi).</p>	<p>Diperoleh 7 gen primer pertahanan tanaman pisang (hasil pada halaman berikut).</p>

II. METODE PENELITIAN

2.1. Materials and methods

Experimental setup, growth conditions and sampling

Micropropagated banana cv. 'Saba' are supplied by Agristart INC *in vitro* from, Florida USA. Plantlets measuring approximately 8 ± 1 cm height with 3 fully developed leaves are received in nutrient agar (Murashige and Skoog, 1962). Every one *in vitro* plantlet is inoculated with 10 gram *Glomus clarum* (AU402B-13, INVAM) and then transplant into 300 gram polyethylene pot containing equal volumes of an autoclaved mixture of enriched commercial vermiculate and sand (2:1,v/v). The plants treatment are hand-water with distilled water until water drain freely from the base of the pots. A fertilizer with Wuxal R Super AA 8-8-6 (Argos Schering, AgrEvo, S. A., Valencia, Spain) was applied every 2 weeks. The control plants (untreat mycorrhizae) are then hand-water. All the plantlets allow to grow and stabilise for approximately 45 days under standardised light/dark regime of 12/12 h at 30/28⁰C respectively with a light intensity of around 300-315 $\mu\text{mol m}^{-2}\text{s}^{-1}$ and a relative humidity of 74%. The plantlet with 7 replicate, 3 replicate for DNA and RNA extraction and 4 replicate for root colonize analysis (figure 1). In the end (45 days old) all the samples are moved from media planted and wash with tap water.

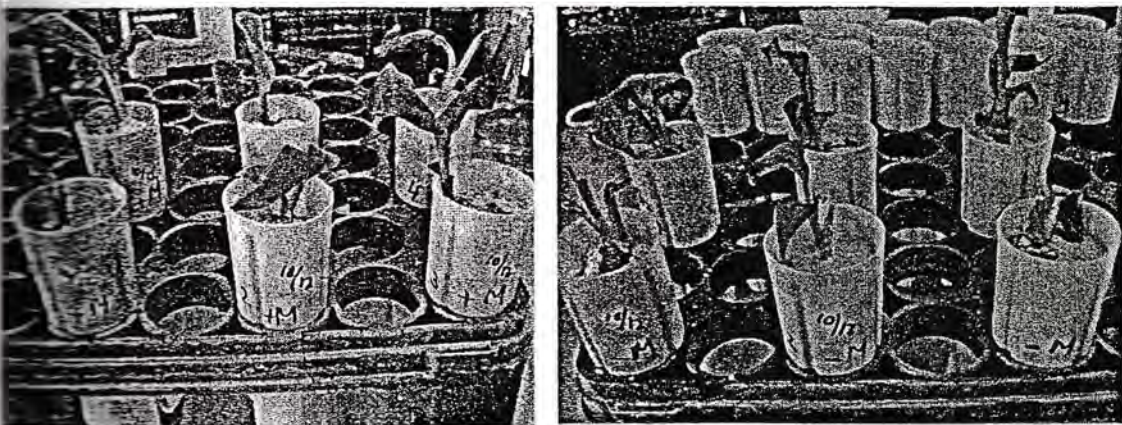


Figure 1. The banana plantlets cv.Saba inoculated and uninoculated AMF and placed in Research green house for 45 days.

For analysis DNA and RNA the both root and leaf samples consist of 10- 13 cm wide strip (± 3 gr fresh weight) remove from one side the middle of the second, fully expand leaf down the top of the plant. Sampels are snap frozen in liquid nitrogen and store at -80°C until analysis.

The root colonization

Roots and their rhizosphere soil are collected making sure that the roots are connected to sampled plants and cleaning the trowels between samples. Clearing and staining root according to Joseph Sheppard from Sylvia (1994). Intact root of each plant was heated in 1.8 M KOH in water bath for 30 min. Rinse 3 times in water and place in beaker with 3% NaOCl acidified with several drops of 5 M HCl. As oon as roots becomes white or transparans immedietly rinse with water (5 times). Cover samples with tap water and add 5 ml HCl for each 200 ml water, stir and drain. Repeats ones. Place samples in 80°C aniline blue stain (800 glycerin, 800 ml lactic acids, 800 ml distilled water and 1.2 gr aniline blue). Keep samples in 80°C stain for 30 min, cool and drain stain into flask for reuse. Rinse samples with water and store samples in ziploc bag in refrigerator untill analysis. The measure root colonization using the Grid-line metode.

Identify PCR primer.

Primers for qPCR was designed to ampify 150-300 bp from each of 6 genes defense and an 18S rRNA control gene (house keeping gene). BLAST search to identify short , exact sequences (Altschul *et al.*, 1997 from <http://www.ncbi.nlm.nih.gov/BLAST>. It was used Primer3 Primer design tool (Rozen & Skaletsky, 2000 , <http://frodo.wi.mit.edu/cgi-bin/primer3/primer3.cgi>).

Mass genomic DNA Extraction

Genomic DNA (gDNA) is isolated from young leaves and root which has been kept in the dark for 48 h to deplete starch and polysaccharide levels using modified CTAB method essentially as according to Michiels et al (2003). Contaminating RNA is removed by addition of 2.5 μ l of a 10 μ l/ml stock solution of Rnase and incubation at 37°C for 30 min. To check the quality and quantity of DNA, 1 μ l samples of isolated DNA are run on a 1% agarose gel in TAE buffer (0.04 M Tris-acetate; 1mM EDTA, pH 7.5) as outlined by Sambrook et al (1989). After staining of the gel with ethidium bromide for 15 min, DNA concentrations are visually estimated by comparison to different amounts of λ -DNA run at the same time. gDNA quality is determined spectrophotometrically using the AU absorbance ratios at 260/280 nm. Samples with a 260/280 ratio of 1.9 – 2.0 is considered as 'pure'.

Mass RNA Extraction

RNA was isolated from 100 mg of liquid nitrogen ground samples of roots of plants by using TRIzol reagent (Invitrogen) according to the manufacturer's instructions. Freeze into liquid nitrogen and keep at -70°C for several minutes. Thaw it and centrifugation at 10,000 rpm for 10 min, 4°C. Take upper supernatant to a new eppendorf tube, add 250 μ l of chloroform, mix well by inverting tube several times. Incubate it at room temperature for 15 minutes. Centrifuge at 10,000 rpm for 10 min at 4°C. Take upper supernatant add 0.6 vol of isopropanol. Incubate at -20°C for 30 min, centrifuge at 10,000 rpm for 15 min, wash by 70% alcohol (0.1% DEPC water). Centrifuge at 5,000 rpm for 5 min, dry for 5 min and dissolve into 87.5 μ l of 0.1% DEPC water.

RNA Purification

100 μ l of RNA add with 350 μ l of buffer RLT, mix thoroughly and add 250 μ l of 80% ethanol, mix thoroughly by pipeting. Apply 700 μ l of the sample into a column in a 2-ml collection tube. Centrifuge at 12,000 rpm for 30 sec, discard the flow. Transfer the spin column into a new collection tube, add 500 μ l buffer RPE into spin column, centrifuge at 12,000 rpm for 30 sec. Add 500 μ l of 80% ethanol (DEPC treated) to column, centrifuge for 2 min at 12,000 rpm, discard the flow. Transfer the spin column

into a new collection tube, centrifugate at 12.000 rpm for 5 min. Elute into 15-20 μ l of elution buffer (Rnase-free water), centrifugate at 12.000 rpm for 1 min . RNA was measured with NanoDrop (ND-1000. V3.5.2).

SuperScript III First strand synthesis for RT-PCR

Total RNA 1 μ g, 50 μ M Oligo dT (20) 1 μ l, 10 mM dNTPs Mix 1 μ l, DEPC water 7 μ l, incubated at 65⁰C for 5 to 10 min, then placed on ice for at least 10 min. Prepare the following cDNA synthesis mix to each component in the indicated order (10x RT buffer 2 μ l; 25 mM MgCl₂ 4 μ l; 0.1 mM dithiothreitol (DTT) 2 μ l, Rnase out (40 U/ μ l) 1 μ l and SuperScript III RT (200 U/ μ l) 1 μ l). Add 10 μ l of cDNA synthesis mix to each RNA/Primer mixture, mix gently and collect by brief centrifugation , incubated at 50⁰C for 50 min. Add 1 μ l of Rnase H to each tube and incubated for 20 min- 30 min at 37⁰C. cDNA synthesis reation can be stored at -20⁰C or used for PCR immedietly.

cDNA Synthesis

The RNA plus primer (oligo dT (20) plus dNTPs was placed in 65⁰C for 5 min for denaturation, and placed on ice for at least 5 min. Add 10 μ l of cDNA synthesis and heat time for 50⁰C for 5 min, 85⁰C for 5 min and chill on ice. Add 1 μ l of RNase at 37⁰C for 20 min and keep at -20⁰C.

Semi-Quantitative PCR

Semi-quantitative RT-PCR is perform on first strand cDNA prepare from the same 'Saba' 45 days old, control and banana plant inoculated *G.clarum*. One μ g of total RNA from pool root sample derive from 3 individual plants per treatment is used for reverse transcription using SuperScript III Reverse Transcriptase using conditions recommended by manufacturer (Invitrogen). The cDNA synthesis reaction is carried out using oligo-dT(20) primers (50 μ g ml⁻¹). PCR amplification of the first strand cDNA is carried out using gene specific primers for a number of transcripts showing > 2-fold difference in expression.

PCR reaction are carried out using 25 μ l per reaction consisting of 5 μ l of cDNA sample, 0.5 μ M of 5'- and 3'-primer, 12.5 μ l of master mix and 6.5 μ l DEPC water

The reaction conditions are 94⁰ C (2 min) for one cycle, and then 94⁰ C (30 s) and 55⁰ C (30 s) and 72⁰ C (30 s), for 24 – 32 cycles, before a final extension of 72 C for 10 minutes. Transcript levels of each gene are normalized to house keeping gene (18S rRNA), and the expression of each gene expressed relative to the expression in control plants.

2.2. Analysis Data.

Relative quantification was calculated using the comparative C_T method. Values were normalized to the expression of the reference housekeeping gene.

2K9USK07 Musa cv. Manoranjitham cDNA library Musa acuminata
AAA Group cDNA clone SU25 similar to catalase 2, mRNA
sequence

