

TFTS NEWSLETTER



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ISHS WORKING GROUP ON TEMPERATE FRUITS IN THE TROPICS AND SUBTROPICS

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Edited by
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Editorial

ISHS-TFTS Newsletter is again on publication after a long break with the **Vol. 2 No. 9**. This newsletter contains usual announcements of the ISHS meetings related to the temperate fruit growing under subtropical and tropical conditions.

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RECENT ACTIVITIES AND ANNOUNCEMENTS

The 29th International Horticultural Congress **will be held in Brisbane, Australia during August 17-22, 2014. It is an Australia-NZ-Pacific event. The detailed information is given at the presentation linked to Web Page of ISHS (<http://www.ishs.org>).**

The 11th International Symposium on Temperate Fruits in the Tropics and Subtropics" will be held in Oman in 2017.

The proceedings of ISHS Acta Horticulturae is available in print format. ISHS also offers a tailor made CD-rom format called **Acta Hort CD_rom**. For more details on this service, or to download ISHS Acta Horticulturae order form, you could visit the 'publications' page at <http://www.ishs.org> or go directly to <http://www.ishs.org/acta-horticulturae>

ISHS and ISHS-TFTS Working Group Individual Membership are open to everybody. For all details and up-to-date information on ISHS membership categories and advantages, including an application form, refer to the ISHS membership pages at <http://www.ishs.org/members>.

IX. INTERNATIONAL SYMPOSIUM ON TEMPERATE FRUITS IN THE TROPICS AND SUBTROPICS

The 9th International Symposium on Temperate Fruits in the Tropics and Subtropics (TFTS) was held at Chiang Mai, Thailand from 26-28 March 2013 with 183 participants from 17 countries. The program consisted of a keynote address, eight invited lectures, and several interesting contributed lectures on production, biotechnology, breeding, physiology, plant protection, postharvest management and processing of temperate fruits in the tropics and subtropics. There were 22 poster presentations with excellent inputs displayed for two days during the symposium. On the third day of the symposium, participants visited Inthanon Royal Agricultural Station, Doi Inthanon and Royal Agricultural Research Station at Chiang Mai. The visit was highly educative to see the improved cultivation techniques of grape, persimmon, fig, strawberry, peaches, kiwifruit, etc. The participants enjoyed the fresh fruits of different cultivars of peach, kiwifruit, grape and apricot.

Social and cultural events and the wonderful banquets featuring Thai cuisine and drinks were enjoyed by the participants. During the symposium, a Working Group meeting was organized and it was decided that the 10th TFTS Symposium will be held in 2017 in Oman. The participants also unanimously elected Prof. Dr. A.B.Küden, Turkey, as the new Working Group Chair of TFTS.

Professor Sisir Mitra
Chair
Section Tropical and Subtropical Fruits

PRODUCTION OF FRUITS IN OMAN

The Sultanate of Oman is located in the South-eastern coast of the Arabian Peninsula, an area that is considered semi-arid to arid. Oman land area is (309,501 km²), around 90% of which is occupied by desert and mountains with a coastal line of 1700 km bordering the Arabian Sea and the Sea of Oman. The population is approximately three millions, one third of whom are expatriates. Oil finances the majority of country's GDP but agriculture and fisheries sectors continue to constitute the main source of income and employment to a large proportion of the society.

Due to the high temperature and low precipitation for most of the year, evapotranspiration (ET) is ten folds higher than the average annual rainfall in Oman, which is approximately 100 mm. However, great variations in geographic and climatic conditions in the country exist which allow for the cultivation of various crops including temperate, subtropical and tropical fruits.

The majority of the agricultural production in the Sultanate is located in the coastal regions and interior plains. In these areas, fruit crops dominated by date palm, but also banana, mango, citrus, and other tropical fruit trees are cultivated. In the southern part of the country, the annual 'Indian Ocean' monsoon rain falls from May to August. These conditions are suitable for commercial production of several types of tropical fruit crops, primarily coconut and banana, as well as other minor tropical trees such as papaya, *annonas*, and sapodilla.

