

FINAL REPORT

Isolation and identification of acetic acid bacteria from sources collected in
Thailand focusing at Thongphaphum district

Investigators:

Ms. Wanchern Potacharoen
Prof. Dr. Yamada Yuzo
Miss Pattaraporn Yukphan
Mr. Taweesak Malimas

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This project was supported by

University Research and Training Program (BRT)

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บทสรุปโครงการ

แบคทีเรียที่ผลิตกรดอะซิติกเป็นแบคทีเรียกลุ่มหนึ่งที่มีความสำคัญในด้านเทคโนโลยีชีวภาพ โดยเฉพาะอย่างยิ่งในอุตสาหกรรมการผลิตน้ำส้มสายชู การผลิตสาร L-sorbose และการผลิตเซลลูโลส แบคทีเรียกลุ่มนี้พบใน ดอกไม้ ผลไม้ เครื่องดื่มแอลกอฮอล์ ฯลฯ ปัจจุบันการศึกษาแบคทีเรียที่ผลิตกรด น้ำส้มสายชูในประเทศแถบเขตร้อน โดยเฉพาะอย่างยิ่งในประเทศไทยจะมุ่งเน้นในด้านผลิตภัณฑ์ที่ได้จากแบคทีเรียชนิดนี้ ซึ่งในธรรมชาตินั้นยังมีแบคทีเรียที่ผลิตกรดน้ำส้มสายชูอีกหลายชนิดที่ยังไม่รู้จัก ดังนั้นควรมีการศึกษาการคัดแยก และจำแนกแบคทีเรียกลุ่มนี้ เพื่อเป็นพื้นฐานที่สำคัญสำหรับนำไปประยุกต์ใช้ต่อไป การศึกษารุ่นนี้มีวัตถุประสงค์เพื่อ เก็บรวบรวมสายพันธุ์แบคทีเรียที่ผลิตกรดน้ำส้มสายชูในประเทศไทย ทำการจำแนกและจัดทำข้อมูลเพื่อสร้างแหล่งรวบรวมสายพันธุ์แบคทีเรียชนิดนี้ในประเทศไทย และพัฒนานักจัดจำแนกจุลินทรีย์ โดยอาศัยความรู้และประสบการณ์จากผู้เชี่ยวชาญที่มาทำงานในประเทศไทยโดยทุนรัฐบาลญี่ปุ่น นอกจากนี้โครงการ BRT ได้กำหนดพื้นที่วิจัยในทองผาภูมิ จ. กาญจนบุรี เพื่อศึกษาความหลากหลายของสิ่งมีชีวิตในบริเวณนี้ ดังนั้นการเก็บตัวอย่างจากบริเวณดังกล่าวเพื่อศึกษาจุลินทรีย์กลุ่มแบคทีเรียจะได้ข้อมูลจำนวนและชนิดของแบคทีเรียกลุ่มนี้เพิ่มขึ้นเพื่อความสมบูรณ์ของข้อมูล ระยะเวลาดำเนินโครงการ 1.5 ปี ตั้งแต่เดือนตุลาคม 2545 ถึง มีนาคม 2547

สำหรับขั้นตอนในการแยกแบคทีเรียที่ผลิตกรดน้ำส้มสายชูนั้นใช้วิธี enrichment ในอาหารเลี้ยงเชื้อ 4 ชนิด คือ Glucose-ethanol-acetic acid medium, Sorbitol medium, Sucrose-acetic acid medium และ Methanol medium และเก็บแบคทีเรียบริสุทธิ์ที่แยกได้โดยการแช่แข็งที่ -80°C เพื่อใช้ในการศึกษาต่อไป สำหรับการจำแนกแบคทีเรียที่แยกได้นั้นทำโดยการศึกษาลักษณะทางสัณฐานวิทยา สรีรวิทยา ชีวเคมี chemo-taxonomy และ การวิเคราะห์ลำดับนิวคลีโอไทด์ของ 16S rDNA

Project Summary

Acetic acid bacteria are very important in biotechnology, especially in vinegar production, production of L-sorbose and biocellulose. The habitats of the bacteria are therefore associated with sugar-rich flower, fruits, and alcoholic juices. The acetic acid bacteria in tropical countries, especially in Thailand are nowadays interested particularly in products from these bacteria. The bacteria are more abundant in nature and many are still unknown. The isolation and characterization of these bacteria are served for potential application. Therefore, this project aims to collect acetic acid bacteria from various sources in Thailand. The acetic acid bacteria database is also created as to establish acetic acid bacteria collection in Thailand and develop microbial taxonomists. As BRT initiated the area-based for biodiversity study, the data on number and genera of bacteria collecting from this area will be part of the BRT Project. This is a 1.5-year project starting from October 2002 to March 2004.

The enrichment technique will be used for acetic acid bacteria isolation in four kinds of enrichment media comprised of Glucose-ethanol-acetic acid medium, Sorbitol medium, Sucrose-acetic acid medium and Methanol medium. Freezing at -80°C will preserve the isolated acetic acid bacteria. The identification of the isolates includes the morphological, physiological and biochemical characteristics, chemotaxonomy and 16S rDNA sequencing analysis.

Expected achievement of the project:

1. Acetic acid bacterial cultures approximately 150 isolates
2. New species at least 3 strains
3. Publications 1
4. Microbial identification facilities available at BIOTEC
5. One or two trained persons to be bacterial taxonomists

บทสรุปรายงาน:

จากการเก็บตัวอย่างบริเวณพื้นที่ทองผาภูมิ จังหวัดกาญจนบุรี และนำมาแยกแบคทีเรียโดยวิธี enrichment สามารถแยกแบคทีเรียบริสุทธิ์ได้จำนวน 468 ตัวอย่าง ซึ่งแบคทีเรียทั้งหมดที่แยกได้นั้นได้ถูกเก็บรักษาไว้ที่อุณหภูมิต่ำ -80 องศาเซลเซียส สำหรับการนำไปศึกษาในอนาคต เพื่อทดสอบลักษณะต่างๆของแบคทีเรียที่แยกได้โดยวิธีแบบดั้งเดิมพบว่า แบคทีเรียจำนวน 307 ตัวอย่างจัดอยู่ในกลุ่มของแบคทีเรียที่ผลิตกรดน้ำส้มสายชู (acetic acid bacteria) และอีก 161 ตัวอย่างเป็นแบคทีเรียในกลุ่มอื่น สำหรับแบคทีเรียที่พบว่าเป็นแบคทีเรียผลิตกรดน้ำส้มสายชูนั้นสามารถแบ่งได้เป็น 5 กลุ่ม ได้แก่ สกุล *Asaia* จำนวน 153 ตัวอย่าง (49.8%) สกุล *Gluconobacter* จำนวน 122 ตัวอย่าง (39.7%) สกุล *Acetobacter* จำนวน 19 ตัวอย่าง (6.2%) สกุล *Gluconacetobacter* จำนวน 12 ตัวอย่าง (3.9%) และกลุ่มที่ไม่สามารถจำแนกได้ จำนวน 1 ตัวอย่าง (0.4%) เมื่อศึกษาลักษณะต่างๆตามวิธีการจำแนกพบว่าสามารถจำแนกชนิดในระดับสปีชีส์ได้ 24 ตัวอย่าง และจำแนกชนิดในระดับสกุลได้ 283 ตัวอย่าง และพบว่าเป็นแบคทีเรียสายพันธุ์ใหม่จำนวน 6 ชนิด ในจำนวนนี้ได้แก่ *Asaia krungthepensis*, Yukphan et al., 2004b) ซึ่งได้อธิบายลักษณะ และลงพิมพ์ในวารสาร International Journal of Systematic and Evolutionary Microbiology และอีก 5 ชนิด อยู่ในระหว่างการศึกษาลักษณะ นอกจากนี้ได้มีการพัฒนาเทคนิคในการจำแนกชนิดโดยการวิเคราะห์รูปแบบของการตัดด้วยเอนไซม์ตัดจำเพาะและการศึกษาลำดับนิวคลีโอไทด์บริเวณ 16S-23S rDNA โดยศึกษากับแบคทีเรียสกุล *Gluconobacter* (Yukphan et al., 2004a) แบคทีเรียที่จำแนกแล้วทุกสายพันธุ์ได้เก็บรักษาที่ห้องปฏิบัติการเก็บรักษาสายพันธุ์จุลินทรีย์ ศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ ซึ่งเป็นแหล่งรวบรวมสายพันธุ์และให้บริการด้านการจำแนกชนิดของแบคทีเรียผลิตกรดน้ำส้มสายชู

Report Summary:

Four hundred and sixty-eight isolates of bacteria were isolated from the samples collected from BRT area-based Thongphaphum district, Kanchanaburi and other sites in Thailand. All isolates were preserved at -80°C freezer for further study. Identification of these isolates by conventional method found that 307 isolates were acetic acid bacteria and 161 isolates were not. These bacteria were divided into 5 groups based on genera: *Asaia* 153 isolates (49.8%), *Gluconobacter* 122 isolates (39.7%), *Acetobacter* 19 isolates (6.2%), *Gluconacetobacter* 12 isolates (3.9%) and unidentified 1 isolates (0.4%). Identification of these isolates to species and generic level can be done for 24 and 283 isolates respectively. Among these, at least six new species were found during this study. One new species (*Asaia krungthepensis*, Yukphan et al., 2004b) was described and published in the International Journal of Systematic and Evolutionary Microbiology. The remaining 5 new species will be further studied and published in the near future. Furthermore, the new technique of identification, the restriction and sequence analysis of the 16S-23S rDNA, has been proposed for the genus *Gluconobacter* (Yukphan et al., 2004a). The identified isolates were deposited at BIOTEC Culture Collection. The specialized collection of acetic acid bacteria is now established at BIOTEC where identification service of bacteria can be performed.

Introduction

Six genera have been described for acetic acid bacteria: *Acetobacter* Beijerinck 1898, *Gluconobacter* Asai 1935, *Acidomonas* Urakami *et al.* 1989, *Gluconacetobacter* Yamada *et al.* 1997, *Asaia* Yamada *et al.* 2000 and *Kozakia* Lisdiyanti *et al.* 2002 (Yamada *et al.*, 2000; Lisdiyanti *et al.*, 2002).

The acetic acid bacteria are routinely identified at the generic level by combining the phenotypic feature of oxidation of acetate and lactate and the chemotaxonomic feature of ubiquinone homologues (Yamada *et al.*, 1999). When an acetic acid bacterium oxidizes acetate and lactate to carbon dioxide and water and has Q-9, it can be identified as *Acetobacter* species. The organism is identified as *Gluconobacter* species, when it does not show any oxidation of acetate and lactate but has Q-10. The members of the genus *Gluconacetobacter* are characterized by the oxidation of acetate and lactate and Q-10. The members of the genus *Asaia* do not produce either acetic acid from ethanol or grow in the presence of 0.35% acetic acid. The member of the genus *Kozakia* is known to produce a lot of levan-like polysaccharides when grown on sucrose as a carbon source. The members of the genus *Acidomonas* grow on methanol as a sole source of carbon.

The joint project between Southeast Asia and Japan was started in April of 1995 and finished in March of 2000. During the last five years, a number of strains of acetic acid bacteria were isolated from sources collected in Thailand, Indonesia and Philippines. Among the isolates of acetic acid bacteria, the strains that constitute *Asaia* and *Kozakia*, the fifth and sixth new genera of the family *Acetobacteraceae*, α -*Proteobacteria* and several new species were reported (Yamada *et al.*, 1999; Yamada *et al.*, 2000; Katsura *et al.*, 2001; Lisdiyanti *et al.* 2000, 2001 & 2002). It is assumed that there are many kinds of unknown acetic acid bacteria in Thailand. The aim of this research is focused on the acetic acid bacteria of Thailand, especially from the taxonomic point of view.

Objectives

1. To study the acetic acid bacteria from various sources in Thailand, especially in Thongphaphum district
2. To initiate acetic acid bacteria collection at BIOTEC
3. To develop bacterial taxonomist

Duration: one year and 6 months (1 January 2002 – 30 June 2003)

Materials and methods

1. Sample collection

Samples were collected from BRT area-based Thongphaphum district, Kanchanaburi and other sites in Thailand during January 2002 to November 2003. The target of sources are flowers, fruits and fruits juice, soil (Rhizosphere), fermented foods, palm sugar, Look-pang (mold brand) and waste.

2. Isolation and purification

An enrichment culture approach was employed at pH 3.5 or pH 4.0 (Yamada *et al.*, 1976). Four kinds of enrichment culture media were used (Yamada *et al.*, 1976 & 1999; Yamada *et al.*, 2000; Lisdiyanti *et al.*, 2001).

a) Glucose-ethanol-acetic acid medium that containing 1.5% D-glucose, 0.5% ethanol, 0.35% acetic acid, 0.3% peptone and 0.3% yeast extract and adjusted at pH 3.5 with HCl.

b) Sorbitol medium that containing 2.0% D-sorbitol, 0.3% peptone and 0.3% yeast extract and adjusted at pH 3.5 with HCl.

c) Sucrose-acetic acid medium that containing 2.0% sucrose, 0.35% acetic acid, 0.3% peptone and 0.3% yeast extract and adjusted at pH 3.5 with HCl.

d) Methanol medium that containing 0.8% methanol, 0.3% peptone and 0.3% yeast extract and adjusted at pH 4.0 with HCl.

Samples were aerobically inoculated in the enrichment culture media (5.0 ml) and incubated at 30°C for 3-4 days without shaking. When microbial growth were occurred, the culture were transfered to Glucose-Ethanol-Calcuim Carbonate Agar (GECA). Colonies capable of making clear zones are selected and purified for further analysis.

Pure cultures were preserved mainly at -80°C in an ultra low temperature freezer. Sterile 20% glycerol in Glucose-Yeast extract-peptone medium was used as a cryoprotectant.

3. Identification

All strains were identified by comparing their characteristics to the type strains (Yamada *et al.*, 1997; Yamada *et al.*, 2000; Lisdityanti *et al.*, 2000; Katsura *et al.*, 2001; Lisdityanti *et al.*, 2001; Katsura *et al.*, 2002 and Lisdityanti *et al.*, 2002). The method to identified of the isolates at the generic level were mostly those described in the previous study (Asai *et al.*, 1964; Yamada *et al.*, 1976; Yamada *et al.*, 1999; Yamada *et al.*, 2000 and Lisdityanti *et al.*, 2002).

3.1. Morphological Characteristics

The bacterial strain were grown on GECA for their colonial morphology and cellular morphology characterization.

3.2. Physiological and Biochemical Characteristics

3.2.1 Oxidation/Fermentation cataboloism test The isolate were inoculated in Hugh and Leifson's medium (Appendix B) by stabbing with a straight needle. After inoculation, overley the medium in only one tube with approximately 2 ml of sterile liquid paraffin. The incubation was done at 30°C. Interpret the results as follow, if only one the aerobic tube is acidified, the organism catabolizes the carbohydrate by oxidation. If both the aerobic and anaerobic tubes are acidified, the organism is capable of fermentation. If neither tube becomes acidified, the organism is unable to catabolized the carbohydrate.

3.2.2 Growth at different pH The isolates were suspended in 0.85% NaCl and inoculated into the different pH medium (Appendix B). The culture were incubated with out shaking for 7 days at 30°C. The pH were tested in this study are followed: pH 3.0, pH 3.5, pH 4.0, pH 4.5 and pH 5.0.