IDENTIFIERS

FAST Id: 64493833
Accession name: 2K9USK07
Bank Acc: G0248770
Bank gi: 224475487

CLONE INFO

Clone Id: SU25
Clone type: cDNA

VECTORS

Cloning: T7
Poly Tail: Unknown

SEQUENCE

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AGCGTGGTTCGGCCGAGGTACAAATGTAGACAAGGCTGACACAACCCTATCCCATCTGA  
TATCATGACAGACTGATATCATGACAATATATCCACTCTTTATATATTGTCATTACTAGC  
TAAGAAGCTGTCACTGGCCACATCGGCAGTCAACACAGGCGCAGGAAGGACCACACTTGC  
AGTCTCCCTCCGTCTCGGCAGCTGCTGGGGCATCGACTACACCATCCAAGTAGCTCTTCT  
CGGTCTCAACAGTCTCGATAGCGTAGCTGTTCCCTTCTTCACGCACTGGCTCTTGTGAG  
CGTACCTGCCCCGGCAGGTACGACTCCATTGCCCGGAAACTACCCGGAGTGGAAAGCTC  
TTCGTTCAAGTTCATGGATCCGGATACCGAGGATCGCTACGACTTCGGCCCGCTCGATGAC  
ACCAAGACATGGCCCCGAAGACCTTCTGCCGCTGCAGCCGGTGGGAAGGCTGGTCTTGAAC  
CGCAACATCGACAACCTTCTTCTCGGAGAACGAGCAGCTAGCGTTCGGCCCCGGTCTGGTG  
GTGCCCGGCATCTACTACTCCGACGACAAGATGCTTCAGTGCAGGGTGTTCACCTATGGC  
GACACGCAACGGTACCTCGGCCGCGACCACGCT
```

Created: Mar 3 2009
Updated: Mar 3 2009

ASSIGNED ID Assigned by submitter
catalase 2

SUBJECT

Accession name: Musa cv. Manoranjitham cDNA library
Accession name: Musa acuminata AAA Group
Accession name: Manoranjitham
Accession name: Unisexual
Accession name: leaf
Accession name: stage: 3 months old tissue cultured plants
Accession name: pGEMT Easy
Accession name: SSH library was made using 3 months old banana cv.
Accession name: Manoranjitham (AAA) leaf as tester and cv. Robusta (AAA)
Accession name: leaf as driver to identify sigatoka resistance genes.

Accession name: Uma, S.
Accession name: Biotechnology
Accession name: National Research Centre for Banana, Trichy

Address: Division of Crop Improvement, Thogamalai Road, Thayanur p
, Trichy- 620 102
Tel: 0431-2618104, 2618106
Fax: 91-431-2618115
E-mail: umabinit@yahoo.co.in

CITATIONS

Title: Use of suppression subtractive hybridization approach to
identify differentially expressed genes responsible for
sigatoka resistance
Authors: Uma,S., Sudhakar,B., Kasin Yadunandam,A., Saravanakumar,A
Year: 2009
Status: Unpublished

MAP DATA

Division of Crop Improvement, Thogamalai Road, Thayanur post
, Trichy- 620 102
0431-2618104, 2618106
91-431-2618115
umabinit@yahoo.co.in

Use of suppression subtractive hybridization approach to
identify differentially expressed genes responsible for
sigatoka resistance
Uma,S., Sudhakar,B., Kasin Yadunandam,A., Saravanakumar,A.S.
2009
Unpublished

Musa acuminata clone 1-158 pectin acetyltransferase precursor,
mRNA, partial cds

5-

DQ531615 674 bp mRNA linear PLN 26-JUN-

Musa acuminata clone 1-158 pectin acetyltransferase precursor, mRNA,
partial cds.

DQ531615
DQ531615.1 GI:109390461

Musa acuminata
Musa acuminata
Eukaryota; Viridiplantae; Streptophyta; Embryophyta;
Spermatophyta;

Spermatophyta; Magnoliophyta; Liliopsida; Zingiberales; Musaceae;
Musa; *Eumusa*.

1 (bases 1 to 674)
van den Berg, N., Berger, D.K., Hein, I., Birch, P.J., Wingfield, M.J.
and Viljoen, A.

Tolerance in banana to *Fusarium* wilt is associated with
up-regulation of four defense-related genes in the roots within

hours of infection
Unpublished

1 (bases 1 to 674)
van den Berg, N., Berger, D.K., Hein, I., Birch, P.J., Wingfield, M.J.
and Viljoen, A.

Direct Submission
Submitted (05-MAY-2006) Microbiology and Plant Pathology,

and Agricultural Biotechnology Institute (FABI), 74 Lunnnonstreet,
University of Pretoria, Pretoria, Gauteng 0002, South Africa

Location/Qualifiers
1..674
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/db_xref="taxon:4641"
/clone="1-158"
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/protein_id="ABG33770.1"
/db_xref="GI:109390462"

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...GWWNLEGGGWCNDIKSCVYRKRSHHGSSYFMEKQLQFTGILSDKP
...KIRYCDGASFLGEGYNKAAGLYFRGQRIWLAAMEELMSNGMHYANQ
...GLATIQCDEFRALFPRNTKVKCLADAGMFLDVVDVAGGHTMRSFFGGV
VSLQGA"

**Musa acuminata pathogenesis-related protein 1 (PR1) mRNA,
partial cds**

EF055881 486 bp mRNA linear PLN 01-NOV-

DEFINITION Musa acuminata pathogenesis-related protein 1 (PR1) mRNA, partial cds.

ACCESSION EF055881

VERSION EF055881.2 GI:158983038

KEYWORDS .

SOURCE Musa acuminata

ORGANISM Musa acuminata
Eukaryota; Viridiplantae; Streptophyta; Embryophyta;
Tracheophyta;
Spermatophyta; Magnoliophyta; Liliopsida; Zingiberales; Musaceae;
Musa; Eumusa.

REFERENCE 1 (bases 1 to 486)

AUTHORS Zhu,S. and Tang,W.

TITLE PR1 of banana

JOURNAL Unpublished

REFERENCE 2 (bases 1 to 486)

AUTHORS Zhu,S. and Tang,W.

TITLE Direct Submission

JOURNAL Submitted (10-OCT-2006) College of Horticulture, South China Agricultural University, Wushan, Tianhe District, Guangzhou, Guangdong 510642, China

REFERENCE 3 (bases 1 to 486)

AUTHORS Zhu,S. and Tang,W.

TITLE Direct Submission

JOURNAL Submitted (01-NOV-2007) College of Horticulture, South China Agricultural University, Wushan, Tianhe District, Guangzhou, Guangdong 510642, China

REMARK Sequence update by submitter

COMMENT On Nov 1, 2007 this sequence version replaced gi:[117574137](#).

FEATURES

Location/Qualifiers

source 1..486
/organism="Musa acuminata"
/mol_type="mRNA"
/db_xref="taxon:4641"

gene 1..>486
/gene="PR1"

cds 1..>486
/gene="PR1"
/codon_start=1
/product="pathogenesis-related protein 1"
/protein_id="ABK41053.2"
/db_xref="GI:158983039"

translation="MRSSNSALAMLSAVALAMACTGILAQNSPQDFVSPHNAARA AVG
GSDSTVAARYAQNYANQRAADCQLVHSGGPYGENIFWGSGRDYTAADAVNAWVSE

ORIGIN

1 tggaaatgcga ccgagttgga ggctgcctac tatggggctg ggggcggcag tccccctc
61 cttgtggggtc tgaccctcat ccaatctgcg gcagctaagg gtgctgtatg tttggatg
121 agcttaccg gttaccactt gcacgtggc tatggatctg aagcgaatag ttgggtg
181 aatttagagg gaggaggctg gtgcaatgac atcaaatcat gtgtttaccg aaagaga
241 caccatgggtt catcctactt catggagaag cagttacaat ttactggaat actcagt
301 aaacctgatg aaaatcctga tttctataac tggaacagag tcaagattcg ttattgt
361 ggtgcatcat ttctaggtga aggatataac aaggctgcag gcctttattt tcgaggg
421 cgtatttggt tggctgctat ggaagaactg atgtcaaagc gaatgcatta tgccaac
481 gctctccttt ctggatgttc tgctggtggt ctggcgacca tacaacactg tgatgat
541 cgagcattat ttccaagaaa cacaaaagtc aagtgccttg ctgatgctgg catgttt
601 gatgttggtg atgtagctgg tggtcacacc atgagatcct tcttcggagg thtagtaa
661 ttgcagggtg cctg

//

1	tggnatggga	ccgagittgga	ggatgcttac	lalggygctg	ggggcggcag	tcctccctctg
61	cttgtgggtr	tgacchrcat	ccaatctgcg	gcagctaagg	gtgctgtatg	tttggatggg
121	agcttccong	gttaccactc	gcctcgtggc	latggatctg	aagcgaatag	ctgggtctgtc
181	gatttagagg	gaggaggctg	gtgcaatgac	atccaatcat	gtglttaccg	aaagagaagt
241	gacctggctt	catcctactc	catgggagag	aglttacaat	ttactggaat	actcagtgac
301	aaactcgttg	aaactcctga	ttctctatac	tggaacagag	tcaagattcg	ttattgtgat
361	gtgcatctc	ttctaggtga	agcatataac	aaggctgcag	gcctttattt	tcgagggcag
421	gttattctgt	ttgctgctac	ggagagaactg	atgtcaaatg	gaatgcatta	tgccaaccag
481	ctcttccctt	ctggctgttc	tgctgggtgg	ctggcgacca	tacaacactg	tgatgaattt
541	cgagcattat	ctctnagaaa	cacaaaagtc	atgtgcttg	ctgatgctgg	catgtttctt
601	gatgtgtgtg	atgtagctgg	tggtcacacc	atgagatcct	tcttcggagg	tgtagtaagc
661	ttgcagggtg	ctctg				

Musa acuminata endochitinase (EndoChit1) mRNA, partial cds

AF416677 862 bp mRNA linear PLN 20-SEP-

DEFINITION Musa acuminata endochitinase (EndoChit1) mRNA, partial cds.

ACCESSION AF416677

VERSION AF416677.1 GI:15705987

ORGANISM Musa acuminata AAA Group

TAXONOMY Musa acuminata AAA Group
 Eukaryota; Viridiplantae; Streptophyta; Embryophyta;
 Angiosperms; Eumusa; Eukaryota; Viridiplantae; Streptophyta; Embryophyta;
 Eumusa; Musa; Musa acuminata AAA Group; Musa; Eumusa.

REFERENCE 1 (bases 1 to 862)

AUTHORS Mbeguie-A-Mbeguie, D., Chillet, M., Hubert, O., Galas, C., Gomez, R. -
 and Fils-Lycaon, B.

TITLE Molecular cloning and nucleotide sequence of a cDNA encoding for
 endochitinase homologs from banana

JOURNAL Unpublished

REFERENCE 2 (bases 1 to 862)

AUTHORS Mbeguie-A-Mbeguie, D., Chillet, M., Hubert, O., Galas, C., Gomez, R. -
 and Fils-Lycaon, B.

TITLE Direct Submission

JOURNAL Submitted (04-SEP-2001) CIRAD-FLHOR, Station Neufchateau - Siante
 Marie, Capesterre-Belle-Eau 97130, France

FEATURES

source Location/Qualifiers
 1..862
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 /cultivar="Grande Naine"
 /db_xref="taxon:214697"
 /clone="Pu Cav Y3"
 /tissue_type="pulp"
 /dev_stage="ripe"
 <1..862
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 <1..690
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 /inference="non-experimental evidence, no additional
 details recorded"
 /note="beta-1,4-N-acetyl-D-glucosamine hydrolase"
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 /protein_id="AAL05885.1"
 /db_xref="GI:15705988"

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 GTRRNDACPGKGFYTYNAFIAAANSFSGFGTTGDDATKKREIA

ORF 1..690
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KQYYDYSNTCAPNKVCGHYTQVVWRSSTAIGCGRVRCNSGAIFIICNYKPPGNYVGQ

RP"

ORIGIN

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1 atgaggtcct caaactcagc tttgggtatg ctctccgccg tggctcttgc catggcatgc
61 accggtatcc tagccagaa ctogcccag gacttcgtga gccccacaa cgccgccgc
121 gccgccgtcg gcgtgggccc cgtgtcgtgg gacaacaccg tcgcggcgta cgccagAAC
181 tacgccaacc agcggggcgc cgactgccag ctcgtgcact ccggtgggcc gtacggcgag
241 aacatcttct ggggctccgg ccgcgactac acggcggcag acgcctcaa cgctgggtc
301 tccgagaagc agtactacga ctacaacagc aacacgtgcg cccctaaca ggtgtgccc
361 cactacaagc aggtgggtgtg gcgttcgtcc acggccatcg gctgcggcgc tgtgcgtgc
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481 cgcct
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RP"

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3 gccgctgctg gcttgggccc cgtgtcgtgg gacaaaccg ccggggggtg tgcaccagaac
4 caccgcaacc agcggggcgg cgactgccag ctctctcact ccggtgggcc gtaaggcgag
5 aacatcttct ggggctccgg ccgcgactac acgggggcag accgggttaa tgcctggggtc
6 tccgagaagc agtactacga ctacaacagc aacacgtgcg ccctcaacaa ggcgtgcggc
7 cactacacgc aggtgggtgt gegtctgtcc acggccatcg gctcgggctg tgtgcgctgc
8 aacagcggcg ccatcttcat catctgcaac tacaaacctc cgggcaacta tgtggggcag
9 cgccct

Musa acuminata ubiquitin-conjugating enzyme mRNA, partial cds

AY651067 297 bp mRNA linear PLN 16-OCT-

Musa acuminata ubiquitin-conjugating enzyme mRNA, partial cds.

AY651067

AY651067.1 GI:49616938

Musa acuminata

Musa acuminata

Eukaryota; Viridiplantae; Streptophyta; Embryophyta;

Spermatophyta; Magnoliophyta; Liliopsida; Zingiberales; Musaceae; Musa; Eumusa.

1 (bases 1 to 297)

Sasari, R., Trivedi, P.K. and Nath, P.

Ethylene-induced ripening in banana evokes expression of defense and stress related genes in fruit tissue

Postharvest Biol. Technol. 46 (2), 136-143 (2007)

1 (bases 1 to 297)

Sasari, R., Trivedi, P.K. and Nath, P.

Direct Submission

Submitted (14-JUN-2004) Plant Gene Expression Lab, National Botanical Research Institute, Rana Pratap Marg, Lucknow, UP

Data

Location/Qualifiers

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/organism="Musa acuminata"

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/db_xref="taxon:4641"

/tissue_type="ripening fruit"

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/codon_start=2

/product="ubiquitin-conjugating enzyme"

/protein_id="AAT67249.1"

/db_xref="GI:49616939"

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FAGYMGSL"

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3  gaattcctaat tcatttgctg gatatatggg tagcttgtaa ataaaaaaaa atgaagtttg
4  gtttgaagat aaattgtggt ggatctacat gtagagaaa gctcgtctgc tcattgatta
5  ctacagtaaa atgtcgattc ttgttcacag tctgtgtcaa tatgattttc tactggt
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IQISFNINYGPAGRAIGSDLLMNPDLVATDATISFKTALWFWMTPOSPKPSCHDVITG

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misc feature 25..93
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/note="putative chitin recognition site; binding site"
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121 agggagatcg cggctttctt ggcgacagcg tctcacgaga cgacaggtgg gtgggacgacg
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241 gactactgcg tcgccagctc gcagtggccg tgcgctgcag gcaagaagta ctacggccga
301 ggccccatcc aaatctcatt caactacaac tacgggcccg ccgggagagc catcggtcc
361 gacctgctca acaaccaga cctggtggcc accgacgcga ccatctcgtt caagacggct
421 ctgtggttct ggatgactcc tcagtcgccc aagccgctct gccacgacgt gataaccggg
481 aggtggacgc catccaacgc cgaccgggcg gccggaaggc ttccgggcta cgggtgcacc
541 accaacatca tcaatggagg gttggagtgc gggaaagggt ccgatgccag ggtggcggat
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661 gactgctaca accagagtcc ctttacttag tccgatacta ctgtgacgaa tccatgtaat
721 aacgcaataa acgctactgc tgagatagcg actccgtgag ttgattgtag aagttgcgga
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841 aaaaaaaaaa aaaaaaaaaa aa
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//

Musa acuminata clone Radka1 26S ribosomal RNA, partial sequence

AF399949 685 bp DNA linear BLN 99-OCT-

DESCRIPTION *Musa acuminata* clone Radka1 26S ribosomal RNA partial sequence.
 ACCESSION AF399949
 VERSION AF399949.1 GI:15529486

KEYWORDS .
 SOURCE *Musa acuminata*
 ORGANISM *Musa acuminata*
 Eukaryota; Viridiplantae; Streptophyta; Embryophyta;
 Tracheophyta;
 Spermatophyta; Magnoliophyta; Liliopsida; Zingiberales; Musaceae;
 Musa; Eumusa.

REFERENCE 1 (bases 1 to 685)
 AUTHORS Valarik, M., Simkova, H., Hribova, E., Safar, J., Dolezelova, M. and Dolezel, J.

TITLE Isolation, characterization and chromosome localization of repetitive DNA sequences in bananas (*Musa* spp.)
 JOURNAL Chromosome Res. 10 (2), 89-100 (2002)
 PUBMED 11993938

REFERENCE 2 (bases 1 to 685)
 AUTHORS Valarik, M., Simkova, H., Hribova, E., Safar, J., Dolezelova, M. and Dolezel, J.

TITLE Direct Submission
 JOURNAL Submitted (16-JUL-2001) Laboratory of Molecular Cytogenetics and Cytometry, Institute of Experimental Botany, Sokolovska 6,

Country 772 00, Czech Republic

FEATURES
 source Location/Qualifiers
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 /mol_type="genomic DNA"
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 /db_xref="taxon:4641"
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 rRNA <1..>685
 /product="26S ribosomal RNA"

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121  gtcaaagtga agaaattcaa ccaagcgccg gtaaaccggc ggagtcacta tgactctctt
181  aaggtagcca aatgcctcgt catctaatta gtgacgcgca tgaagtggga ttaacgagat
241  tccactgtc cctgtctact atccagcgaa accacagacc aaaggaacg ggctttggca
301  gaatcagcgg gggaaagaag accctgttga gcttgactct agtccgactt tgtgaaatga
361  cttgagaggt gtaggataag tgggagccgg ttcgcccggc gaagtgaaat accactactt
421  ttaacgttat ttacttatt ccgtgagtcg gaggcggggc cggcccctc cttttggacc
481  caaggcccg ctagcggggc gatccggggc gaagacattg tcaggtgggg agtttggctg
541  gggcggcaca tctgttaaaa gataacgcag gtgtcctaag atgagctcaa cgagaacaga
601  aatctcgtgt ggaacaaaag ggtaaaagct cgtttgattc tgatttccag tacgaatagc
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Musa acuminata 18S small subunit ribosomal RNA gene, complete sequence

Features

Sequence

LOCUS AF069226 1742 bp DNA linear PLN 26-JUL-1998

DEFINITION Musa acuminata 18S small subunit ribosomal RNA gene, complete sequence.

ACCESSION AF069226

VERSION AF069226.1 GI:3342039

KEYWORDS .

SOURCE Musa acuminata

ORGANISM Musa acuminata
Eukaryota; Viridiplantae; Streptophyta; Embryophyta;
Tracheophyta;

Spermatophyta; Magnoliophyta; Liliopsida; Zingiberales; Musaceae; Musa; Eumusa.

REFERENCE 1 (bases 1 to 1742)

AUTHORS Hershkovitz, M., Hahn, W.J. and Zimmer, E.A.

TITLE Ribosomal DNA sequences and plant systematics

JOURNAL Unpublished

REFERENCE 2 (bases 1 to 1742)

AUTHORS Hahn, W.J.

TITLE Direct Submission

JOURNAL Submitted (01-JUN-1998) CERC, Columbia University, 1200 Amsterdam Ave., New York, NY 10027, USA

FEATURES Location/Qualifiers

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/db_xref="taxon:4641"
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/product="18S small subunit ribosomal RNA"

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121 aaccgtagta attctagagc taatacgtgc aacaaacccc gacttccgga agggatgcat
181 ttattagata aaaggctgac gcgggctttg ctcgctgctc cgatgattca tgataactcg
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421 acccaatcct gacacgggga ggtagtgaca ataaataaca ataccgggct cttcagagtct
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661 tcccacccct tctgtcggcg atgcgtgctt ggcccttaact ggccgggtcg tgccctcggc
721 gctgttaact tgaagaaatt agagtgtcga aagcaagccc acgctctgga tacattagca
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841 taagagggac agtcgggggc attcgtatct catagtcaga ggtgaaatc ttggatttat
901 gaaagacgaa ccaactgcga agcatttggc aaggatgttt tcattaatca agaacgaaag
961 ttgggggctc gaagacgatc agataaccgtc ctagtctcaa ccataaacga tgccgaccag
1021 ggatcrgcgg atgttgctyt taggactccg cyggcacctt atgagaaatc aaagtctttg
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1081 ggttccgggg ggagtatggt cgcaaggctg aaacttaaag gaattgacgg aagggcacca
1141 ccaggagtgg agcctgcggc ttaatttgac tcaacacggg gaaacttacc aggtccagac
1201 atagyaagga ttgacagact gagagctctt tcttgattct atgggtgggtg gtgcatggcc
1261 gttcttagtt ggtggagcga tttgtctggt taattccgat aacgaacgag acctcagcct
1321 gctaactagc tacgcggagg catccctccg cggtcagctt cttagagggga ctatggccgt
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1561 attcctagta agcgcgagtc atcagctcgc gttgactacg tcctgcctt ttgtacacac
1621 cgcccgtcgc tcctaccgat tgaatggtcc ggtgaagtgt tcggatcgag gcgacggggg
1681 cggttcgccg cccgcgacgt cgcgagaagt ccactgaacc ttatcattta gaggaaggag
1741 ag

1. *Musa acuminata* catalase 2 (Cat2) mRNA, complete cds

>gi|157418809|gb|EU139298.1| *Musa acuminata* catalase 2 (Cat2) mRNA, complete cds

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GCGTCCAGACGCCGATCATCCTCCGTCTCTCCACCGTCATCCACGAGCGTGGCAGCCCTGAAACCATCAG
AGACCCCGCGGGTTTCGCCGTCAAGTTCTACACCCGAGAGGGAAACTGGGATCTGCTGGGGAACAACCTT
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CGTTACGACTTCGACCCGCTCGATGACACCAAGACATGGCCCGAAGACCTTCTGCCGCTGCAGCCGGTGG
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GTGATTCCCAAGCAAAACGATTTCAAGCAACCCGGAGAGCGTTACCGTTCCTGGGCACCTGATAGGCAAG
AGCGTTTCGTCCGCCGTTGGGCCGAGCAATTAGCACACCCAAAGGTCAGCTATGAGCTCCGCAGCATCTG
CATCTCGTTTCTGTGCAAGTGCACACATCGCTGGGACAGAAGGTGGCGAATCGCCTCAACATGAGAGCA
AACATCTGA
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Catalase-F: GCGTCAACACCTACACCTT Tm: 60

Catalase-R: TCGTAACGGTCTCCGGTATC Tm: 60

Product size: 233

2. *Musa acuminata* clone 1-158 pectin acetyltransferase precursor, mRNA, partial cds

>gi|109390461|gb|DQ531615.1| *Musa acuminata* clone 1-158 pectin acetyltransferase precursor, mRNA, partial cds

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CGTGGCTATGGATCTGAAGCGAATAGTTGGGTTGTCAATTTAGAGGGAGGAGGCTGGTGCATGAC
CGAATCATGTGTTTACCGAAAGAGAAGTCACCATGGTTCATCCTACTTCATGGAGAAGCAGTTACAAT
TTCTGGATACTCAGTGACAAACCTGATGAAAATCCTGATTTCTATAACTGGAACAGAGTCAAGATTCTG
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CGAGTGTCTGCTGGTGGTCTGGCGACCATAACAACACTGTGATGAATTTCCGAGCATTATTTCCAAGAAA
CGAAGTCAAGTGCCTTGCTGATGCTGGCATGTTTCTTGATGTTGTTGATGTAGCTGGTGGTACACC
CGAATCCTTCTTCGGAGGTGTAGTAAGCTTGCAGGGTGCCTG
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Pectinase-F: CAGGCTCTCCTTTCTGGATG Tm: 60

Pectinase-R: TCCGAAGAAGGATCTCATGG Tm: 60

Product size: 171

3. *Musa acuminata* pathogenesis-related protein 1 (PR1) mRNA, partial cds

>gi|158983038|gb|EF055881.2| *Musa acuminata* pathogenesis-related protein 1 (PR1) mRNA, partial cds

