DEPARTMENT OF EDUCATION AND TRAINING

CAN THO UNIVERSITY

REPORT OF FIELD TRIP

MODULE CODE: BT200

CLASS: DA1066T1

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I. INTRODUCTION:

1.1. Aim:

The module of field trip which is a typical form of practical lesson is an important part of the course in order to help student have a opportunity for directly approaching to new research and invention in the major of biotechnology. Besides that, it provides student with practical experience and useful knowledge surrounding biotechnology major so that they can get specific idea of not only the prospective work but also scientific research topics.

The key point of this module is preparation of practical and general knowledge that benefits student in applying jobs and planing for future work well.

Followings are some main points designed for the whole trip such as

- Survey and learn from techniques, immediate and indirect applications of biotechnology in different aspects of life such as agriculture, industry, business and so on.
- Support student with enlargement of understanding via practical observation to consolidate theory comprehension that already have mentioned in class.
- Improvement students' skills in scientific research that leads to establishment of a steady background for them to well accomplish both graduating thesis and prospective research of science.
- Orientation of career and creation of original and cerviceable idea for student based on studying from practical applications.

Figure 1. A photo in field trip

1.2. Time schedule:

Table 1. Time schedule and contents of learning during field trip

Date	Time	Destination	Content of learning
December 9th, 2013 (Monday)	5:05 am	Departure from campus 2 of Can Tho University	
	7:00 am	Breakfast in Tien Giang province	
	7:55 am	Southern Fruit-tree Research Institute	- Aspects of operation. - Some techniques that is effectively applied in breeding and seedling prodution.
	9:40 am	Dong Tam Snake Farm	- Aspects of operation. - 5 species of snake that are important in health care and socioeconomic field.

	14:00 am	Rest at the guest house of Educational Management School. Address: number 7, Nguyen Binh Khiem street, Ho Chi Minh city.	
	15:20 am	Zoological and botanical garden of Ho Chi Minh city	- Observation of natural lanscape. - 5 species of plant which should be conserved. - 5 species of animal which are in danger.
December 10th, 2013 (Tuesday)	1:00 pm	Moving to Nha Trang city and stop at Doi Hong to have breakfast.	
	6:00 am	Departure	
	9:05 am	- Vinh Hao Algae Joint Stock Company - Address of original office: Vinh Son hamlet, Vinh Hao village, Tuy Phong district, Binh Thuan province, Vietnam.	- Management and operation of company. - The process of *Spirulina* algae production. - Some anchor products manufactured by this company.
	13:14 am	Ba Moi Wine Processing Establishment. Location: Ninh Thuan province.	- Management and operation of company. - The process of wine production.
	17:00 am	Rest at the guest house of Pasteur Institute. Address: number 8 Pasteur, Nha Trang city.	
December 11th, 2013 (Wednesday)	The early morning	Bathe in the sea and getting breakfast.	
	8:37 am	Nha Trang Oceanographic Institute	- Aspects of operation and establishment of this oceangraphic institute. - An example of practical research or interested application created by oceangraphic institute.
		Visiting of Linh Son	

		pagoda, Thap Ba tower, Dam market.	
December 12th, 2013 (Thursday)	6:00 am	Going to Dalat and having breakfast at Ben Loi mountain pass.	
		Flower garden of Dalat city.	
	Afternoon	Getting lunch and rest at Tung Hoa hotel. Address: number 7 Bis Bui Thi Xuan street, Dalat city.	
	Early evening	Love Valley, Rung Hoa company (fresh and dry flowers production)	
	Everning	Cultural and peforming arts exchange with other groups of ethnic minority.	
December 13th, 2013 (Friday)	7:00 am	Langbiang top of mountain and Golden valley.	
	2:00 am	Tay Nguyen Biological Institute	- Aspects of operation and establishment of this institute. - 5 species of animal listed on Vietnam Red Book. - An example of practical research or interested application created by this institute.
December 14th, 2013 (Saturday)	8:50 am	Bao An private company of Civet Coffee production.	The process of production.
	10:00 am	Cuong Hoan Silk factory of silk production.	The process of production.
	Affternoon	Some other tours such as Truc Lam flower-garden, Datala cascade, Truc Lam zen monastery.	
December 15th, 2013 (Sunday)	4:00 am	Going back Can Tho city from Dalat city	

II. CONTENT:

2.1. Southern Fruit-tree Research Institute:

2.1.1. General information:

Southern Fruit-tree Institute which had been formerly Long Dinh Fruit Center was established by the Prime Minister with the Decision of No. 116/QD- TTg, on the 26th of March in 1994 and transformed into Southern Fruit-tree Institute with the Decision of No. 1056/1997/QD-TTg on the 9th of December in 1997. The Institute headquarter is situated on 1A National Highway in Long Dinh Village, Chau Thanh District, Tien Giang Province. Additionally, it is distant from Ho Chi Minh City about 75 kilometer to the West with an area of 67 hectare. Furthermore, it composes of two directly under centers. The first one is the Southeast Fruit-tree Research Center located in the Tan Thanh district, Ba Ria - Vung Tau Province with total area of 436 hectare. Another center is Technical Transfer Center placed in the Institute.

Figure 2. Southern Fruit-tree Research Institute

Presently, there are a total of 8 main departments:

- Department of Plant Protection
- Department of Biotechnology .
- Department of Post-harvest Technology .
- Department of Market Research.

- Department of Breeding.
- Department of Cultural Engineering.
- Department of Vegetable Research .
- Department of Flowers and Ornamental Research.

The priority function of Southern Fruit-tree Institute consists of:

- Research, selection and production varieties of fruit-trees, vegetables, flowers that own high yield and good quality for supplying of domestic processing, consumption and a part for export.
- Improvement of production technology such as farming, plant protection, pre- and post-harvest of agricultural products to serve manufacture of farm produce with high quality and safety.
- Development of technical packaging, processing and product marketing of horticulture professionally.
- Technology transfer with local companies and other entities based on training , horticultural services and establishment of research contracts.

2.1.2. Typical researches and applications:

Currently, a number of methods that are directly related to biotechnology is on the way of research and application such as

- The process of producing pathogen-free banana seedlings using the method of plant tissue culture.
- Using PCR, Crop Plants' doctor kit No. 1, ELISA method, strip test for the diagnosis of diseases on citrus.
- Production of disease-free citrus by using micro-grafting method of apical meristem.

❖ **The pathogen-free banana tree production by means of plant tissue culture:**

Plant tissue culture not only is an important technical advance in banana cultivation but also brings to farmers an inexpensive and helpful solution in order to increase productivity, fruit quality and effectively manage diseases of bananas. This process is carried out by 4 steps:

- **Step 1: Regeneration of shoots:**

Banana buds (0.5 to 1.0 m) were taken out of parent trees which already passed the disease diagnose with negative result. Next, pseudo-body layer and outer roots (6 - 8cm in diameter and 10cm in height) of banana buds were removed.

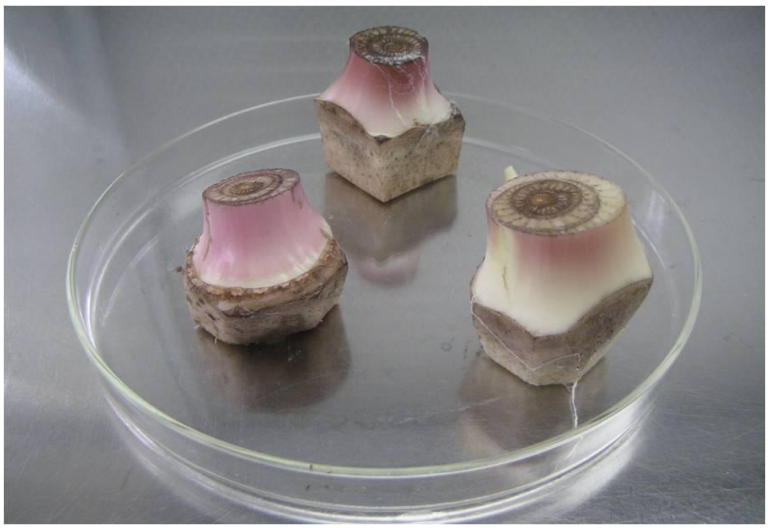

Figure 3. Banana buds from parent trees

These buds were sterilized with 70% alcohol solution. Then, the stage of eliminating the remain layers of pseudo-body and the tip of meristem was carry out in sterile condition.

