



# Bio-Bridge Initiative Pilot Project Convention on Biological Diversity



National Institute of Biological Resources  
Republic of Korea



Ministry of Environment

National Institute of  
Biological Resources



Ministry of Environment

National Institute of  
Biological Resources



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Convention on  
Biological Diversity

# I. Introduction



Division	Contents		
Titles	Transfer of DNA Barcode Analysis for Biodiversity Monitoring		
Duration	Sept. ~ Dec. 2016	Budget	\$ 42,735
Department	Plant and Animal resources divisions		
Staffs	Total 13 people		
The Results	<ul style="list-style-type: none"><li>➤ 12 trainee from Asia for DNA Barcoding Analysis</li><li>➤ Report from the project</li><li>➤ Implementation of Strategic plans BD 2011~2020</li></ul>		

# I. Introduction



## 【 An Objective and Backgrounds】

- ▶ To facilitate technical and scientific cooperation(TSC) among Parties to the CBD and to its Protocols on Cartagena and Nagoya
- ▶ CBD COP X/39 and COP XI/29 recommended sharing taxonomic tools such as DNA barcoding for identification and analysis of threatened species, invasive alien species, and species subject to illegal trafficking etc.

ABT 9 Invasive alien species/ ABT12 Reducing risk of extinction

ABT13 Safeguarding genetic diversity

ABT19 Sharing Information and Knowledge



## II. Strategic Actions



### ▶ Operation Method :

- Collaboration with related divisions of NIBR in aspects which are facilities, experts for lectures and training program etc.

#### < The procedures >

Government employees, experts, and students who investigate biodiversity in Asia region (dispatch e-mail to CBD focal points or related Institutions of Parties) ⇒ trainee confirmation ⇒ financial supporting to participate the program (Sending invitation letters etc.) ⇒ the workshop (including Field trips) ⇒ Presentation of outcomes of the workshop (side event in CBD cop13) ⇒ A final report

## II. Strategic Actions



### ► Priorities to participate the workshop

- ⇒ Trainee **recommended by the CBD focal points** of parties
- ⇒ Trainee have **degree of master or Ph.D. in Taxonomy, Ecology and Biology, and Subjects related to Biodiversity etc.**
  - People who are officials, experts, students related to Biodiversity works (People who were born since 1975)
  - People have experiences which are Capacity Building Program in Global Taxonomy Initiative
- ⇒ People from **East Asia region**( Southeast Asia, Northeast Asia)
  - Asian parties do not relatively have enough taxonomists
  - to build up long term cooperation for technology transfer
  - to solve the Asia-issued common problems with outreach (e.g., CITES-listed species identification)
- ⇒ **Gender balance**



## II. Strategic Actions



- ▶ 16 people in 12 countries  $\Rightarrow$  12 people in 8 countries



## II. Strategic Actions



- ▶ Lab experiences from DNA extraction to DNA sequences
- ▶ Roundtable discussions to solve potential obstacles in applying DNA barcoding analysis tools in each party
- ▶ Schedule of the workshop :  
14, Nov.(Mon) ~ 25 Nov.(Fri) 12days
- ▶ Dividing into 2 team
  - Plant and Animal Resources



## II. Strategic Actions



- ▶ Materials for analyses :
  - CITES species, Invasive species
  - Unknown powdery herbal medicines, feces, and hairs without recognizable morphological characteristics
  
- ▶ For identifying species which is necessary for:
  - (1) prioritization and management of protected area,
  - (2) agriculture and aquaculture relevant to food security,
  - (3) control and management of invasive alien species,
  - (4) species inventories and monitoring in the ABS era

# II. Strategic Actions



Date	Date	Activity	Action in detail
1	14(Mon) Nov	- Arrival at the lodge and Registration	
2	15(Tue) Nov	- Registration - Opening ceremony, Lecture(1~3)	Ceremony with President of NIBR
3	16(Wed) Nov	- Lecture(4~6) - Demonstration of lab works(1 and Discussion	DNA extraction
4	17(Thu) Nov	- Demonstration of lab works(2) - Discussion	PCR (Polymerase Chain Reaction)
5	18(Fri) Nov	- Experiments (participants in person) - Discussion	DNA extraction, PCR
6,7	19(Sat), 20(Sun) Nov	- Field trips (other institute related to Biodiversity)	
8	21(Mon) Nov	- Lecture(7~9) - Experiments and Discussion	Assembling of sequences
9	22(Tue) Nov	- Field trip (visiting Amore-Pacific)	
10	23(Wed) Nov	- Lecture(10~12) - Experiments and Discussion	Alignment of sequences, Making NJ tree and Analysis
11	24(Thu) Nov	- Experiments and Round table discussion - Survey for participants	Farewell Ceremony with President of NIBR
12	25(Fri) Nov	- Closing ceremony - Departure to each country	