3.2.3 Oxidation of acetate and lactate The isolates were inoculated into oxidation of acetate and lactate test medium (Appendix B). The culture were incubated with out shaking for 7 days at 30°C. A positive was indicated by bue color. Yellow color indicated a negative test.

3.2.4 Growth in the media containing 0.3% acetic acid at pH3.5 The isolates were inoculated into the medium containing 0.3% acetic acid at pH3.5 (Appendix B). The culture were incubated with out shaking for 7 days at 30°C.

3.2.5 Growth in the media containing 30% D-Glucose The isolates were inoculated into the medium containing 30% D-Glucose (Appendix B). The culture were incubated with out shaking for 7 days at 30°C.

3.2.6 Formation of water-soluble brown pigment The isolates were inoculated on the GECA medium. After incubating at 30°C for 7-30 days, water soluble brown to dark brown pigment were observed.

3.2.6 Growth and acid production from different kind of Carbohydrates The isolates were suspended in 0.85% NaCl and inoculated into the growth and acid production test medium (Appendix B). The culture were incubated with out shaking for 7 days at 30°C, and observed the results everyday. The carbon sources were used in this study are followed: D-glucose, D-Mannose, D-Galactose, D-Fructose, L-Sorbose, D-Xylose, D-Arabinose, L-Arabinose, L-Rhamnose, D-Mannitol, D-Sorbitol, Dulcitol, m-Erythritol, Glycerol, Maltose, Lactose, Melibiose, Sucrose, Raffinose and Ethanol.

3.3. Chemotaxonomic characteristic

3.3.1 Ubiquinone analysis

The ubiquinone of acetic acid bacteria isolates were extracted and quanlitative determined. The isolates were culture in glycerol medium (Appendix B) with shaking condition at 30°C for 48 hours. Cells were collected by centrifugation and approximately 1 g wet cell were suspend in 100 ml of absolute ethanol: diethylether (1:3) and shaken for 20

minutes. After filtration, the extract was completely evaporated and dissolved in a small amount of acetone. The acetone solution was applied to silica gel TLC (0.5 mm silica gel, 60F₂₅₄ layers on 20x20 cm glass plate, Merck) and developed with hexane:diethyl ether (85:15) about 30 min. A yellow band, corresponding to a yellow spot of the reference standard that also visualize as a dark band under short wave UV light, is scrapped off. The silica gel powder is transferred to a tube and extracted with 1 ml of acetone. The solution is filtered with a 0.2 µm membrane filter and concentrated by N₂ gas. This sample could be stored at -20°C until use. Ubiquinone homologues are separated and identified by HPLC, using Cosmosil column (Waters, 5C18, 4.6 mm x 250 mm), methanol:isopropyl alcohol (2:1) as mobile phase at the flow rate of 1 ml/min. Ubiquinones is detected at 275 nm, and with known ubiquinones as standards.

3.4. Molecular characteristics

3.4.1 Ribosomal DNA sequencing and phylogenetic tree analysis For the precise identification at the generic and specie level, especially on proposal of a new species of acetic acid bacteria, rDNA sequencing and phylogenetic tree analysis were done.

- Isolation of DNA for amplification by PCR The bacterial isolates were harvest and suspend in 180 µl of Tris-EDTA buffer. Then, added 20 µl of 10% SDS and incubation at 50 °C for 10 minutes. Supernatant were extracted twice with 200 µl of Phenol:chloroform:isoamyl alcohol (25:24:1 v/v). DNA was precipitated with colded absolute ethanol, place at 20°C for 10 minutes and collected the DNA by centrifugation at 14,500 rpm for 15 minutes. DNA pellet were rinsed with 70% and 90% ethanol and then dried up (15-30 minutes at room temperature). The dried DNA is dissolved in 50 µl milli Q water.

- Amplification of 16S rDNA The 16S rDNA were amplified with primers 20F (5'-GAG TTT GAT CCT GGC TCA G-3', Position 9-27) and 1500R (5'-GTT ACC TTG TTA CGA CTT-3', Position 1509-1492) (Yamada *et al.*, 2000 and Katsura *et al.*, 2001). Position in the rDNA fragment were based on the Escherichia coli numbering system (accession number V00348; Brosius *et al.*, 1981). Amplification is carried out in 100 µl of reaction mixture containing 100 ng of genomic DNA, 2.5 U of Taq polymerase, 20 mM of each dNTP, 10 pM of each primer, 10 mM Tris-HCl and 1.5 mM MgCl₂. The reaction is performed for pre-denaturing at 94°C for 3 min and followed by 25 PCR cycles of denaturation at 94°C for 1

min, annealing at 55°C for 1 min and extension at 72°C for 2 min and then followed by the final extension at 72°C for 3 min. The amplified DNA is purified with QIAquick PCR Purification Kit according to the manufacturer's instruction. Visualization of the purified of amplified DNA is performed by electrophoresis using 0.8% agarose in 1X TAE buffer (0.09M Tris-borate, 0.001M EDTA; pH 8.0) and stained with ethidium bromide (8×10^{-5} µg/ml) and observed under UV Transilluminator.

- DNA sequencing Amplified 16S rDNA were sequenced directly with an ABI PRISM BigDye Terminator cycle sequencing ready reaction kit on an ABI PRISM model 310 Genetic Analyzer (both from Applied Biosystems). The following primers were used for sequencing: 20F, 1500R, 520F (5'-CAG CAG CCG CGG TAA TAC-3', Position 519-536), 520R (5'-GTA TTA CCG CGG CTG CTG-3', Position 536-519), 920F (5'- AAA CTC AAA TGA ATT GAC GG-3', Position 907-926) and 920R (5'- CCG TCA ATT CAT TTG AGT TT-3', Position 926-907).

- Phylogenetic analysis The sequences are pairwise compared by BLAST Homology Search (<http://www.ncbi.nlm.nih.gov/>). Multiple alignments of the sequences were carried out with the program CLUSTAL X (Version 1.81) (Thompson *et al.*, 1997). Distance matrices for the aligned sequences were calculated by using the two-parameter method of Kimura (1980) The neighbour-joining method was used to construct a phylogenetic tree (Saitou & Nei, 1987). Sites where gaps existed in any sequences are excluded. Bootstrap analysis is performed from 1,000 random re-samplings (Felsenstien, 1985).

3.4.2 DNA-DNA hybridization of acetic acid bacteria For the precise identification at the species level, especially on proposal of new species. The DNA-DNA similarity experiments were made by the method of Ezaki *et al.* (1983; 1989).

Results and Discussion

Part I: Isolation of acetic acid bacteria

Four hundred and sixty-eight isolates of bacteria were isolated from flowers, fruits, fermented foods, mushroom and some other substrates; such as Look-Pang, waste, soil etc. (Table 1 and Appendix D; Figure B) They were collected from BRT area - based Thongphaphum district, Kanchanaburi and other sites in Thailand (Appendix A; Table A and Appendix D; Figure A). The acetic acid bacteria isolates were purified and preserved at -80°C freezer at BIOTEC Culture Collection.

Table 1. Type of samples and number of acetic acid bacteria isolates.

province	Fermented food	Flower	Fruit	Mushroom	Other	Grand Total
Ayutaya	5		1		1	7
Bangkok		59	7		2	68
Chaing-Mai		35	17			52
Kanchanaburi		138	45	11	7	201
Nakornratchasima	10	3	20		8	41
Nonthaburi		19	14			33
Ratchaburee		31				31
Samutsakorn		14	2		1	17
Suratthani		18				18
Grand Total	15	317	106	11	19	468

Part II: Identification of the isolates by conventional methods

All isolates were tested the growth at different pH and oxidation/ fermentation metabolism, one hundred and sixty one isolates (34.4%) were identified as non acetic acid bacteria since they showed the fermentative metabolism and/or no growth in medium at pH 3.5. The remaining 307 isolates (65.6%) were assumed to be acetic acid bacteria (Figure 1).

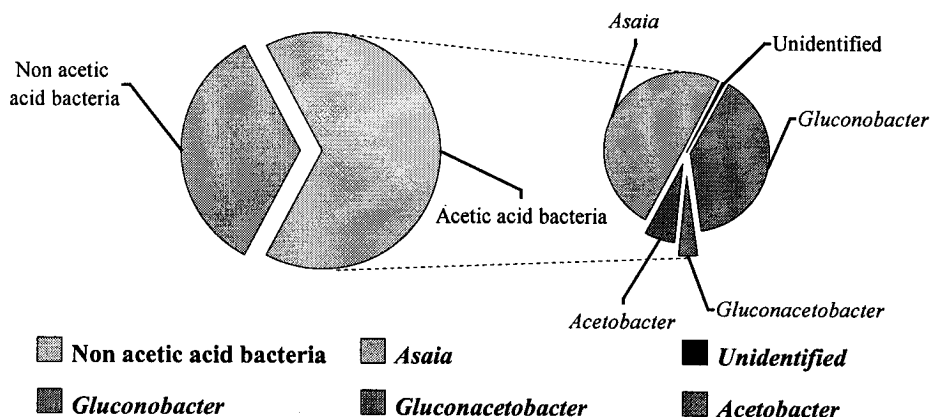


Figure 1. Chart of number of acetic acid bacteria classified to be 5 genera.

Three hundred and seven of acetic acid bacteria isolates were classified based on the growth characteristics in the media containing 0.3% acetic acid at pH3.5 and sorbital, oxidation of acetate and lactate, growth in the media containing 30% D-Glucose, formation of water-soluble brown pigment and type of ubiquinone (Appendix A; Table B).

The isolates can be classified by above morphological, biochemical and physiological characteristics into 5 groups, namely, genus *Asaia* (153 isolates), genus *Gluconobacter* (122 isolates), genus *Gluconacetobacter* (12 isolates), genus *Acetobacter* (19 isolates) and unidentified (1 isolates).

Among the isolates, the first eighty isolates that classified into genus *Asaia* and some strains in genus *Gluconobacter* and genus *Gluconacetobacter* were test acid formation from twenty C-sources for grouping and identification in species level. The results were shown in Appendix A; Table C.

The results of acid production from C-sources and other tested characteristics showed various characteristics and somewhat different from the known species. So, the phenotypic characteristics are difficult to identified these isolates at the specific level. However, these characteristics can be used for grouping very similar isolates and selected the different isolate to determine 16S rDNA for specie identification.

Part III: Species-identification by 16S rDNA sequence and phylogenetic analysis

The phylogenetics tree based on the 16S rDNA sequences of the thirty six representative isolates of acetic acid bacteria were analized and constructed from the evolutionary distance data according to Kimura (1980) by the neighbor-joining method (Saitou and Nei, 1987).

The results showed that thirty four isolates were located in various genera of acetic acid bacteria. The remaining two isolates were located in the cluster of *Erwinia* and *Lactococcus*, as shown in Figure 2. The isolates in the cluster of acetic acid bacteria were located in five genera, 19 isolates in the cluster of *Asaia*, 1 isolate in the cluster of *Kozakia*, 11 isolates in

the cluster of *Gluconobacter*, 1 isolate in the cluster of *Gluconacetobacter* and 2 isolates in the cluster of *Acetobacter*.