In northern Oman, a mountain range, called the *Hajar* chain of mountains, peaks at 3,000 m above sea level and receives an average annual precipitation of about 350 mm, the highest in the country. High precipitation coupled with low winter temperatures provide a suitable environment for the cultivation of subtropical and temperate fruit crops. Ancient settlers of these mountains have created terraces where crops such as pomegranate, walnut, apple, grapes, pear and stone fruits are grown. Pomegranates constitute the main source of livelihood and income for mountain inhabitants.

Al Jabal Al Akhdar mountains in northern Oman (23° 04' N, 57° 38' E, and approximately 2000 m altitude) has the largest population density of mountain inhabitants who have primarily lived on crops and livestock. Due to its high altitude, the Al Jabal Al Akhdar is ideal for the cultivation of pomegranates and other deciduous fruit crops. The minimum temperature during the winter months (Dec. – Feb.) reaches below 0°C, which allows for the cultivation of various low-chill deciduous fruit crops. Pomegranate is the most important crop in this region where a single fruit can be sold at an average price of \$ 2.56. Several local cultivars of pomegranates are cultivated in Al Jabal Al Akhdar, four of which [namely, Helow (sweet), Qusum (hard-seeded), Malasi (soft-skinned), and Hamedh (sour)] have been studied to determine their fruit development and postharvest quality and the molecular characterization of these cultivars is being explored. Further research is needed to improve the fruit yield and quality of pomegranates in Oman.

Major limitations of fruit production in Oman are biotic factors including major pests, such as the Dubas bug and Red Palm Weevil of the date palm, and diseases, such as Witches' Broom Disease of Lime and Mango Sudden Wilt. Abiotic factors that limit the expansion of fruit crops in Oman are soil and water salinity, poor soil fertility, desertification, and lack of renewable water resources. In recent years, cyclones landed in Oman in unprecedented frequency, Gonu in 2007, Phet in 2010, and floods of 2013, which suggest that extreme effects of climate change may threaten the limited agricultural production in the country.

As issues such as food insecurity and unpredictable future of climate and economy continue to present a challenge worldwide, fruit production remains a vital part of the agricultural sector to many countries, particularly those with limited alternative resources such as Oman. Further exploitation and development of the available land, water and local genetic resources will ensure its sustainable production for many generations to come.

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Deciduous Crop Plants of Oman: Cultivation and Utilization

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ABSTRACT

Oman is located in the South Eastern part of the Arabian Peninsula. The climate is generally characterized by low rainfall (< 100 mm annually) and high temperature for most of the year. However, mountains in the northern part of the country (i.e. Hajar Mountains) reach an altitude of approximately 3,000 m above sea level, where temperature drops significantly to allow for the growth and cultivation of various temperate-zone fruit crops and other plants. Pomegranate is the most significant crop in this region, however, walnut, peach, apricot, fig, almond, apple and pear, also contribute significant income to the local inhabitants. Other crops of economic importance include roses and cold-climate vegetables. This paper will be providing an overview of the traditional cultivation methods, challenges and uses of temperate-zone crops in Oman.

INTRODUCTION

The Sultanate of Oman is a subtropical country located between 26°-16° N and 51°-59° E in the South-Eastern part of the Arabian Peninsula. The low average annual precipitation (< 100 mm) which is lower than average evapotranspiration (1000 mm from seminar book) therefore, Oman is considered an 'Arid' country. Geographically, desert occupy 75% of the total area of the country with little vegetation, however, the remaining area varies greatly in topographic and climatic conditions, which allows for the cultivation of various types of fruit crops including tropical, subtropical and temperate fruit crops.

The highest altitude reaches to over 2400 m in the mountains located in the northern and southern parts of the country. The northern mountains (i.e. Hajar Mountains) separate the humid coastal region from the dry interior and receive the highest amount of average annual rainfall (approximately 350 mm). Due to its high altitude, this region also is characterized by the low winter temperatures to accumulate the chill units needed for several fruit crops.