Continuously, banana samples were cut into blocks (1.5 x 1.5 x 1.0 cm) and transfered into culture media (MS media and some necessary substances). After 4 - 5 weeks,a number of 10 - 12 shoots or explant were regenerated.

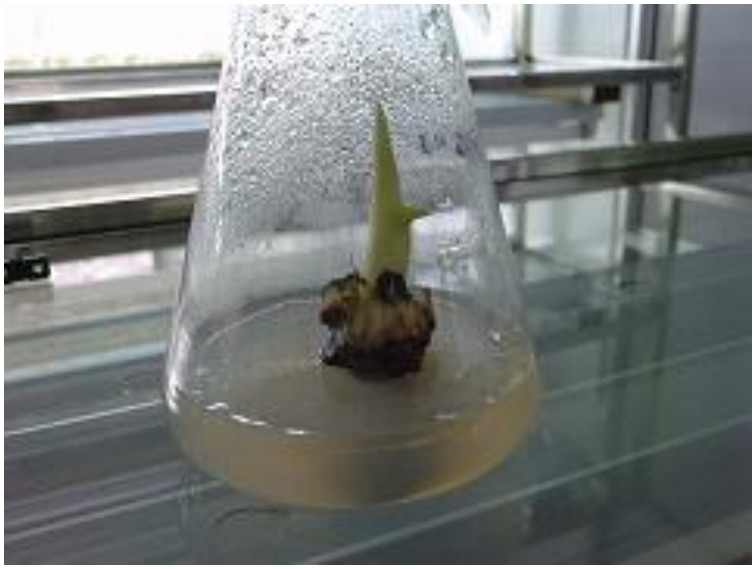

Figure 4. Regeneration of banana block

- **Step 2: Multiplication of shoot cluster:**

Buds were regenerated into small clusters and each one brought 2 – 3 shoots. Then, these shoots in clusters were separated to culture in rapid multiplication medium.

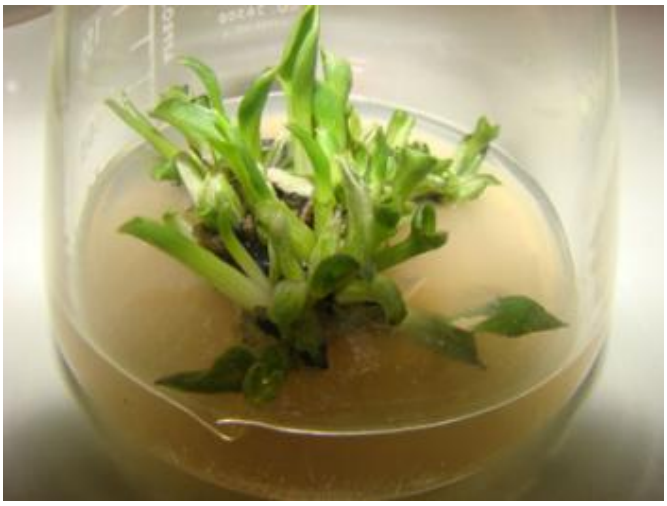

Figure 5. Multiplication of banana shoot

- **Step 3: Growth of shoots and formation of roots:**

2 – 3 buds of each cluster were splitted and grown in the medium contained BAP and activated charcoal. Additionally, the BAP concentration was reduced. These components facilitated shoots to grow and stimulated formation of roots at the final passages. The cultivation should not be more than 6 times.

Figure 6. Formation and development of banana roots

- **Step 4: Acclimatation in a greenhouse:**

Complete plantlets were moved to the greenhouse and had kept in cool climate for 2-3 weeks before they were transplanted into soil. Plantlets which were reached the height of 5cm elected to directly grow in private soil containers while smaller ones had

to be concentratively taken care in soil tray during 2 - 3 weeks before transfering into private pots. Seedlings should reach 20 - 25cm in height combined with formation of 5 - 6 leaves as the standard.

Figure 7. Acclimatation of banana plantlets

2.2. Dong Tam Snake Farm:

2.2.1. General information:

Dong Tam Snake Farm which is distant from My Tho city for 9 kilometer and situated in Chau Thanh distric of Tien Giang province is also known as Pharmaceutical Cultivation – Research – Manufacture Center of the Military Region 9. Formerly, this center was called by the name of Enterprises 408 but then upgraded to a center of pharmaceutical cultivation, research and manufacture. It is an attractive destination of tours for both local residents and foreigners. In particular, Dong Tam Snake Farm is also a service center where people is supported for treating of wounds caused by venomous snakes. Moreover, it is responsible for the conservation of precious medicinal resources, manufacture of Vietnamese traditional medicine, emergency together with treatment of poisonous snakes' bites for the people and also army in Mekong Delta.

Figure 8. Dong Tam Snake Farm

2.2.2. Aspects of operation:

The main function of Dong Tam Snake Farm includes many aspects such as conservation of snakes as well as rare animals and precious medicinal resources, production of Vietnamese traditional medicine, emergency and cure venomous snakes' bites. Nearly during 30 years, the operation of this center has accomplished many achievements in community service and national defence. An undeniable proof is that more than 500 cases of people injured by poisonous snakes have been received and well treated at Dong Tam Snake Farm each year. Fortunately, nearly 100% of victims who get the treatment from this center overcome the fatal venom of snakes in case these ones are obtained cure opportunely. The center also creates a combination with local clinics to propagate and disseminate the knowledge of how to prevent people from venomous snakes as well as the first-aid for victims before moving to the nearest hospital.

Especially, Dong Tam Snake Farm is not only the center for curing of patients bitten by poisonous snakes but also is a wonderful place for tours because of firsthand seeing of hundreds kinds of snake ranging from the gentle snakes such as water snake, grass snake, Ho Hanh snake and so on, to the poisonous snakes involved cobra, krait, bongar and so forth. Besides that, visitors can also be seen some rare animals such as pythons, crocodiles, turtles, foxes, bears and so on. There are about 30 - 40 thousands of international and domestic tourists visiting this place each year. To attract more visitors, the Department of Commerce and Tourism of Tien Giang province is

coorperating with Dong Tam Snake Farm to make an investment on upgrading the infrastructure of snake farm, planting trees, intensifying conservation with many animals which are in danger.

For the valuable contribution to community health care, Dong Tam Snake Farm was conferred the title of Labour Hero by Vietnamese Government in 1989 and has become a prestigious scientific research center. Currently, the total area of the Dong Tam Snake Farm is 12 hectare. It consists of feeding area of cobra, soil cobra, red viper, cat cobra and so forth combined with medicinal plantations, hospital for snakes' bite treatment, research laboratories, animal sanctuary and museum of snakes.

2.2.3. Some valuable snakes:

2.2.3.1. King copperhead:

- **Scientific name:** *Ophiophagus hannah.*
- **Family:** *Elapidae.*
- **Description:** King copperhead which belongs to venomous group of snake has the largest size among snakes. It has ability of largely spreading its neck but not wide as cobra's. The above surface of King copperhead has 2 dots made by 2 large scales. The back of mature snake has some colors such as greenish yellow, brown or sometimes only leaden color. However, juvenile one's back owns black with many lighten streaks and scales on neck creates an inverted V-shaped with yellow color. The body length of King copperhead can reach 3 - 4 meters and sometimes up to 5 meters.