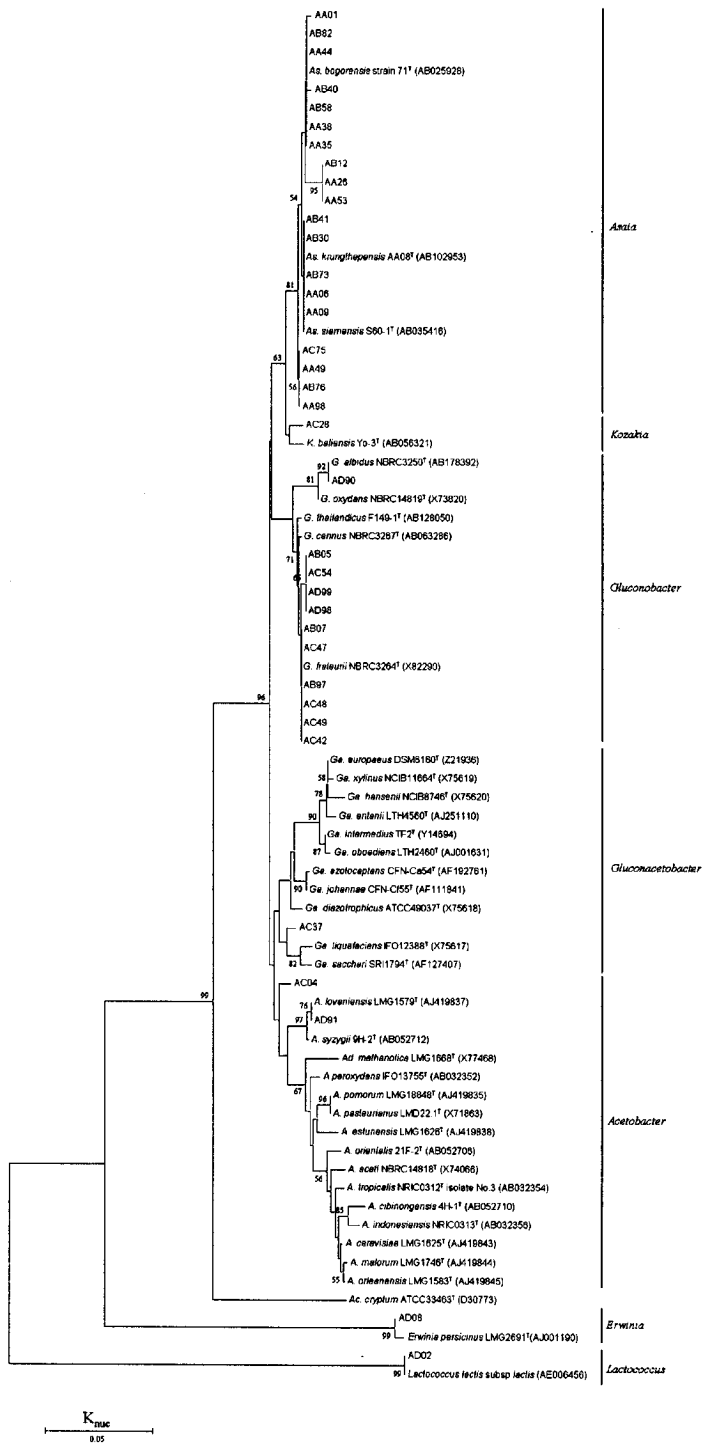


Figure 2. Phylogenetic tree of all strains

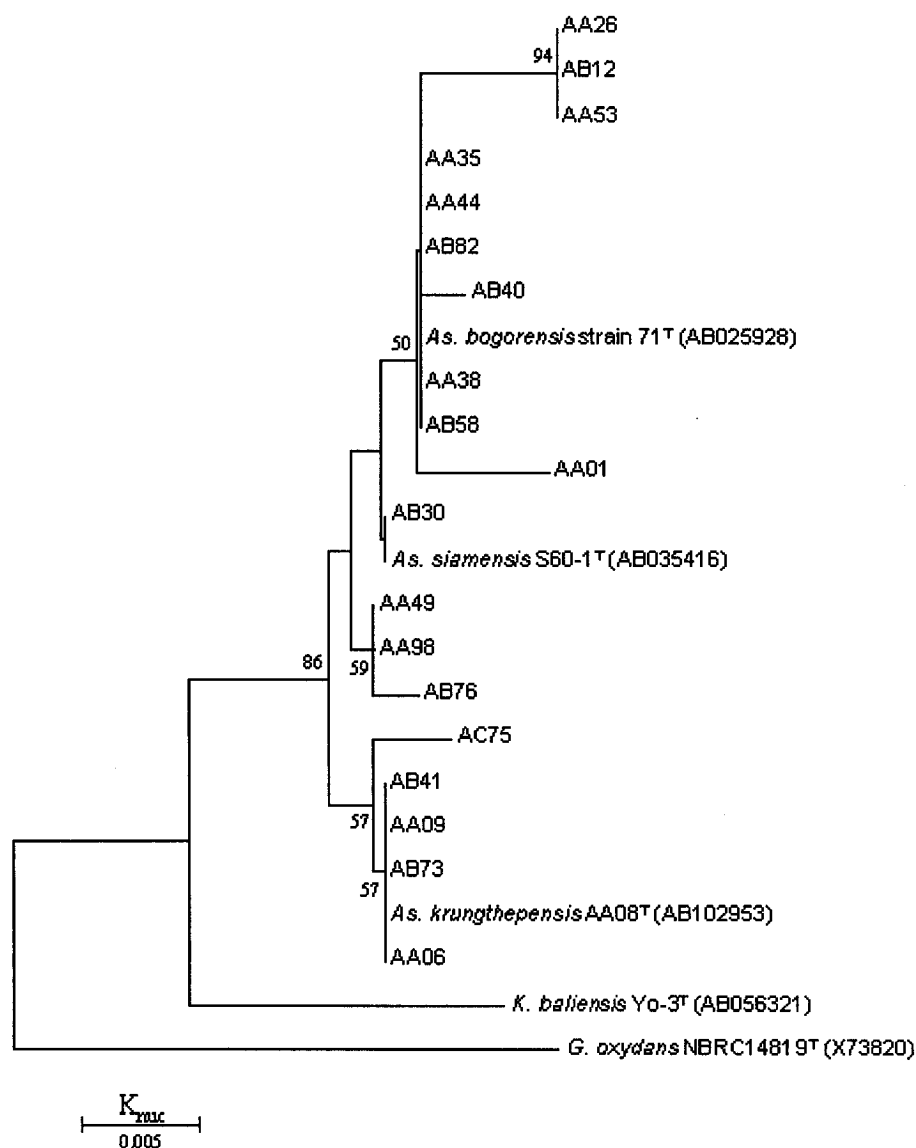


Figure 3. Phylogenetic tree of the strains assigned to genus *Asaia*

Nineteen isolates of *Asaia* can be divided into four clusters, as shown in Figure 3. Ten isolates (AA26, AA12, AA53, AA35, AA44, AB82, AB40, AA38, AB58 and AA01) were clustered with the type strain of *Asaia bogorensis* cluster. One isolate, AB30, was clustered with the cluster of type strain of *Asaia siamensis*. Nine isolates were located in the different two clusters of the known species. Among them, five isolates (AA08, AA06, AA09, AB41 and AB73) were characterized and proposed to be *Asaia krungthepensis* sp. nov. (Appendix X; Yukphan; 2004). Four isolates (AA49, AA98, AB76 and AC75) were located in the separate two clusters, they may be two new species (I; AA49, AA98 and AB76, II; AC75). However, the information of DNA-DNA hybridization, G+C content and so on are necessary for publication.

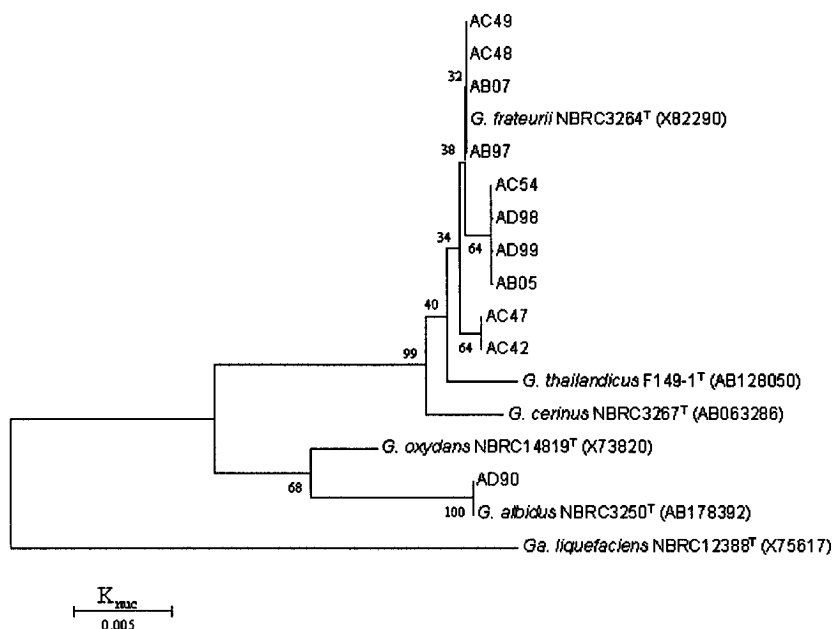


Figure 4. Phylogenetic tree of the strains assigned to genus *Gluconobacter*

Eleven isolates of *Gluconobacter* can be divide into four cluster, as showed in Figure 4. Four isolates (AC49, AC48, AB07 and AB97) were clustered with the type strain of *Gluconobacter frateurii* cluster. One isolate, AD90, was clustered with the cluster of type strain of *Gluconobacter albidus*. Six isolates were located in the different two clusters of the known species, they may be two new species (III; AC54, AD98, AD99 and AB05, IV; AC47 and AC42). However, the information of DNA-DNA hybridization, G+C content and so on are necessary for publication.

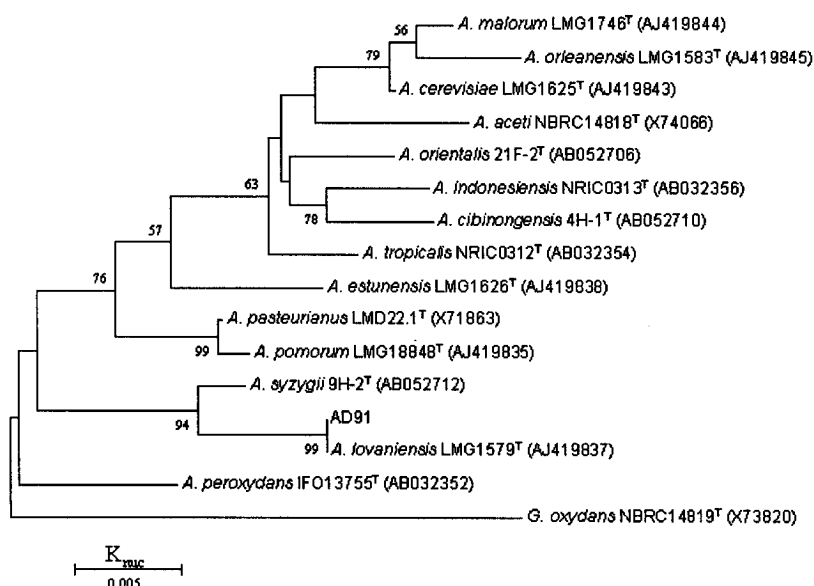


Figure 5. Phylogenetic tree of the strains assigned to genus *Acetobacter*

There is only one isolate, AD91, were located in the *Acetobacter* lineage. This isolate was located in the same cluster of *Acetobacter lovaniensis* (Figure 5).

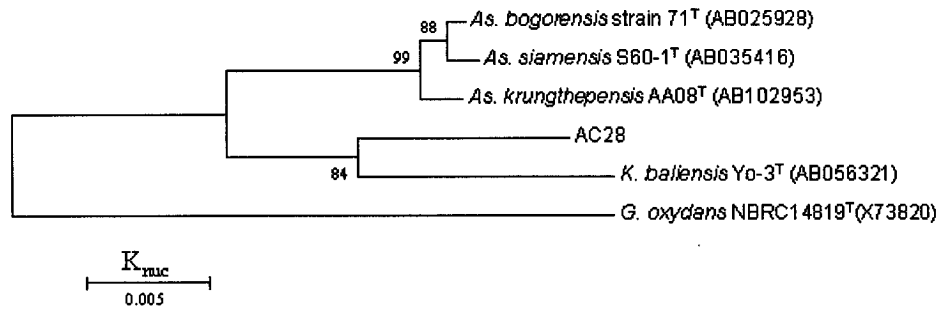


Figure 6. Phylogenetic tree of the strains assigned to genus *Kozakia*

Phylogenetic relationship showed that the isolate AC28 was located in the same cluster with *Kozakia baliensis* (Figure 6), however the phylogenetic distance between AC28 and *Kozakia baliensis* is very long. The isolate AC28 may be the additional new specie.

The results of phylogenetic analysis based on 16S rDNA were compared with the conventional methods as showed in Table 5.

Table 5. Identification by 16S rDNA sequence and phylogenetic analysis

Code	Identified as	
	Conventional methods	16S rDNA sequence and phylogenetic analysis
AA01	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AB82	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AA44	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AB40	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
Ab58	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AA38	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AA35	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AB12	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AA26	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AA53	<i>Asaia</i> sp.	<i>Asaia bogorensis</i>
AB41	<i>Asaia</i> sp.	<i>Asaia krungthepensis</i>
AB30	<i>Asaia</i> sp.	<i>Asaia siamensis</i>
AB73	<i>Asaia</i> sp.	<i>Asaia krungthepensis</i>
AA06	<i>Asaia</i> sp.	<i>Asaia krungthepensis</i>
AA09	<i>Asaia</i> sp.	<i>Asaia krungthepensis</i>
AA08	<i>Asaia</i> sp.	<i>Asaia krungthepensis</i>
AC75	<i>Asaia</i> sp.	<i>Asaia</i> sp.
AA49	<i>Asaia</i> sp.	<i>Asaia</i> sp.
AB76	<i>Asaia</i> sp.	<i>Asaia</i> sp.
AA98	<i>Asaia</i> sp.	<i>Asaia</i> sp.
AC28	Unidentified	<i>Kozakia</i> sp.
AD90	<i>Gluconobacter</i> sp.	<i>Gluconobacter albidus</i>
AB05	<i>Gluconobacter</i> sp.	<i>Gluconobacter</i> sp.
AC54	<i>Gluconobacter</i> sp.	<i>Gluconobacter</i> sp.
AD99	<i>Gluconobacter</i> sp.	<i>Gluconobacter</i> sp.
AD98	<i>Gluconobacter</i> sp.	<i>Gluconobacter</i> sp.
AB07	<i>Gluconobacter</i> sp.	<i>Gluconobacter</i> sp.
AC47	<i>Gluconobacter</i> sp.	<i>Gluconobacter frateurii</i>
AB97	<i>Gluconobacter</i> sp.	<i>Gluconobacter frateurii</i>
AC48	<i>Gluconobacter</i> sp.	<i>Gluconobacter frateurii</i>

Table 5. Continued.

Code	Identified as	
	Conventional methods	16S rDNA sequence and phylogenetic analysis
AC49	<i>Gluconobacter</i> sp.	<i>Gluconobacter frateurii</i>
AC42	<i>Gluconobacter</i> sp.	<i>Gluconobacter</i> sp. nov.
AC37	<i>Gluconacetobacter</i> sp.	<i>Gluconacetobacter</i> sp.
AC04	<i>Gluconacetobacter</i> sp.	<i>Acetobacter</i> sp.
AD91	<i>Acetobacter</i> sp.	<i>Acetobacter lovaniensis</i>
AD08	Not determined	<i>Erwinia persicinus</i>
AD02	Not determined	<i>Lactococcus lactis</i>

Table 6. The number of isolates were devided in groups by sampling sources and genera.

Genus	Fermented food	Flower	Fruit	Mushroom	Other	Grand Total
<i>Acetobacter</i> sp.		9	8	2		19
<i>Asaia</i> sp.		132	19	2		153
<i>Gluconacetobacter</i> sp.		7	2		3	12
<i>Gluconobacter</i> sp.	12	42	60	2	6	122
Unidentified (acetic acid bacteria)		1				1
non acetic acid bacteria	3	126	17	5	10	161
Grand Total	15	317	106	11	19	468

The most number of isolates from flowers were identified as *Asaia* sp. (132 isolates; 86.77% of 317 isolates) and non acetic acid bacteria (126 isolates; 78.26% of 317 isolates). The most isolates from fruits were identified as *Gluconobacter* (60 isolates; 49.18% of 106 isolates). The most *Asaia* sp. were isolated from flowers (132 isolates; 86.27% of 153 isolates) most *Gluconobacter* sp. were isolated from fruits (60 isolates; 49.8% of 122 isolates and flowers (42 isolates; 34.42% of 122 isolates). These results indicated the dominant species of acetic acid bacteria may have some relations with the sources of isolation. Distibution of all isolates were shown in Table 7.

Table 7. The number of isolates were devided in groups by genera and provinces.

Province	<i>Acetobacter</i> sp.	<i>Asaia</i> sp	<i>Gluconacetobacter</i> sp.	<i>Gluconobacter</i> sp.	Unidentified	non acetic acid bacteria	Grand Total
Ayutaya				2		5	7
Bangkok		19	4	12		33	68
Chaing-Mai	5	16	5	18	1	7	52
Kanchanaburi	14	72		54		61	201
Nakornratchasima			3	36		2	41
Nonthaburi		10				23	33
Ratchaburi		18				13	31
Samutsakorn		9				8	17
Suratthani		9				9	18
Grand Total	19	153	12	122	1	161	468

Conclusion

Four hundred and sixty-eight isolates of bacteria were isolated from the samples collected from BRT area-based Thongphaphum district, Kanchanaburi and other sites in Thailand. All isolates were preserved at -80°C freezer at BIOTEC Culture Collection and identified by conventional methods. Three hundred and seven isolates were identified as acetic acid bacteria and can be divide into 5 groups by conventional methods; *Asaia* 153 isolates (49.8%), *Gluconobacter* 122 isolates (39.7%), *Acetobacter* 19 isolates (6.2%), *Gluconacetobacter* 12 isolates (3.9%) and unidentified 1 isolates (0.4%). Unidentified isolates and the precised species identification of some isolates were done by 16S rDNA sequence and phylogenetic analysis. In this study, twenty-four isolates can be identified at species level and the remaining 283 isolates can be identified at genus level. Among the isolates, at least additional six new species can be found in this study, one new species (*Asaia krungthepensis* (Yukphan et al., 2004) was described and published in International Journal of Systematic and Evolutionary Microbiology. The remaining new species should be studied the further characteristics and perform DNA-DNA hybridization to describe the new species. These results showed high species diversity of acetic acid bacteria in Thailand.