MAJOR FRUIT CROPS OF OMAN

Fruit production is of significant economic importance in Oman. Fruit crops occupy 58% (42,372 ha) of the total area cultivated in Oman but production constitute a quarter (303,551 MT) of all commodities produced in the country. Date palm (*Phoenix dactylifera*) is by far the most important fruit crop in terms of production and value (Table 1) although its cultivation is restricted to the northern part of the country. Banana, on the other hand, is cultivated throughout Oman and is the second most important fruit crop. Banana is another crop that is particularly important for export to countries in the Middle East. Lime and mangoes are major crops grown in various parts of the country.

Figure 1. Percentages of fruit crop area and production quantities relative to other agricultural commodities in Oman (MoA, 2005).

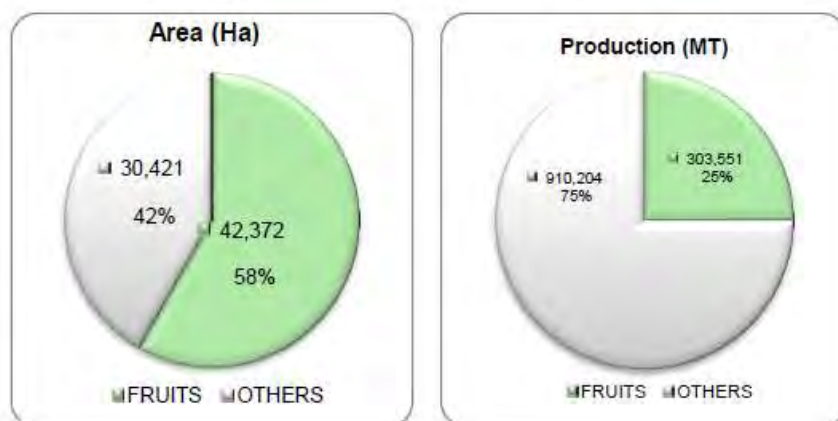


Table 1. Major temperate fruit crops in Oman (Source: MAF 2005, FAO, 2010).

Crop	Area (Faddan) 2005	Area (Ha) 2005	Number of Plants	Import (MT-2007FAO)	Export (MT-2007FAO)
Pomegranate	133.43	56.06	50,930		
Grapes	55.5	23.32	35,572	3775	54
Fig	16.84	7.08	32,372		
Apricot	4.71	1.98	937	208	1
Pear	3.67	1.54	333	5653	81
Mullberry	3.36	1.41	12,589		
Almond	2.23	0.94	700	19	0
Boob	0.24	0.10	142		
Apple	0.18	0.08	443	25,201	427

Pomegranate:

The pomegranate (*Punica granatum*) grows on a commercial scale in the northern mountainous region of Jabal Akhdar of Oman (23° 04' N, 57° 38' E, and approximately 3000 m altitude). Due to its high altitude, the Jabal Akhdar is ideal for the cultivation of pomegranates and other deciduous fruit crops. The minimum temperature during the winter months (December to February) reaches below 0 °C, which allows for the cultivation of various low-chill deciduous fruit crops (Al-Yahyai et al., 2009). This is the single most important crop in this region where a single fruit can be sold at \$ 2.56. Several local cultivars of pomegranates are cultivated in Jabal Akhdar, four of which have been studied to determine their fruit development (Al-Yahyai et al., 2009) and postharvest quality (Al-Said et al. 2009). Further research is needed to improve the fruit yield and quality of pomegranates in Oman.

Pome Fruits:

Pome fruits such as apple (*Malus domestica*) and pear (*Pyrus communis*) have been successfully cultivated in the high-altitude mountains in northern Oman. Similarly, stone fruits including peach (*Prunus persica*), apricot (*Prunus armeniaca*), and nut crops such as walnut (*Juglans regia*), almond (*Prunus dulcis*), and cashew (*Anacardium occidentale*) are currently cultivated in local small-holder farms in these mountains.

Information on these crops remains limited as little research has been done to study cultivation practices and factors that influence yield and fruit quality.

WILD FRUITS

Several wild plants produce fruits that are traditionally consumed fresh or in various preparations. *Monotheca buxifolia* (Boot) is a shrub that is commonly found in the northern mountains of Oman, producing small, sweet-tasting fruits (Al-Yahyai and Al-Nabhani, 2008). Other wild plants that produce edible fruits include nimt (*Sageretia spiciflora*), utom (wild olive, *Olea europaea*), *Ziziphus spina-christi* (Sidr), and sawqam (*Ficus sycomorus*). There have been no horticultural studies on these wild plants and information regarding their potential use as cultivated fruit crops in Oman is limited.