Figure 9. A King copperhead

- **Biological characteristics:** although lizard and other kinds of snake are often the prey of King copperhead, sometimes bird and mouse are also alternative food sources. This type of snake mostly lays 20 - 30 eggs per a brood. Eggs laid in nest are also

watched by mother or father snake until the eggs hatch out. Especially, the maximal life span of King coppoerhead is 17 years.

- **Habitat and ecological feature:** King copperhead usually lives in the midlands and mountainous areas but less common in the plain. It mostly resides in caves located under large trees, tree-trunk beside a stream in the forest and sometimes bleak places. Remarkably, King copperhead has excellent ability of climb tree and swim but it generally prefers living on land. Additionally, this kind of snake hunts for preys in both daytime and nighttime. King copperhead is poisonous and most ferocious because it actively attacks people, especially in cases of guarding nests or being teased.
- **Distribution:**

- **In Vietnam:** this species is predominantly allocated in many provinces such as Lao Cai, Yen Bai, Bac Thai, Vinh Phu, Ha Tay, Hoa Binh, Bac Ha, Quang Ninh, Ha Nam, Ninh Binh, Nghe An, Ha Tinh, Dak Lak, Lam Dong, Phu Yen, Ninh Thuan, Binh Thuan, Tay Ninh, Dong Nai and Ba Ria - Vung Tau (Con Dao).

- **In the world:** King copperhead is often found out in Nepal, India, Myanmar, China, Thailand, Laos, Cambodia, Philippines, Malaysia and Indonesia.

- **Value:** Toxicity of King copperhead venom is high. Victims can be killed because of large amount of venomous secretion from this type of snake after being bitten in half an hour. The venom of the King copperhead is valuable source used for medicinal purposes and export. Furthermore, the leather arisen from skin of King copperhead is also preferred.

2.2.3.2. Red-tailed viper (mallet head):

- **Scientific name :** *Trimeresuirus albolabris.*
- **Distribution:** India, China, Thailand and so on.
- **Habitat:** Bamboo hedges, thickets, places near rivers and streams.
- **Food:** Insects, frogs, birds, mice and so forth.
- **Reproduction:** cubbing of 6 – 10 offsprings per a brood.

Figure 10. Red-tailed viper (mallet head)

- **Lifespan:** 4 – 5 years .

Red-tailed viper is a member of the venomous group of snake and the venomous toxicity of this one is ranked at the second position following King copperhead's. It often inhabits in Asian countries. According to the knowledge of oriental medicine, enjoying the beverage made from preservation of Red-tailed viper's fetus in alcoholic or eating raw its fetus is good for men's physiological functions. In some cases, foods processed from Red-tailed viper can be efficient in antidotal effect and tumor vanishment but the requirement is prevention these snakes from falling to the ground. Red-tailed viper can spray its venome away for 2 meters. This kind of snake is one among animals that are in danger so this species should be protected.

- **Distribution:** Red-tailed viper primarily resides in high mountainous areas and deep forests of Annamite Mountains and mountainous areas of the Northwest of Vietnam. It mostly dwells in trees so the skin with green color enables it to disguise easily. The eyesight of Red-tailed viper is very good at nighttime but this one is contrary during daytime.

2.2.3.3. Krait:

- **Scientific name:** *Bungarus fasciatus*
- **Family:** *Elapidae*
- **Description:** For Krait with large size, its head is slightly differentiated from neck and there is not scales on cheek. Its eyes is small beside an embrossed bone edge

at the spine. There are 15 rows of body scale. Each spine scale has 6-edge shape and larger size in comparison with accompanied scales. The body alternatively has crossed by black and yellow lines which are approximately the same size. The minimal body length of Krait is about 1 meter.

Figure 11. A krait in Dong Tam Snake Farm

- **Biological characteristics:** Familiar food of Krait is other kinds of snake. However, it also eats frogs, toads, lizards, snakes' egg, rats and fish. The peiod of time for this species to lay eggs often falls from the ending of May to the mid of June annually. For each brood, there is a number of 2 – 15 eggs with the dimension about 6,25 x 3,75centimeter. Life expectancy is about 10 years.

- **Habitat and ecology:** Krait is often found in forests, near residental area, the rat's cave or termite's cave, bunds dropped connections, hills, river banks, embankments, gardens, bamboo hedges and the edge of ponds. At daytime, Krait's motion is not brisk. As s result, this species primarily looks for food at nighttime. Krait seldom wounds people via snakebite but the victim can be died in case of getting bitten.

- **Distribution:**

- **In Vietnam:** Presence of Krait becomes popular all over the delta, midland and mountainous regions.

- **In the world:** Krait appears in Nepal, India, Myanmar, China, Thailand, Laos, Cambodia, Malaysia and Indonesia.

- **Value:** the preservation of krait combined with cobra and grass-snake in alcohol is the preparation of a special beverage called long-range alcohol that is effective in

treatment of arthritis and rheumatism. Otherwise, raw Krait also serves as an exportable commodity.

- **Status:** the individual quantity of this species is very limited due to hunting thoroughly.
- **Threatened level:** grade T.
- **Suggested protective measures:** the policy related to prohibition of hunting for small snakes in breeding season should be promulgated. Besides that, the organization of feeding Krait needs to be strengthened.

2.2.3.4. Golden spitting cobra:

- **Scientific name:** *Naja Sumatrsna*
- **Family:** *Elapidae*
- **Distribution:** The Asian countries

Golden spitting cobra which is predominantly discovered in mountainous area and midland is also one among venomous snakes. A special feature of this species is that it can spray venom away from 1,4 to 1,6 meters. Major distributive region are the edge of jungle, hillsides, rocky mountain and contiguous area of the water source.

Figure 12. Golden spitting cobra

- **Nourishment:** Insects, frogs, lizards, birds, rats, chicks, reptiles' eggs and other type of snakes.
- **Reproduction:** laying of 12 – 20 eggs per brood.
- **Lifespan:** 8 – 12 years.

Golden spitting cobra is also belong to the group of animals that are in danger. Thus, emergency measure of preservation for this species should be early activated.

2.2.3.5. Onion snake:

- **Scientific name:** *Xenopeltis unicolor*
- **Family:** *Xenopeltidae*
- **Distribution:** China, Vietnam, Indonesia, Thailand.
- **Habitat:** Tends to live in open areas such as forest clearings, gardens and parks. Often encountered in rice paddies.
- **Food:** The diet is varied, consisting primarily of frogs, reptiles, including other snakes, and small mammals.

Figure 13. An onion snake

- **Reproduction:** This is a primitive snake known for both its highly iridescent scales and its ability to reproduce quickly, as it is oviparous and as such can lay up to 10 eggs at a time. No subspecies are currently recognized.

Xenopeltis unicolor is a non-venomous sunbeam snake species found in Southeast Asia and some regions of Indonesia. Onion snake often grows to an average of about 1 metter. A fossorial species, the head is wedge-shaped and narrow with little neck delineation, which makes it easy to push through the soil. Its most defining characteristic is its iridescent, highly polished scales that give this snake its common name. They have a layer of dark pigmentation just below the surface on each scale that enhances the iridescence. The youngs look very similar to the adults, except that they have a strong white "collar" of scales evident just below the head. This

coloration fades within the first year. This is a primitive form of snake with both boid and python characteristics; which family it belongs to is still a matter of debate. These snake are constrictors, killing their prey by suffocation in their muscular coils. They are fossorial and spend most of their time below ground. They may bite readily if handled roughly but mostly it will just try to escape if picked up. They also observed to vibrate their tails as if in a rattlesnake fashion when they feel threatened. Onion snake is also considered as a valuable animal which is in danger so the quantitative maintenance has been deploying.