Achievement of project

1. Collection of acetic acid bacteria: 283 isolates.
2. New species: 6 newspecies
3. New technique of identification
4. Two publications and six presentation at the conferences (Appendix C)
5. One bacterial taxonomist
6. Identification facilities at BIOTEC (90%)
7. Identification service established at BIOTEC
8. Network of acetic acid bacteria taxonomists (Chulalongkorn University, Kasetsart University; Thailand and NITE-BRC, Japan)
9. Good collaboration with foreign organization (NITE-BRC, Japan)

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Reference

- Asai, T., Iizuka, H. & Komagata, K. (1964). The flagellation and taxonomy of genera *Gluconobacter* and *Acetobacter* with reference to the existence of intermediate strains. *J Gen Appl Microbiol* **10**, 95-126.
- Ezaki, T., Hashimoto, Y. & Yabuuchi, E. (1989). Fluorometric deoxyribonucleic acid-deoxyribonucleic acid hybridization in microdilution wells as an alternative to membrane filter hybridization in which radioisotopes are used to determine genetic relatedness among bacterial strains. *Int J Syst Bacteriol* **39**, 224-229.
- Ezaki, T., Yamamoto, N., Ninomiya, K., Suzuki, S. & Yabuuchi, E. (1983). Transfer of *Peptococcus indolicus*, *Peptococcus asaccharolyticus*, *Peptococcus prevotii* and *Peptococcus magnus* to the genus *Peptostreptococcus* and proposal of *Peptostreptococcus tetradius* sp. nov. *Int J Syst Bacteriol* **33**, 683-698.
- Felsenstein, J. 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evol.* **39**: 738-791.
- Katsura, K., Yamada, Y., Uchimura, T., and Komagata, K. (2002) *Gluconobacter asaii* Mason and Claus 1989 is a junior subjective synonym of *Gluconobacter cerinus* Yamada and Akita 1984. *Int. J. Syst. Evol. Microbiol.*, **52**, 1635-1640.
- Katsura, K., Kawasaki, H., Potacharoen, W., Saono, S., Seki, T., Yamada, Y., Uchimura, T. & Komagata, K. (2001). *Asaia siamensis* sp. nov., an acetic acid bacterium in the α -*Proteobacteria*. *Int J Syst Evol Microbiol* **51**, 559-563.
- Kimura, M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *J. Mol. Evol.* **16**: 111-120.
- Lisdiyanti, P., Kawasaki, H., Seki, T., Yamada, Y., Uchimura, T., and Komagata, K. (2000) Systematic study of the genus *Acetobacter* with descriptions of *Acetobacter indonesiensis* sp. nov., *Acetobacter tropicalis* sp. nov., *Acetobacter orleanensis* (Henneberg 1906) comb. nov., *Acetobacter lovaniensis* (Frateur 1950) comb. nov., and *Acetobacter estunensis* (Carr 1958) comb. nov. *J. Gen. Appl. Microbiol.*, **46**, 147-165.
- Lisdiyanti, P., Kawasaki, H., Seki, T., Yamada, Y., Uchimura, T., and Komagata, K. (2001). Identification of *Acetobacter* strains isolated from Indonesian sources, and proposals

- of *Acetobacter syzygii* sp. nov., *Acetobacter cibinongensis* sp. nov., and *Acetobacter orientalis* sp. nov. *J. Gen. Appl. Microbiol.*, **47**, 119-131.
- Lisdiyanti, P., Kawasaki, H., Widyastuti, Y., Saono, S., Seki, T., Yamada, Y., Uchimura, T. & Komagata, K. (2002) *Kozakia baliensis* gen. nov., sp. nov., a novel acetic acid bacterium in the α -Proteobacteria. *Int J Syst Evol Microbiol* **52**, 813-818.
- Saitou, N. and M. Nei. 1987. The neighbor-joining method: A new method for reconstructing phylogenetic trees. *Mol. Biol. Evol.*, **4**, 406-425.
- Thompson, J. D., Gibson, T. J., Plewniak, F., Jeanmougin, F. & Higgins, D. G. (1997). The CLUSTAL X windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. *Nucleic acid Res* **25**, 4876-4882.
- Yamada, Y., Okada, Y., and Kondo, K. (1976). Isolation and Characterization of "Polarly Flagellated Intermediate Strains" in Acetic Acid Bacteria. *J. Gen. Appl. Microbiol.*, **22**, 237-345.
- Yamada, Y., Hoshino, K., and Ishikawa, T. (1997). The Phylogeny of Acetic Acid Bacteria Based on the Partail Sequences of 16S Ribosomal RNA: The Elevation of the Subgenus *Gluconoacetobacter* to the Generic Level. *Biosci. Biotech. Biochem.*, **16**, 1244-1251.
- Yamada, Y., Hosono, R., Lisdiyanti, P., Widyastuti, Y., Saono, S., Uchimura, T. & Komagata, K. (1999). Identification of acetic acid bacteria isolated from Indonesian sources, especially of isolates classified in the genus *Gluconobacter*. *J Gen Appl Microbiol.*, **45**, 23-28.
- Yamada, Y., Katsura, K., Kawasaki, K., Widyastuti, Y., Saono, S., Seki, T., Uchimura, T. & Komagata, K. (2000). *Asaia bogorensis* gen. nov., sp. nov., an unusual acetic acid bacterium in the α -Proteobacteria. *Int J Syst Evol Microbiol.*, **50**, 823-829.
- Yukphan, P., Potacharoen, W., Nakagawa, Y., Tanticharoen, M., and Yamada, Y. (2004a) Identification of strains assigned to the genus *Gluconobacter* Asai 1935 based on the sequence and the restriction analyses of the 16S-23S rDNA internal transcribed spacer regions. *J. Gen. Appl. Microbiol.*, **50**, 9-15.
- Yukphan, P., Potacharoen, W., Tanasupawat, S., Tanticharoen, M., and Yamada, Y. (2004b) *Asaia krungthepensis* sp. nov., an acetic acid bacterium in the α -Proteobacteria. *Int. J. Syst. Evol. Microbiol.*, **54**, 313-316.

Appendix A

List and characteristics of acetic acid bacteria

Table A. List of acetic acid bacteria isolated from from BRT area-based Thongphaphum district, Kanchanaburi and other sites in Thailand