CONCLUSIONS

Fruit crops constitute a major part of agricultural food crops in Oman. Due to its diverse climate and geography, many fruit crops can be successfully cultivated in the Sultanate. However, major challenges and limitations need further research, particularly the limiting biotic and abiotic factors that influence fruit yield and postharvest quality. Preservation of the country's fruit crop biodiversity is essential as there are numerous date palm, banana, mango and citrus cultivars throughout the country. Economic factors such as labor and market also influence the spread and distribution of fruits. Further research on the limiting factors to fruit production in Oman is essential to ensure the continued availability of locally-produced fruits.

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IMPORTANCE of WILD SPECIES

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The success of crop depends on: the efforts to maintain steady production and to improve yield. Both aspects are linked by the availability of appropriate germplasm and the sources of it, which in a modern agriculture are manipulated and emphasised by appropriated agronomic practices.

Many of the species from which the crop-plants were selected continue to grow in the wild, even to the present day. So also do their closely related species. This "pool" of wild species comprises the "wild relatives" of crop. The wild relatives grow by different rules from crop. They have evolved to survive droughts and floods, extreme heat and cold, and they have become adapted to cope with many natural hazard. Moreover they have developed resistance to the pests that caused damage to the related crops.

The genes of wild relatives have unknown traits and special strengths. Crops can benefit from having some of these genes bred into them to allow them to meet the ever-changing conditions of modern agriculture. The wild relatives of the crops crowded at the edges of the farmers' field, in the forestry and woods, and sometimes crossbred with the crops. This interbreeding was a natural process and the genes flow from the wild relatives helped to keep the crops diverse and healthy. The crosses were easy because both grew in the same areas. Local crops varieties developed in primitive agriculture by the human and natural selection over long periods of time. They remained almost unmodified from the wild species and adapted to the particular human and environmental influences. Since the 19th century the plant breeders started to improve the land-race that originated cultivated varieties that increased the yield of the species and reduced the food needs of many countries. But the latter have been become genetically uniform because they descended from a small number of ancestral and susceptible to diseases and pest.

To cope with problems arising from the modern agriculture it is essential to maintain the genetic diversity with crop genepools. This is not limited to protect the crop but it is involved the natural genetic diversity among the species, in which many individuals, each somewhat different genetically, thrive together, allows a population to withstand challenges to diets survival.

The breeder use elite materials, rather than primitive such as land races because of the undesirable linkages in the latter: often the material is not adapted due to new breeding aims. Although pragmatically the breeders are looking for a useful genes, the germplasm available should represent an assemblage of populations from the range of geographic and ecologies of the crop gene pool. This strategy has rarely been utilised because the collection come from amalgamation of old breeding samples together with new samples considering only the landrace and often neglecting the wild species.

The cultivated species are relatively recent in time instead the wild species spanned millions of years during which gene mutation accumulated. The wild species show great ecological amplitude more than those of the crops. The hybridisation between the wild species and domesticates showed the potentiality of the former, in particular in proving to sources of resistance's to diseases, pests and other attributed. The recognition especially of widespread environmental problems (environmental problem, over-exploitation of natural areas) and the use of biotechnology have provide new opportunities for them.

Although the breeder have reluctance to use wild species because they prefer to find the genetic diversity in cultivated germplasm, it seems necessary accelerate their collection and conservation because of loss of their gene pools and the availability of genetic engineering will bring these species to be a new resource.

Many crops, far removed from wild species genetically, are those of major importance in the rural area in the tropics and subtropics. Additional scientific interests *in situ* conservation of crop relatives will have to be built into the strategies, but by far the great synergy will be between preservation of populations of perennial species in *in situ* reserve areas and germplasm in *ex situ* collections.