# II. Strategic Actions



# III. Outcomes



# III. Outcomes



## ▶ Preparation the final report

 Convention on Biological Diversity

**CBD Bio-Bridge Initiative Project**  
**The Workshop on DNA Bar-Coding Analysis**  
**Technology for Biodiversity monitoring**

생물다양성 모니터링을 위한 DNA바코드 분석 워크숍

Duration 14. Nov. 2016 (Mon) ~ 25. Nov. 2016(Fri)  
Venue National Institute of Biological Resources  
Hosted and organized by  National Institute of Biological Resources

 Biodiversity  
 CBD  
 DNA Bar-Code

Rapid identification of species using DNA barcoding




National Institute of Biological Resources (NIBR)

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국립생물자원관 (Korean Forynha)  
주요사업: 생물다양성 보전, 생물자원 관리, 생물자원 이용  
연구 분야: 생물다양성 평가, 생물자원 관리, 생물자원 이용  
연구 분야: 생물다양성 평가, 생물자원 관리, 생물자원 이용  
연구 분야: 생물다양성 평가, 생물자원 관리, 생물자원 이용

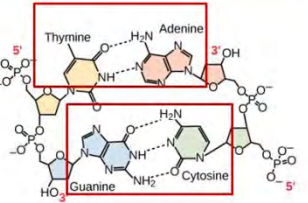
4. Application of DNA barcoding : identify true ones

- Distinguish misused, mixed products from real ones

Polygonaceae	Asclepiadaceae	
1. 하수오 <i>Fallopia multiflora</i>	2. 백수오 <i>Cynanchum afflictil</i>	3. 이엽우피소 <i>Cynanchum auriculatum</i>
		

3. DNA barcoding





# III. Outcomes



- ▶ Contribution to Implement Strategic Plan for Bio diversity 2011-2020 and Achievement of Achi Targets in Asia
  - to make them understand some technologies of species identification using advanced tools
- ▶ Many developing countries would be able to monitor and manage their biodiversity
  - can identify species of interests and unknown species
  - can enhance capacity building of parties which have high(mega) biodiversity
- ▶ A gap would be narrowed between developing countries and developed countries in scientific and technical aspects

# IV. Consideration of the program



- ▶ So diverse situations of parties
  - knowledge and lab experiences on DNA barcoding
  - experimental facilities and experts
  
- ▶ One way training is not a good model for BBI
  - transfer technologies to be applicable to recipient parties
  - real support such as lab setting, facilities, expert dispatch
  
- ▶ Connection is needed from technology transfer to application
  - Person-based training is good, but institution-based is better for future collaboration
  - More programs will be developed and expanded to narrow technology gaps by triggering



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**Thank you very much**

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# Species identification : morphology

- External morphology
  - Vegetative characters : leaf shape and arrangement (opposite, alternate, simple, compound), stem habit (vine, woody, herbaceous), and etc.
  - Sexual characters : inflorescence, flowers (calyx, petals, stamen, and pistil)
- Taxonomic keys to the genus *Bupleurum* in Korea