CODE	BCC Code	Original code	Source	Location	Date of collection
AA01	15641	2B3S1	Flower of <i>Hibiscus</i> sp.	Benjasiri Park ¹	22-Jan-02
AA02	15642	2B3S2	Flower of <i>Hibiscus</i> sp.	Benjasiri Park ¹	22-Jan-02
AA03	-	2B10M1	Flower of <i>Plumeria</i> sp.	Emporium Suites ¹	23-Jan-02
AA04	15643	2B12S3	Flower of <i>Heliconia</i> sp. (ปักชำสววรรค์)	Emporium Suites ¹	23-Jan-02
AA05	15644	2B12G4	Flower of <i>Heliconia</i> sp. (ปักชำสววรรค์)	Emporium Suites ¹	23-Jan-02
AA06	12977	2B12SU1-1	Flower of <i>Heliconia</i> sp. (ปักชำสววรรค์)	Emporium Suites ¹	23-Jan-02
AA07	15645	2B12SU1-2	Flower of <i>Heliconia</i> sp. (ปักชำสววรรค์)	Emporium Suites ¹	23-Jan-02
AA08	12978	2B12SU2-1	Flower of <i>Heliconia</i> sp. (ปักชำสววรรค์)	Emporium Suites ¹	23-Jan-02
AA09	12979	2B12SU2-2	Flower of <i>Heliconia</i> sp. (ปักชำสววรรค์)	Emporium Suites ¹	23-Jan-02
AA10	15646	2B13SU1-1	Flower of <i>Heliconia</i> sp. (ก้ามปู)	Emporium Suites ¹	23-Jan-02
AA11	12457	2B13SU1-2	Flower of <i>Heliconia</i> sp. (ก้ามปู)	Emporium Suites ¹	23-Jan-02
AA12	12458	2B13SU2-1	Flower of <i>Heliconia</i> sp. (ก้ามปู)	Emporium Suites ¹	23-Jan-02
AA13	15647	2B13SU2-2	Flower of <i>Heliconia</i> sp. (ก้ามปู)	Emporium Suites ¹	23-Jan-02
AA14	-	2P1M2	Flower of <i>Crinum asiaticum</i>	Samutsakorn ²	7-Feb-02
AA15	15648	2P3S2	Flower of <i>Allamanda cathartica</i>	Samutsakorn ²	7-Feb-02
AA16	-	2P5S2	Flower of <i>Hibiscus rosa-sinensis</i>	Samutsakorn ²	7-Feb-02
AA17	-	2P5M1	Flower of <i>Hibiscus rosa-sinensis</i>	Samutsakorn ²	7-Feb-02
AA18	15649	2P7S2	Unknown	Samutsakorn ²	7-Feb-02
AA19	15650	2P8S2	Fruit of <i>Citrus maxima</i>	Samutsakorn ²	7-Feb-02
AA20	15651	2P9S1	Flower of <i>Celotropis gigantea</i>	Samutsakorn ²	7-Feb-02
AA21	15652	2P9S2	Flower of <i>Celotropis gigantea</i>	Samutsakorn ²	7-Feb-02
AA22	-	PK12S21	Flower of <i>Artabotrys siamensis</i>	Pak-Kret ³	19-Mar-02
AA23	-	PK12S11	Flower of <i>Artabotrys siamensis</i>	Pak-Kret ³	19-Mar-02
AA24	15653	PK17S1-1	Fruit of <i>Punica granatum</i>	Pak-Kret ³	19-Mar-02
AA25	15654	PK17S2-1	Fruit of <i>Punica granatum</i>	Pak-Kret ³	19-Mar-02
AA26	15655	EP2S2'	Flower of <i>Alstonia scholaris</i>	Emporium Suites ¹	14-Mar-02
AA27	15656	EP2S2	Flower of <i>Alstonia scholaris</i>	Emporium Suites ¹	14-Mar-02
AA28	-	BJ11M1	Flower of <i>Alcea rosea</i>	Benjasiri Park ¹	14-Mar-02
AA29	15657	BT17S21	Fruit of <i>Sandoricum indicum</i>	Bang-Bua-Tong ³	25-Mar-02
AA30	15658	BT7M22	Fruit of <i>Coccinia grandis</i>	Bang-Bua-Tong ³	25-Mar-02
AA31	15659	BT7M23	Fruit of <i>Coccinia grandis</i>	Bang-Bua-Tong ³	25-Mar-02
AA32	-	BT16S22	ดอกสมเด็ยง	Bang-Bua-Tong ³	25-Mar-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AA33	-	BT16M23	ดอกสมเด็ญย่า	Bang-Bua-Tong ³	25-Mar-02
AA34	15660	BT17S12	Fruit of <i>Sandoricum indicum</i>	Bang-Bua-Tong ³	25-Mar-02
AA35	15661	KU12S11	Flower of <i>Plumeria</i> sp.	Kasetsart University ¹	17-Apr-02
AA36	15662	KU12M11	Flower of <i>Plumeria</i> sp.	Kasetsart University ¹	17-Apr-02
AA37	15663	KU12M21	Flower of <i>Plumeria</i> sp.	Kasetsart University ¹	17-Apr-02
AA38	15664	N2S2	Flower of <i>Citharexylum spinosum</i>	On-nuch BTS station ¹	14-Mar-02
AA39	15665	N2S2-1	Flower of <i>Citharexylum spinosum</i>	On-nuch BTS station ¹	14-Mar-02
AA40	15666	Y1SU1	Plum fruit	Dr. Yamada ¹	20-Mar-02
AA41	-	K23M1'	Flower of Unknown, yellow	Kasetsart ¹	27-Feb-02
AA42	15667	RB5S1-2	Flower of <i>Ixora</i> sp.	Ratchaburi ⁴	13-Mar-02
AA43	15668	RB5S1-2'	Flower of <i>Ixora</i> sp.	Ratchaburi ⁴	13-Mar-02
AA44	15669	RB7S1	Flower of <i>Jasminum sambac</i>	Ratchaburi ⁴	13-Mar-02
AA45	-	RB8M2	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AA46	-	RB14M1	Flower of <i>Gardenia jasminoides</i>	Ratchaburi ⁴	13-Mar-02
AA47	-	RB2M12	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AA48	-	RB2M22	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AA49	15670	RB2S11	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AA50	15671	RB2S21	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AA51	-	RB8M21	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AA52	-	RB8M24-1	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AA53	15672	RB10S21-1	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AA54	15673	RB10S22-1	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AA55	-	RB10M21	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AA56	-	RB10M22	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AA57	-	RB11S2	Flower of <i>Cordia sebestena</i>	Ratchaburi ⁴	13-Mar-02
AA58	-	RB16S1	Flower of <i>Solanum torvum</i>	Ratchaburi ⁴	13-Mar-02
AA59	-	PK6M1	Fruit of <i>Eugenia malaccensis</i>	Pak-Kret ³	19-Mar-02
AA60	-	BT14M11	Flower of <i>Scirpus grossus</i>	Bang-Bua-Tong ³	25-Mar-02
AA61	-	BJ1S2	Flower of <i>Plumeria</i> sp.	Benjasiri Park ¹	14-Mar-02
AA62	-	BJ14S1	Flower of <i>Adenium obesum</i>	Benjasiri Park ¹	14-Mar-02
AA63	-	BT15S22	Fruit of <i>Carica papaya</i>	Bang-Bua-Tong ³	25-Mar-02
AA64	-	PK6G2	Fruit of <i>Eugenia malaccensis</i>	Pak-Kret ³	19-Mar-02
AA65	-	RB12M2	Orchid (Vanda)	Ratchaburi ⁴	13-Mar-02
AA66	-	RB15M2	Flower of <i>Impatiens balsamina</i>	Ratchaburi ⁴	13-Mar-02
AA67	15674	2P8S2	Fruit of <i>Citrus maxima</i>	Samutsakorn ²	7-Feb-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AA68	15675	2P3S2	Flower of <i>Allamanda cathartica</i>	Samutsakorn ²	7-Feb-02
AA69	15676	RB10S23-2	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AA70	-	BT13M1	Unknown	Bang-Bua-Tong ³	25-Mar-02
AA71	-	BJ13M22	Flower of <i>Lagerstroemia macrocarpa</i>	Benjasiri Park ¹	14-Mar-02
AA72	-	BT14M12	Flower of <i>Scirpus grossus</i>	Bang-Bua-Tong ³	25-Mar-02
AA73	-	K55M1	Unknown	Kasetsart ¹	27-Feb-02
AA74	-	AY4S1	Fermented fish	Ayutaya ⁵	6-Mar-02
AA75	-	RB14M2	Flower of <i>Gardenia jasminoides</i>	Ratchaburi ⁴	13-Mar-02
AA76	-	2P34M1	Plam sugar	Samutsakorn ²	7-Feb-02
AA77	-	2P7M1	Unknown	Samutsakorn ²	7-Feb-02
AA78	-	RB3S2	Flower of <i>Euphorbia millii</i> .	Ratchaburi ⁴	13-Mar-02
AA79	-	AY4S2	Fermented fish	Ayutaya ⁵	6-Mar-02
AA80	15677	K34SU4	Flower of <i>Leucaena leucocephalade</i>	Kasetsart ¹	27-Feb-02
AA81	-	BT8S21	Flower of <i>Lagenaria siceraria</i>	Bang-Bua-Tong ³	25-Mar-02
AA82	-	BT8S22	Flower of <i>Lagenaria siceraria</i>	Bang-Bua-Tong ³	25-Mar-02
AA83	-	K24S1	Orchid Flower	Kasetsart ¹	27-Feb-02
AA84	-	AY12M1	Fruit of <i>Borassus flabellifer</i>	Ayutaya ⁵	6-Mar-02
AA85	15678	BT17S13	Fruit of <i>Sandoricum indicum</i>	Bang-Bua-Tong ³	25-Mar-02
AA86	-	2P3S1	Flower of <i>Allamanda cathartica</i>	Samutsakorn ²	7-Feb-02
AA87	-	2P19S1	Flower of <i>Clome spinosa</i>	Samutsakorn ²	7-Feb-02
AA88	-	RB8M21-1	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AA89	15679	Y2G2	Plum fruit	Dr. Yamada ¹	20-Mar-02
AA90	-	K34SU2	Flower of <i>Leucaena leucocephalade</i>	Kasetsart ¹	27-Feb-02
AA91	-	BT14M2	Flower of <i>Scirpus grossus</i>	Bang-Bua-Tong ³	25-Mar-02
AA92	-	BT13M21	Unknown	Bang-Bua-Tong ³	25-Mar-02
AA93	-	K52S1	Unknown	Kasetsart ¹	27-Feb-02
AA94	15680	Y2SU1	Plum fruit	Dr. Yamada ¹	20-Mar-02
AA95	-	RB6M2	Flower of <i>Quisqualis indica</i>	Ratchaburi ⁴	13-Mar-02
AA96	-	2P7M2	Unknown	Samutsakorn ²	7-Feb-02
AA97	-	2B19S3	Flower of <i>Plumeria</i> sp.	Benjasiri Park ¹	30-Jan-02
AA98	15681	RB2S22	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AA99	15682	Y2SU22	Plum fruit	Dr. Yamada ¹	20-Mar-02
AB01	-	K55M3	Unknown	Kasetsart ¹	27-Feb-02
AB02	-	BT16M22	ดอกสมเด็จย่า	Bang-Bua-Tong ³	25-Mar-02
AB03	-	BT15S11	Fruit of <i>Sandoricum indicum</i>	Bang-Bua-Tong ³	25-Mar-02
AB04	15683	2P9S3	Flower of <i>Celotropis gigantea</i>	Samutsakorn ²	7-Feb-02
AB05	15684	Y2G1	Plum fruit	Dr. Yamada ¹	20-Mar-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AB06	-	RB8M24-1	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AB07	15685	2B12G3	Flower of <i>Heliconia</i> sp. (นักษัตรวงศ์)	Emporium Suites ¹	23-Jan-02
AB08	15686	RB2S1-2	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AB09	-	RB2S1-3	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AB10	15687	RB10S24-1	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AB11	15688	RB2S1-1	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AB12	15689	RB10S24-2	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AB13	-	RB8M24-2	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AB14	-	PK12S1-2	Flower of <i>Artabotrys siamensis</i>	Pak-Kret ³	19-Mar-02
AB15	-	SR2S2	Unknown	Suratthani ⁶	5-May-02
AB16	-	2B10M2	Flower of <i>Plumeria</i> sp.	Emporium Suites ¹	23-Jan-02
AB17	-	BJ11S1-1	Flower of <i>Alcea rosea</i>	Benjasiri Park ¹	14-Mar-02
AB18	15690	BJ14S2-1	Flower of <i>Adenium obesum</i>	Benjasiri Park ¹	14-Mar-02
AB19	-	SR2M1	Unknown	Suratthani ⁶	5-May-02
AB20	-	SR8S1	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB21	-	SR2M3	Unknown	Suratthani ⁶	5-May-02
AB22	-	SR11S1	Flower of <i>Parkia speciosa</i>	Suratthani ⁶	5-May-02
AB23	-	SR2S1	Unknown	Suratthani ⁶	5-May-02
AB24	15691	SR7S1	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB25	15692	SR7S2	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB26	15693	SR6S2	Unknown	Suratthani ⁶	5-May-02
AB27	-	SR1M2	Flower of <i>Allamanda cathartica</i>	Suratthani ⁶	5-May-02
AB28	15694	SR7M3	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB29	15695	SR7M2	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB30	15696	SR7M1	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB31	15697	SR7S3	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB32	15698	SR6S1	Unknown	Suratthani ⁶	5-May-02
AB33	15699	SR6S3	Unknown	Suratthani ⁶	5-May-02
AB34	15700	RB10S23-2	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AB35	15701	RB10S22-2	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AB36	15702	RB10S22-1	Flower of <i>Adenium obesum</i>	Ratchaburi ⁴	13-Mar-02
AB37	-	SR5M2	Flower of <i>Ixora</i> sp.	Suratthani ⁶	5-May-02
AB38	-	BJ7S1-1	Flower of <i>Plumeria</i> sp.	Benjasiri Park ¹	14-Mar-02
AB39	-	BJ7S1-2	Flower of <i>Plumeria</i> sp.	Benjasiri Park ¹	14-Mar-02
AB40	15703	2P7S1	Unknown	Samutsakorn ²	7-Feb-02
AB41	15704	BT7M22	Fruit of <i>Coccinia grandis</i>	Bang-Bua-Tong ³	25-Mar-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AB42	-	Y1SU1	Plum fruit	Dr. Yamada ¹	20-Mar-02
AB43	15705	2B12S3	Flower of <i>Heliconia</i> sp. (ไม้เขาสวรรค์)	Emporium Suites	23-Jan-02
AB44	-	RB8M21-2	Unknown	Rajabhat Institute Suansunandha ¹	19-Mar-02
AB45	15706	RB2S2-1	Flower of <i>Canna</i> sp.	Ratchaburi ⁴	13-Mar-02
AB46	-	AY13M2	Molasses	Ayutaya ⁵	6-Mar-02
AB47	-	N8S1	Flower of <i>Quisqualis indica</i>	On-nuch BTS station ¹	14-Mar-02
AB48	-	SR2M2	Unknown	Suratthani ⁶	5-May-02
AB49	-	19S3-2	Starter of sweeten rice	Ms. Wanchern ¹	-
AB50	-	N4M1	Flower of <i>Ixora</i> sp.	On-nuch BTS station ¹	14-Mar-02
AB51	15707	N2S1-2	Flower of <i>Citharexylum spinosum</i>	On-nuch BTS station ¹	14-Mar-02
AB52	15708	N2S1-1	Flower of <i>Citharexylum spinosum</i>	On-nuch BTS station ¹	14-Mar-02
AB53	-	19S3-1	Starter of sweeten rice	Ms. Wanchern ¹	-
AB54	15709	RB2S2-2	Flower of <i>Canna</i> sp.	Ratchabun ⁴	13-Mar-02
AB55	-	BJ7S1-1	Flower of <i>Plumeria</i> sp.	Benjasiri Park ¹	14-Mar-02
AB56	-	BJ7S1-2	Flower of <i>Plumeria</i> sp.	Benjasiri Park ¹	14-Mar-02
AB57	15710	2B4M1	Orchid Flower	Benjasiri Park ¹	22-Jan-02
AB58	15711	2B4M2	Orchid Flower	Benjasiri Park ¹	22-Jan-02
AB59	15712	2B10S1	Flower of <i>Plumeria</i> sp.	Emporium Suites ¹	23-Jan-02
AB60	15713	2B10S3	Flower of <i>Plumeria</i> sp.	Emporium Suites ¹	23-Jan-02
AB61	15714	2B12G1	Flower of <i>Heliconia</i> sp. (ไม้เขาสวรรค์)	Emporium Suites ¹	23-Jan-02
AB62	15715	AY9S1	<i>Zizyphus mauritiana</i> (Preserved fruit)	Ayutaya ⁵	6-Mar-02
AB63	15716	AY9S2	<i>Zizyphus mauritiana</i> (Preserved fruit)	Ayutaya ⁵	6-Mar-02
AB64	-	AY9S3	<i>Zizyphus mauritiana</i> (Preserved fruit)	Ayutaya ⁵	6-Mar-02
AB65	-	N4S1	Flower of <i>Ixora</i> sp.	On-nuch BTS station ¹	14-Mar-02
AB66	-	PK2S21	Flower of <i>Canaga odorata</i>	Pak-Kret ³	19-Mar-02
AB67	-	PK2S23	Flower of <i>Canaga odorata</i>	Pak-Kret ³	19-Mar-02
AB68	-	PK4S21	Flower of <i>Nelumbo nucifera</i>	Pak-Kret ³	19-Mar-02
AB69	-	PK4S22	Flower of <i>Nelumbo nucifera</i>	Pak-Kret ³	19-Mar-02
AB70	-	PK10M2	Flower of <i>Sesbania grandiflora</i>	Pak-Kret ³	19-Mar-02
AB71	-	PK10M3-1	Flower of <i>Sesbania grandiflora</i>	Pak-Kret ³	19-Mar-02
AB72	15717	BT7M12	Fruit of <i>Coccinia grandis</i>	Bang-Bua-Tong ³	25-Mar-02
AB73	15718	BT8S1	Fruit of <i>Lagenaria siceraria</i>	Bang-Bua-Tong ³	25-Mar-02
AB74	-	K55M2	Unknown	Kasetsart ¹	27-Feb-02
AB75	-	Y2M1-2	Plum fruit	Dr. Yamada ¹	20-Mar-02
AB76	15719	CHB04S2	Flower of <i>Ixora</i> sp.	Chaing-Mai ⁷	25-Jun-02
AB77	15720	CHB04G1	Flower of <i>Ixora</i> sp.	Chaing-Mai ⁷	25-Jun-02
AB78	15721	CHB04GA1	Flower of <i>Ixora</i> sp.	Chaing-Mai ⁷	25-Jun-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AB79	15722	CHB04G3	Flower of <i>Ixora</i> sp.	Chaing-Mai ⁷	25-Jun-02
AB80	15723	CHB04GA4	Flower of <i>Ixora</i> sp.	Chaing-Mai ⁷	25-Jun-02
AB81	15724	CH7S2	Flower of <i>Allamanda cathartica</i>	Chaing-Mai ⁷	4-Jun-02
AB82	15725	CH7G1	Flower of <i>Allamanda cathartica</i>	Chaing-Mai ⁷	4-Jun-02
AB83	-	CH7G2	Flower of <i>Allamanda cathartica</i>	Chaing-Mai ⁷	4-Jun-02
AB84	-	CH7G3	Flower of <i>Allamanda cathartica</i>	Chaing-Mai ⁷	4-Jun-02
AB85	15726	CH9S2	Flower of <i>Zinnia elegans</i>	Chaing-Mai ⁷	4-Jun-02
AB86	15727	CHB09S1	Flower of <i>Zinnia elegans</i>	Chaing-Mai ⁷	25-Jun-02
AB87	15728	CHB16S1	Flower of <i>Canna</i> sp.	Chaing-Mai ⁷	25-Jun-02
AB88	15729	CHB16S2	Flower of <i>Canna</i> sp.	Chaing-Mai ⁷	25-Jun-02
AB89	15730	CHB19S2	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	25-Jun-02
AB90	15731	CHB19S1	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	25-Jun-02
AB91	15732	CHB19G2	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	25-Jun-02
AB92	15733	CHB19GA1	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	25-Jun-02
AB93	51734	CHB19GA2	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	25-Jun-02
AB94	15735	CHB20S1	Unknown (Picture 5)	Chaing-Mai ⁷	25-Jun-02
AB95	15736	CHB22S4	Unknown (Picture 6)	Chaing-Mai ⁷	25-Jun-02
AB96	15737	CHB22S1	Unknown (Picture 6)	Chaing-Mai ⁷	25-Jun-02
AB97	15738	CHB22GA4	Unknown (Picture 6)	Chaing-Mai ⁷	25-Jun-02
AB98	15739	CH32G1-1	Flower of <i>Heliconia</i> sp.	Chaing-Mai ⁷	20-Sep-02
AB99	15740	CH32G1-2	Flower of <i>Heliconia</i> sp.	Chaing-Mai ⁷	20-Sep-02
AC01	15741	CH32G1	Flower of <i>Heliconia</i> sp.	Chaing-Mai ⁷	20-Sep-02
AC02	15742	CH32S1	Flower of <i>Heliconia</i> sp.	Chaing-Mai ⁷	20-Sep-02
AC03	15743	CH32S2	Flower of <i>Heliconia</i> sp.	Chaing-Mai ⁷	20-Sep-02
AC04	15744	CH33S1	Flower of Ginger	Chaing-Mai ⁷	20-Sep-02
AC05	15745	CH33S2	Flower of Ginger	Chaing-Mai ⁷	20-Sep-02
AC06	15746	CH35S1	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	20-Sep-02
AC07	15747	CH35S2	Flower of <i>Crinum asiaticum</i>	Chaing-Mai ⁷	20-Sep-02
AC08	15748	CH46GA1	Flower of <i>Rosa hybrida</i>	Chaing-Mai ⁷	20-Sep-02
AC09	-	CH54GA2	Fruit of Grape (green)	Chaing-Mai ⁷	20-Sep-02
AC10	15749	CH55GA1	Fruit of <i>Cleidopus gloriamaris</i>	Chaing-Mai ⁷	20-Sep-02
AC11	15750	CH56GA1	Fruit of Grape (green)	Chaing-Mai ⁷	20-Sep-02
AC12	15751	CH57GA1	Long-Kong tallen	Chaing-Mai ⁷	20-Sep-02
AC13	15752	CH57GA2	Long-Kong tallen	Chaing-Mai ⁷	20-Sep-02
AC14	15753	CH58GA1-1	Fruit of <i>Manilkara zapota</i>	Chaing-Mai ⁷	20-Sep-02
AC15	15754	CH58GA1-2	Fruit of <i>Manilkara zapota</i>	Chaing-Mai ⁷	20-Sep-02
AC16	15755	CH58GA1-3	Fruit of <i>Manilkara zapota</i>	Chaing-Mai ⁷	20-Sep-02
AC17	15756	CH58G2	Fruit of <i>Manilkara zapota</i>	Chaing-Mai ⁷	20-Sep-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AC18	15757	CH59GA1	Orchid Flower	Chaing-Mai ⁷	20-Sep-02
AC19	15758	CH59GA3	Orchid Flower	Chaing-Mai ⁷	20-Sep-02
AC20	15759	CH63GA1-1	Fruit of <i>Citrullus vulgaris</i>	Chaing-Mai ⁷	20-Sep-02
AC21	15760	CH63GA1-2	Fruit of <i>Citrullus vulgaris</i>	Chaing-Mai ⁷	20-Sep-02
AC22	-	CH65G1	Fruit of <i>Annona squamosa</i>	Chaing-Mai ⁷	20-Sep-02
AC23	-	CH65G2	Fruit of <i>Annona squamosa</i>	Chaing-Mai ⁷	20-Sep-02
AC24	15761	CH65GA1	Fruit of <i>Annona squamosa</i>	Chaing-Mai ⁷	20-Sep-02
AC25	-	CH65GA2	Fruit of <i>Annona squamosa</i>	Chaing-Mai ⁷	20-Sep-02
AC26	-	CH67G1	Fruit of <i>Cleidopus gloriamaris</i>	Chaing-Mai ⁷	20-Sep-02
AC27	15762	CH68GA1	Fruit of <i>Aglaia</i> sp.	Chaing-Mai ⁷	20-Sep-02
AC28	15763	CH70GA2	Flower of <i>Alpinia purpurata</i>	Chaing-Mai ⁷	20-Sep-02
AC29	15764	SK5GA1-1	Fermented fruit (Plot 10)	Sakarat ⁸	17-Apr-02
AC30	15765	SK5GA1-2	Fermented fruit (Plot 10)	Sakarat ⁸	17-Apr-02
AC31	15766	SK5GA3	Fermented fruit (Plot 10)	Sakarat ⁸	17-Apr-02
AC32	15767	SK5G2-1	Fermented fruit (Plot 10)	Sakarat ⁸	17-Apr-02
AC33	15768	SK5G2-2	Fermented fruit (Plot 10)	Sakarat ⁸	17-Apr-02
AC34	15769	SK5G3	Fermented fruit (Plot 10)	Sakarat ⁸	17-Apr-02
AC35	15770	SK6G1	Seed (Plot 10)	Sakarat ⁸	17-Apr-02
AC36	15771	SK6G2	Seed (Plot 10)	Sakarat ⁸	17-Apr-02
AC37	15772	SK7GA2-1	Soil Plot A0	Sakarat ⁸	17-Apr-02
AC38	15773	SK7GA2-2	Soil Plot A0	Sakarat ⁸	17-Apr-02
AC39	15774	SK7GA3	Soil Plot A0	Sakarat ⁸	17-Apr-02
AC40	-	SK9G1	Seed (Plot A0)	Sakarat ⁸	17-Apr-02
AC41	-	SK9G1-2	Seed (Plot A0)	Sakarat ⁸	17-Apr-02
AC42	15775	SK9GA3	Seed (Plot A0)	Sakarat ⁸	17-Apr-02
AC43	15776	SK11G2	Fruit (red) Plot A1	Sakarat ⁸	17-Apr-02
AC44	15777	SK11G3	Fruit (red) Plot A1	Sakarat ⁸	17-Apr-02
AC45	15778	SK13G1	Fruit (Yellow) Plot A1	Sakarat ⁸	17-Apr-02
AC46	15779	SK13G1-2	Fruit (Yellow) Plot A1	Sakarat ⁸	17-Apr-02
AC47	15780	SK13GA1	Fruit (Yellow) Plot A1	Sakarat ⁸	17-Apr-02
AC48	15781	SK14G1	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC49	15782	SK14G2	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC50	15783	SK14G3-1	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC51	15784	SK14G3-2	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC52	15785	SK14GA1	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC53	15786	SK14GA3-1	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC54	15787	SK14GA3-2	Fruit Plot A1	Sakarat ⁸	17-Apr-02
AC55	15788	SK21G1-1	Fruit (red) Plot A8	Sakarat ⁸	17-Apr-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AC56	15789	SK21G1-2	Fruit (red) Plot A8	Sakarat ^s	17-Apr-02
AC57	15790	SK21G2-1	Fruit (red) Plot A8	Sakarat ^s	17-Apr-02
AC58	15791	SK21G2-2	Fruit (red) Plot A8	Sakarat ^s	17-Apr-02
AC59	15792	SK21G3-1	Fruit (red) Plot A8	Sakarat ^s	17-Apr-02
AC60	15793	SK21G3-2	Fruit (red) Plot A8	Sakarat ^s	17-Apr-02
AC61	15794	SK22GA1	Fermented fruit Plot A8	Sakarat ^s	17-Apr-02
AC62	15795	SK22GA2	Fermented fruit Plot A8	Sakarat ^s	17-Apr-02
AC63	15796	SK22GA3	Fermented fruit Plot A8	Sakarat ^s	17-Apr-02
AC64	15797	SK22GA3-2	Fermented fruit Plot A8	Sakarat ^s	17-Apr-02
AC65	15798	SK31G1	Fruit from Dam	Sakarat ^s	17-Apr-02
AC66	15799	SK32G1	Flower from Dam	Sakarat ^s	17-Apr-02
AC67	15800	SK32G2	Flower from Dam	Sakarat ^s	17-Apr-02
AC68	15801	SK32G3	Flower from Dam	Sakarat ^s	17-Apr-02
AC69	15802	SK38G2	Fruit of <i>Lepisanthes rubiginosa</i>	Sakarat ^s	17-Apr-02
AC70	15803	TPP1NaGA1	Flower of <i>Gardenia jasminoides</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	19-Feb-03
AC71	15804	TPP1NaGA2	Flower of <i>Gardenia jasminoides</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	19-Feb-03
AC72	15805	TPP1NaGA3	Flower of <i>Gardenia jasminoides</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	19-Feb-03
AC73	15806	TPP2NaGA1	Flower of <i>Ipomoea</i> sp., บ่อมตำรวจท่ามะเดื่อ	Tong-Pha-Phum ⁹	19-Feb-03
AC74	15807	TPP2NaGA2	Flower of <i>Ipomoea</i> sp., บ่อมตำรวจท่ามะเดื่อ	Tong-Pha-Phum ⁹	19-Feb-03
AC75	15808	TPP34NaGA1-1	Flower of <i>Canna</i> sp. ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AC76	15809	TPP34NaGA1-2	Flower of <i>Canna</i> sp. ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AC77	15810	TPP34NaGA2	Flower of <i>Canna</i> sp. ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AC78	15811	TPP34NaGA3	Flower of <i>Canna</i> sp. ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AC79	15812	TPP34GEA1	Flower of <i>Canna</i> sp. ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AC80	15813	TPP34GEA2	Flower of <i>Canna</i> sp. ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AC81	15814	TPP54GEA1	Soil พรุป่าชี่น (Peat Swamp Forest)	Tong-Pha-Phum ⁹	19-Feb-03
AC82	15815	TPP54GEA2	Soil พรุป่าชี่น (Peat Swamp Forest)	Tong-Pha-Phum ⁹	19-Feb-03
AC83	-	TPP56GEA1	Flower of <i>Thumbergia Laurifolia</i> , พรุป่าชี่น (Peat Swamp Forest)	Tong-Pha-Phum ⁹	19-Feb-03
AC84	-	TPP56GEA2	Flower of <i>Thumbergia Laurifolia</i> , พรุป่าชี่น (Peat Swamp Forest)	Tong-Pha-Phum ⁹	19-Feb-03
AC85	15816	TPP66GEA1	Flower of <i>Mangifera indica</i> ผลิตกลาง ดชด	Tong-Pha-Phum ⁹	19-Feb-03
AC86	15817	TPP66GEA2	Flower of <i>Mangifera indica</i> ผลิตกลาง ดชด	Tong-Pha-Phum ⁹	19-Feb-03
AC87	-	TPP71GEA1-1	Flower of <i>Heliconia</i> sp. ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC88	-	TPP71GEA1-2	Flower of <i>Heliconia</i> sp. ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC89	-	TPP71GEA2	Flower of <i>Heliconia</i> sp. ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC90	-	TPP71GEA3	Flower of <i>Heliconia</i> sp. ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC91	-	TPP71GEA3-4	Flower of <i>Heliconia</i> sp. ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC92	15818	TPP75GEA1-1	Flower of <i>Gardenia jasminoides</i> , ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC93	15819	TPP75GEA1-2	Flower of <i>Gardenia jasminoides</i> , ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AC94	15820	TPP75GEA2-1	Flower of <i>Gardenia jasminoides</i> , ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC95	15821	TPP75GEA2-2	Flower of <i>Gardenia jasminoides</i> , ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC96	15822	TPP75GEA3	Flower of <i>Gardenia jasminoides</i> , ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AC97	15823	TPP1S1	Flower of <i>Gardenia jasminoides</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	19-Feb-03
AC98	15824	TPP1S2	Flower of <i>Gardenia jasminoides</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	19-Feb-03
AC99	15825	TPP1S3	Flower of <i>Gardenia jasminoides</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	19-Feb-03
AD01	-	TPP11S1	Flower of <i>Thumbergia Laurifolia</i> , โป่งพุร้อน	Tong-Pha-Phum ⁹	19-Feb-03
AD02	-	TPP12S1	ดินได้ต้นไม้ โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	19-Feb-03
AD03	-	TPP12S2	ดินได้ต้นไม้ โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	19-Feb-03
AD04	-	TPP18S1	Flower of <i>Thumbergia Laurifolia</i> , โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	19-Feb-03
AD05	-	TPP18S2	Flower of <i>Thumbergia Laurifolia</i> , โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	19-Feb-03
AD06	-	TPP24S1	เปลือกกล้วยน้ำว้า พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	19-Feb-03
AD07	-	TPP28S1-1	ดอกไม้คล้ายดอกมะลิ ต้นไม้ยักษ์	Tong-Pha-Phum ⁹	19-Feb-03
AD08	-	TPP28S1-2	ดอกไม้คล้ายดอกมะลิ ต้นไม้ยักษ์	Tong-Pha-Phum ⁹	19-Feb-03
AD09	15826	TPP31S1	Fruit of <i>Cocos nucifera</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD10	15827	TPP31S2	Fruit of <i>Cocos nucifera</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD11	15828	TPP33S1	Fruit of <i>Artocarpus heterophyllus</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD12	15829	TPP33S3	Fruit of <i>Artocarpus heterophyllus</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD13	15830	TPP33S4	Fruit of <i>Artocarpus heterophyllus</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD14	15831	TPP33S5	Fruit of <i>Artocarpus heterophyllus</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD15	15832	TPP33S6	Fruit of <i>Artocarpus heterophyllus</i> ในหมู่บ้าน	Tong-Pha-Phum ⁹	19-Feb-03
AD16	15833	TPP54S1	ดิน พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	19-Feb-03
AD17	15834	TPP75S1	Flower of <i>Gardenia jasminoides</i> , ชัยอารีย์	Tong-Pha-Phum ⁹	19-Feb-03
AD18	-	TPP76S1	Flower of <i>Cochlospermum religiosum</i>	Tong-Pha-Phum ⁹	19-Feb-03
AD19	-	TPP76S2	Flower of <i>Cochlospermum religiosum</i>	Tong-Pha-Phum ⁹	19-Feb-03
AD20	15835	TPP102S1	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	2-Jul-02
AD21	15836	TPP102S2	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	2-Jul-02
AD22	-	TPP112G1	Flower of <i>Caladium</i> sp. สีส้มพู โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	2-Jul-02
AD23	15837	TPP114G1	Flower of Unkonwn โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	2-Jul-02
AD24	15838	TPP114G2	Flower of Unkonwn โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	2-Jul-02
AD25	15839	TPP137G1	Flower of <i>Thumbergia Laurifolia</i> , พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD26	15840	TPP139S2	Flower of <i>Zingiber cassumunar</i> พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD27	15841	TPP140S2	Flower of Unknown พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD28	15842	TPP142S1	Flower of Unknown พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD29	-	TPP147S	เห็ดสีขาว พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD30	-	TPP148S1	เห็ดร่างแห พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD32	-	TPP155S2	Fruit of <i>Diospyros rhodocalyx</i> พรุราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AD33	-	TPP169G1	Flower of <i>Curcuma aeruginosa</i> พัสดุกกลาง ดชด	Tong-Pha-Phum ⁹	2-Jul-02