The institution of that Farmers' Rights which will be implemented through an international fund on plant genetic resources will support plant genetic conservation and utilization programs, particularly, but not exclusively, in the developing countries;

In particular the wild fruit species that are known to be of potential use are unlikely to receive attention except at local level and virtually nothing is known of their genetic variation. It is hoped that these species do not remain orphaned by the research community although there are continuing ethnobotanic interests.

Concerning the relation wild species and disease and pest only a limited number of wild germplasm-pathogen systems have been extensively studied (apple tree). Most studies related to disease of wild germplasm of use in crop improvement have been done *ex situ*. Considerable variability for resistance has been recognised in these co-evolved systems. However, successful disease resistance in wild germplasm populations is related to both individual and population survival. This is why the former has an identifiable genetic base while the latter results primarily from the spatial and temporal dynamics of wild populations and their pathogens.

Knowledge of diseases and pathogens of wild germplasm allows construction of maps of geographic patterns of disease resistance that can facilitate more effective collection of resistance germplasm. Nevertheless there is not necessarily a parallel between the centre of diversity of the crop and one of the pathogens. The best sources of resistance may be found in the centre of diversity of geographically distant wild germplasm. High levels of resistance to *Uncinula necator* and *Plasmopara vitis* for *Vitis* have been found in North America and not among *Vitis vinifera* relatives in Middle East and Mediterranean Basin.

In the constitution of crop gene pools only the wild relatives are candidates for the conservation in their natural habitats (*in situ*) because they alone live in natural communities. In these situations, the plants continue to evolve, thus they co-evolve with their pests. In *ex situ* conservation and storing in the seed banks stop the evolution of the species. Most protected areas were set up for wildlife conservation in some cases to protect famous landscapes; even so, conserving one place where a species grows does not necessarily conserve its genetic variation.

In the point five will be discussed the actions to maintain the wild species and the biodiversity.

Apple

Nobody knows where the genus *Malus* originated. Wilcox stated that *Malus* originated in the regions of Asia Minor, the Caucasus and former Soviet Central Asia, but others in China or in Europe.

About thirty species are classified by the taxonomist some of them lived in the tropical and subtropical zones (Middle East, North India, South and Central China, Taiwan, and Japan): *M. Trilobata*, *M. Sikkimensis*, *M. Prattii*, *M. Yunnnanensis*, *M. Hupehensis*, *M. Honanensis*, *M. asiatica*, *M. Micromalus*, *M. doumeri* and *M. tsochonoskij*.

Unfortunately the characteristics of these species that grow in the forests have not been studied enough in their agronomic and phenological characteristics, in particularly those required for tropics and subtropics (low-chilling requirement, resistance to drought, waterlogged and calico soils) instead there are good knowledge's concerning the diseases resistance. The difficulty to study these species depends on the easiness to interspecific crossing compatibility's in the *Malus* species. The hybrids have beautiful flowers and fruits.

The last investigations arranged by scientists of Cornell University in collaboration with Kazakhstan Academy of Science and Uzbek Research Institute of Fruit Growing have given more information about the botanical and genetic character of the wild species , in particular of *M. sieversii*.

The genetic resources of this species is mainly sited in the cultivars and clonal selection arranged in, although the range of resistance to soil problems have not been established for various rootstocks selected. Few indications are reported, e.g. M.7, M.9, M.111 and *Malus prunifolia* are supposed resistance to drought. Thus the resistance to soil problems and the influence of rootstocks on the chilling requirement of the scion. A study on Fe uptake was started in China on 29 *Malus* species and ecotypes in vitro. The results have showed that three selections are high uptake of Fe.

Someone suppose that it is possible that some of the *Malus* species are nearly extinct but none has been so documented literature. Some species are known as only one or few clones, e.g. *M. sargentii* and *M. tschonoskii*. Human population growth need for living more space and in the developing countries there is a constant cleaning of forests.

Hence a large population of apple trees and perhaps entire *Malus* species could thus be destroyed. The genetic dilution of wild *Malus* population bordering on the populations of more advanced forms could threaten the loss of available *Malus* diversity. The modern cultivars selected are large fruited, red skinned and good eating. This has performed apple types in which significant genetic dilution happened, and most cultivars have lost disease resistance's and other good characteristics which their wild ancestors had.