```
ATGAGGTCCTCAAACCTCAGCTTTGGCTATGCTCTCCGCCGTGGCTCTTGCCATGGCATGCACCGGTATCC
TAGCCCAGAACTCGCCCCAGGACTTCGTGAGCCCCACAACGCCGCCCGCCGTCGGCGTGGGCCC
CGTGTCTGGGACAACACCGTTCGGCGGTACGCCAGAACTACGCCAACAGCGGGCGGCGACTGCCAG
CTCGTGCCTCCGGTGGGCGGTACGGCGAGAACATCTTCTGGGGCTCCGGCCGCGACTACACGGCGGCAG
ACGCCGTCAACGCCTGGGTCTCCGAGAAGCAGTACTACGACTACAACAGCAACACGTGCGCCCCTAACAA
GGTGTGCGGCCACTACACGCAGGTGGTGTGGCGTTTCGTCCACGGCCATCGGCTGCGGCCGTGTGCGCTGC
AACAGCGGCGCCATCTTCATCATCTGCAACTACAAACCTCCGGGCAACTATGTGGGGCAGCGCCCT
```

PR1-F: CAGCTTTGGCTATGCTCTCC Tm: 60

PR1-R: CAGAAGATGTTCTCGCCGTA Tm: 60

Product size: 235

4. *Musa acuminata* endochitinase (EndoChit1) mRNA, partial cds

>gi|15705987:1-690 *Musa acuminata* endochitinase (EndoChit1) mRNA, partial cds

```
GGCACGAGGGCGCAACGACGCAGCCTGCCCGGCAAGGGCTTCTACACGTACAACGCCTTCATCGCCGCCG
CCAACTCCTTCAGCGGGTTTCGGGACGACCGGCGACGACGCCACGAAGAAGAGGGAGATCGCGGCTTTCTT
GGCGCAGACGTCTCACGAGACGACAGGTGGGTGGGCGACGGCGCCCCGATGGTCCGTACCGGTGGGGTTAC
TGCTTCGTCCAGGAACAGAACCCCCCATCGGACTACTGCGTCCGACGCTCGCAGTGGCCGTGCGCTGCAG
GCPAGAAGTACTACGGCCGAGGCCCCATCCAAATCTCATTCAACTACAACACGCGGCCGCGGGAGAGC
CATCGGCTCCGACCTGCTCAACAACCCAGACCTGGTGGCCACCGACGCGACCATCTCGTTC AAGACGGCT
CTGTGGTTCTGGATGACTCCTCAGTCGCCCAAGCCGTGTCGCCACGACGTGATAACCGGGAGGTGGGAGC
CATCCAACGCCGACCGGGCGGCCGGAAGGCTTCGGGCTACGGTGTCAACCAACATCATCAATGGAGG
ETTGAGTGCGGGAAAGGGTCCGATGCCAGGTTGGCGGATAGGATCGGCTTCTACAAGAGGTACTGCGAC
TTGCTGGGGGTGAGCTACGGAGACAACCTGGACTGCTACAACCAGAGTCCCTTTACTTAG
```

EndoChit1-F: GCTTCGTCCAGGAACAGAAC Tm: 60

EndoChit1-R: ACCAGGTCTGGGTTGTTGAG Tm: 60

Product size: 175

5. *Musa acuminata* ubiquitin-conjugating enzyme mRNA, partial cds

>gi|49616938:1-160 *Musa acuminata* ubiquitin-conjugating enzyme mRNA, partial cds

```
CGTGAGCTGCACCAGAGGCCTGCTGCTAGAGTTCAGAAGCCCTTGGATGATCGTTTTCTCACTTGGGCT
CGTCTGGTTGGTGGTTGCTATTTTGCTCCTCTTAGTGAAGAAGTTTTTGAATCTAATTCATTTGCTG
GATATGGGTAGCTTGTA
```

Ube-F: CGTGAGCTGCACCAGAGG Tm: 60

Ube-R: CAAGCTACCCATATATCCAGCA Tm: 60

Product size: 156

6. *Musa acuminata* clone Radka1 26S ribosomal RNA, partial sequence

>*Musa acuminata* clone Radka1 26S ribosomal RNA, partial sequence
(AF399949)

```
1 cgaacagccg actcagcaac tggtagcgac aaggggaatc cgactgttta attaaaacaa
   61 agcattgccg tggccccgc ggatgctcac gcaatgtgat ttctgccag
tgctctgaat
   121 gtcaaagtga agaaattcaa ccaagcgcg gtaaaccgcg ggagtacta
tgactctctt
   181 aaggtagcca aatgcctcgt catctaatta gtgacgcgca tgaagtggga
ttaacgagat
   241 tcccactgtc cctgtctact atccagcgaa accacagacc aaagggaacg
ggctttggca
   301 gaatcagcgg gggaaagaag acctgttga gcttgactct agtccgactt
tgtgaaatga
   361 cttgagaggt gtaggataag tgggagccgg ttcgcccggc gaagtgaat
accactactt
   421 ttaacgttat tttacttatt ccgtgagtcg gaggcggggc ccggcccctc
cttttgacc
   481 caaggcccgc ctacgcccgc gatccggggc gaagacattg tcaggtgggg
agtttggtg
   541 gggcggcaca tctgttaaaa gataacgcag gtgtcctaag atgagctcaa
cgagaacaga
   601 aatctcgtgt ggaacaaaag ggtaaaagct cgtttgatc tgatttccag
tacgaatag
   661 aaccgtgaaa gcgtggccta tcgat
```

26SrRNA-F: ctcagcaactggtagcgaca Tm: 60

26SrRNA-R: atgacgagcatttggctac Tm: 60

Product size: 192

7. *Musa acuminata* 18S small subunit ribosomal RNA gene, complete sequence

>*Musa acuminata* 18S small subunit ribosomal RNA gene, complete sequence
(AF069226)