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AD34	15843	TPP175G1	Flower of <i>Cucurbita moschata</i> ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD35	-	TPP175G4	Flower of <i>Cucurbita moschata</i> ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD36	-	TPP178G3-1	Fruit of <i>Artocarpus heterophyllus</i> ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD37	15844	TPP178G3-2	Fruit of <i>Artocarpus heterophyllus</i> ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD38	15845	TPP180G1	เห็ด ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD39	15846	TPP180G2	เห็ด ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD40	15847	TPP180G3	เห็ด ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD41	15848	TPP180G4	เห็ด ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	2-Jul-02
AD42	15849	TPP181G1	เห็ด สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD43	15850	TPP181G2	เห็ด สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD44	-	TPP181S1	เห็ด สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD45	-	TPP181S2	เห็ด สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD46	15851	TPP183G1	Flower of Unknown สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD47	15852	TPP195GEA1	Fruit of Unknown สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD48	15853	TPP195GEA2	Fruit of Unknown สวนป่าทองผาภูมิ	Tong-Pha-Phum ^๑	2-Jul-02
AD49	15854	TPP201GE1	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD50	15855	TPP201GE2	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD51	15856	TPP201GE3	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD52	15857	TPP201GE4	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD53	15858	TPP201GE5	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD54	15859	TPP201S1	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD55	15860	TPP201S2	Flower of Unknown น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD56	15861	TPP202GE1	Flower of Unknown ดอกสีม่วง น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD57	-	TPP202GE2	Flower of Unknown ดอกสีม่วง น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD58	-	TPP202GE4	Flower of Unknown ดอกสีม่วง น้ำตกผาตาด	Tong-Pha-Phum ^๑	4-Nov-03
AD59	-	TPP204GE1	ดอกทวายเหิน บ้านพักผู้ช่วย BRT	Tong-Pha-Phum ^๑	4-Nov-03
AD60	-	TPP204GE2	ดอกทวายเหิน บ้านพักผู้ช่วย BRT	Tong-Pha-Phum ^๑	4-Nov-03
AD61	-	TPP204GE3	ดอกทวายเหิน บ้านพักผู้ช่วย BRT	Tong-Pha-Phum ^๑	4-Nov-03
AD62	-	TPP206S1	Flower of <i>Canna</i> sp. ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD63	-	TPP206S2	Flower of <i>Canna</i> sp. ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD64	-	TPP207GE1	Fruit of <i>Volkameria fragrans</i> , ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD65	15862	TPP207GE2	Fruit of <i>Volkameria fragrans</i> , ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD66	15863	TPP208GE1	Flower of <i>Volkameria fragrans</i> , ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD67	15864	TPP208S1	Flower of <i>Volkameria fragrans</i> , ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD68	15865	TPP208S2	Flower of <i>Volkameria fragrans</i> , ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD69	15866	TPP209GE1	Flower of Southern Sakura ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD70	15867	TPP209GE2	Flower of Southern Sakura ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03
AD71	15868	TPP210GE1	Fruit of <i>Laffa cylindricular</i> ฟักดูกลาง ตชด	Tong-Pha-Phum ^๑	4-Nov-03