Peach

Peach is native to China. Wild peaches known as Maotao" (hairy peach) or "Yitao" (wild peach) currently exist in remote areas of China where they are used as seedling rootstocks for improved cultivars. The Chinese horticulturists recognise three diverse groups: The Southern group are grown along the Yangtze River, where the climate is mild winters and hot, wet summers. The Northern group is along the Yellow River. And the Northwest group in the arid area, where yellow-fleshed peaches and nectarines are found, in contrast to the white-fleshed types common in the other areas of China.

From there the peach spread through Persia following the trade routes from 1500 BC.

The first and the third group are the most interesting for the tropics and the subtropics. In the warm States of USA from 1850 the introduction of "Chinese Cling" seeding that reduced the local germplasm and was used extensively in peach breeding programmes for cultivar improvement. Moreover most of these cultivars were and are cultivated in other countries too.

Along with *P. persica* other four peach species are recognised, of which only could have useles.

Prunus fergariensis grows in areas Xinjiang of China and its varieties has good fruit quality with yellow, white flesh also with smooth skin (nectarines).

Prunus kansuensis is species used for rootstock in China because the white flesh is of poor quality.

Prunus mira is grown in Tibet, India and Himalayan foothills of China; it is used as rootstock in India. Fruit characteristics are variable in shape and colour and size. Someone supposes that it is closer to wild almond than any other peach relative because its seed proteins are similar.

The characteristics of these species that grow in the cited areas have not been studied enough in their agronomic and phenological characteristics, in particularly those required for tropics and subtropics (low-chilling requirement, resistance to drought, waterlogged and calcic soils) , thus the knowledge's are not good concerning the diseases resistance : leaf curl (*T. Deformans*), powdery mildew (*S. pannosa*) and rust (*T. discolor*). From many authors it has been emphasised that the selection of low-chilling cultivars have low levels of breeding because coming from few wild species from China. Therefore it would be necessary to enhance the effort to know the species listed above. In fact there is the lack of programmes of exploration and collection in particular for the species grown in central and eastern Asia and to value the land-races for rootstocks, because they can be suited to the local environment conditions. The peach selection for high pH soils arranged in Mexico and Pakistan are a first approaches to resolve these problems.

In rainfall tropic areas the growth of peach is related to waterlogging and diseases that found in humid condition the best situation to become dangerous. Here the germplasm resources appear poor particularly for rootstocks , hence the use of plum should be done.

Apricot

Most cultivars of apricot belong to *Prunus armenica*, that many scientist believe to originate in the Northern and Northeast China. Wild apricots grow in the Tien Shan Mountain in the Xinnijang and Zailing Mountains in Central Asia. This is considered a secondary centre of origin . The species is cultivated in many other areas central Asia, Afghanistan, Cashmere, Iran, Turkey, Iraq, Palestine, and Arabic Peninsula. The tree are big and prefer dry rocky hillside soils, do not tolerate excess soil moisture or a humid climate; the blossom is early and their buds tolerate -25° to -30° C when dormant. The fruits of wild seedling are edible but often are with heavily fibrous flesh and bitter after taste.

In this species some authors suggest to distinguish eight eco-geographical groups, of which five are interesting for the tropics and subtropics zones. These are;

The Dzhungar-Zailij group is the most primitive and it is sited in the mountain of Dzharskent, Alma Alta (Kazakistan) and Xinnjiang (China) ; the trees have cold hardiness and resistance to withering in midwinter, but mainly the fruit size is small, although in the Zailij Mountains the large fruits are common.

The second group is sited in Central Asia and it is the oldest and the richest in diversity of forms. it included local apricot of Afghanistan , Baluchistan, Kashmir, Turkmenistan , Uzbekistan, and Xinjiang of China. These seedlings are in local orchard over centuries and are vigorous and long lived. They are resistant to dry atmospheric conditions but they suffer of lack of moisture in the soil. They have a late blossom, resisting to fluctuating temperature in late winter. The fruit are small but with high sugar content. The ripping is over a very long period (May up to September).

The last group included local selections of Caucasian Republics, Iran Iraq, Syria, Turkey and North Africa. The tree have habitus similar to the latter group , the leaves are larger and shiny. Many local varieties need low chilling requirement and the blossom is early. The fruits are suited and variable in size in relation to the variety.