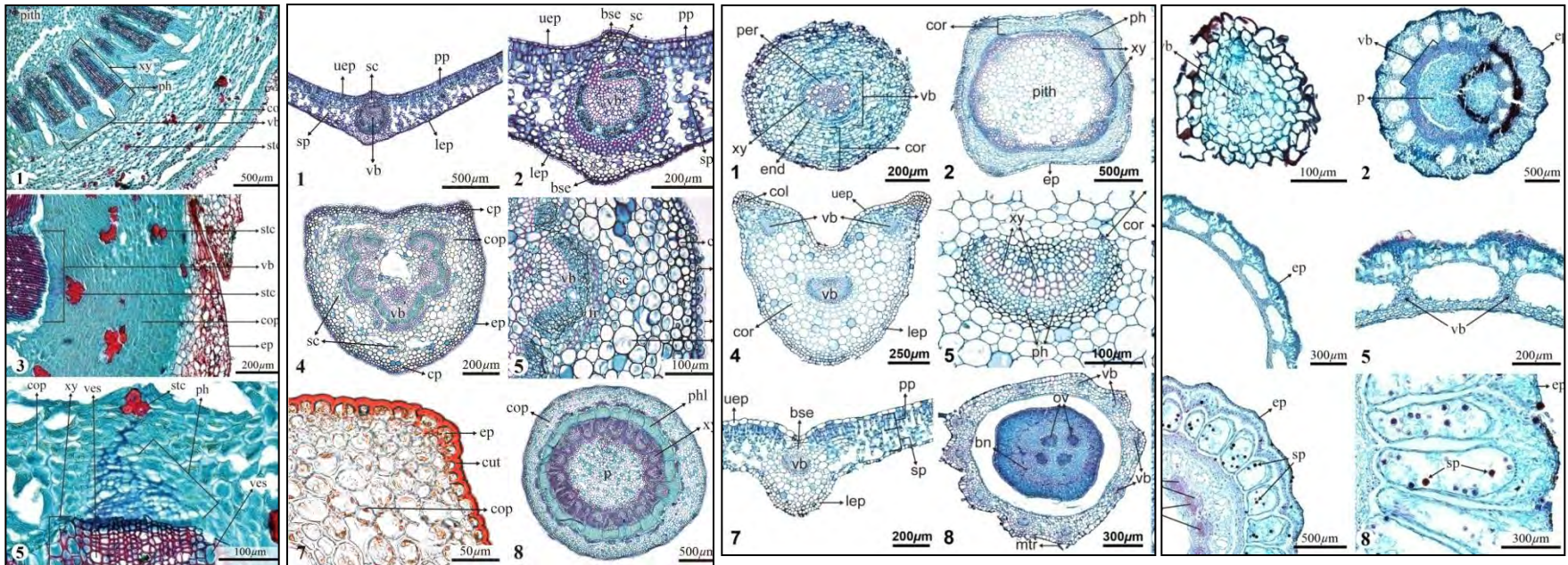
1. cauline leaf narrow, leaf base not covered stems ----- *B. falcatum*
1. cauline leaf broad, leaf base covered stems
  2. bracts and bractlets linear ----- *B. longiradiatum*
  2. bracts and bractlets not linear
    3. cauline leaf oval to lanceolate, sessile ----- *B. euphorbioides*
    3. cauline leaf reniform to ovate, long petiolated ----- *B. latissimum*

- Problems
  - **Terminology** is not familiar, not understandable to the public
  - **No typical form**, too many variation of morphology in the Nature

# Species identification : anatomy

- Anatomical morphology

- Compare shapes and arrangement of cells, tissues and fibers from cross sections of roots, stems, leaves, petioles, fruits or seeds