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AD72	15869	TPP210GE3	Fruit of <i>Laffa cylindricular</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD73	15870	TPP211S2	Fruit of <i>Psidium guajava</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD74	15871	TPP211S2-2	Fruit of <i>Psidium guajava</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD75	15872	TPP212GE1	Fruit of <i>Psidium guajava</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD76	15873	TPP212GE2	Fruit of <i>Psidium guajava</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD77	15874	TPP213GE1-2	Fruit of <i>Psidium guajava</i> พัสตุกลาง ดชด with ants	Tong-Pha-Phum ⁹	4-Nov-03
AD78	15875	TPP214GE1	Flower of <i>Mucuna pruriens</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD79	15876	TPP214GE2	Flower of <i>Mucuna pruriens</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD80	15877	TPP218GE1	Fruit of <i>Duranta repens</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD81	15878	TPP218GE2	Fruit of <i>Duranta repens</i> พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD82	15879	TPP226G1	Flower of <i>Solanum torvum</i> , พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD83	15880	TPP226GE1	Flower of <i>Solanum torvum</i> , พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD84	15881	TPP226GE2	Flower of <i>Solanum torvum</i> , พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD85	15882	TPP226GE3	Flower of <i>Solanum torvum</i> , พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD86	15883	TPP226S2	Flower of <i>Solanum torvum</i> , พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD87	15884	TPP230GE1	Fruit of <i>Psidium guajava</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD88	15885	TPP230S1	Fruit of <i>Psidium guajava</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD89	15886	TPP230S2	Fruit of <i>Psidium guajava</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD90	15887	TPP235GE1	Fruit of <i>Artocarpus heterophyllus</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD91	15888	TPP235GE2	Fruit of <i>Artocarpus heterophyllus</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD92	15889	TPP236GE1	Fruit of <i>Artocarpus heterophyllus</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD93	15890	TPP236GE2	Fruit of <i>Artocarpus heterophyllus</i> , fermented พัสตุกลาง ดชด	Tong-Pha-Phum ⁹	4-Nov-03
AD94	15891	TPP237GE1	Flower of <i>Senna alata</i> , พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AD95	15892	TPP237GE2	Flower of <i>Senna alata</i> , พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AD96	15893	TPP238GE1	Fruit of Unknown พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AD97	15894	TPP238GE2	Fruit of Unknown พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AD98	15895	TPP238GE3	Fruit of Unknown พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AD99	15896	TPP239GE1	Flower of Unknown พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AE01	15897	TPP239GE2	Flower of Unknown พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AE02	15898	TPP239GE3	Flower of Unknown พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AE03	-	TPP244S1	Flower of <i>Tacca chantrieri</i> , พรุปราชินี (Peat Swamp Forest)	Tong-Pha-Phum ⁹	4-Nov-03
AE05	15899	TPP249GE1	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE06	15900	TPP249GE2	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE07	15901	TPP252S1	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE08	15902	TPP252S2	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE09	15903	TPP253GE1	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE10	15904	TPP253GE2	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE11	-	TPP254GE2	ดอกผกากรองป่า โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AE12	-	TPP254S1	ดอกผกากรองป่า โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE13	-	TPP254S2	ดอกผกากรองป่า โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE14	-	TPP255S1	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE15	-	TPP255S2	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE16	-	TPP255S3	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE17	15905	TPP258GE2	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE18	15906	TPP259GE1	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE19	-	TPP259GE2	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE20	-	TPP259GE3	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE21	-	TPP259S1	Flower of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE22	15907	TPP260GE2	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE23	15908	TPP260GE3	Fruit of Unknown โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	4-Nov-03
AE24	15909	TPP262GE1	Flower of <i>Gossypium barbadense</i> โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	
AE25	15910	TPP262GE2	Flower of <i>Gossypium barbadense</i> โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	
AE26	-	TPP263GE2	Unknown from sensei	Tong-Pha-Phum ⁹	
AE27	-	TPP264S1	Unknown from sensei	Tong-Pha-Phum ⁹	
AE28	15911	TPP264S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE29	15912	TPP264S3	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE30	-	TPP265S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE31	-	TPP265S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE32	-	TPP266GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE33	-	TPP266GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE34	-	TPP266S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE35	-	TPP266S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE36	-	TPP266S3	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE37	-	TPP266S4	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE38	15913	TPP267GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE39	15914	TPP267GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE40	15915	TPP267S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE41	-	TPP267S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE42	15916	TPP268GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE43	15917	TPP268GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE44	15918	TPP269GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE45	15919	TPP269GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE46	15920	TPP269S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE47	15921	TPP270GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE48	15922	TPP270GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE49	-	TPP270S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03

Table A. Continued.

CODE	BCC Code	Original code	Source	Location	Date of collection
AE50	15923	TPP270S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE51	15924	TPP270S3	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE52	15925	TPP270S4	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE53	15926	TPP271GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE54	15927	TPP271GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE55	15928	TPP271S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE56	15929	TPP271S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE57	15930	TPP272GE1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE58	15931	TPP272S1	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE59	15932	TPP272S2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AE60	15933	TPP282GE2	Unknown from sensei	Tong-Pha-Phum ⁹	4-Nov-03
AG92	-	TPP111G2	Flower of <i>Caladium</i> sp. สีขาว โป่งพุร้อน (Wet licks)	Tong-Pha-Phum ⁹	2-Jul-02
AG93	-	TPP148S2	เห็ดร้างแห พรุราชนิ (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AG94	-	TPP158G2	รังผึ้ง (ที่กิ่งไม้) พรุราชนิ (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AG95	-	TPP159G2	รังผึ้ง (ที่กิ่งไม้) พรุราชนิ (Peat Swamp Forest)	Tong-Pha-Phum ⁹	2-Jul-02
AG96	15934	TPP175G2	Flower of <i>Cucurbita moschata</i> ฟักตุกลาง ดชด	Tong-Pha-Phum ⁹	2-Jul-02
AG97	15935	TPP175G3	Flower of <i>Cucurbita moschata</i> ฟักตุกลาง ดชด	Tong-Pha-Phum ⁹	2-Jul-02
AG98	15936	TPP178G2	Fruit of <i>Artocarpus heterophyllus</i> ฟักตุกลาง ดชด	Tong-Pha-Phum ⁹	2-Jul-02
AG99	15937	TPP186G1	Flower of <i>Heliconia</i> sp. สวนป่าทองผาภูมิ	Tong-Pha-Phum ⁹	2-Jul-02
AH01	15938	TPP186G2	Flower of <i>Heliconia</i> sp. สวนป่าทองผาภูมิ	Tong-Pha-Phum ⁹	2-Jul-02
AH02	15939	TPP186G2-2	Flower of <i>Heliconia</i> sp. สวนป่าทองผาภูมิ	Tong-Pha-Phum ⁹	2-Jul-02
AH03	15940	TPP192S1	Fruit of <i>Solanum stramonifolium</i> , สวนป่าทองผาภูมิ	Tong-Pha-Phum ⁹	2-Jul-02
AH04	-	TPP195GEA3	Fruit of Unknown สวนป่าทองผาภูมิ	Tong-Pha-Phum ⁹	2-Jul-02
AH05	15941	TPP198GEA1	Flower of <i>Thunbergin offinis</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	2-Jul-02
AH06	15942	TPP198GEA2	Flower of <i>Thunbergin offinis</i> , เขื่อนวชิราลงกรณ์	Tong-Pha-Phum ⁹	2-Jul-02

Abbrivation: ¹ Bangkok; ² Samutsakorn; ³ Nonthaburi; ⁴ Ratchaburi; ⁵ Ayuthaya; ⁶ Suratthani; ⁷ Chaing Mai;

⁸ Nakornratchasima; ⁹ Kanchanaburi

Table B. Characteristics of acetic acid bacteria isolates and their generic level identification

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AA01	P	ND	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA02	P	ND	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA04	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AA05	P	ND	+/-	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AA06	P	w	+/-	+++	w	w	Q10	+++	<i>Asaia</i> sp.
AA07	P	w	+/-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA08	P	w	+/-	+++	w	w	Q10	ND	<i>Asaia</i> sp.
AA09	P	w	+/-	+++	w	w	Q10	ND	<i>Asaia</i> sp.
AA10	C	+(S)	+++	+/-	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AA11	C	+(S)	+++	+	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AA12	C	+(S)	+++	+	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AA13	C	+(S)	+++	+	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AA15	P	ND	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA18	C	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA19	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA20	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA21	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA24	P	ND	+/-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA25	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA26	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA27	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA29	Y	ND	-	+++	w/-	w/-	ND	+++	<i>Asaia</i> sp.
AA30	Y	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA31	Y	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA34	P	ND	-	+++	w/-	w/-	ND	+++	<i>Asaia</i> sp.
AA35	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA36	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA37	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA38	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA39	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA40	C	-	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AA42	P	ND	-	+++	w/-	w/-	ND	+++	<i>Asaia</i> sp.
AA43	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA44	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA49	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA50	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA53	P	ND	+/-	+++	w	w	ND	ND	<i>Asaia</i> sp.

Table B. Continued.

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AA54	P	ND	-	+++	w	w	ND	ND	<i>Asaia</i> sp.
AA67	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA68	P	ND	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA69	P	ND	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA80	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA85	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA89	W	ND	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AA94	W	ND	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AA98	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AA99	P	ND	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB04	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB05	P	ND	++	+++	-	-	ND	++	<i>Gluconobacter</i> sp.
AB07	P	ND	++	+++	-	-	ND	++	<i>Gluconobacter</i> sp.
AB08	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB10	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB11	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB12	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB18	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB24	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB25	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB26	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB28	P	ND	++	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB29	P	ND	++	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB30	P	ND	-	-	w	w	ND	+++	<i>Asaia</i> sp.
AB31	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB32	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB33	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB34	W	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB35	W	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB36	W	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB40	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB41	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB43	W	ND	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB45	P	ND	++	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB51	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB52	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB54	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB57	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB58	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB59	W	ND	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB60	W	ND	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB61	W	ND	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB62	W	ND	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB63	W	ND	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB72	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB73	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.

Table B. Continued.

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AB76	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB77	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB78	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB79	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB80	P	ND	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB81	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB82	P	ND	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB85	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB86	P	w	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB87	P	-	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB88	P	-	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB89	P	w	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB90	P	w	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB91	P	w	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB92	P	w	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB93	P	w	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB94	P	w	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AB95	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB96	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AB97	C	-	+	+++	-	-	ND	+++	<i>Gluconobacter</i> sp.
AB98	C	+(S)	+++	+	+	+	Q9	-	<i>Acetobacter</i> sp.
AB99	C	+(S)	+++	++	+	+	Q9	-	<i>Acetobacter</i> sp.
AC01	C	+(S)	+++	+	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AC02	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC03	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC04	C	+	+++	+++	+	w	ND	-	<i>Gluconacetobacter</i> sp.
AC05	C	+	+++	+++	+	w	ND	-	<i>Gluconacetobacter</i> sp.
AC06	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC07	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC08	C	-	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC10	C	+(S)	+	++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC11	C	+(S)	-	++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC12	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC13	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC14	C	+(S)	+++	-	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AC15	C	+(S)	+++	-	+	+	Q10	-	<i>Gluconacetobacter</i> sp.
AC16	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC17	C	-	+++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AC18	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC19	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC20	C	+(S)	+	++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC21	C	+(S)	+	++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC24	C	-	+++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AC27	C	-	+++	-	+	w	Q9	-	<i>Acetobacter</i> sp.
AC28	C	+(S)	++	+++	-	-	ND	+++	Unidentified
AC29	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.

Table B. Continued.

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AC30	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC31	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC32	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC33	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC34	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC35	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC36	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC37	C	+(S)	++	+++	-	-	Q10	+++	<i>Gluconacetobacter</i> sp.
AC38	C	+(S)	++	+++	-	-	Q10	+++	<i>Gluconacetobacter</i> sp.
AC39	C	+(S)	++	+++	-	-	Q10	+++	<i>Gluconacetobacter</i> sp.
AC42	C	+(S)	-	+++	-	-	ND	+++	<i>Gluconobacter</i> sp.
AC43	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC44	C	-	+	+++	-	-	Q10	-	<i>Gluconobacter</i> sp.
AC45	C	-	+	+++	-	-	Q10	-	<i>Gluconobacter</i> sp.
AC46	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC47	C	+(S)	+	+++	-	-	ND	+++	<i>Gluconobacter</i> sp.
AC48	C	-	-	+++	-	-	ND	+++	<i>Gluconobacter</i> sp.
AC49	C	-	-	+++	-	-	ND	++	<i>Gluconobacter</i> sp.
AC50	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC51	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC52	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC53	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC54	C	-	-	+++	-	-	ND	+++	<i>Gluconobacter</i> sp.
AC55	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC56	C	+	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC57	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC58	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC59	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC60	C	+	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC61	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC62	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC63	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC64	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC65	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC66	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC67	C	+	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC68	C	-	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC69	C	+	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AC70	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC71	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC72	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC73	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC74	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC75	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC76	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC77	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.

Table B. Continued.

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AC78	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC79	C	+	+++	-	+	+	Q9	ND	<i>Acetobacter</i> sp.
AC80	C	+	+++	-	+	+	Q9	ND	<i>Acetobacter</i> sp.
AC81	C	-	+	++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AC82	C	-	+	++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AC85	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC86	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC92	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC93	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC94	P		-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC95	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC96	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AC97	P	-	++	+++	+	w	ND	ND	<i>Asaia</i> sp.
AC98	P	ND	++	+++	+	+	ND	ND	<i>Asaia</i> sp.
AC99	P	ND	++	+++	+	+	ND	ND	<i>Asaia</i> sp.
AD09	P	ND	+	+++	+	w	ND	ND	<i>Asaia</i> sp.
AD10	P	ND	+	+++	+	w	ND	ND	<i>Asaia</i> sp.
AD11	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD12	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD13	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD14	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD15	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD16	C	ND	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD17	C	ND	+	+++	+	w	ND	ND	<i>Asaia</i> sp.
AD20	C	+	-	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD21	P	+	-	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD23	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD24	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD25	C	-	+	-	w	+	Q9	ND	<i>Acetobacter</i> sp.
AD26	C	+	-	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD27	C	-	-	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD28	C	-	-	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD34	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD37	C	+	+/-	++	w	w	ND	+++	<i>Asaia</i> sp.
AD38	C	-	++	-	+	+	Q9	ND	<i>Acetobacter</i> sp.
AD39	C	-	+++	-	+	+	Q9	ND	<i>Acetobacter</i> sp.
AD40	C	+	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD41	C	+	+/-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD42	C	-	++	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD43	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD46	W	-	+++	-	+	+	Q9	ND	<i>Acetobacter</i> sp.
AD47	C	-	+	++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD48	C	-	+	++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD49	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD50	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.

Table B. Continued.

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AD51	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD52	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD53	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD54	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD55	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD56	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD65	C	-	+	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD66	C	-	++	+++	-	-	ND	ND	<i>Gluconobacter</i> sp.
AD67	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD68	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD69	P	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD70	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD71	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD72	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD73	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD74	C	-	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD75	C	+(S)	-	++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD76	C	+(S)	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD77	C	+(S)	+	+++	-	-	ND	+	<i>Gluconobacter</i> sp.
AD78	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD79	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD80	P	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD81	P	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD82	C	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD83	C	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD84	C	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD85	C	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD86	C	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AD87	C	-	++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AD88	C	-	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD89	C	+	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD90	C	+(S)	+	+++	w	+	ND	+++	<i>Gluconobacter</i> sp.
AD91	C	-	+++	-	w	+	Q9	-	<i>Acetobacter</i> sp.
AD92	C	+(S)	++	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD93	C	+(S)	++	+++	-	-	ND	+	<i>Gluconobacter</i> sp.
AD94	C	+	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD95	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD96	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD97	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AD98	C	-	+	+++	-	-	ND	++	<i>Gluconobacter</i> sp.
AD99	C	-	+	+++	-	-	ND	++	<i>Gluconobacter</i> sp.
AE01	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AE02	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AE05	C	+(S)	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AE06	C	+(S)	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AE07	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.

Table B. Continued.

CODE	Color	Water soluble brown pigment	Growth in media containing		Oxidation of		Ubiquinone	Growth at 30% Glucose	Identified as
			Glucose+ 0.3% acetic acid	Sorbitol	Acetate	Lactate			
AE08	C	-	+	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AE09	C	+(S)	-	+++	-	-	ND	-	<i>Gluconobacter</i> sp.
AE10	C	+(S)	-	+++	-	-	ND	+	<i>Gluconobacter</i> sp.
AE17	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE18	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE22	C	-	+++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AE23	C	-	+++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AE24	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE25	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE28	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE29	P	ND	-	++	w	w	ND	+++	<i>Asaia</i> sp.
AE38	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE39	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE40	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE42	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE43	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE44	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE45	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE46	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE47	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE48	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE50	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE51	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE52	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE53	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE54	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE55	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE56	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE57	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE58	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE59	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AE60	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AG96	P	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AG97	P	+	+	+++	w	w	ND	+++	<i>Asaia</i> sp.
AG98	C	-	+++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AG99	C	+	++	-	+	+	Q9	-	<i>Acetobacter</i> sp.
AH01	C	+	+++	-	+	w	ND	-	<i>Acetobacter</i> sp.
AH02	C	+	+++	-	+	w	Q9	-	<i>Acetobacter</i> sp.
AH03	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AH05	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.
AH06	P	+	-	+++	w	w	ND	+++	<i>Asaia</i> sp.