2.3. Zoological and botanical garden of Ho Chi Minh city:

2.3.1. General information:

Figure 14. Zoological and botanical garden of Ho Chi Minh city

Zoological and Botanical Garden of Ho Chi Minh city which is located at number 2 Nguyen Binh Khiem street, Ben Nghe Ward, District 1, Ho Chi Minh City is also known as Ho Chi Minh City Zoo, Saigon Zoo or the Botanical Gardens. It is the first home of collections of plants and animals in Vietnam. Construction was commenced on March in 1864 and completed in 1865.

Figure 15. A corner of Hochiminh City Zoo with a stream.

This zoo is considered as the largest cultural and scientific park regarding to animal and plant with an area of 17,6 hectares in Vietnam. Saigon Zoo is typically one of the cultural centers in Ho Chi Minh City. The conservation is reinforced towards plants and animals that are in danger. Especially, its flora and fauna is ranked of the 8th all over the world in term of the life span.

Figure 16. A part of Saigon Zoo with plants

After more than 130 years of construction, the Botanical Gardens has become a major national zoo with 590 animal individuals belonged to 125 species including 107 of the world's endangered animals such as Douc langur black, Fire wolf, Clouded Leopard, Brocaded Leopard, Sarus Crane, Star pheasant and so on. In term of plant, the total amount of tree is 1,800 composed of 23 species of domestic orchid, 33

species of cacti, 34 categories of bonsai and 260 species of perennial plants such as sandalwood, monkey skull tree or conch tree, otter oil tree and so forth. In general, Zoological and Botanical Garden of Ho Chi Minh city is divided into several areas such as animals farms, orchid and ornamental area and amusement part. There are thousands of visitors coming here for doing sightseeing and research daily.

2.3.2. Some precious plant species:

2.3.2.1. Jamun:

- **Scientific name :** *Syzygium cumini (L.) Skeels*
- **Family:** *Myrtaceae*.
- **Common name:** Syzygium cumini, jambul, jambolan, jamblang, or jamun.
- **Description:** A slow growing species, it can reach heights of up to 30 m and can live more than 100 years. Its dense foliage provides shade and is grown just for its ornamental value. At the base of the tree, the bark is rough and dark grey, becoming lighter grey and smoother higher up. The wood is water resistant. Because of this it is used in railway sleepers and to install motors in wells. It is sometimes used to make cheap furniture and village dwellings though it is relatively hard to work on.

Figure 17. Jamun leaves

The leaves which are an aroma similar to turpentine, are pinkish when young, changing to a leathery, glossy dark green with a yellow midrib as they mature. The leaves are used as food for livestock, as they have good nutritional value. Its leaves which has oval shape is 8 – 10 cm in length and 3 – 9 cm width. The above layer of leaves is shiny but dark color while the below surface is pale. The petiole is 10 – 20

mm in length. Jambul's inflorescence flower has tower-shape with 5cm in length. Furthermore, it is almost sessile and appeared at axillary part. Fruit's shape is oblong or slightly curved with 13 – 15 mm in length and 10 mm in thick. The fruit is oblong, ovoid, starts green and turns pink to shining crimson black as it matures. A variant of the tree produces white coloured fruit. The fruit has a combination of sweet, mildly sour andastringent flavour and tends to colour the tongue purple. Its seed has tapering form with 3,5 cm in length and change from green to brown in case of ripeness.

Figure 18. Jamun ripe fruits

- **Parts for ultilization:** fruit, seed, bark and leaves.
- **Habitat and harvest:** This species is a familiar plant in tropical area of Asian countries and Australia. In Vietnam, jamun is primarily found in the Central Highlands and Southern provinces and also commonly grown as a type of fruit-tree.
- **Medicinal effects:** The seed is also used in various alternative healing systems like Ayurveda (to control diabetes, for example), Unani and Chinese medicine for digestive ailments. The leaves and bark are used for controlling blood pressure and gingivitis. Wine and vinegar are also made from the fruit. It has a high source in vitamin A and vitamin C.
- **Directed and coordinated ultilization:** People use the jamun bark in combination with some typical materials to create healthy beverage or mouthwash.

Moreover, raw bark extract blended with sheep milk used for the treatment of diarrhea in children effectively. Seeds are available as a powder to cure diabetes. Surprisingly, it reduces the amount of urine and eliminate sugar out of urine after 18 hours and during treatment time. It help diabetes patient can still eat the starchy substances without causing damage. The leaves can be cooked as a kind of beverage that advantages digestion. Leaf juice can be alone employed or in combination with other herbs to treat dysentery.

2.3.2.2. Monkey skull:

- **Scientific Name:** *Khaya senegalensis A.Juss*.
- **Family:** *Meliaceae*.
- **Vietnamese name :** nacre, Monkey skull.
- **Common name:** African mahogany, dry zone mahogany, Gambia mahogany, khaya wood, Senegal mahogany, cailcedrat, acajou, djalla, and bois rouge.

Figure 19. Monkey skull

- **Description:** African mahogany is a medium-sized tree which can grow up to 30 – 40 meters in height and 2 meters in diameter (in Ho Chi Minh city Zoo). The bark is dark grey to grey-brown while the heartwood is brown with a pink-red pigment made up of coarse interlocking grains. The tree is characterised by leaves arranged in a spiral formation clustered at the end of branches. Blossom season falls between April and

May. The white flowers are sweet-scented and the fruit changes from grey to black when ripening. Ripen fruit is sprung into 4 pieces.

Figure 20. Monkey skull fruits

- **Growth:** Monkey skull prefers living in places where light intensity is high. It is easy to grow this species, even germination by seed or regeneration by bud. The growth of Monkey skull is very fast and powerful that enable it to well grow on any form of terrain, diverse type of soil and even sandy soil of coastal region in the middle of Vietnam. Especially, this species has ability of strong resistance to pests and diseases.
- **Usage:** In Vietnam, African mahogany was introduced from Africa and widely planted as landscape trees, shade trees on sidewalks, in parks and schools. Monkey skull has been grown in big cities of Vietnam such as Hanoi, Hai Phong, Da Nang, Buon Me Thuot and Ho Chi Minh City. In addition, the wood arisen from African mahogany owns reddish heartwood and reddish-brown sapwood. Because the wood fibers of Monkey skull can be twisted and curved easily, it is often material in boat and household furniture manufacure.

2.3.2.3. Bastard poon tree:

- **Scientific name:** *Sterculia foetida L.*
- **Family:** *Sterculiaceae*.
- **Vietnamese name:** Trom Hoi.
- **Common names:** bastard poon tree, java olive tree, hazel sterculia, and wild almond tree.

- **Distribution:** *Sterculia foetida* has been found in many areas. These aforementioned areas are the Chinese Taipei, Vietnam, Thailand, the Philippines, United States (Hawaii), Indonesia, Ghana, Australia, Mozambique, and Togo.

Figure 21. Bastard poon tree with green fruits

- **Description:** *Sterculia foetida* is a soft wooded tree that can grow up to 115 feet tall. It was described in 1753 by Carolus Linnaeus. The origin of the bad-smelling *Sterculia* genus comes from the Roman god, Sterquilinus, who was the god of ferilizer or manure.

The branches of *Sterculia foetida* are arranged in whorls, and they spread horizontally. The tree's bark is smooth and grey. The leaves of the plant are situated at the ends of branchlets containing 7 – 9 leaflets. The leaflets grow elliptically, and are 10 – 17 cm. Also they are shortly petiouled with eachpetiole being 12,5 – 23 cm long. The petioles are the source of the foul smell of the plant. Evidence suggests that the seeds of *Sterculia foetida* are edible, but they should be roasted prior to eating. Each fruit generally contains 10 – 15 seeds. The flowers are found as panicles, and they are 10 – 15 cm long. The green or purple flowers are large and unisexual as male and female flowers are found on different trees. The calyx is a dull orange color and divided into five parts. Each sepal is 1-1.3 cm long. The follicles are scarlet. In India, flowers appear in March, and the leaves appear between March and April. The fruit is ripe in February (11 months after the flowers appeared).