```
1 catatgcttg tctcanagat taagccatgc atgtgtaagt atgaactatt tcagactgtg
   61 aaactgcgaa tggctcatta aatcagttat agtttgttt atggtacgtg
ctactcggat
   121 aaccgtagta attctagagc taatacgtgc aacaaacccc gaattccgga
agggatgcat
   181 ttattagata aaaggctgac gcgggctttg ctcgctgctc cgatgattca
cgataactcg
   241 acggatcgca cggccctcgt gccggcgacg catcattcaa atttctgccc
tatccaacttt
   301 cgatggtagg atagggccct accatggtgg tgacgggtga cggagaatta
cggttcgatt
   361 ccggagaggg agcctgagaa acggctacca catccaagga aggcagcagg
cgggcaaatt
```


421 acccaatcct gacacgggga ggtagtgaca ataaataaca ataccgggct
 cttcagagtct
 481 ggtaattgga atgagtacaa tctaaatccc ttaacgagga tccattggag
 ggcaagtctg
 541 gtgccagcag ccgcggaat tccagctcca atagygtata ttttaagttgt
 tgcagttaaa
 601 aagctcgtag ttggactttg ggacgggtcg gtcggtcgc ctgcgggtg
 gcaccggtcg
 661 tccatccct tctgtcggcg atgcgtgcct ggccttaact ggccgggtcg
 tgccctcggc
 721 gctgttactt tgaagaaatt agagtgtca aagcaagccc acgctctgga
 tacattagca
 781 tgggataaca tcacaggatt tcggctctat tgtgttgcc ttcgggatcg
 gagtaatgat
 841 taagaggac agtcgggggc attcgtatct catagtcaga ggtgaaattc
 ttggatttat
 901 gaaagacgaa ccaactgcga agcatttgcc aaggatgttt tcattaatca
 agaacgaaaag
 961 ttgggggctc gaagacgac agatacgc ctagtctcaa ccataaacga
 tgccgaccag
 1021 ggatcrgcgg atgttgctyt taggactccg cyggcacctt atgagaaatc
 aaagtctttg
 1081 ggttcggggg ggagtatggt cgcaaggctg aaacttaaag gaattgacgg
 aagggcacca
 1141 ccaggagtgg agcctgcggc ttaatttgac tcaacacggg gaaacttacc
 aggtccagac
 1201 atagyaagga ttgacagact gagagctctt tcttgattct atgggtggtg
 gtgcatggcc
 1261 gttcttagtt ggtggagcga tttgtctggt taattccgat aacgaacgag
 acctcagcct
 1321 gctaactagc tacgcgagag catccctccg cggtcagctt cttagagggga
 ctatggccgt
 1381 ttagggcacg gaagtttgag gcaataacag gtctgtgatg cccttagatg
 ttctgggccc
 1441 cacgcgct acaactgatgt attcaacgag tctatagcct tggccgacag
 gcccggttaa
 1501 tctttgaaaa tttcatcgtg atggggatag atcattgcaa ttgttggctc
 ttaacgagga
 1561 attcctagta agcgcgagtc atcagctcgc gttgactacg tccctgcct
 ttgtacacac
 1621 cgcccgtcgc tctaccgat tgaatggctc ggtgaagtgt tcggatcgag
 ggcgacggggg
 1681 cggttcgccc cccgcgacgt cgcgagaagt ccaactgaacc ttatcattta
 gaggaaggag
 1741 ag

18SrRNA-F: aaacggctaccacatccaag Tm: 60
 18SrRNA-R: cctccaatggatcctcgta Tm: 60
 Product size: 153

Catalase-F: GCGTCAACACCTACACCTT Tm: 60

- Catalase-R: TCGTAACGGTCCTCGGTATC Tm: 60
 Product size: 233
2. Pectin-F: CAGGCTCTCCTTTCTGGATG Tm: 60
 Pectin-R: TCCGAAGAAGGATCTCATGG Tm: 60
 Product size: 171
3. PR1-F: CAGCTTTGGCTATGCTCTCC Tm: 60
 PR1-R: CAGAAGATGTTCTCGCCGTA Tm: 60
 Product size: 235
4. EndoChit1-F: GCTTCGTCCAGGAACAGAAC Tm: 60
 EndoChit1-R: ACCAGGTCTGGGTTGTTGAG Tm: 60
 Product size: 175
5. Ubi-F: CGTGAGCTGCACCAGAGG Tm: 60
 Ubi-R: CAAGCTACCCATATATCCAGCA Tm: 60
 Product size: 156
6. 26SrRNA-F: ctcagcaactggtacggaca Tm: 60
 26SrRNA-R: atgacgaggcatttggctac Tm: 60
 Product size: 192
7. 18SrRNA-F: aaacggctaccacatccaag Tm: 60
 18SrRNA-R: cctccaatggatcctcgta Tm: 60
 Product size: 153

Primers for order:

Catalase-F: GCGTCAACACCTACACCTT
 Catalase-R: TCGTAACGGTCCTCGGTATC

Pectin-F: CAGGCTCTCCTTTCTGGATG
 Pectin-R: TCCGAAGAAGGATCTCATGG

PR1-F: CAGCTTTGGCTATGCTCTCC
 PR1-R: CAGAAGATGTTCTCGCCGTA

EndoChit1-F: GCTTCGTCCAGGAACAGAAC
 EndoChit1-R: ACCAGGTCTGGGTTGTTGAG

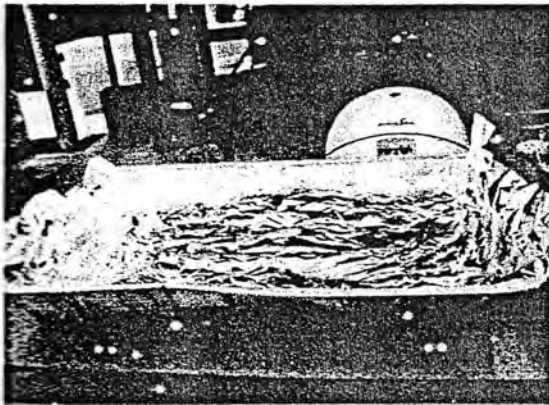
Ubi-F: CGTGAGCTGCACCAGAGG
 Ubi-R: CAAGCTACCCATATATCCAGCA

26SrRNA-F: ctcagcaactggtacggaca
 26SrRNA-R: atgacgaggcatttggctac

18SrRNA-F: aaacggctaccacatccaag
 18SrRNA-R: cctccaatggatcctcgta

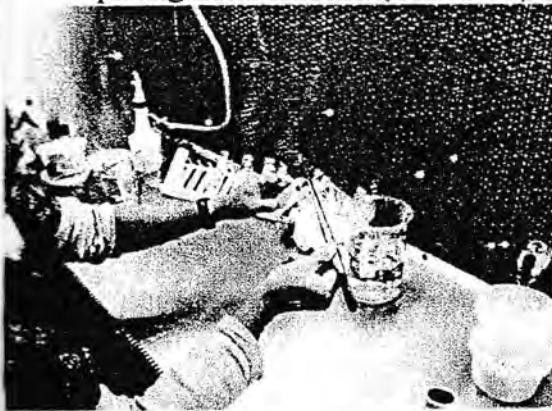
Pemesanan 7 pair primer ke NCBI company.	Perolehan pesanan memerlukan waktu 3 hari.
--	--

D LAPORAN KEGIATAN SANDWICH MINGGU 5 (7 Des - 13 Des 2009)	
1 Kegiatan yang dilakukan	Hasil yang dicapai
Persiapan bahan dan alat : media tanam plantlet pisang yaitu :vermiculate dan pasir perbandingan (2:1,v/v), sterilisasi di autoclave.	Tersedia media vermiculite:pasir sebanyak 4 kg (dalam kondisi steril).

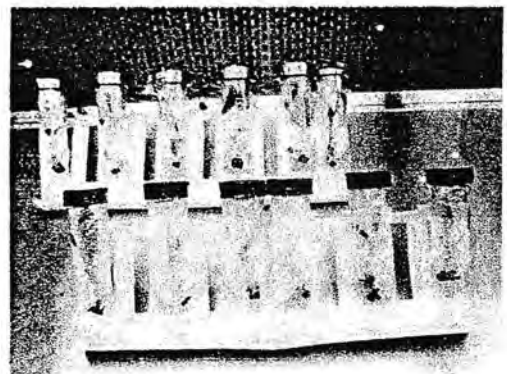


Gambar 1 . Media tanaman pisang cv.saba (vermiculite:pasir (2:1 v/v)

- ❖ Pembuatan media Murashige Koog (MS) dan perakaran plantlet pisang kultivar Saba (Gambar 2)



Perakaran 12 plantlet pisang cv.Saba



Introduksi mikoriza pada plantlet pisang cv.Saba dengan perlakuan: FMA (+), kontrol (tanpa FMA), 7 Ulangan.

Perlakuan sebanyak 14 container plantlet pisang cv.Saba ditempatkan di rumah kaca (Research Green house, USU, dengan kondisi: cahaya siang/malam 12/12 jam pada 30/28°C intensitas

cahaya 300-315 u mol m⁻² detik s⁻¹ dan RH 74 (Gambar 3)



Gambar 3 . Tanaman pisang yang diintroduksi dengan FMA (A) dan kontrol (-FMA) (B).

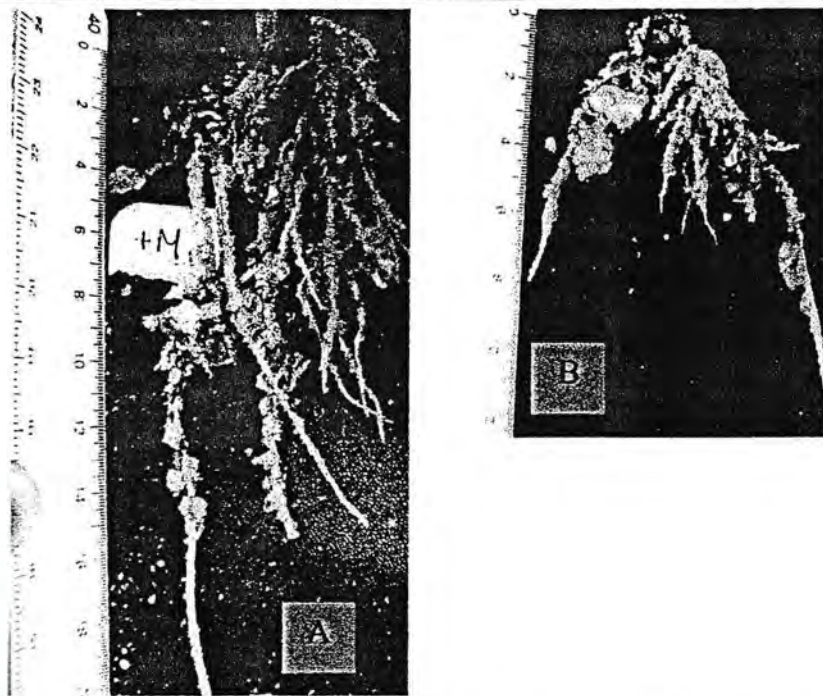
D LAPORAN KEGIATAN SANDWICH MINGGU 6 (14 Des - 21 Des 2009)

1	Kegiatan yang dilakukan	Hasil yang dicapai
	Pengamatan tanaman pisang: tinggi tanaman (cm) dan jumlah daun. Pengukuran dilakukan setiap 2 minggu.	Kondisi tanaman dan pertumbuhan tanaman pisang dengan aplikasi FMA lebih baik dibandingkan kontrol. Tinggi dan jumlah daun dan kondisi perakaran dapat dilihat pada Tabel dan Gambar.

Perlakuan	Ulangan	Panjang akar (cm)	Rata-rata (cm)
Kontrol	2	20.5	28.6
	4	10.5	
	6	26.0	
G.clarum	2	21.5	19.0
	4	19.5	
	6	37.5	



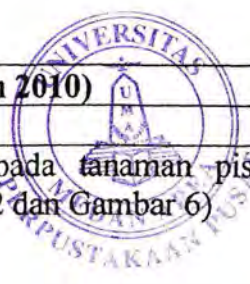
Gambar 4 . Pertumbuhan tanaman pisang cv.Saba pada umur 20 hari setelah tanam (hst).



Gambar 5 . Perakaran tanaman pisang umur 20 hst. A. + FMA; B. Kontrol (-FMA)

D LAPORAN KEGIATAN SANDWICH MINGGU 7 (22 – 29 Des 2009)	
1 Kegiatan yang dilakukan	Hasil yang dicapai
Liburan hari Natal dan Tahun Baru 2010	Libur akademis.

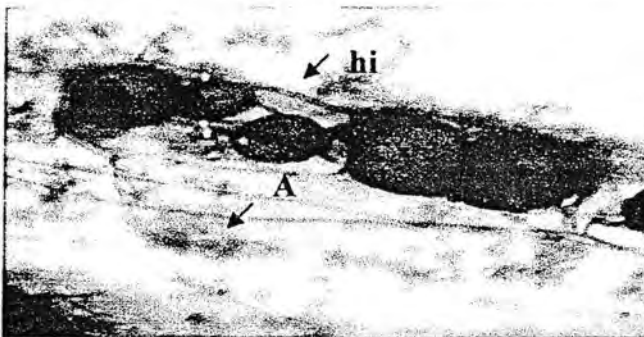
D LAPORAN KEGIATAN SANDWICH MINGGU 8 (29 Des – 3 Jan 2010)	
1 Kegiatan yang dilakukan	Hasil yang dicapai
Pengamatan pertumbuhan dan pemeliharaan tanaman pisang di rumah kaca	Kondisi pertumbuhan tanaman pisang tampak berbeda antara introduksi FMA (+FMA) dengan kontrol (-FMA).
Mengikuti kegiatan perkuliahan Propagation dan seminar mingguan di Agriculture Faculty.USU dengan mahasiswa S1.	Berhasil diikuti sebanyak 7 kali tatap muka hingga akhir semester. Berhasil diikuti 6 kali pertemuan seminar di Agriculture Faculty.USU



D	LAPORAN KEGIATAN SANDWICH MINGGU 9 (4 Jan – 11 Jan 2010)	
1	Kegiatan yang dilakukan	Hasil yang dicapai
	Pengamatan kolonisasi FMA pada perakaran tanaman pisang umur 30 hst, menggunakan metode Joseph Sheppard from Sylvia (1994).	Tingkat kolonisasi FMA pada tanaman pisang cv.Saba umur 30 hst (Tabel 2 dan Gambar 6)

Tabel 2. Kolonisasi FMA dalam akar tanaman pisang cv.Saba umur 30 hst

Perlakuan	Ulangan	Kolonisasi akar (%)
<i>G.clarum</i>	3	39.29
	5	25.93
	7	29.41
Kontrol	3	0.00
	5	0.00
	7	0.00



Gambar 6. Struktur kolonisasi *G.clarum* pada tanaman pisang cv.Saba .
A.Arbuskular, hi.hifa internal dan v.vesicular

Ekstraksi DNA akar dan daun tanaman pisang umur 45 hsa menggunakan metode Michiels *et al* (2003).

Analisis data

Diperoleh konsentrasi DNA akar dan daun tanaman pisang (Tabel 3)

Tabel 2. Konsentrasi DNA akar tanaman pisang cv.Saba umur 30 hst

Perlakuan	Ulangan	Konsentrasi DNA (ng/ul)
<i>G.clarum</i>	3	181.90
	5	180.89
	7	179.60
Kontrol	3	123.60
	5	121.56
	7	124.50

D LAPORAN KEGIATAN SANDWICH MINGGU 10 (12 Jan – 19 Jan 2010)																					
1	Kegiatan yang dilakukan	Hasil yang dicapai																			
	Ekstraksi RNA akar dan daun tanaman pisang umur 45 hsa menggunakan reagent Trizon (Invitrogen) menurut instruksi pabrik. Analisis data	Diperoleh konsentrasi DNA akar dan daun tanaman pisang (Tabel 4) Tabel 4. Konsentrasi RNA tanaman pisang cv.Saba umur 45 hst																			
		<table border="1"> <thead> <tr> <th>Perlakuan</th> <th>Jaringan tanaman</th> <th>Konsentrasi RNA</th> <th>Nilai 260/280</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Kontrol</td> <td>Daun</td> <td>220.5</td> <td>2.13</td> </tr> <tr> <td>Akar</td> <td>282.4</td> <td>2.12</td> </tr> <tr> <td rowspan="2">G.clarum</td> <td>Daun</td> <td>267.8</td> <td>2.12</td> </tr> <tr> <td>Akar</td> <td>286.1</td> <td>2.11</td> </tr> </tbody> </table>	Perlakuan	Jaringan tanaman	Konsentrasi RNA	Nilai 260/280	Kontrol	Daun	220.5	2.13	Akar	282.4	2.12	G.clarum	Daun	267.8	2.12	Akar	286.1	2.11	
Perlakuan	Jaringan tanaman	Konsentrasi RNA	Nilai 260/280																		
Kontrol	Daun	220.5	2.13																		
	Akar	282.4	2.12																		
G.clarum	Daun	267.8	2.12																		
	Akar	286.1	2.11																		
