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Conservation and Utilization on Vegetable, Flower, and Fruit Genetic Resources in the South of Vietnam

By

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Summary

Southern Fruit Research Institute (SOFRI) was established in April 1994. Right from the establishment, we have started collection and conservation on fruit germplasm. A total of fruit genetic resources until December 2006 are 721 varieties/clones of about 40 families of tropical and subtropical fruit trees with 348 local and 383 foreign ones. All of them have been conserving at farms, net houses of Institutes and Universities and at farmers' orchards. Evaluation on morphological and genetic characteristics has been conducted. Many of them are valuable commercial cultivars such as nam roi pomelo, da xanh pomelo, king mandarin, hong mandarin, duong mandarin, cat Hoa Loc mango, cat chu mango, abortive seed milky yellow flesh durian, Ri6 durian, Java rambutan, nhan rambutan, xuong com vang longan, tieu da bo longan, etc. Most of the introduced fruit varieties collected from Thailand, Taiwan, Australia, France, and USA. Some promising cultivars are belonging to fruit kinds such as mango, durian, rambutan, pineapple, jackfruit...; they have been tried for adaptability in the south of Vietnam.

In 2005, department of floriculture and department of vegetable were established at SOFRI, collection and conservation on flowers and vegetables have been conducted with 85 vegetable varieties/clones of 3 families and 163 flower varieties/clones of 18 families.

Introduction

Fruit genetic resources in the south of Vietnam are very rich and diversity. In addition, many fruits have high commercial values; however, rare and wild fruit varieties are still in the

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natural populations. Selective pressure on high quality and yield fruit varieties is more and more strong, so others will be lost in the future. Thus, it is very important and necessary to collect and conserve on fruit varieties, especially on rare and wild fruit varieties. At SOFRI, the genetic resources of fruit have been collected from 1994 and of vegetable and flower from 2004 and these materials are conducted to evaluate, conserve and utilize in efficiency.

Materials and Methods

Materials:

All vegetable, flower, and fruit varieties are collected and grown in SOFRI farms and farmers' orchards. These plant germplasm materials and products are used for investigating agronomical characters, and for chemical analysis in biotechnological lab and fruit quality analysis lab.

Methodology:

- Collection: All seeds, scions, buds, shoots are collected from farms, farmers' orchards, forest, etc. The procedure of collection and method of description of fruit germplasm are following the protocol of IPGRI.

- Conservation:

The implementation of conservation on fruit germplasm includes two methods: *in-situ* and *ex-situ* conservation.

1. *In-situ* conservation: germplasm conserved at farms, farmers' orchards where fruit trees growing originally.
2. *Ex-situ* conservation: germplasm collected and conserved in other farms, net house and tissue culture room et al., or at the repository nursery in research institutes or universities.

Genrally, the germplasm of vegetables and flowers are collected and then conserved in net house and *in-vitro* by using ex-situ conservation.

- Evaluation and utilization:

1. Fruit varieties have been evaluated on fruit quality characteristics, reaction to salinity, flooding, and *Phytophthora* diseases. Fruit clones/varieties bearing high yield and good quality have been selected using for mother stock trees or becoming commercial varieties as well as using as parents in hybridization. The varieties with high tolerance to salinity, flooding, and Phytophthora disease have been used for rootstock and also as mother stocks as well.

2. In our commercial fruit varieties, one or some characteristics could be improved by inducing mutation.

3. The evaluation of utilization on fruit genetic diversity in all fruit gerplasm conservation could be conducted by using RAPD and SSR molecular.

Results and Discussions

Collection and Conservation of Fruit Germplasm

For the germplasm collection and conservation of fruits from 1994 to 2006, totally, 721 varieties/clones about 40 families including 348 local varieties and 373 foreign varieties have collected and conserved (Table 1). Most of those genetic resources have been conserved at farms of research institutes, center, universities, and farmers' orchards. Germplasms of flower and vegetables have been collected and conserved in recent years at SOFRI. So far, totally, 85 vegetable varieties/clones of 3 families and 163 flower varieties/clones of 18 families have been conserved and evaluated in farm at Tiengiang (Table 2).