Some authors suppose that *Prunus armeniaca* presents two varieties: *ansu* and *holosericea*. The former is cultivated in humid areas of China, Korea and Japan. It is resistant to many diseases, including *Monilia laxa*. The fruit are small and sour, but edible. The latter is native to eastern Tibet and western Sichuan (China). The tree are small (3-5m) and the leavers have dense reddish pubescence on the vein. The size of fruits is medium with thin flesh; the stone is large and oval.

Prunus mume called Japanese apricot is native in the mountains of central China along the 30th parallel. They live in warm and humid climate and wet soils, do not like cold condition. The trees are exhibit small and shrubby but there is high variation in their habit. Also the quality of the fruit is variable in size and characteristics of flesh.

In the countries of the central Asia grows a hybrid of *P. cerasifera* and *P. armeniaca*, who lives isolated. The trees are very small but resistant to many disease, tolerant low temperatures. The fruits have dark purple skin, their size is small and its flesh is sour yellow or red. The stone is dark purple.

As the other fruit crops unfortunately the characteristics of these species that grow in the cited areas have not been studied enough in their agronomic and phenological characteristics, in particularly those required for tropics and subtropics (low-chilling requirement, resistance to drought, waterlogged and calcic soils) , thus the knowledge's are not good concerning the diseases resistance. The difficulty to study these species depends on the easiness to interspecific crossing compatibility's in the apricot species, the lack of programme of exploration and collection in particular for the species grown in central and eastern Asia and in Caucasian area , moreover apricot germplasm is threaten because the rural Asian people cut the trees for firewood and house construction.

The cultivars of this species are mainly characterized by limited adaptation to climate condition, thus it is necessary to improve the local species, where are existing, or to introduce suited species or varieties and arrange programmes of selection.

Plum

The plum is known and cultivated from many centuries BC whether in Europe or in Asia. Many species are classified and hence the centres of origin are many, spread many in the northern hemisphere and mostly in the temperate zone. However the plum has been diffused everywhere due to the its size, colour of the skin and tasted flesh. In fact it is possible to see it in the dry zones (North and Central Africa, Western and central Asia). Although the taxonomist distinguish two groups European and Japanese plums many other species there are that are only cited by the name and origin but that concerning their characteristic and utilities less is known.

Wild plums have less rigid requirements than apricots for climate and soil conditions; but their genetic improvement has determined a limited capacity of adaptation of the cultivars. Thus there is a genetic erosion of germplasm of the species that has induced in the European plum varieties susceptibility to diseases and insect attack, and lack of adaptation to low-chilling area, hot and dry or wet climate. Also in those Japanese there is narrow genetic base, even though they have more diverse origin than the European plums. They have early blooming (that is correlated to low-mid chilling requirement) but they have susceptibility to root diseases.

Hence is necessary to utilise the wild species in centres of origin.

According the botanical classification of Ingram for the *Prunus* spp. in section Prunophora there are two group the *Euprunus* and the *Prunocerasus*.

In the first:

Prunus cerasifera grows wild in the Euroasia and the various ecological condition of this huge area provides great gene source of it that is little explored or used whether variety or rootstock creation. A related species is *P. monticola*.

Prunus domestica is the main species that is originated from Caucasus Mountains and the Caspian Sea, and diffused then in Europe. It has great polymorphism concerning the characteristics of the fruits .Other specie related to it is *P. insitia* (dwarf specie with polymorphic fruits and drought resistance) grown in Western Asia.

P. spinosa : although has small, round, black fruits with greenish and bitter flesh, it is considered interesting for the drought resistance as rootstocks. Related species is *P. curdina*, placed in Armenia that is not well known.

P. salicina: Japanese plum, it could be useful for low chilling climate for early blooming, it has good fruit characteristics; related specie is *P. ursina* that it is not well studied and sited in Asia Minor.

In the section of Prunocerasus (sited in the North and Meso America) two species (*P. hortulana* and *mexicana*) could be interesting as source germplasm of varieties and rootstocks for the tropic and subtropics zones.