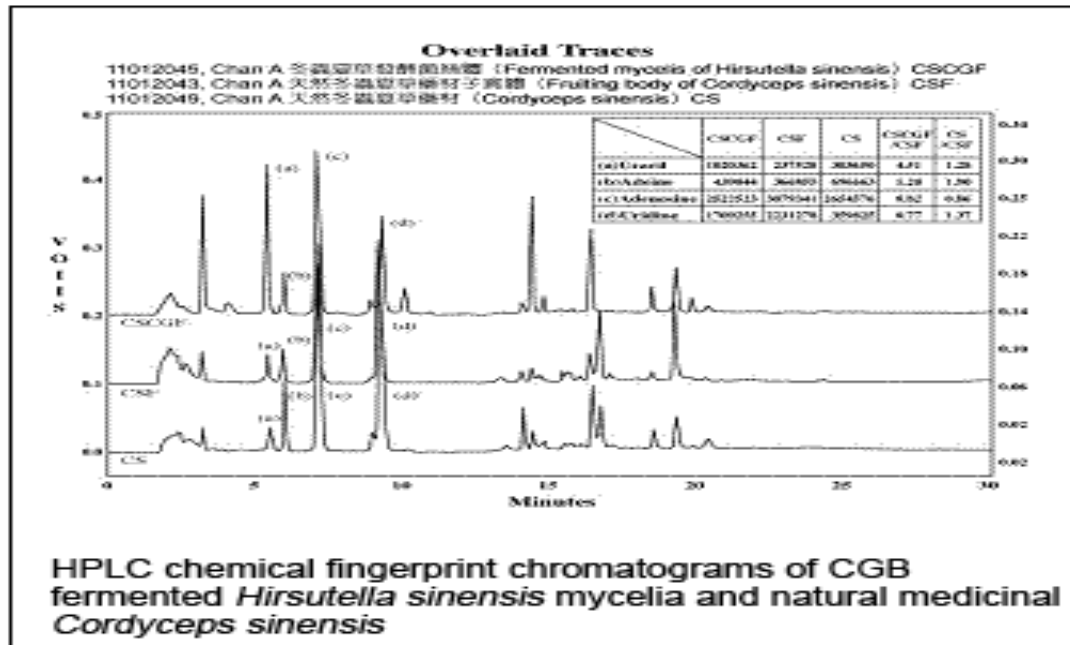


- Problems

- Terminology is not familiar, not understandable to the public
- Good at the genus level, but weak at the species level

# Species identification : chemical fingerprinting

- Chemical taxonomy
  - Classify organisms based on the distribution of natural products; chemical extracts in the case of vascular plants



- Problems
  - **No quantitative indication** is given, presence (traced, big spots) or absence
  - **Secondary metabolisms are turned on or off** by environmental or developmental factors

# Species identification : which one is a spinach ?

The image shows a screenshot of the QUSAC Pharma website. The header features the QUSAC Pharma logo and the text 'NATURAL BOTANICAL EXTRACTS'. Below the header is a navigation menu with links for Home, History, Products, Plant Tour, Our Partners, and Contact. The main content area is a grid of product listings. Each listing includes a small image of the powder, the product name, and links to 'Product Information Sheet' and 'Typical COA'. The products listed are: Pharmaceutical Grade Natural Caffeine, Green Coffee Extract Powder (Coming August 2012), Cranberry Extract Powder, Wild Blueberry Extract Powder, Strawberry Extract Powder, Broccoli Extract Powder, Onion Extract Powder, and Spinach Extract Powder. To the right of the grid, blue arrows point from the product names in the grid to a list of labels: Caffeine, Green Coffee, Cranberry, Blue berry, Strawberry, Broccoli, Onion, and Spinach.

Image	Product Name	Product Information Sheet	Typical COA
	Pharmaceutical Grade Natural Caffeine	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Green Coffee Extract Powder (Coming August 2012)	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Cranberry Extract Powder	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Wild Blueberry Extract Powder	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Strawberry Extract Powder	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Broccoli Extract Powder	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Onion Extract Powder	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>
	Spinach Extract Powder	<a href="#">Product Information Sheet</a>	<a href="#">Typical COA</a>

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Caffeine

Green Coffee

Cranberry

Blue berry

Strawberry

Broccoli

Onion

Spinach

# Species identification : Molecule (DNA)

- Molecular phylogenetics
  - Compare homologous sequences for genes using sequence alignment techniques to identify similarity among species
  
- Problems
  - No quantitative indication is given, presence (traced, big spots) or absence
  - Secondary metabolisms are turned on or off by environmental or developmental factors

# DNA barcoding (Hebert et al, 2003)

## Biological identifications through DNA barcodes

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and Jeremy R. deWaard

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Although much biological research depends upon species diagnoses, taxonomic expertise is collapsing. We are convinced that the sole prospect for a sustainable identification capability lies in the construction of systems that employ DNA sequences as taxon 'barcodes'. We establish that the mitochondrial gene cytochrome *c* oxidase I (COI) can serve as the core of a global bioidentification system for animals. First, we demonstrate that COI profiles, derived from the low-density sampling of higher taxonomic categories, ordinarily assign newly analysed taxa to the appropriate phylum or order. Second, we demonstrate that species-level assignments can be obtained by creating comprehensive COI profiles. A model COI profile, based upon the analysis of a single individual from each of 200 closely allied species of lepidopterans, was 100% successful in correctly identifying subsequent specimens. When fully developed, a COI identification system will provide a reliable, cost-effective and accessible solution to the current problem of species identification. Its assembly will also generate important new insights into the diversification of life and the rules of molecular evolution.

**Keywords:** molecular taxonomy; mitochondrial DNA; animals; insects; sequence diversity; evolution

- Universality: same primers to amplify all of specific DNA regions
- High quality of amplified DNA sequences
- Amplified sequences: good enough for species discrimination

## 4. 반성 및 발전 방안