Table 1. Fruit germplasm collected and conserved in farm of SOFRI from April 1994 to December 2006. (SOFRI annual report, 2006)

Kinds of fruit	Scientific name	Total	No. of local var.	Introduced varieties	
				No. of var.	Origin/sources
1. Langsat	*Lansium domesticum* Correa.	2	1	1	Thailand
2. Avocado	*Persea americana* Mill.	22	7	15	USA, Australia, Israel
3. Wild mangosteen	*Garcinla loureiri*	1	0	1	Thailand
4. Pomelo	*Citrus maxima* (Burm) Merr.	81	73	8	France, USA, Thailand, China, Malaysia
5. Grapefruit	*Citrus paradisi Macf.*	7	-	7	France, USA, Australia, India
6. Orange	*Citrus sinensis* Osbeck.	51	16	35	France, USA, China, Australia, India, Japan.
7. Lemon, lime	*Citrus limon* (L.) Burm. and *C. aurantifolia Sw.*	15	7	8	France, USA, Australia
8. Rambutan	*Nephelium lappacum* L.	7	5	2	Malaysia, Thailand

9. Banana	*Musa* spp.	55	54	1	
10. Otaheite apple	*Spondias dulcis* Soland.	2	1	1	Thailand
11. Wild, hybrid citrus	*(a)*	20	14	6	France, USA
12. Walnut	*Castanea crenata* Sieb.et Zucc.	1	-	1	Japan
13. Pineapple	*Anonas comosus* (L.) Merr.	47	12	35	Taiwan, Thailand, Australia, France, Malaysia
14. Rambai	*Baccaucera* spp.	1	1	-	
15. Strawberry	*Fragaria ananassa* Duch.	1	-	1	USA
16. Peach	*Prunus persica* (L.) Batsch.	4	-	4	USA, Australia
17. Papaya	*Carica papaya L.*	28	6	22	USA, Malaysia, Thailand, Japan
18. Citrus vars. for rootstock	*(b)*	19	-	19	France, USA, Australia, India
19. Persimon	*Diospyros* spp.	8	-	8	Australia, Japan, USA
20. Kumquat	*Fortunella* spp.	6	5	1	
20. Calamondin	*Cito microcarpa mitis*				
21. Star fruit	*Averrhoa carambola* L.	18	-	18	Malaysia, Taiwan, Thailand, Israel.
22. Passion fruit	*Passiflora edulis*	2	1	1	Japan
23. Egg fruit	*Lucuma caimito* Roem.	1	-	1	Taiwan
24. Pomegranate	*Punica granatum*	2	-	2	India, China
25. Nectarine	*Prunus* spp.	8	-	8	Australia, USA
26. Water apple	*Eugenia aquea* *Syzygium* spp.	21	18	3	Thailand, Taiwan, Malaysia,
27. Plum	*Prunus salicina*	3	-	3	Australia, USA
28. Sweetsop	*Annona squamosa* L.	3	3	-	Australia, Israel
29. Sour sop	*Annona muricata* L.	1	1	-	
30. Mangosteen	*Garcinia mangostana* L.	1	1	-	
31. Tamarind	*Taramindus indica* L.	14	-	14	Thailand
32. Jack fruit	*Artocarpus heterophyllus* Lamk.	12	5	7	Thailand
33. Apricot	*Prunus armeniaca* L.	1	-	1	USA
34. Longan	*Dimocarpus longan* Lour.	20	19	1	Thailand
35. Grape	*Vitis vinifera* L.	8	-	8	Thailand, Israel
36. Custard apple	*Annona reticula*	1	1	-	
37. Guava	*Psidium guajava L.*	27	12	15	India, Malaysia, Thailand