	<i>cDNA Synthesis</i> Sintesis cDNA akar dan daun tanaman pisang umur 45 hsa menurut instruksi pabrik Analysis data	Diperoleh konsentrasi cDNA akar dan daun tanaman pisang (Tabel 5).																			
		<table border="1"> <thead> <tr> <th>Perlakuan</th> <th>Jaringan tanaman</th> <th>Konsentrasi cDNA</th> <th>Nilai 260/280</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Kontrol</td> <td>Daun</td> <td>287.3</td> <td>1.82</td> </tr> <tr> <td>Akar</td> <td>370.7</td> <td>1.82</td> </tr> <tr> <td rowspan="2">G.clarum</td> <td>Daun</td> <td>350.9</td> <td>1.82</td> </tr> <tr> <td>Akar</td> <td>359.6</td> <td>1.82</td> </tr> </tbody> </table>	Perlakuan	Jaringan tanaman	Konsentrasi cDNA	Nilai 260/280	Kontrol	Daun	287.3	1.82	Akar	370.7	1.82	G.clarum	Daun	350.9	1.82	Akar	359.6	1.82	
Perlakuan	Jaringan tanaman	Konsentrasi cDNA	Nilai 260/280																		
Kontrol	Daun	287.3	1.82																		
	Akar	370.7	1.82																		
G.clarum	Daun	350.9	1.82																		
	Akar	359.6	1.82																		
		Tabel 5. Konsentrasi RNA tanaman pisang cv.Saba umur 45 hst																			

D LAPORAN KEGIATAN SANDWICH MINGGU 11 (19 Jan – 26 Jan 2010)			
1	Kegiatan yang dilakukan	Hasil yang dicapai	
	qRT-PCR Kuantifikasi gen-gen ketahanan (6 gen dan house keeping gen (18S rRNA) menggunakan alat RT-PCR Machine : Opticon 2 (MJ Research)	Berhasil dilakukan di Laboratorium Biosystem Teknologi Building.USU.	
	Analysis data	Kuantifikasi relatif menggunakan metode C_T komparatif. Nilai yang diperoleh dibandingkan dengan nilai yang diekspresikan house keeping gen (18S rRNA).	

Tabel 6. Hasil q RT-PCR gene ketahanan tanaman pisang cv.Saba setelah diinduksi dengan *G.clarum* dan kontrol.

Well	Dye	Type	Label	C(T)	Quantity
A1	Run 1:SBG1	Sample	Cs1	34.918	1
A2	Run 1:SBG1	Sample	Cs1	17.631	1
A3	Run 1:SBG1	Sample	Cs1	37.709	1
A4	Run 1:SBG1	Sample	Ts1	39.56	1
A5	Run 1:SBG1	Sample	Ts1	None	N/A
A6	Run 1:SBG1	Sample	Ts1	27.255	1
A7	Run 1:SBG1	Sample	Cs2	None	N/A
A8	Run 1:SBG1	Sample	Cs2	39.05	1
A9	Run 1:SBG1	Sample	Cs2	None	N/A
A10	Run 1:SBG1	Sample	Ts2	31.662	1
A11	Run 1:SBG1	Sample	Ts2	30.773	1
A12	Run 1:SBG1	Sample	Ts2	24.161	1
B1	Run 1:SBG1	Sample	Cs3	None	N/A
B2	Run 1:SBG1	Sample	Cs3	28.838	1
B3	Run 1:SBG1	Sample	Cs3	None	N/A
B4	Run 1:SBG1	Sample	Ts3	39.999	1
B5	Run 1:SBG1	Sample	Ts3	33.607	1
B6	Run 1:SBG1	Sample	Ts3	36.817	1
B7	Run 1:SBG1	Sample	Cs4	20.341	1
B8	Run 1:SBG1	Sample	Cs4	20.23	1
B9	Run 1:SBG1	Sample	Cs4	26.363	1
B10	Run 1:SBG1	Sample	Ts4	23.313	1
B11	Run 1:SBG1	Sample	Ts4	25.211	1
B12	Run 1:SBG1	Sample	Ts4	23.198	1
C1	Run 1:SBG1	Sample	Cs5	38.127	1
C2	Run 1:SBG1	Sample	Cs5	34.407	1
C3	Run 1:SBG1	Sample	Cs5	35.311	1
C4	Run 1:SBG1	Sample	Ts5	31.02	1
C5	Run 1:SBG1	Sample	Ts5	30.035	1
C6	Run 1:SBG1	Sample	Ts5	23.255	1
C7	Run 1:SBG1	Sample	Cs6	10.456	1
C8	Run 1:SBG1	Sample	Cs6	13.11	1
C9	Run 1:SBG1	Sample	Cs6	14.131	1
C10	Run 1:SBG1	Sample	Ts6	12.919	1
C11	Run 1:SBG1	Sample	Ts6	13.242	1
C12	Run 1:SBG1	Sample	Ts6	14.997	1
D1	Run 1:SBG1	Standard	Cs7	19.733	0
D2	Run 1:SBG1	Standard	Cs7	19.955	0
D3	Run 1:SBG1	Standard	Cs7	19.62	0
D4	Run 1:SBG1	Standard	Ts7	17.688	0
D5	Run 1:SBG1	Standard	Ts7	18.213	0
D6	Run 1:SBG1	Standard	Ts7	17.218	0

D7	Run 1:SBG1	Blank	negative	23.771	1
D8	Run 1:SBG1	Blank	negative	21.705	1
D9	Run 1:SBG1	Blank	negative	22.433	1
D10	Run 1:SBG1	Blank	negative	22.922	1
D11	Run 1:SBG1	Blank	negative	23.802	1
D12	Run 1:SBG1	Blank	negative	19.626	1
E1	Run 1:SBG1	Sample	Cr1	27.797	1
E2	Run 1:SBG1	Sample	Cr1	30.258	1
E3	Run 1:SBG1	Sample	Cr1	27.347	1
E4	Run 1:SBG1	Sample	Tr1	26.725	1
E5	Run 1:SBG1	Sample	Tr1	29.478	1
E6	Run 1:SBG1	Sample	Tr1	25.044	1
E7	Run 1:SBG1	Sample	Cr2	28.834	1
E8	Run 1:SBG1	Sample	Cr2	31.281	1
E9	Run 1:SBG1	Sample	Cr2	26.074	1
E10	Run 1:SBG1	Sample	Tr2	29.56	1
E11	Run 1:SBG1	Sample	Tr2	28.032	1
E12	Run 1:SBG1	Sample	Tr2	28.453	1
F1	Run 1:SBG1	Sample	Cr3	31.72	1
F2	Run 1:SBG1	Sample	Cr3	None	N/A
F3	Run 1:SBG1	Sample	Cr3	34.134	1
F4	Run 1:SBG1	Sample	Tr3	30.505	1
F5	Run 1:SBG1	Sample	Tr3	34.495	1
F6	Run 1:SBG1	Sample	Tr3	31.197	1
F7	Run 1:SBG1	Sample	Cr4	28.148	1
F8	Run 1:SBG1	Sample	Cr4	20.969	1
F9	Run 1:SBG1	Sample	Cr4	23.863	1
F10	Run 1:SBG1	Sample	Tr4	4.826	1
F11	Run 1:SBG1	Sample	Tr4	27.255	1
F12	Run 1:SBG1	Sample	Tr4	22.739	1
G1	Run 1:SBG1	Sample	Cr5	31.287	1
G2	Run 1:SBG1	Sample	Cr5	36.284	1
G3	Run 1:SBG1	Sample	Cr5	30.173	1
G4	Run 1:SBG1	Sample	Tr5	33.264	1
G5	Run 1:SBG1	Sample	Tr5	32.246	1
G6	Run 1:SBG1	Sample	Tr5	24.312	1
G7	Run 1:SBG1	Sample	Cr6	10.079	1
G8	Run 1:SBG1	Sample	Cr6	12.435	1
G9	Run 1:SBG1	Sample	Cr6	5.647	1
G10	Run 1:SBG1	Sample	Tr6	13.844	1
G11	Run 1:SBG1	Sample	Tr6	14.674	1
G12	Run 1:SBG1	Sample	Tr6	14.786	1
H1	Run 1:SBG1	Standard	Cr7	17.82	0
H2	Run 1:SBG1	Standard	Cr7	17.848	0
H3	Run 1:SBG1	Standard	Cr7	18.111	0

H4	Run 1:SBG1	Standard	Tr7	18.926	0
H5	Run 1:SBG1	Standard	Tr7	17.008	0
H6	Run 1:SBG1	Standard	Tr7	17.644	0

*CS = control shoot
 CR = control root
 TS = treatment shoot
 TR = treatment root
 1-7 = nomor gen
 1 = Cat2
 2 = Pec
 3 = PR-1
 4 = Chit
 5 = Ubi
 6 = 26S rRNA
 7 = 18S rRNA

D LAPORAN KEGIATAN SANDWICH MINGGU 12 (27 Jan – 31 Jan 2010)

1	Kegiatan yang dilakukan	Hasil yang dicapai
---	-------------------------	--------------------

Analisis data
 Diperoleh data kuantitatif gen-gen ketahanan tanaman pisang yang dibandingkan dengan gen house keeping (18S rRNA) yang diintroduksi FMA dan tanpa FMA (kontrol)

Tabel 7. Nilai rata-rata ct gene Catalase2, Pectin, PR1, Endochitinase, Ubiquitin, 26S rRNA dan 18S rRNA pada akar dan daun tanaman pisang cv.Saba yang diinokulasi *G.clarum* dan kontrol.

Jaringan tanaman	Gen	Nilai ct kontrol	Nilai ct perlakuan	Perlakuan/kontrol
Daun	Catalase2	30.06	33.35	0.00
	Pectin	39.05	28.80	220.00
	PR1	28.80	36.76	0.00
	Endochitinase	22.26	23.86	0.10
	Ubiquitin,	35.93	28.10	44.00
	26S rRNA	12.53	13.66	0.10
	18S rRNA	19.73	17.66	-
Akar	Catalase2	28.40	27.03	2.40
	Pectin	28.66	28.63	1.00
	PR1	32.90	32.00	1.70
	Endochitinase	24.26	24.97	0.60
	Ubiquitin,	32.50	9.900	5.30
	26S rRNA	9.33	14.36	0.00
	18S rRNA	17.90	17.83	-

	Presentasi hasil penelitian dengan Advisor	Hasil yang diperoleh mencapai 100% (Rencana penelitian awal). Data yang diperoleh sangat mendukung hasil penelitian (4 tahap) Disertasi yang telah dilakukan di Indonesia. Hasil yang diperoleh akan dipublikasi dalam Seminar Internasional Biological Control, Graz, Austria, 7-10 Juni 2010.
2	Komentar dan Saran	Waktu 3 bulan dirasakan tidak cukup untuk memperoleh data yang lengkap dengan penggunaan peralatan teknologi tinggi, analisis data dan penulisan draft publikasi internasional. Waktu yang dirasakan tepat adalah 6 bulan.

E	RANGKUMAN/SIMULAN DARI KEGIATAN SANDWICH yang SESUAI DENGAN PROGRAM PASCA DI INDONESIA	
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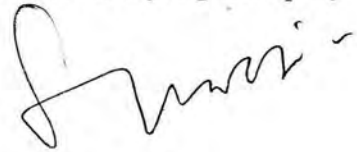
1	Kegiatan penelitian yang dilakukan di Agriculture Faculty, USU, USA sangat mendukung dalam perolehan data kajian molekuler 6 gen ketahanan tanaman pisang (Catalase2, Pectinase, Endochitinase, Ubiquitin, 26S rRNA) setelah dikolonisasi oleh mikoriza arbuskular. Secara kuantitatif keenam gen tersebut mengalami peningkatan dibanding dengan 18S rRNA pada kontrol (tanpa mikoriza).	
---	---	--

Komentar dan Saran

Disamping keenam gen ketahanan tanaman pisang dan gen pengatur 18S rRNA, tanaman pisang masih memiliki ribuan gen-gen lain yang berperan dalam pengaturan metabolisme tanaman sehingga dipandang perlu melakukan penelitian lanjut. Metode yang digunakan penelitian kuantitatif dengan perlakuan introduksi mikoriza pada tanaman pisang, menggunakan Affymetry Microarray.

Hal ini sudah dikonfirmasi dan disusun rencana penelitian dengan advisor. Peralatan yang dimiliki oleh Caisson laboratorium dan Biotechnology Laboratory sangat memungkinkan untuk dilakukannya kegiatan tersebut. Total dana yang dibutuhkan berkisar USD 8000 – 10000. Sudah dicoba mencari dana dari Banana Biodiversity, France, tetapi belum ada tanggapan. Untuk itu sangat diperlukan adanya dukungan dana dari DIKTI guna merealisasikan rencana tersebut.

Padang, 10 Februari 2010
Mahasiswa yang melapor,



Ir. Suswati. MP

Mengetahui,

Direktur Program Pascasarjana,
Universitas Andalas Padang

Ketua Pembimbing Disertasi



Prof. Dr. Ir. Novirman Jamarun. MSc.



Prof. Dr. Trimurti Habazar

Supervisor



John G. Carman. Ph.D.
Professor Plant Genetic

Lampiran 1. Dokumentasi kegiatan Program Sandwich 2009 di Utah State University, USA. 3 Nop 2009 – 1 Feb 2010.