Table C. Acid formation from various C-sources of the isolates

CODE	Acid production from																			
	D-Glucose	D-Mannose	D-Galactose	D-Fructose	L-Sorbose	D-Xylose	D-Arabinose	L-Arabinose	L-Rhamnose	D-Mannitol	D-Sorbitol	Dulcitol	m-Erythritol	Glycerol	Maltose	Lactose	Melibiose	Sucrose	Raffinose	Ethanol
AA01	+	+	+	+	+(7)	+	-	+	+(7)	+	+(7)	+(7)	ND	+(7)	ND	ND	+	+	+(7)	+(4)
AA02	+	+	+	+	+(4)	+	-	+	+(4)	+	+(7)	+(7)	ND	+(7)	ND	ND	+	+	+(7)	+(4)
AA04	+	+	+	+	+	+	+	+	-	+	+(7)	+	+	+	-	-	+	+	+	+
AA05	+	+	+	+	+	+	+	+	-	+	+(5)	+	+	+	-	-	+	+	+	+
AA06	+	+	+	+	+(7)	+	-	+	+	+	+(7)	+(7)	ND	+(7)	ND	ND	+	+	+	-
AA07	+	+	+	+	+(7)	+	-	+	+	+	+(7)	+(7)	ND	ND	ND	ND	+	+		-
AA08	+	+	+	+	+(5)	+	+(6)	+	+	+	+	+(3)	+	+	+(+/-)	-	+	+	-(+/-)	-
AA09	+	+	+	+	+(6)	+	+(7)	+	+	+	+	+(4)	+	+	-(+/-)	-	+	+	-(+/-)	-
AA10	+	+	+	-	-	+	+	+(4)	-	-	-	-	+(7)	-	-	-	-	-	-	+
AA11	+	+	+	-	-	+	+	+(4)	-	-	-	-	+(7)	-	-	-	-	-	-	+
AA12	+	+	+(6)	-	-	+	+	+(4)	-	-	-	-	+(7)	-	-	-	-	-	-	+
AA13	+	+	+	-	-	+(5)	-	+	-	-	-	-	+(7)	-	-	-	-	-	-	+
AA15	+	+	+	+	+	+	+(7)	+	+	+	+	+(4)	+	+	-	-	+	+	+	-
AA18	+	+	+	+	+	+	+(5)	+	+	+	+	+(5)	+	+	-	+(7)	+	+	+	+(5)
AA19	+	+	+	+	+	+	+(5)	+	+	+	+	-	+	+	-	-	+	+	-	-
AA20	+	+	+	+	+	+	+(5)	+	+	+	+	+(4)	+	+(5)	-	-	+	+	+(4)	4
AA21	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AA24	+	+	+	+	+(6)	+	-	+	+(5)	+(4)	+(6)	-	+	+(7)	-	-	+	+	+(5)	-
AA25	+	+	+	+	+(5)	+	-	+	+(4)	+(4)	+(4)	-	+	+(6)	-	-	+	+	+(5)	-
AA26	+	+	+	+	+(7)	+	+(7)	+	+	+(5)	+(7)	-	+	+(7)	-	-	+	+	+(7)	-
AA27	+	+	+	+	+(7)	+	+(7)	+	+	+(4)	+(6)	-	+	+(7)	-	-	+	+	+(6)	-
AA29	+	+	+	+	+(5)	+	+(7)	+	+	+(4)	+(5)	+(6)	+	+(4)	-	-	+	+	+	-
AA30	+	+	+	+	+(4)	+	+(7)	+	+	+	+(6)	+(6)	+	+	-	-	+	+	+	-
AA31	+	+	+	+	+(5)	+	+(7)	+	+	+	+(6)	+(6)	+	+(6)	-	-	+	+	+	-
AA34	+	+	+	+	+(6)	+	+(7)	+		+	+(6)	+(6)	+	+	-	-	+	+	+	-
AA35	+	+	+	+	+	+	+(7)	+	+(6)	+	+(5)	+	+	+	-	-	+	+	+(5)	-
AA36	+	+	+	+	+(5)	+	+(7)	+	+	+	+(5)	+(5)	+	+	-	-	+	+	+	-
AA37	+	+	+	+	+(5)	+	+(5)	+	+	+	+(4)	+(4)	+	+	-	-	+	+	+	-
AA38	+	+	+	+	-	+	+(7)	+	+(7)	+(5)	-	-	+	+(5)	-	-	+	+	+	-
AA39	+	+	+	+	-	+	+(7)	+	+(7)	+(5)	-	-	+	+(5)	-	-	+	+	+	-
AA40	+	+	+	+(4)	+	+	+	+	-	+(6)	+	-	+	ND	-	-	+	-	+	+
AA42	+	+	+	+	+(5)	+	-	+	+	+(5)	+(5)	+(6)	+	+(6)	-	-	+	+	+	-
AA43	+	+	+	+	+(5)	+	-	+	+	+(4)	+(5)	+(5)	+	+(5)	-	-	+	+	+	-
AA44	+	+	+	+	+(5)	+	-	+	+	+	+(4)	+(4)	+	+(5)	-	-	+	+	+(5)	+
AA49	+	+	+	+	+(4)	+	+(7)	+	+(7)	+	+(4)	-	+	+	-	-	+	+	-	+
AA50	+	+	+	+	+	+	+(5)	+	+(5)	+	+(4)	-	+	+	-	-	+	+	-	+(5)
AA53	+	+	+	+	+(7)	+	+	+	+	+	+(5)	-	+	+	-	-	+	+	+(5)	-
AA54	+	+	+	+	+(6)	+	+(4)	+	+(4)	+	+(6)	-	+	+(6)	-	-	+	+	+(5)	-
AA67	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	-
AA68	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	+	-

Table C. Continued.

CODE	Acid production from																			
	D-Glucose	D-Mannose	D-Galactose	D-Fructose	L-Sorbose	D-Xylose	D-Arabinose	L-Arabinose	L-Rhamnose	D-Mannitol	D-Sorbitol	Dulcitol	m-Erythritol	Glycerol	Maltose	Lactose	Melibiose	Sucrose	Raffinose	Ethanol
AA69	+	+	+	+	+(4)	+	-	+	+(4)	+	+	-	+	+	-	-	+	+(4)	-	-
AA80	+	+(4)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+(5)	+	+
AA85	+	+	+	+	+	+	-	+	+	+(4)	+	+(4)	+	+	-	-	+	+	+	-
AA89	+	+	+	+	+	+	+	+	+(4)	+	+	-	+	+	-	-	+	+	+	+
AA94	+	+	+	+	+(4)	+	+	+	+(5)	+	+	-	+	+	-	-	+	+	+	+
AA98	+	+	+	+	+	+	+(5)	+	+(5)	+	+	-	+	+	-	-	+(4)	+	-	+
AA99	+	+	+	+	+	+	+	+	+(4)	+	+(5)	+(6)	+	+	+(6)	+(6)	+	+	+	+
AB04	+	+	+	+	+(5)	+	-	+	+	+	+(5)	+(4)	+	+	-	-	+	+	+	-
AB05	+	+	+	+	+(4)	+	+	+	+(5)	+	+	+(7)	+	+	-	-	+	+	+	+
AB07	+	+	+	+	+(4)	+	+	+	+(5)	+(3)	+(3)	+(7)	+	+	-	-	+	+	+	+
AB08	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	+
AB10	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	+	-
AB11	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+
AB12	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	-	+	-
AB18	+	+	+	+(4)	-	+	+(6)	+	+(6)	+(4)	+(4)	+(6)	+	+(4)	-	-	+	+	+	-
AB24	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AB25	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AB26	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+
AB28	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AB29	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AB30	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AB31	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+
AB32	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+
AB33	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+
AB34	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	+	-	-
AB35	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	+	-	-
AB36	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	-
AB40	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	+	+
AB41	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	+	-
AB45	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+
AB51	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-
AB52	+	+	+	+	+	+	-	+	-	+	+	+	+	+	-	-	+	+	+	-
AB54	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	+
AB57	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	-
AB58	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	-	-	-
AB72	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	-	-
AB73	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	+	-	-
AB76	+	+	+	+	+	+	+	+	-	+	+	-	+	+	-	-	+	-	+	-
AB77	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	-	+	-
AB78	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-
AB79	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	-	+	-
AB80	+	+	+	+	+	+	-	-	+	+	+	+	+	+	-	-	+	-	+	-
AB81	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	+	+	-
AB82	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	-	+	-

Appendix B
Media Composition

1. Glucose-Ethanol-Calcium Carbonate agar (GECA)

2.0% glucose
0.5% ethanol
0.5% peptone
0.5% yeast extract
0.7% CaCO_3
1.2% agar

2. Glucose-ethanol-acetic acid medium

1.5% D-glucose
0.5% ethanol
0.35% acetic acid
0.3% peptone
0.3% yeast extract
adjusted at pH 3.5 with HCl

3. Sorbitol medium

2.0% D-sorbitol
0.3% peptone
0.3% yeast extract
adjusted at pH 3.5 with HCl

4. Sucrose-acetic acid medium

2.0% sucrose
0.35% acetic acid
0.3% peptone
0.3% yeast extract
adjusted at pH 3.5 with HCl

5. Methanol medium

0.8% methanol

0.3% peptone

0.3% yeast extract

adjusted at pH 4.0 with HCl

6. Glucose-yeast extract-peptone medium with 20% glycerol

2.5% Glucose

0.3% Yeast extract

0.5% Peptone

20% Glycerol

7. Different pH medium

2.0% Glucose

0.5% Ethanol

0.3% Peptone

0.5% yeast extract

adjusted at pH 3.0-6.0 with HCl

8. Oxidation of acetate and lactate medium

0.3% Peptone

0.2% Yeast extract

0.002% Bromothymol blue

0.2% acetate or lactate

9. Medium containin 0.3% acetic acid at pH 3.5

2.0% Glucose

0.5% Ethanol

0.3% Peptone

0.5% yeast extract

0.3% acetic acid

adjusted at pH 3.5 with HCl

10. Medium containing 30% D-Glucose

30% D-Glucose

0.5% Yeast extract

11. Glycerol medium

3.0% Glycerol

0.5% Glucose

0.8% Peptone

0.5% Yeast extract

12. Growth and acid production from test medium

0.5% yeast extract

0.2% bromocresol purple

1% of each carbon sources

Appendix C

Publications

1. International Journal

- a. Yukphan, P., W. Potacharoen, Y. Nakagawa, M. Tanticharoen, and Y. Yamada. 2004. Identification of strains assigned to the genus *Gluconobacter* Asai 1935 based on the sequence and the restriction analyses of the 16S-23S rDNA internal transcribed spacer regions. J. Gen. Appl. Microbiol. 50 (1): 9-15.
- b. Yukphan, P., W. Potacharoen, S. Tanasupawat, M. Tanticharoen and Y. Yamada. 2004. *Asaia krungthepensis* sp. nov., an acetic acid bacterium in the α -*Proteobacteria*. Int. J. Syst. Evol. Microbiol. 54: 313-316.

2. Presentation and Proceeding

- a. Yukphan, P., W. Potacharoen and Y. Yamada. Isolation and Identification of Acetic Acid Bacteria from Flowers Collected in Bangkok. The 14th Annual General Meeting of the Thai Society for Biotechnology, 12-15 November 2002.
- b. Yukphan, P., W. Potacharoen, Y. Nakagawa, M. Tanticharoen and Y. Yamada. 2003. Identification of strains assigned to the genus *Gluconobacter* Asai 1935 based on the sequence and the restriction analyses of the 16S-23S rDNA internal transcribed spacer regions "BioThailand 2003: Technology for Life" (Micro-02). 17-20 July 2003.
- c. Yukphan, P., W. Potacharoen, S. Tanasupawat, M. Tanticharoen and Y. Yamada. 2003. *Asaia krungthepensis* sp. nov., an acetic acid bacterium in α -*Proteobacteria*. "BioThailand 2003: Technology for Life" (Micro-01). 17-20 July 2003.

- d. Yukphan, P., W. Potacharoen, Y. Nakagawa, M. Tanticharoen and Y. Yamada. Identification of strains assigned to the genus *Gluconobacter* Asai 1935 based on the sequence and the restriction analyses of the 16S-23S rDNA internal transcribed spacer regions. งานประชุมวิชาการประจำปีของโครงการพัฒนาศักยภาพและศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทย. 13-16 ตุลาคม 2546.
- e. Yukphan, P., T. Malimas, M. Takahashi, W. Potacharoen, T. Busabun, S. Tanasupawat, Y. Nakagawa, M. Tanticharoen, and Y. Yamada. 2004. Re-identification of *Gluconobacter* Strains Based on the Restriction Analysis of the 16S-23S rDNA Internal Transcribed Spacer Regions. In *Proc. The 15th Annual Meeting of the Thai Society for Biotechnology*. Chaing-Mai, Thailand, 3 February 2004.
- f. Yukphan, P., T. Malimas, W. Potacharoen, M. Tanticharoen, and Y. Yamada. 2004. Isolation and identification of acetic acid bacteria from sources collected in Thailand, especially at Thongphaphum, Kanchanaburi. งานประชุมวิชาการประจำปีของโครงการพัฒนาศักยภาพและศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทย 14-16 ตุลาคม 2547.

Appendix D

Activities and sources of samples during this study

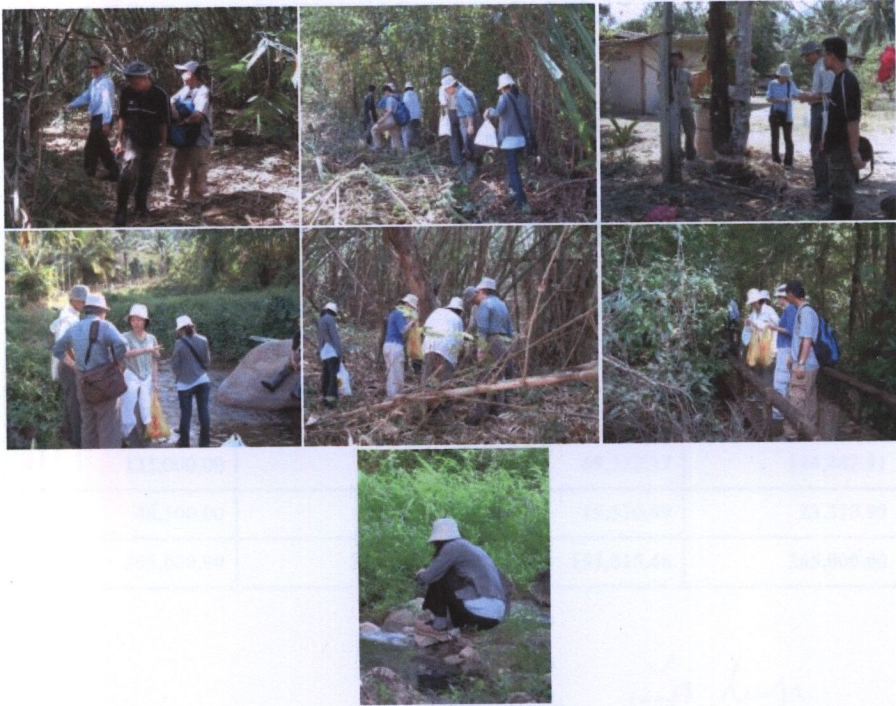


Figure A Sampling activities at BRT area-based Thongphaphum district, Kanchanaburi.



Figure B Sample of sources for acetic acid bacteria isolation.