Figure 22. Ripe Bastard poon fruits

- **Used parts:** seeds, bark and leaves, seed's oil and latex.

The oil of *Sterculia foetida* has been found to be comparable to sunflower, soybean, and rapeseed oils for the use of biofuels.

- **Habitat and harvest :** tropical areas are suitable place for the growth of this apecies. It is also found in wild or cultivated as shade trees in streets and gardens. Picking of leaves and bark is carried out all year round. The raw form is familiar one in using. Besides that, mature seed is an important material to prepare oil.

Figure 23. Dry Bastard poon fruits

- **Chemical composition:** the content of fatty oil in seed approximately changes from 30,80 to 51,78 %. There are also presence of protein (21 %) and starch (12 %) in seed.

- **Medicinal effects:** the seed oil can be considered as aperient and benefit to digestion. Its latex serves as refresher. Furthermore, the bark has the diuretic effect. Leaves is effective in antibiotics, laxative and decrease of inflammation.
- **Directed and coordinated ultilization:** the oil from Trom Hoi can be used for not only preparing foods but also lighting. Seed powder is a common material in food and many kind of cakes. The latex is ultilized to make healthy beverage in family. Especially, the bark is also consumed to treat rheumatism and gout. In Cambodia, people use the bark for fever medication. Leaf is boiled with water to collect extract then used to cure the rash, skin diseases, problems of hair and scalp, sprain, bites, cuts and other injuries.

2.3.2.4. Erythrophleum fordid:

- **Scientific name:** *Erythrophleum fordii*
- **Family:** *Fabaceae*
- **Description:** *Erythrophleum fordii* is a species of legume. It is a tree about 10 metres (33 ft) tall, occasionally reaching 30 metres. It is found in southeastern China, Taiwan, and Vietnam. It is a valuable timber tree threatened by overexploitation. It is under second-class national protection in China.

The stem is straight and round but the foot of this species has broad parts. The outer bark is brown with brownish nodules that are later peelled while the inner layer is reddish-brown. Some primary charcteristics of *Erythrophleum fordii* are described such as compound leaf, flower in clusters with hermaphroditic ones, tapering fruits, flattened and blackish brown seed.

Figure 24. Erythrophleum fordid

- **Ecology:** It grows slowly. Although mature trees well grow under high intensity of light, plantlets prefer living in shades of other trees. The capable of regenerating by seed and shoot of this species is well. Distribution region of *Erythrophleum fordii* is often clay or loam area with tropical monsoon climate. It is mainly istributed in Vietnam , Taiwan and China.
- **Usage:** this species is consider as precious wooden plant, shade tree and significant plant of scientific researchs. In addition, the bark contains tannins used for dyeing.
- **Status:** it has been seek and exploited exhautesly.

2.3.2.5. Copaiba:

- **Scientific name:** *Copaifera officinalis L.*
- **Family:** *Fabaceae* or Legume family or *Caesalpiniaceae*
- **Common name:** Copaiba, copaiba balsam, copaiva, Jesuit's balsam, copal, palo de aceite and capivi.

Figure 25. Copaiba tree

- **Description:** *Copaifera officinalis* is a well branched tropical tree that grow up to 100 feet tall. Its leaves belongs to the pinnate leathery group and blossoms developed from whitish racemes are white color, small size and aromatic. The coriceous legume containing only a single seed is the feature of fruit. The oleoresin accumulated in cavities within the trunk is achieved from making incisions in the tree trunk. The resin is referred to as a balsam but exactly it belongs to natural oil with change from thick clear pale to golden yellow color. For art restoration, this oil is an important material with ability of restoring color to old paintings. Besides that, the most significant characteristic of this plant are the medicinal effect arisen from the oil.

Figure 26. Copaipa oil product

- **Medical effects:** antibacterial activity is one of good effect of copaiba oil. This component is also applied in perfumes, soaps, creams, bubble bath and lotions. In term of health care, copaiba contributes to improve human's health by diuretic, disinfectant and stimilant possessions. Furthermore, it is especially useful in treatment of chronic mucous affections, chronic gonorrhea, bronchitis, irritable conditions of bladder, gleet, leucorrhea, chronic catarrh, chronic diarrhea and obstinate piles.
- **Distribution:** tropical regions.

2.3.3. Some endangered animals:

2.3.3.1.White tiger:

- **Scientific name:** *Panthera tigris tigris*
- **Family:** *Felidae*.
- **Features:** each individual commonly reaches 130 – 200 kg of weight. The body length is about 2,5 – 3 meters. Two special features are blue eyes and pink nose. White tiger is a beautiful animal with creamy white fur with alternating pale yellow stripes. Distribution: India, Nepal, Bangladesh, Bhutan and Myanmar.

Figure 27. White tiger

- **Ecology:** white tiger often lives in couple and mainly resides in regions which are near watery sources, habitat of preys and shelters. Its diet is usually cattle, deer, horses, pigs, chickens, dogs and so on.
- **Reproduction:** Pregnancy is approximately 102 days and there are 2 – 3 parities cub per each brood.
- **Status:** Critically Endangered.

2.3.3.2. Spotted deer:

- **Scientific name:** *Cervus nippon pseudaxis*.
- **Family:** *Cervidae.*
- **Characteristics:** the weight of each individual is often 60 – 80 kg. The horn of male spotted deer is composed from 2 to 4 small branches and smaller than antlers' stag.
- **Distribution:** Vietnam, China, Korea, Russia and Japan.

Figure 28. Spotted deer

- **Ecology:** spotted deer mainly inhabit in the hilly woodlands and dry places. Its feed is commonly grass and leaves.
- **Reproduction:** from February to May is the reproductive season of spotted deer. The pregnant period is about 7 – 7,5 months with only one cub per brood.
- **Status:** In Vietnam, this species has gone to extinction in wild.

2.3.3.3. Indochinese Tiger:

- **Scientific name:** *Panthera tigris corbetti*
- **Family:** *Felidae*
- **Characteristics:** a mature Indochinese Tiger can reach the weight of 200 – 250 kg. Its boby is covered by a buff fur with black stripes.

Figure 29. Indochinese Tiger

- **Distribution:** Indochina, Myanmar, Malaysia and Thailand.
- **Ecology:** Indochinese Tiger primarily resides in the mountains areas, bushland or region having reeds. Prey of this species is diverse such as deer, wild boar, stag, rabit and so forth.
- **Reproduction:** Pregnancy is approximately 100 – 108 days with 2 – 4 cubs per brood.
- **Status:** Critically Endangered.

2.3.3.4. Tibetan bear:

- **Scientific name:** *Elenarctos thibetanus*
- **Family:** *Ursidae*
- **Distribution:** The Far East (Russia), China, Japan, Myanmar, India, Thailand and Indochina.
- **Habitats:** mountainous forests.
- **Food:** fruits, bamboo shoots, insects and small mammals.
- **Reproduction:** mature age is in the 3th or 4th year. The pregnancy is 210 – 240 days with 1 – 4 cubs per brood. Life expectancy is 25 years.
- **Status:** under threat of extinction (grade E).

Figure 30. Tibetan bear

2.3.3.5. Gray Legs Pelican:

- **Scientific name:** *Pelecanus philippensis*.
- **Family:** *Pelecanidae.*
- **Features:** the beak is unusually big with a bag under. and hanging down. Its head is gray with a bristly crest.
- **Distribution:** Vietnam, India, Myanmar and Cambodia.

Figure 31. Gray Legs Pelican

- **Ecology:** Gray Legs Pelican basically forages for fish and other aquatic animals in the wetlands.
- **Reproduction:** the reproductive season is from January to April. Each female individual often lays 2 eggs in average and spends 31 days for incubation.
- **Status:** being endangered.