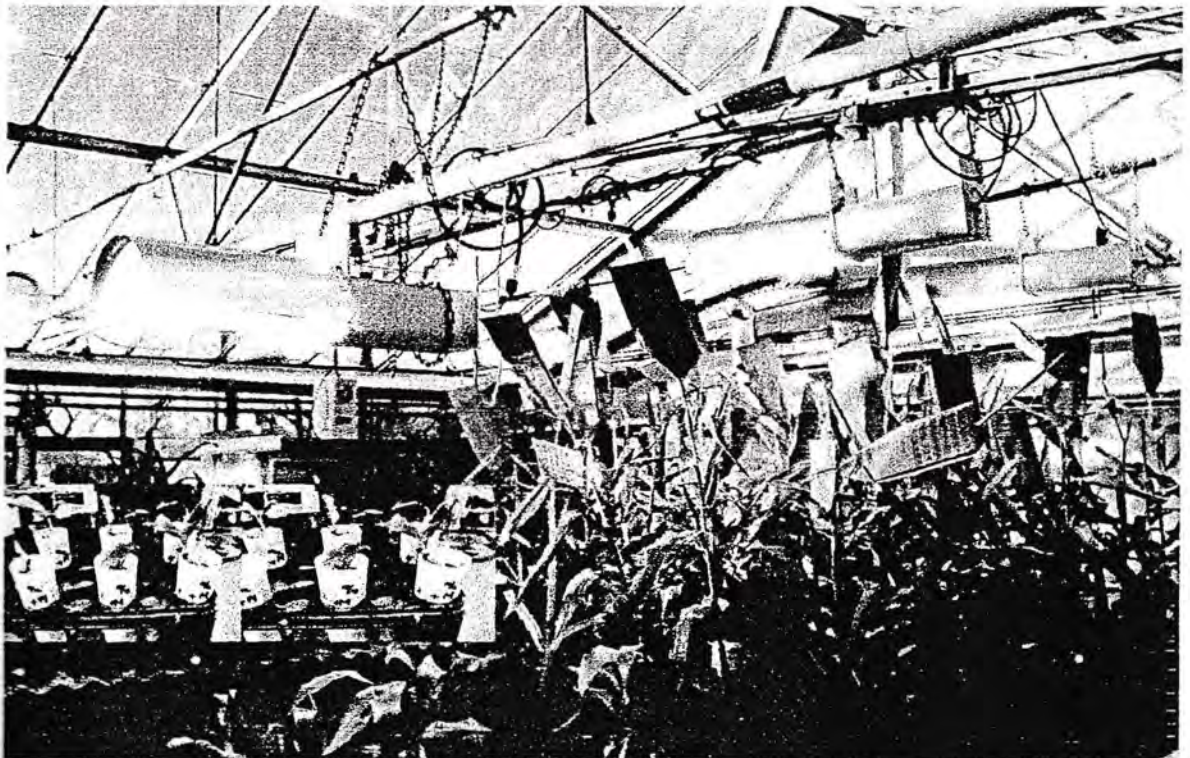
Gambar 1. Penandatanganan MOU antara Utah State University dengan Program Pascasarjana Universitas Andalas, Universitas Nusa Cendana, NTT dan Universitas Sumatera Utara.



Gambar 2. Berfoto bersama para peserta Sandwich Indonesia dengan Presiden Directur International Scholarship,USU dengan Direktur PPS Unand, Ibu Direktur PPS Univ.Sumatera Utara dan Direktur PPS Nusa Cendana. NTT.



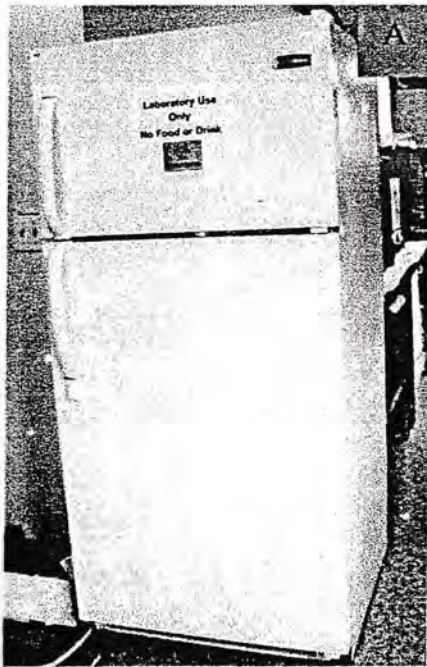
Gambar 3. Penulis berfoto di depan lokasi rumah kaca Utah State University. Tempat penanaman tanaman pisang yang diintroduksi dengan *Glomus clarum*



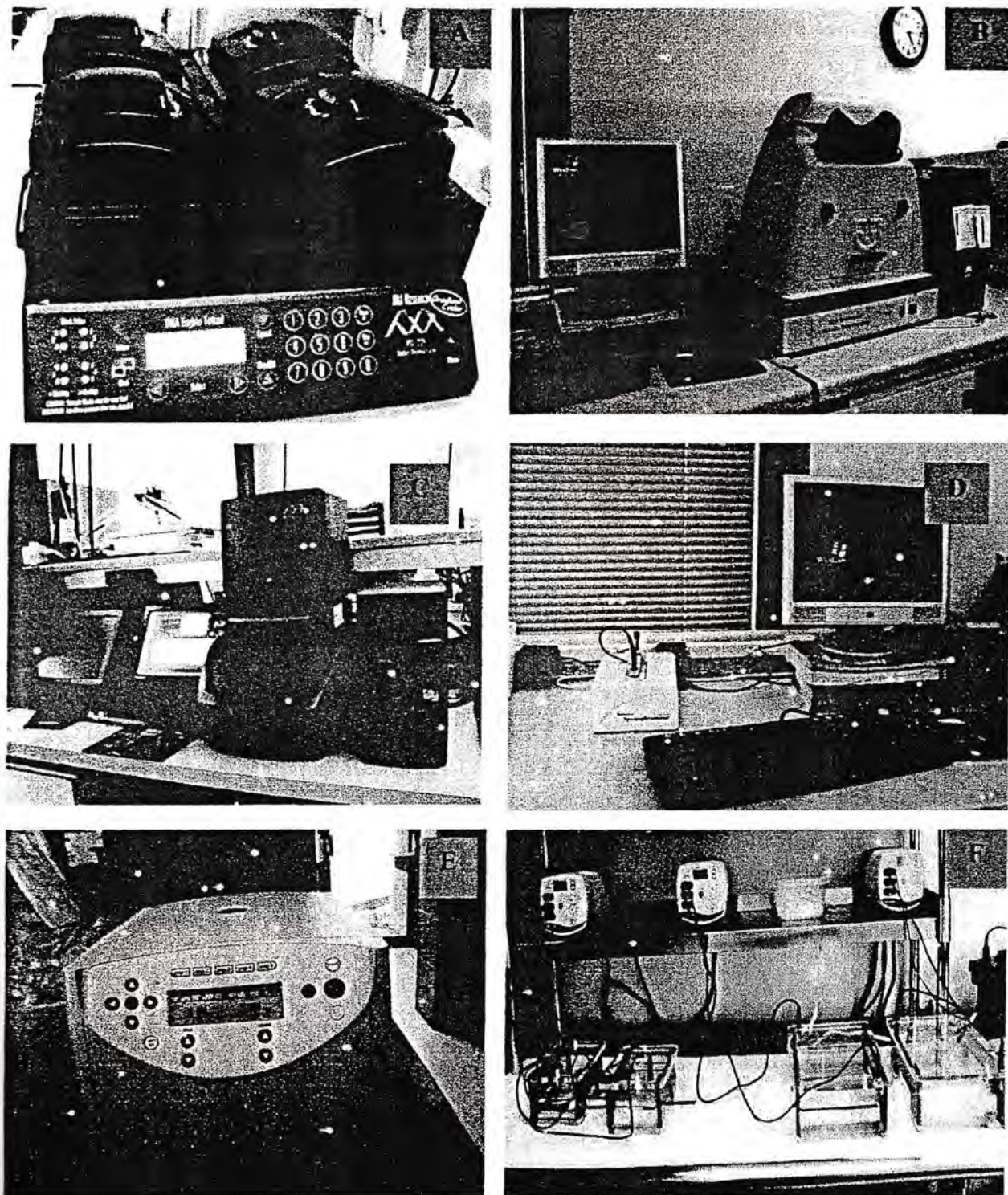
Gambar 4. Kondisi rumah kaca tempat penanaman tanaman pisang kultivar Saba. Ruang khusus tanaman-tanaman yang berasal dari daerah tropik. Research Green House, Utah State University.



Gambar 4. Penulis berfoto di Caisson Laboratorium Inc. tempat penulis melakukan penelitian bersama DR. Krishna Dwipedi dan Advisor John.G. Carman. PhD (Professor Plant Genetic).



Gambar 5. Tempat penyimpanan sampel ekstrak DNA, RNA, cDNA di dalam refrigerator
A. Refrigerator -20°C , B. Refrigerator -80°C



Gambar 6. Sejumlah peralatan yang dipergunakan dalam penelitian di Caisson Laboratorium Inc dan Biosystem Technology Building, USU.
 Keterangan. A. DNA Engine Tetrad Type PTC-225 Pelties Thermal Cycler, B. Gel Doc Ultraviolet Transilluminator, C. RT-PCR Machine, Opticon 2. MJ Research, D. NanoDrop Type ND-1000, E. Centrifuge 5430, F. Unit Gel Electrophoresis dan G. Refrigerator -80°C.

Lampiran 2. Kelengkapan Dokument Program Sandwich DIKTI 2009

Persetujuan ke Luar Negeri dari Pogram Pascasarjana Universitas Andalas

Persetujuan penugasan untuk mengikuti program Sandwich di USU,USA dari Sekretariat Negara Republik Indonesia

Persetujuan perolehan Visa dari Kedubes USA, Jakarta

Copy Phasport

Copy Visa

LoA dari Advisor di Utah State University, USA

Rincian pendanaan Program Sandwich TA 2009 dari DIKTI
SPPD

Lampiran 3. Sertifikat Laboratory Safety Initial dari Utah State University, USA.



DEPARTEMEN PENDIDIKAN NASIONAL
UNIVERSITAS ANDALAS
PROGRAM PASCASARJANA

Alamat : Gedung E, Kampus Unand Limau Manis, Po Box. 271 PADANG - 25163
Telp. 0751 - 71686, Fax. 0751 - 71691 E-mail : pps-and@telkom.net

Nomor : 050 /J.16/PP/2009

Padang, 10 September 2009

Lamp : 1 (satu) berkas

Hal : Persetujuan ke Luar Negeri dan Paspor Dinas
untuk Ir. Zulfatri.MSc dan kawan-kawan

Kepada Yth. Kasubdit Pengembangan Ketenagaan
Ditjen Dikti Gedung D. Lantai 5
Jalan Sudirman Pintu I Senayan
Jakarta, 10002

Bersama ini kami sampaikan bahwa yang tersebut di bawah ini:

1. Nama / NIP : Ir. Zulfatri.MSc/131 601 108
Status Pendidikan : Mahasiswa S-3 pada Program Ilmu-Ilmu
Pertanian Universitas Andalas
Status Pekerjaan : Dosen pada Fakultas Pertanian
Universitas Riau
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan
2. Nama / NIP : Ir. Arief.MS/131 757 365
Status Pendidikan : Mahasiswa S-3 pada Program Ilmu-Ilmu
Pertanian Universitas Andalas
Status Pekerjaan : Dosen Fakultas Peternakan Universitas
Andalas
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan
3. Nama / NIP : Ir. Eri Samah.MP./131 286 655
Status Pendidikan : Mahasiswa S-3 pada Program Ilmu-Ilmu
Pertanian Universitas Andalas
Status Pekerjaan : Dosen pada Fakultas Pertanian
Universitas Pembinaan Masyarakat
Indonesia (UPMI) Medan
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan
4. Nama / NIP : Irfandri.SP.MS/132 240 004
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Pertanian Universitas Andalas
Status Pekerjaan : Dosen pada Fakultas Pertanian
Universitas Riau
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan
5. Nama / NIP : Ir.Suswati.MP/131 866 324
Status Pendidikan : Mahasiswa S-3 pada Program Ilmu-Ilmu



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Universitas Medan Area. Sumatera Utara
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan
- 6 Nama / NIP : Ir.Yulfi Desi.MP/131 669 039
Status Pendidikan : Mahasiswa S-3 pada Program Ilmu-Ilmu
Pertanian Universitas Andalas
Status Pekerjaan : Dosen pada Fakultas Pertanian,
Universitas Ekasakti.Padang
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan
- 7 Nama / NIP : Milda Ernita .SSi.MP.
Status Pendidikan : Mahasiswa S-3 pada Program Ilmu-Ilmu
Pertanian Universitas Andalas
Status Pekerjaan : Dosen pada Fakultas Pertanian,
Universitas Taman Siswa
Maksud ke Luar Negeri : Mengikuti Program Sandwich di Utah
State University USA selama 4 bulan

Sehubungan dengan ini kami menyetujui, dan kami mohon kiranya Saudara memberi izin kepada yang bersangkutan untuk bisa mengikuti program tersebut, serta memproses dokumen yang diperlukan seperti Persetujuan dari Sekretariat Negara dan Paspor Dinas.

Sebagai bahan pertimbangan bagi Saudara dengan ini kami lampirkan antara lain:

1. Surat izin melaksanakan kegiatan program Sandwich di Luar negeri dari Direktur/Dekan Pascasarjana
2. LoA terbaru
3. Daftar Riwayat Hidup (4 rangkap)
4. Pasphoto berwarna 4x6 sebanyak 8 lembar
5. Permohonan paspor dinas (4 rangkap)
6. Rencana keberangkatan

Demikianlah surat ini kami sampaikan. Atas perhatian dan bantuan Saudara kami ucapkan terima kasih.

Padang, 10 September 2009



Prof. Dr. Ir. H. Novirman Jamarun. MSc
NIP. 130.819.552

Tembusan Yth:

1. Kepala Biro Kerjasama Luar Negeri, Depdiknas
2. Arsip



DEPARTEMEN PENDIDIKAN NASIONAL
UNIVERSITAS ANDALAS
PROGRAM PASCASARJANA

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Nomor : 850 /J.16/PP/2009

Padang, 10 September 2009

Lamp : 1 (satu) berkas

Hal : Persetujuan ke Luar Negeri dan Paspor Dinas
untuk Ir. Zulfatri.MSc dan kawan-kawan

Kepada Yth. Kasubdit Pengembangan Ketenagaan
Ditjen Dikti Gedung D. Lantai 5
Jalan Sudirman Pintu I Senayan
Jakarta, 10002

Bersama ini kami sampaikan bahwa yang tersebut di bawah ini:

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State University USA selama 4 bulan

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5. Permohonan paspor dinas (4 rangkap)
6. Rencana keberangkatan

Demikianlah surat ini kami sampaikan. Atas perhatian dan bantuan

Saudara kami ucapkan terima kasih.



Tembusan Yth:

1. Kepala Biro Kerjasama Luar Negeri, Depdiknas
2. Arsip



**SEKRETARIAT NEGARA
REPUBLIK INDONESIA**

Nomor : B- 17351 /Setneg/Setmen/KTLN/08/2009 Jakarta, 3 September 2009
Sifat : Biasa
Lampiran : -
Hal : Persetujuan penugasan

Yth. Sekretaris Jenderal
Departemen Pendidikan Nasional
u.p. Kepala Biro Perencanaan dan Kerjasama Luar Negeri
di
Jakarta

Sehubungan dengan surat Saudara nomor 65524/A2.4/LN/2009 tanggal 1 September 2009, dengan hormat diberitahukan bahwa Pemerintah menyetujui penugasan 7 (tujuh) orang peserta program Pascasarjana Universitas Andalas ke luar negeri :

1. Ir. Zulfatri, M.Sc – NIP. 131601108
2. Ir. Arief, MS – NIP. 131757365
3. Ir. Eri Samah – NIP. 131286655
4. Irfandri, SP, MS – NIP. 132240004
5. Ir. Suswati, MP – NIP. 131866324
6. Ir. Yulfi Desi, MP – NIP. 131669039
7. Milda Ernita, Ssi, MP

untuk mengikuti program *Sandwich*, di Utah State University, Amerika Serikat, selama 4 (empat) bulan mulai tanggal 1 September 2009

Persetujuan Pemerintah ini diberikan dengan ketentuan-ketentuan :

1. Biaya penugasan mereka dibebankan pada anggaran **Ditjen Pendidikan Tinggi, Depdiknas**;
2. Setibanya di negara yang dituju yang bersangkutan menghubungi dan menyampaikan maksud kedatangannya kepada Kedutaan Besar RI/Perwakilan RI setempat;
3. Setelah tiba kembali-di Indonesia yang bersangkutan menyampaikan laporan tertulis kepada Sekretariat Negara;
4. Sesuai dengan Keputusan Presiden Nomor 42 Tahun 2002 tanggal 28 Juni 2002, perjalanan yang bersangkutan harus menggunakan perusahaan penerbangan nasional, sepanjang jalurnya memungkinkan.

Atas perhatian Saudara, kami sampaikan terima kasih.

a.n. Sekretaris Menteri Sekretaris Negara
Kepala Biro Kerjasama Teknik Luar Negeri,



Disusun:

Kepala BPKP

Diren Anggaran dan PK, Depkeu

Diren Perbendaharaan, Depkeu

Dir Konsuler, Deplu

UNIVERSITAS MEDAN AREA



DEPARTMENT OF FOREIGN AFFAIRS
REPUBLIC OF INDONESIA

No. 009394/KAB/63/2009

The Department of Foreign Affairs of the Republic of Indonesia presents its compliments to the Embassy of the United States of America in Jakarta and has the honour to request the latter to issue visa(s) to:

Name(s) : List of names attached
Profession : Officials of the Department of National Education
Passport Number(s) : List of passport numbers attached
Required visa(s)/valid for : Short Visit Visa
Date of Departure : September , 2009
Purpose of Visit : To participate in the Sandwich Program at the Utah State University

While conveying its gratitude, the Department of Foreign Affairs of the Republic of Indonesia avails itself of this opportunity to renew to the Embassy of the United States of America in Jakarta the assurances of its highest consideration.

Jakarta, September 08, 2009

Embassy of the United States of America
in Jakarta





DEPARTMENT OF FOREIGN AFFAIRS
REPUBLIC OF INDONESIA

Attachement

No	Name	Passport Number
1	Mr. Zulfatri	S189282
2	Mr. Arief	S189283
3	Mrs. Eri Samah	S189284
4	Mr. Irfandri	S189285
5	Mrs. Suswati	S189286
6	Mrs. Yulfi Desi	S189287
7	Mrs. Milda Ernita	T393673





**DIRECTORATE GENERAL OF HIGHER EDUCATION
DEPARTMENT OF NATIONAL EDUCATION**

Jalan Jenderal Sudirman Pintu I Senayan, Tromol Pos 190
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Email : subditpk@ditnaga-dikti.org [Http://www.ditnaga-dikti.org](http://www.ditnaga-dikti.org).

TO WHOM IT MAY CONCERN

647/D4.4/PK/2009

On behalf of the Directorate General of Higher Education (DGHE) of Indonesia, I would like to notify that the DGHE graduate sandwich program scholarship for:

Name of Recipient : Suswati
University Origin : University of Andalas
Enrolled at (University) : Utah State University, USA
Program : Sandwich

has been approved. The scholarship will cover the following components:

No.	Components	Amount (USD)	Period
1.	Living Allowance (monthly)	1,200	3 months
2.	Book Allowance	300	Once
3.	Institutional Fee	3,750	Once
4.	Health Insurance	500	Once
5.	International air-fare (at cost)		Roundtrip

Time-line of DGHE Sandwich scholarship for the Awardee is for 3 months, commencing from October 2009.

For further enquiries, please do not hesitate to contact our office.

Jakarta, 15 September 2009

Sub Directorate for Human Resource Development
Head,


Istri Hardiyati



**DIRECTORATE GENERAL OF HIGHER EDUCATION
DEPARTMENT OF NATIONAL EDUCATION**

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Email : subditpk@ditnaga-dikti.org [Http://www.ditnaga-dikti.org](http://www.ditnaga-dikti.org)

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Sub Directorate for Human Resource Development
Head,

Istri Hardiyati
Istri Hardiyati

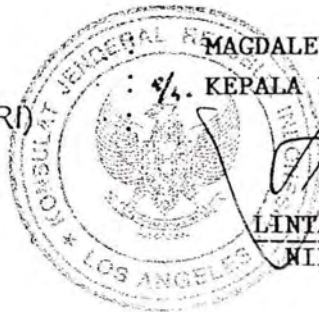
TANDATANGAN PERGURUAN TINGGI ASAL

NAMA :
NIP :
JABATAN :
CAP (STEMPEL PT ASAL) :



**TANDATANGAN SETIBA DI NEGARA TUJUAN
KBRI / KONJEN**

NAMA : **MAGDALENA F.W. TOMPODUNG**
JABATAN : **1/4. KEPALA KANSELERAI/ HOC**
CAP (STEMPEL KBRI) :



LINTANG TETRAENI
WIP. 020004415

KIRIM KEMBALI

SUBDIT PENGEMBANGAN KETENAGAAN LT. 5
REKTORAT KETENAGAAN, DITJEN DIKTI
DEPARTEMEN PENDIDIKAN NASIONAL
JALAN JENDERAL SUDIRMAN PINTU SATU SENAYAN
KARTASURA

Berangkat dari :
ke :
Pada tanggal :
Kepala,

Tiba di : Los Angeles
Pada tanggal :
Kepala, Kanselerai/ HOC

(Magdalena F.W. Tompodung)
NIP. 020004008

Berangkat dari : Los Angeles
ke :
Pada tanggal :
Kepala, Kanselerai/ HOC

(Magdalena F.W. Tompodung)
NIP. 020004008

Tiba di :
Pada tanggal :
Kepala,

(.....)

Berangkat dari :
ke :
Pada tanggal :
Kepala,

(.....)

Tiba di :
Pada tanggal :
Kepala,

(.....)

Berangkat dari :
ke :
Pada tanggal :
Kepala,

(.....)

Tiba kembali di :
(tempat kedudukan)
Pejabat yang memberi perintah.

(.....)

Telah diperiksa dengan keterangan bahwa perjalanan tersebut diatas benar dilakukan atas perintahnya dan semata-mata untuk kepentingan jabatan dalam waktu sesingkat-singkatnya.

Penanggungjawab Kegiatan,

(Drs. Agus Susilohadi, M.Si)
NIP. 132 061 153

CATATAN LAIN-LAIN

PERHATIAN

Pejabat yang berwenang menerbitkan SPPD, pegawai yang melakukan perjalanan dinas, para pejabat yang mengesahkan tanggal berangkat/tiba serta bendaharawan bertanggungjawab berdasarkan peraturan-peraturan keuangan negara apabila negara menderita rugi akibat kesalahan, kelalaian dan kealpaan, angka 8, lampiran surat edaran Menteri Keuangan tanggal 3 April 1979, No. 247/MK.03/1979



Utah State
UNIVERSITY

CERTIFICATE OF TRAINING

Suswati

has successfully completed

Laboratory Safety Initial

Presented on November 19, 2009


Environmental Health & Safety Office

Lampiran 4. Rincian Dana pengeluaran selama kegiatan Program Sandwich DIKTI TA
2009

No.	Peruntukan	Biaya (Rp)
1	Transportasi pengurusan phasport Padang-Jakarta (pengurusan kolektif)	475.000
2	Akomodasi selama 2 hari di Jakarta	200.000
3	Transportasi pengurusan Visa Padang-Jakarta (pp)	1.300.000
4	Akomodasi	300.000
5	Transportasi lokal selama di Jakarta	100.000
6	Bench fee	36.037.500
7	Deposit untuk akomodasi selama di USU,USA	910.000
8	Sewa apartement 3 Nov 2009- 30 Januari 2010	6.342.600
9	Buku Mycorrhizae and Plant Health	420.000
10	Buku Current Advances in Mycorrhizae Research	420.000
11	Ongkos kirim	200.000
12	Biaya pembelian 24 plantlet pisang Saba dari AgriStar, Florida	240.000
13	Biaya pembelian mikoriza dan ongkos kirim	650.000
14	Biaya konsumsi selama 3 bulan di USU,USA	13.500.000
15	Ansuransi Travel Save	1.905.000
16	Print jurnal	2.000.000
17	Foto copy	2.000.000
18	Ticket Jakarta – Salt Lake city (pp)	12.500.000
19	Padang-Jakarta (pp)	2.000.000



UtahStateUniversity
OFFICE FOR INTERNATIONAL EDUCATION

INTERNATIONAL SCHOLARSHIP PROGRAMS

November 10, 2009

To Whom It May Concern:

This letter is to verify that Utah State University received a wire transfer in the amount of US\$26,250 as payment for the Indonesian Sandwich Program whose participants are students from the University of Andalas. This payment is for the bench fee of US\$1,250 per month for each program participant, and is a total of US\$3,750 for the three month program for each of the following participants: Zulfatri, Arief, Irfandri, Eri Samah, Yulfi Desi, Suswati, Milda Ernita.

Cordially,

Shelly Hernández
Program Coordinator



Utah State University
OFFICE FOR INTERNATIONAL EDUCATION

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Shelly Hernández
Program Coordinator

Setoran/transfer/kliring/inkaso
 Deposit/transfer/clearing/collection form



Bank Mandiri (Persero) Tbk.

Untuk transaksi berikut please do this transaction:

Tanggal date 30-10-2009

setoran ke rekening sendiri
 deposit to own account

transfer
 transfer

Kliring-Inkaso
 clearing-collection

Bank Draft
 bank draft

Isi dengan huruf cetak fill in with block letters

10153 1110110 105 07 30/10/2009 11:15:39 AM 2111
 36.037.500.00 BR
 419663-1 711 FATRI IDR 36.037.500.00 CR
 0 1.0000000
 TI KP PDR
 FFFKTFIF 30/10/2009

PENGIRIMAN
 applicant

penduduk
 resident

bukan penduduk
 non-resident

Nama
 name

IR. SUDWATI, MP

PADANG. 001365845116

Alamat & nomor telepon
 address & telephone number

penduduk
 resident

bukan penduduk
 non-resident

IR. JULIATRI, USC
108-00-041966-1
HANDOUT PERALABU. MANGKA
PERABAWA

SUMBER DANA TRANSAKSI
 source of fund

Tunai
 cash

Debet rekening:
 debit account:

Cek/bilyet giro
 cheque

bank Tertarik drawee bank	Nomor cek/BG cheque number	Valuta currency	Nominal amount
			<u>36.037.500</u>

Jumlah setoran/transfer/kliring/inkaso
 deposit/transfer/clearing/collection amount

Rp 36.037.500

Terbilang
 in words

Tiga puluh enam juta tiga puluh tujuh
ribu lima ratus rupiah

BIAYA TRANSAKSI
 handling charge

Tunai
 cash

Debet rekening:
 debit account:

Biaya bank koresponden
 correspondent charge

Pengirim
 applicant

Penerima
 beneficiary

Lainnya
 others

TUJUAN TRANSAKSI
 underlying transaction

BEACH FEE UTAH STATE UNIV

Bank filled out by bank

RTGS/SKN)	
dependent charge	
authorization	Tanda tangan pemohon applicant's signature
SPRIS Teller	



Utah State University
OFFICE FOR INTERNATIONAL EDUCATION

INTERNATIONAL SCHOLARSHIP PROGRAMS

November 5, 2009

To Whom It May Concern:

This is to verify that we have received a payment of \$100.00 from Suswati for the accommodations fee Utah State University incurred when reserving housing arrangements for the time they will spend at our Logan campus as part of the Indonesian Sandwich Program, funded by the General Directorate of Higher Education for the Republic of Indonesia.

Cordially,

Shelly Hernandez

Program Coordinator



Utah State University
OFFICE FOR INTERNATIONAL EDUCATION