38. Mandarin	*(c)*	43	14	29	France, USA, China, Australia, India, Japan.
39. Salacca	*Salacca edulis* Reinw.	2	-	2	Thailand
40. Sapodilla	*Manikara zapota* (L.) Van Royan.	5	5	-	
41. Durian	*Durio zibethinus Murr.*	14	5	9	Thailand, Malaysia, Australia
42. Apple	*Zizyphus mauritiana* Lamk.	2	-	2	Thailand
43. Acerola	*Malpighia glabra*	3	2	1	Thailand
44. Dragon fruit	*Hylocereus undulatus* Britte.	19	4	15	Colombia, Taiwan, France, Thailand
45. Gandaria	*Bouea oppositifolia* Meis.	2	1	1	Thailand
46. Star apple	*Chrysophllum caimito*	8	8	-	
47. Mango	*Mangifera* spp	99	45	54	Thailand, USA, Australia, Israel, Malaysia, China, India, Taiwan, Philippines.
48. Feijoa	*Acca sellowiana*	2		2	Israel
49. Miracle plant	-	1		1	Israel
	Total	**721**	**348**	**373**	

Notes: *(a): C. medica L., Limonia acidissima, Murray paniculata, Tangor (C. reticulata Blanco x C. sinensis Osbeck), Tangelo (C. reticulata x C. paradisi);*

(b): C. limon (L.) Burm., *C. sinensis (L.)* Osbeck, Citrumelo (C. *paradisi Macf.* x P. *trifoliata Raf.), Citrange (C.sinensis Osbeck.* x P. *trifoliata Raf.), C. aurantium L.,C. tachibana Tan., C. madurensis Lour;*

(c): C. reticulata Blanco, C. reticulata var austera, C. unshiu Marc;

Table 2. Germplasm collection and conservation of vegetables and flower in farm of SOFRI. (SOFRI annual report, 2006)

Vvegetables/ flowers	Science name	Family	No. of var.	Origin/Source
1. Cucumber	*Cucumis sativus* L.	Cucurbitaceae	6	Vietnam
2. Tomato	*Lycopersicon esculentum Mill*	Solanaceae	52	Vietnam (2), India (32), AVRDC (18)
3. Eggplant	*Solanum melongena L.*	Solanaceae	9	Vietnam (5), India (2), AVRDC (2)
4. Hot pepper	*Capsicum annum* L.	Solanaceae	11	Vietnam
5. Okra	*Hibicus esculentus*	Malvaceae	7	Vietnam, China
1. Gerbera	*Gerbera* sp.	Asteraceae	40	Da Lat, Tien Giang, Dong Thap - Vietnam
2. Anthurium	*Anthurium andreanum*	Araceae	11	Da Lat, Can Tho - Vietnam
3. Phyllocactus	*Epiphyllum* sp.	Cactaceae	7	Da Lat - Vietnam
4. Chrismas cactus	*Zygocatus truncatus*	Cactaceae	10	Da Lat, Can Tho - Vietnam
5. Life-plant	*Kalanchoe blossfeldiana*	Crassulaceae	6	Tien Giang, Da Lat - Vietnam
6.Chrysanthemum	*Chrysanthemum* sp.	Asteraceae	44	Tien Giang, Da Lat, Can Tho - Vietnam
7. Daisy	*Aster amellus* sp.	Asteraceae	3	Tien Giang - Vietnam
8. Orchid	*Dendrobium* sp., *Cattleya sp., Oncidium sp.*	Orchidaceae	18	Tien Giang - Vietnam
9. Strelitzia	*Strelitzia reginae* Banks.	Strelitziaceae	2	Da Lat - Vietnam, Thailand
10. Begonia	*Begonia* sp.	Begoniaceae	2	Da Lat - Vietnam
11. Torch Ginger	*Etlingera sp.*	Zingiberaceae	3	Thailand
12. Alpinia	*Alpinia* sp.	Zingiberaceae	1	Thailand
13. Iris	*Iris* sp.	Iridaceae	1	Da Lat - Vietnam
14. Jasmine	*Camellia japoniaca*	Theaceae	1	Da Lat - Vietnam
15. Gloxinia	*Sinningia speciosa*	Gesneriaceae	7	Can Tho - Vietnam
16. African Violet	*Saintpaulia ionantha*	Gesneriaceae	3	Can Tho - Vietnam
17. Carnation	*Dianthus caryophyllus*	Caryophyllaceae	2	Tien Giang - Vietnam
18. Amaryllis	*Hippeastrum spp.*	Amaryllidaceae	2	Thailand
	Total		**248**	