2.4. Vinh Hao Algae Joint Stock Company:

2.4.1. Management and operation of company:

Vinh Hao Algae Corporated Company was established in May 4th, 2008. The main product of this company is a type of algae with scientific name called by *Spirulina platensis*. According to ancient documents, it was mentioned that three million years ago from the land of Africa, there was a very poor tribe named Kanembu. However, it was so strange that both new born babies and the elderly with hundred years old are really healthy proven by strong bodies and seldom geting sicks. The supposition is recognized that Kenembu tribe had simple habits in daily activities. Every day they picked green algae in a pond near the tribal region, then mixed with flour to make foods. As a result, this algal species became a major material of their food. The green algae used by Kenembu tribe is *Spirulina*. This algal species supplies a very high protein content ranging from 60-70 % and it is rich in vitamins, minerals and beta-carotene.

Figure 32. Vinh Hao Algae Joint Stock Company

In documents published by the international Food and Agriculture Organization (FAO) and World Health Organization (WHO), *Spirulina* has been widely admitted as the source of natural super food and the best foodstuff for humanity in the 21st century because of protective effects on health. Scientists has conducted researches and test cultivation at Vinh Hao since the early 70s of the last century. This area has bestowed by the nature with an invaluable resource that is mineral water sources. The key point is that Bicarbonate level and trace elements contained in water usefully works on body

nourishment and digestive aid. With the high light intensity as burning and continuous winds as sea-breeze, algae is enabled to grow and develop well. Thus, Vinh Hao Algae Joint Stock Company has applied modern technique in algal cultivation and production with industrial scale. This is also consider as the bigest algal farming area in Vietnam until now.

Total area of algal cultivation and production: 12.000 m^2

- **Biomass yield:** 11,5 – 12 g/m^2/day.
- **Production capacity:** 26 – 30 tonnes/year .
- **Total number of employees:** 49 individuals.

2.4.2. The process of *Spirulina* algae production:

Algal production process includes many stages listed below:

- The algal breed was produced in the same petri dishes and stored in the storage room.
- The algal breed from storage rooms was moved to high-rate multiplication room. In this stage, *Spirulina* algae rapidly grew in term of biomass for 5 days.

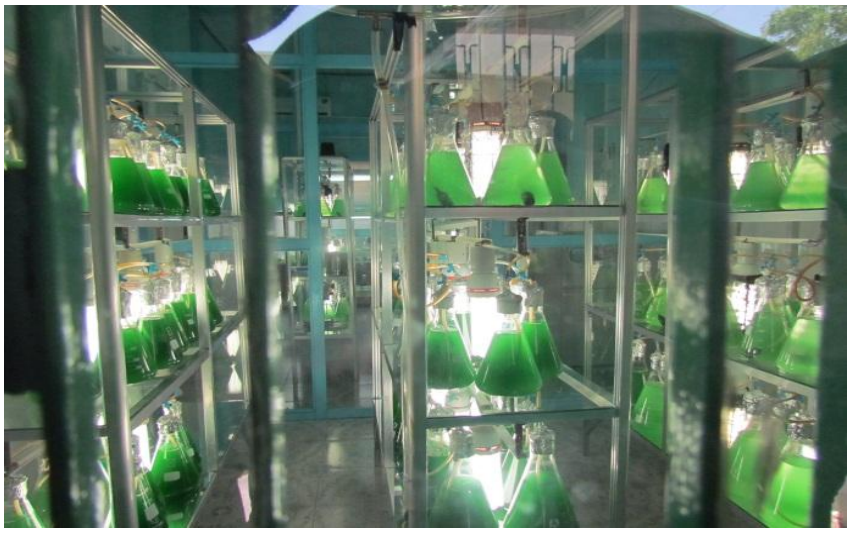

Figure 33. Algal cultivation in high-rate multiplication room

- Then algae were cultivated in big tubes outdoor during 3 days.

Figure 34. Growth of *Spirulina* algae in tubes

- Next, algae planted in tubes were removed to tanks for growing. Each tank had the area of 43 m^2. Besides that, algae were continuously agitated to avoid prolonged exposure to light and help culturing media be evenly distributed.
- After that, algae in above tanks were transferred to pools with area of 500 m^2 and left one week before harvesting.

Figure 35. Algae in pools

- Finally, algal solution were filtrated and dried to gain the raw material algae.

Figure 36. Raw algal powder

2.4.3. Some anchor products:

Main products of Vinh Hao Algae Joint Stock Company consist of raw algae supplied for Hau Giang Pharmaceutical Company and algal powder sold in the market.

Figure 37. Some algal product of Vinh Hao Algae Joint Stock Company

2.5. Ba Moi Wine Processing Establishment:

2.5.1. Management and operation of company:

Activities of production that is based on the household scale primarily includes management of manufacture and selling products. Its main products consists of wine and fermented fermented grape treacle.

Figure 39. Ba Moi grape garden

2.5.2. The process of wine production:

- Grapes were pre-treated with fruits washing chemicals lisenced by the Department of Health then partly pounded.

Figure 40. Fresh grape for wine fermentation

- After that, it was mixed with a proportion of 25:3 corresponed with grape and sugar respectively. The calculation could be equivalent to 1 ton of grapes mixed with 1,2 kg sugar. Then, this mixture was naturally fermented in glazed terra-cotta jar.

Figure 41. Glazed terra-cotta jars for fermentation

- The following step is regulation of conditions inside and outside vases.
- After about 3 - 6 months, wine is harvested and packaged.

Figure 42. Wine products of Ba Moi company

2.6. Nha Trang Oceanographic Institute:

2.6.1. Establishment:

The Department of Indochina Fisheries, the forerunner of Nha Trang Oceanographic Institute, was established on September 14th, 1922. Over the past of 80 years of operation and development, Nha Trang Oceanographic Institute has contributed a large amount of researchs, which work for the conquest, exploitation and preservation of imcome sources of the East China Sea, including publication of 1100 printed materials such as biological diversity (62.6%), physical oceanography (11.6%),

ecological environment (7.6%), marine geology and geomorphology (5.4%), marine chemistry and biochemistry (4.4%). Thereby, Nha Trang Oceanographic Institute has participated to the implementation of scientific goals in national and international stature.

Figure 43. Nha Trang Oceanographic Institute

2.6.2. Aspects of operation:

With the duty of sea study, Nha Trang Oceanographic Institute is enhanced with professional scientific staff in both sides of quality and quantity combined with the most modern equipments in order to meet mission of national modernization.

❖ **Main functions:**

- To study the problems of science and technology in the following areas.
- To investigate and research natural conditions, biological and other resources (minerals, oil, coal, transportation, shipping and so forth), processes occurring in the hydrosphere, atmosphere and lithosphere in the territorial waters of Vietnam and the East China Sea such as estuaries, lagoons, bays, islands.
- To survey and study the status and further development of marine pollution.
- To research and propose solutions to handle contamination for ensuring ecological balance and resources development in stable manner.
- To discover the special phenomena such as storm, unusual surges, tsunamis, erosion and accretion of the sea to serve the disaster prevention.

- To research marine technologies to support design and construction of marine new building projects and aquaculture development.
- To manufacture sea products and extraction of activated substances from marine organisms.
- To design and tools and machinery exclusively used in oceanography.
- To coordinate with other domestic research and manufacture agencies to organize deployment, application and technological transfer of research results into practice.
- To participate in training of staff served in scientific research - technology and oceanography.
- To organize international cooperation and conferences in the field of oceanography.

2.6.3. Remarkable research:

One of the prominent research of Institute is artificial breeding of sea-horses that has been successed since 2009. This is also the first scientific study that is succesfully carried out on prickle sea-horses (*Hippocampus spinosissimus*) in Vietnam. In the past, researches surrounding artificial reproduction of black sea-horses (*Hippocampus kuda*) and streaky sea-horses (*Hippocampus comes*) was successfully raised. According to engineer Ho Thi Hoa, Division of Aquaculture Technology, prickle sea-horses is selected for this study because it has diversity of colors that meets the requirement of ornamental fish and export. The catch output of this species in nature have plummeted in recent years caused by exhausted exploitation.