INTERNATIONAL SCHOLARSHIP PROGRAMS

November 5, 2009

To Whom It May Concern:

This is to verify that we have received a payment of \$100.00 from Suswati for the accommodations fee Utah State University incurred when reserving housing arrangements for the time they will spend at our Logan campus as part of the Indonesian Sandwich Program, funded by the General Directorate of Higher Education for the Republic of Indonesia.

Cordially,

Shelly Hernandez

Program Coordinator

Policy No. / No. Polis : 29-48-09-490016
 Invoice No. / No. Kwitansi : 29-48-09-490016

TRAVEL SAFE INSURANCE POLICY
(Polis Asuransi TRAVEL SAFE)

This Policy and the Schedule shall be read together as one contract and any word or expression to which a specific meaning has been attached in any part of this Policy or of the Schedule shall bear such specific meaning wherever it may appear / *Polis ini dan Ikhtisarnya merupakan satu kesatuan kontrak asuransi dan setiap kata atau ungkapan dengan arti yang khusus dimanapun dicantumkan di dalam Polis ini atau Ikhtisar akan mempunyai arti khusus yang sama dimanapun berada.*

THE SCHEDULE / Ikhtisar

Type of Policy / Tipe Polis : Individual / Individu ()
 Family / Keluarga ()
 Group / Grup ()

The Insured / Tertanggung : IR. SUSHATI
 Business / Bisnis : DOSEN
 Address / Alamat : JL. SUNGAI BALANG PAUH V RT.002 RW.004, PADANG
 Telephone Number / No. Telepon :

The Insured Person(s) / Tertanggung : SUSHATI
 Date of Birth / Tanggal Lahir : 25 M E I 1965
 Occupation / Pekerjaan : DOSEN
 Passport Number / No. Paspor : S189286
 Destination / Negara Tujuan : UNITED STATES OF AMERICA
 Selected Plan / Plan yang dipilih : VIP PLAN

Beneficiary (ies) / Ahli Waris : FEBRIANI SOFYAN (DAUGHTER)

The Period of Insurance / Periode Asuransi
 From / Dari : 03 NOVEMBER 2009 To / Sampai : 03 FEBRUARI 2010 Both Date Inclusive

Additional Clause / Klausula Tambahan : 40 42 TS1

Premium / Premi : USD 188.00
 Policy Cost & Stamp Duty / Biaya Polis & Materai : USD 2.50
 Total : USD 190.50

IN WITNESS whereof the undersigned, acting on behalf of the Company hereto set his hand / *Dengan ini dinyatakan bahwa yang bertandatangan dibawah ini, bertindak untuk dan atas nama Perusahaan*

For any emergency case or if you need assistance during the journey, please contact to 24-hour BLUE DOT Assistance Hotline No. (62-21)-56961177.

At / di : PADANG Date / tanggal : 02 NOVEMBER

PT ASURANSI CENTRAL ASIA
 CAGUNG PADANG
 60000 PADANG
 METEOR STAMPEL

Travel Agent / Agen Perjalanan : DIRECT PADANG

Authorized Signature / Tanda tangan yang bertanggung

04617





COLDWELL BANKER GOLD KEY REALTY, INC.

135 SOUTH MAIN, SUITE 100

LOGAN, UTAH 84321

PHONE: (435) 753-8824

3123

DATE Nov 5, 2009

Received from Suswati
Six Hundred Sixty Only Dollars \$ 660.

For rent of: 755 East 700 No #32B

From Nov 1, 2009 To Feb 1, 2010

AMOUNT OF ACC'T	\$	<u>660.⁰⁰</u>	CASH	<input checked="" type="checkbox"/>
AMOUNT PAID	\$	<u>660.⁰⁰</u>	CHECK	<input type="checkbox"/>
BALANCE DUE	\$	<u>-0-</u>	OTHER	<input type="checkbox"/>

COLDWELL BANKER GOLD KEY REALTY, INC.
By Sharon R. Welsh
THANK YOU!

Starts, Inc.

Barbara R. M. K. E. L. E.
Packing Slip

Park Road
32712
407-889-8055
-889-2523

Order # 2172800
Ship date 12/07/09
Cust. # 4129

UNIVERSITY
LS & CLIMATE DEPT

843224820

Ship to

UTAH STATE UNIVERSITY
PLANTS, SOILS & CLIMATE DEPT

LOGAN, UT 843224820
Phone # 435-797-2238

BIT CARD P.O. #

Carrier FED EX STD O/N

Trays B/O Item

24.00 0 Micro Musa 'Saba'-1

24.00

State of Florida
Department of Agriculture and Consumer Services
1911 SW 34 St. / PO Box 147100, Gainesville, FL 32614-7
Nematode inspection certificate
04720397
843224820 (21), F.S.

AGRI-STARTS, INC.
1000 ELLY PARK RD
PKA FL 32712

This nursery stock has been visually
examined for pests and meets at least the
requirements of Chapter 581, Florida Statutes

12/09/03

NO DELAY

State of Florida
Department of Agriculture and Consumer Services
1911 SW 34 St. / PO Box 147100, Gainesville, FL 32614-7

Texas Certificate
Section 581.031(23)(a)F.S.

AGRI-STARTS, INC.
Nematode Certification number 1219
Nursery Registration number 04720397

This is to certify that the materials in this shipment have
been examined and found apparently free of burrowing
nematode and meet the requirements for Texas Quarantine
4TAC, Chapter P. Diaprepes root weevil.

DACS - 08048 Revised 09/03
This certificate is valid unless revoked for cause

FLORIDA DEPARTMENT OF AGRICULTURE
AND CONSUMER SERVICES
DIVISION OF PLANT INDUSTRY
Section 581.031 (17) F.S.

AGRI-STARTS, INC.
4720397

Meets the requirements of Mississippi apple snail
quarantine, Apple snail is not known to occur in the
area of production

DACS - 08210 Revised 03/01



Invoice Number 03002

Customer Joseph B Morton

WVU FIMS# _____

Invoice Date 02 December 2009

Customer Address Dept. Plants Soils Climate, Utah State University

Agency 300

P.O. No _____

4820 Old Main Hill

WVU F.E.I.N. 55-6000842

Logan, Utah 84322-4820

DESCRIPTION	CUMULATIVE	CURRENT PERIOD
Glomus clarum AU402B (200 cc)	\$50	
Shipping (UPS overnight)	\$15	
MAKE CHECKS PAYABLE TO: WEST VIRGINIA UNIVERSITY-----TOTAL DUE		\$65

Dept Name Plant and Soil Sciences

Phone 304-293-8836

Name Joseph Morton (jbmorton@mail.wvu.edu)

Title Professor

Signature Joseph B Morton

Date _____ Receipt Number _____ Total Receipt Amount _____

Amount	Campus	DA	Fund	Line Item	Function	Project
\$65	1,1	5,5,0,2,3,0,3,7,9	1,1,3,0,0,6,9,8	4,1,0,8,5,0,1	9,9,9	9,9,9,9,9,9,9,9

Bag # _____

CHECK \$ _____

UNIVERSITAS MEDAN AREA

Mail Payment To: **Dr. Joseph B. Morton**
1090 Agricultural Sciences Building
P.O. Box 6108
Morgantown, WV 26506-6108



Garuda Indonesia

ELECTRONIC TICKET RECEIPT

DUPLICATE

GARUDA INDONESIA (NPWP: 01.001.634.3-051.000)
KEBON SIRIH NO 44 GAMBIR JAKARTA-PUSAT

THANK YOU FOR USING GARUDA INDONESIA ELECTRONIC TICKET SERVICE.
THIS IS YOUR TRAVEL ITINERARY AND RECEIPT. THE NAME ON THE
IDENTITY CARD MUST MATCH WITH THE NAME OF THE PASSENGER SHOWN
BELOW :

PASSENGER NAME : SUSWATI/MRS
BOOKING REFERENCE : RFBUGL/GA I
ELECTRONIC TICKET NUMBER : 126 3840597137
ISSUED BY : 31OCT09 TCXODXY AGENT : 15081345
CAHAYA-BERSAMA
JLN LEMATANG23 JAKARTA

FROM 1515 JAKARTA CGK GA 164 OK 03FEB-03APR
1655 PADANG PDG ECONOMY 20K
MOX

PERMITS : FARE RESTRICTIONS APPLY

FARE CALC. : JKT GA PDG810000IDR810000
TAXES : IDR810000
SERVICES : IDR810000IDR100000IW IDR2700000YQ
CURRENCY : IDR1171000
PAYMENT : CASH

YOUR AIRLINE TICKET IS ELECTRONICALLY STORED IN OUR SYSTEM AND
IS SUBJECT TO CONDITIONS OF CONTRACT.

PLEASE BRING THIS RECEIPT AND YOUR IDENTITY CARD ON YOUR TRAVEL
AS REQUIRED BY AIRPORT / CHECK-IN COUNTER / CUSTOMS AND
IMMIGRATION OFFICIALS AS PROOF OF PURCHASE.

FARE ABOVE IS SUBJECT TO THE APPLICABLE CONDITIONS.

CHECK-IN COUNTERS WILL BE CLOSED 45 MINUTES PRIOR TO DEPARTURE.
PASSENGERS HAVE TO BE AT THE BOARDING GATE AT LEAST 30 MINUTES BEFORE
THE FLIGHT DEPARTS OR WE WILL LEAVE WITHOUT YOU TO AVOID UNNECESSARY
DELAYS.

TERMS AND CONDITIONS :
SERVICES AND OTHER SERVICES PROVIDED BY THE CARRIER ARE SUBJECT
TO THE CONDITIONS OF CARRIAGE WHICH ARE HEREBY INCORPORATED BY
REFERENCE. THESE CONDITIONS MAY BE OBTAINED FROM THE ISSUING
CARRIER.

DANGEROUS GOODS
FOR SAFETY REASON DANGEROUS ARTICLES SUCH AS COMPRESSED GASES /
FLAMMABLE /NON FLAMMABLE /POISONOUS /CORROSIVES /ACIDS /ALKALIS
WET CELL BATTERIES/ETOLOGIC AGENTS /BACTERIA /VIRUSES ETC/
EXPLOSIVES MUNITIONS/FIREWORKS /FLARES /RADIO ACTIVE /OXIDIZING
SUBSTANCES OR OTHER DANGEROUS GOODS ARTICLE MUST NOT BE CARRIED
IN PASSENGERS BAGGAGE.



Nomor :
 Tanggal : 00011532/09/PDGI
 Kepada : 03 Nov 2009
 ZULFATRI/MR

TANDA TERIMA

Tempo : 03 Nov 2009 Cust No : 888888

KETERANGAN					SATUAN	TOTAL
ZULFATRI/MR	PDG JKT	T	990 7777 357200	INV 00041505/09/JK2I	03/11	0.0
WATI/MRS	PDG JKT	T	990 7777 357201	INV 00041505/09/JK2I	03/11	0.0
LI DESI/MRS	PDG JKT	T	990 7777 357202	INV 00041505/09/JK2I	03/11	0.0
DA ERNITA/MRS	PDG JKT	T	990 7777 357203	INV 00041505	03/11	0.0
SAMAH/MR	PDG JKT	T	990 7777 357204	INV 00041505/09/JK2I	03/11	0.0
EF/MR	PDG JKT	T	990 7777 357205	INV 00041505/09/JK2I	03/11	0.0
ANDRI/MR	PDG JKT	T	990 7777 357206	INV 00041505/09/JK2I	03/11	0.0
					Grand Total	
					Total	IDR 0.0
					Grand Total	IDR 0.0

LUNAS
 03 Nov 2009

PDG - 061248

[Signature]
 Penetima

[Signature]
 Bagian Kassa

[Signature]
 WAWAN
 Pembuat