Source: Department of Vegetables and Department of Floriculture – (SOFRI 2006)

Evaluation of Fruit Genetic Resources

- Evaluation on morphological and agronomic characteristics

Totally, 25 among 49 kinds of fruit trees have been evaluated on morphological and agronomic characteristics. Several important characteristics were investigated and evaluated in 446 cultivars of 25 kinds of fruit germplasms listed in Table 3.

Table 3. Important characteristics were recorded and evaluated in 446 cultivars of fruit trees at SOFRI during 1994-2006.

No.	Kinds of fruits	No. of cultivars evaluated	No. of characteristics evaluated
1	Langsat	1	8
2	Pomelo	56	13
3	Grape fruit	7	13
4	Orange	49	13
5	Lemon/lime	15	13
6	Rambutan	7	11
7	Wild and hybrid citrus	10	13
8	Pineapple	28	16
9	Papaya	16	15
10	Citrus for rootstock	7	13
11	Calamondin	6	13
12	Star fruit	18	12
13	Passion flower	1	12
14	Water apple	21	12
15	Tamarind	13	11
16	Jack fruit	3	12
17	Longan	22	16
18	Guava	4	12
19	Mandarin	42	13
20	Sapodilla	2	12
21	Durian	6	12
22	Apple	1	6
23	Acerola	1	6
24	Dragon fruit	24	11
25	Mango	86	13
	Total	**446**	

- Evaluation on tolerance to salinity and flood

Vo Huu Thoai and Nguyen Minh Chau (2002) evaluated the tolerance to salinity and flood on 18 pomelo varieties. The results indicated that some pomelo varieties have high tolerance to flooding period of 30 days. These pomelo varieties are Duong Hong Pomelo (Binh Duong), Bong Pomelo (Hue), Hong Duong Pomelo (Can Tho), and Oi Pomelo (Binhduong). Pomelo varieties such as Duong Hong (Binh Duong), Hong Duong (Can Tho), Chua Pomelo (CanTho), Chua Pomelo (Ben Tre) also showed bearing high tolerance to salinity.

- Evaluation on tolenrant to *Phytophthora citrophthora* on citrus

Barley (2001) showed that 42 citrus varieties from Vietnam were tested having reaction to *P. citrophthora*. However, the results also showed that Xiem mandarin, Hong Kim mandarin, Ta mandarin, Tau orange expressed tolerance to *P. citrophthora* growing in pot condition.

- Evaluation genetic diversity on citrus and pineapple

131 local citrus varieties/clones were used for analysis on genetic diversity by using micro-satellite molecular markers (Tran Thi Oanh Yen *et al*.). 30 varieties/clones including Queen and Cayenne of local and introduced varieties were used for analysis on genetic diversity by using RAPD molecular markers (Tran Thi My Hanh *et al*., 2005).

- Fruit varieties in farmers' orchards selected for developing commercial varieties:

Many fruit varieties were selected in farmers' orchards, farms and certificated by Ministry of Agriculture and Rural Development (MARD) and then released as commercial variety, such as cat Hoa Loc mango, cat chu mango, seedless milk yellow flesh durian, mangosteen, da xanh pomelo, nam roi pomelo, duong la cam pomelo, nghe jackfruit, etc.

- Improvement of commercial fruit varieties:

Generally, commercial fruit varieties have good quality; somehow, there are one or some characteristics necessary to be improved such as the number of seeds in citrus varieties, thin skin in cat Hoa Loc mango, and fruit dropping in xuong com vang longan. The fruit breeding program inducing mutation, traditional breeding, and embryo culture were conducted in SOFRI.

The obvious results were obtained on hybridization between commercial dragon fruit variety and introduced dragon fruit. The red flesh dragon fruit cultivar – Long Dinh 1 having good quality and high yield were denominated and released.

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