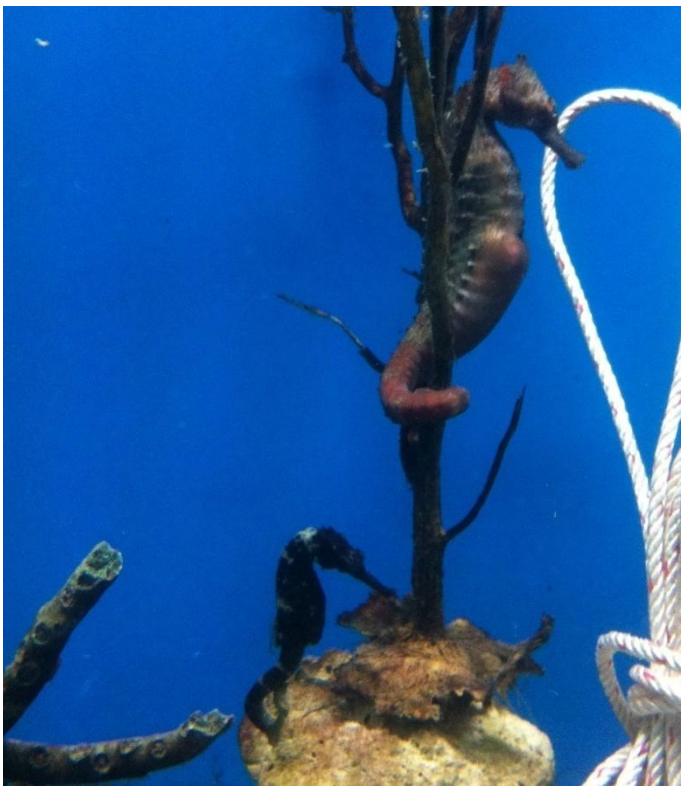

Figure 44. Sea-horse in Nha Trang Oceanographic Institute

Fortunately, thousands of prickle sea-horses has been artificially reproduced and still come out on 1,000 healthy individuals that were raised. The survival rate of 50 % , according to engineer Hoa, is the good result. The reason is that it is really difficult to breed as well as mate and reproduce prickle sea-horses in comparison with other species of sea-horses. In Europe and America, prickle sea-horse is mostly kept as pet. Each individual of this species can reachs 12 cm in length. Prickle sea-horse is also accounted as a precious medicine in China, Vietnam, Japan, Taiwan and some other nations.

Figure 45. Artificial breeding of sea-horses

2.7. Tay Nguyen Biological Institute:

2.7.1. Aspects of operation and establishment:

Tay Nguyen Biological Institute, which is a scientific research unit directly under the Science and Technology Institute, located in the Central Highlands (Tay Nguyen) of Vietnam and the former is Scientific Research Center in Dalat. It was established by the 496/VKH-TCCB Decision of Vietnam Academy of Science on September 20th in 1978. Additionally, Tay Nguyen Biological Institute was placed in the organizational structure of Science Institute of Vietnam with original office in Ho Chi Minh city.

Main functions: basically research in biology belonged to the Central Highlands (Tay Nguyen) of Vietnam.

Figure 46. Tay Nguyen Biological Institute

❖ **Duties:**

- To survey and research on the Fauna and Flora of the Central Highlands of Vietnam that lead to protection, restoration and development of endangered species, genetic resources, biological templates, plants and animals.
- To study scientific facility serving for regular use and intensive protection of biological resources of the Central Highlands of Vietnam.
- To research for domesticating of animals and plants that is not only highly appreciated in economic value but also suitable for bredding in the highlands and high mountains.
- To study and apply modern biological methods in breeding work, improving crop, livestock and preserving genetic resources that is meaningful in construction of plant gene Bank for Tay Nguyen.
- To carry out basical researches on microbial technology that is a promising way for environmental protection, food processing and preservation.
- To domesticate and develop a number of microorganisms and fungi that give high economic value beside construction of microorganisms and fungi reproduction model.
- To study and test activity of extracts arisen from plants and semi-synthetic compounds owning high biological activity, then employ these substances on the pharmaceutical sector, cosmetics and agriculture.
- To organize collection, build and manage the collections of specimens corresponding to national standards and hold a display together with disseminate the knowledge relating to natural and environmental protection.
- To execute international cooperation in biological research.
- To participate in training of human resources in term of Science and Technology serving for the Central Highlands of Vietnam.

2.7.2. Some endangered animals:

2.7.2.1. Giant Muntjac:

Figure 47. Giant Muntjac

The Giant Muntjac sometimes referred to as the Large-Antlered Muntjac (*Muntiacus vuquangensis*) is a species of muntjac deer. It is the largest muntjac species and was discovered in 1994 in Vũ Quang, Hà Tĩnh Province of Vietnam and in central Laos. This is a new mammal discovered in Vietnam. The giant muntjac is commonly found in evergreenforests, jungle and savanna with nocturnal activity. The food is mainly grass, leaves and fruit. This species has solitary life and just pair only during estrus. The weigh is approximately 30 – 50 kg. It has a red brown coat and is an even-toed ungulate. Due to slash-and-burn agriculture, combined with hunting, the giant muntjac is considered endangered. It is preyed upon by animals such as the tiger and leopard. It is most closely related to the Indian muntjac.

2.7.2.2. *Bos gaurus* Gaur:

Figure 48. *Bos gaurus* Gaur

Bos gaurus Gaur primarily has herd instinct with 5 – 10 individuals per each flock. It shelters are often forest, evergreen jungle and secondary forest. *Bos gaurus* Gaur's feed are mostly grass and young leaves sprout. It belongs to the group of diurnal activity animal. Annually, *Bos gaurus* Gaur just gives one cub.

2.7.2.3. Chamois:

Figure 49. Chamois

Chamois live in small groups of 3 – 4 individuals in the mountainous areas with elevations from 50 – 2000 meters. It often look for food at daytime on the halfway of mountains or top of mountain and spend nighttime on residing in natural caves. Reproductive season focuses on March and April. Likely to *Bos gaurus* Gaur, each

female individual of chamois give only one cub per year. It is also one of endangered animals listed in Vietnam Red Book with the fifth grade.

2.7.2.4. Marbled Cat:

Figure 50. Marbled Cat

The marbled cat (*Pardofelis marmorata*) is a small wild cat of South and Southeast Asia. Since 2002 it has been listed as vulnerable by IUCN as it occurs at low densities. The marbled cat is similar in size to a domestic cat, with a more thickly furred tail (which may be longer than the body), showing adaptation to its arboreal life-style, where the tail is used as a counterbalance. The coat is thick and soft, and varies in background color from dark grey-brown through yellowish grey to red-brown. Spots on the forehead and crown merge into narrow longitudinal stripes on the neck, and irregular stripes on the back. They are primarily associated with moist and mixed deciduous-evergreen tropical forest. It is probable that forest canopies provide the marbled cat with much of its prey such as birds, squirrels, other rodents and reptiles. A few marbled cats have been bred in captivity, with gestation estimated at between 66 and 82 days. In the few recorded instances, two kittens were born in each litter, and weighed from 61 to 85 g. The eyes open at around twelve days, and the kittens begin to take solid food at two months, around the time that they begin actively climbing.

No information about protection status is available from Vietnam.

2.7.2.5. Land Phoenix:

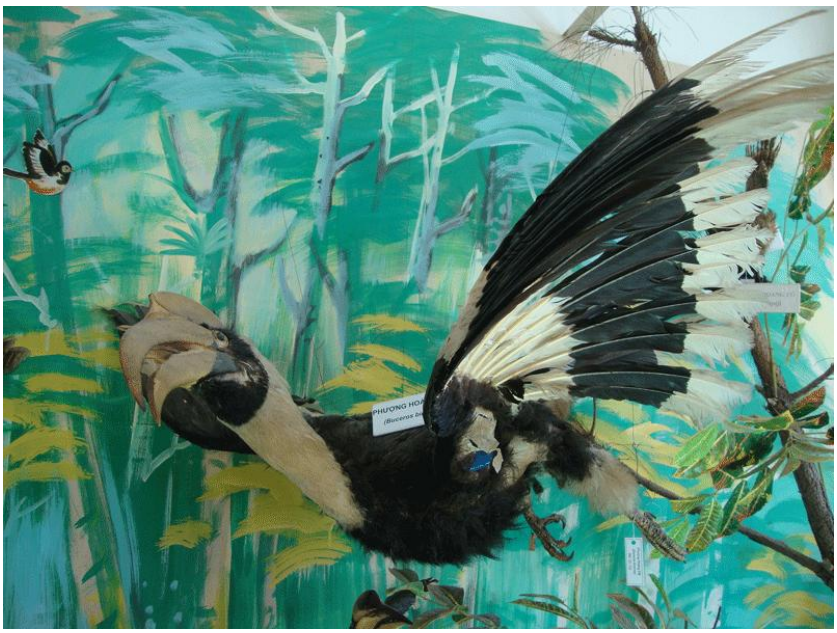

Figure 51. Land Phoenix

Phoenix Land resides and nest in dense forests. It often forages on upper storeys of the forest because main food source of Phoenix Land is fruit. It also has herd instinct with 5 – 7 individuals for each group. Land Phoenix is listed in the group of endangered animals.

2.7.3. Practical research:

Figure 52. Ngoc Linh Ginseng

Tay Nguyen Biological Institute has conducted a systematic study of thin layer of cells culture to preserve Ngoc Linh Ginseng. The selection of sample sources and size of explants to regenerate roots, shoots, callus, embryos and plantlet has been successfully carried out via engineering of thin layer cell culture in case the Ngoc Linh

Ginseng was cut vertical and horizontal dimension. This study is really meaningful in the conservation of Ngoc Linh Ginseng. Besides that, it is also a prerequisite for breeding studies related to Ngoc Linh Ginseng. Furthermore, this research can actively control other programs arising form of Ginseng in vitro.

Figure 53. Invitro cultivation of Ngoc Linh Ginseng

2.8. Bao An private company of Civet Coffee production:

The great believers of drinking coffee must be familiar with the name of Civet Coffee, which is famous for the uniqueness, masterstroke of manufacture and very distinct taste without comparison with any other kind of coffee. Civet is a wildlife species and it retains its own valuable natural features although it is recently adopted for commercial purposes. Civets are very fussy about their food, especially coffee fruit. In captivity farms, they just choose eatting of coffee fruits which are fresh, ripe, freshly picked, full of nutrients and also absolutely not kept overnight.

Figure 54. Coffee fruits in Bao An company

Additionally, civets often throw away the outer layer of coffee beans before eating and swallow whole grains with sweet and nutritious pulp layer. The enzyme in civet stomach that digests the pulp layer is combined with the natural musk in glands and then permeates each coffee beans. Thus, a brewed process coincidentally has been created that brings a special type of coffee – Civet Coffee – into the world.

❖ **The process of production:**

Civets will choose the most delicious coffee fruits based on their wild instincts. Usually, they select about 30% of ripe coffee fruits to eat. After digestion occurs, the producer obtain coffee beans in civet's dung as a result of fermentation with support of enzyme and musk. These coffee beans are naturally dried to avoid high temperatures and direct sunlight that can denature or degrade the enzyme and musk.

For Bao An civet coffee, silk shells with impurities of raw coffee beans are primarily cleaned to obtain pure ones before roasting. In Bao An company, workers roast coffee beans by their own experience with manual methods. It includes many stages such as strictly steamed and brewed coffee to produce the coffee products that own special flavour and are uniform in quality without any support from chemicals or color addition and. Finally, Civet Coffee is packed and secured in the term used for each product.

Figure 55. Exposure of cevet coffee

2.9. Cuong Hoan Silk factory of silk production:

Silk which is a protein fiber arisen from animals or insects. It is the main component of cocoons and webs. There are many kind of insects with ability of various strands regurgitation. However, most of these one are not used for commercial purposes even with the basic research on the structure of the filaments while silkworm is a worth insect for silk production. The process of silk production and trade of product are complex and laborious with many stages.

- **Incubation of silkworm eggs:**

The small eggs of moths are incubated until the larvae hatch.

Figure 56. Silkworms

- **Feed for silkworm:**

After hatching, silkworms are placed in large and flat basket with feeding by large number of young mulberry leaves. Silkworms can also eat Osage orange, mulberry family trees or lettuce leaves but silk produced by silkworm fed with bulberry leaves has the best quality and most beautiful color. Especially, silkworms constantly eat bulberry leaves during 6 weeks. The shiny skin and stopping of eating is signal of a mature silkworm. In this stage,mature silkworms tend to find suitable place for nesting.

Figure 57. Nesting of silkworm

- **Cocoon formation:**

When silkworms change the color to yellow, it is the time for cocoon formation on wooden frames. The frame containing mature silkworms should be exposed under a little sunshine that will support this species to create dry, aromatic and golden color silkworm cocoons. Additionally, this step also help the unravel silkworm cocoons process be more convenient.

Figure 58. Silkworm cocoons

- **Unravel of silkworm cocoons:**

After golden wilkworm cocoons were taken up from wooden frames, any cocoons that seems to be dirty, thin, addled and leaky will be eliminated. Unravel silkworm cocoons is the outsourcing process that helps tiny fibre of cocoons be pulled into separate yarns.

Figure 59. Unravel of silkworm cocoons

- **Spinning process:**

Raw silk yarns will be spun together, depending on the nature and number of strands together with whorl and loom, to weave thread into different kinds of silk fabric. Silk is rolled into the tube compressors.

Figure 60. Spinning process

- **Types of silk product:**

Regarding to how silk strands have been weaving, the different kinds of silk with special and diverse patterns will be created. Then, the silk is dyed with natural dyestuff derived from plants.

Figure 61. Diversity of silk type

III. CONCLUSION AND SUGGESTION:

3.1. Conclusion:

To sum up, the field trip enables students to approach the actual situation of effectively applying the biotechnological technique in some aspects of life. To give a concrete example, biotechnology has been present in not only the simple process as wine fermentation with small scale but also the complex production line required high technical background as algae cultivated with large scale or propagated by means of in vitro culture. From these overviews, biotechnological application has been spread in many areas of life. Especially, visiting scientific institutes, parks and museums where animals and plants are conserved benefits students to get a clear viewpoint of biodiversity value in science, economy and life. This trip functions as guider for students in learning and developing the passion of biotechnology. Furthermore, it is also a great period of time to maintain and strengthen wonderful memories of friendship.

3.2. Suggestion:

Addition to many considerable advantages of the field trip, there are several spots which seem to be limitation should be overcome. This module should be included in the freshman curriculum or scheduled for sophomores so that students can essentially outline what features their prospective major owns and what aspects of biotechnology they are interested in. By joining in this module, students achieve an opportunity to experience how biotechnology is applied in practice and preliminarily learn about the biotechnological industry that is helpful for them to select the appropriate pathway in the future. Time of the tour is partly influenced to learning flawless techniques of establishments and attraction of this trip. Because of limitation of time, it is immpossible for student to have ability of acquiring, analysing and selecting desirable information.

The source of information was mainly focused on the field of food manufacture and agriculture. With the hope for prospective field trips, destinations of other fields such as molecular biology and enzymology will be candidates for a study.