The analyses of the genetic resources of the *European Prunus* has showed that there is a narrow genetic base among the species and the major existing cultivars limiting the plum production to specific areas. It is believed that pear arisen in the mountainous region of western and southwestern China, but Vavilov identified three centres of diversity : Chinese, the central Asia and Asia minor.

The *Pyrus comunis*, the species more cultivated, was probably involved during its domestication in hybridisation with other species *P.ussuruensis* and *pyrifolia*. The probable ancestral of the pear are *P.communis* var *pyraster* and *P. caucasica*. Between the 22 wild species someone are interesting for the temperate fruit cultivation in the tropics and subtropics.

In relation to the distribution they are distinguished in:

European: *P.communis*, *P. Koshinsky*, *P. cordeta*;

Circum-Mediterranean : *P. amygdaliformis*, *P. syriaca*, *P. longipes*, *P. gharbiana*, *P. mamorensis*

Mid-Asian : *P. glabra*, *P. pashia*, *P. salicifolia*, *P. regelii*, *P. Pashia*

East-Asian: *P. betulifolia*, *P. pyrifolia (serotinia)*, *P. calleryana*, *P. hondoensis*, *P. dimorphophylla*, *P. fauriei*, *P. Kawakamii*

These wild populations are to varying degrees threatened, due to the modernisation of agriculture and replacement of numerous indigenous cultivars with others from different countries. The loss of forestry for expanding cultivation's of some crops and firewood gathering also accounts for loss. In fact in China and Asia Minor the native germplasm seems to be lost.

Some wild species like *P. amygdaliformis*, *P. pashia*, *P. calleryana*, *P. betulifolia*, *P. fauriei*, *P. kawakamii*, have low chilling requirement and others like *P. communis*, *P. cordeta*, *P. syriaca*, *P. longipes*, *P. gharbiana*, *P. mamorensis*, *P. glabra* need medium chilling requirement. Concerning to resistance to high pH and dry soil *P.communis*, *P. koshinskyi*, *P. Amygdaliformis*, while *P. Betulifolia*, *P. Calleryana* need neutral or acid soils.

Concerning the mean diseases (collar rot and pear scab) that attract the plantations in the tropics and subtropics conditions *P. Betulifolia* and *P. Calleryana* appears to have resistance for both, instead *P. Amygdaliformis*, *P. hondoensis*, *P. dimorphophylla*, *P. fauriei*, *P. Kawakamii* have shown resistance for pear scab.

Almond

Almond is a fruit that contain high concentrations of both oil and protein. In particular the oil has showed positive health value. As other *Prunes* species almond has been grown in the gardens since the antiquity in Asia and Europe. The centre of origin of this species is central Asia but in that site it is possible to identify many species close to it. The related specie of it (*Prunus amygdalus* o *P. dulcis*) has been classified in five taxonomic sections, of which the most interesting are considered for tropics and subtropics.

P. argentea and *orientalis* grow in Iraq, Syria and Palestina ; the plants are bushes about 3 m tall , the nut are small and hard shelled.

P. fenzeliana grows in the Caucasus Mts., and Armenia the habit is bushed about 3 m tall; nuts are small, flat, and hard shelled; kernels are bitter.

P. zabalica recently found in Afghanistan has upright habit ,2-3 m tall, fruits are almost red ,at maturity, round and fleshy, the kernels are smooth and slight bitter.

Section Eumygdalus

P. communis is sited in two areas: in the mountain of Turkmenistan and in Uzbekistan on the western slopes of the Tian Shan Mountains. The nut size and weight presents considerable variation. It is reported that this material has high drought tolerance, early bloom and early leafing with high response to warm temperature in spring.

Section Spartioides

In this group there are species lived in xerophytic condition (Iran, Armenia, Saudi Arabia, Syria, Iraq, Afghanistan): *P. spartioides*, *P. arabica*, *P. glauca*. The trees are 3-4 m tall; fruit are small, shells are thin, smooth and very hard; kernels are small, dark brown and bitter.

Section Lycioides

This is a large group (*P. spinosissima*, *P. brahuica*, *P. eburnea*, *P. erioclada*, *P. horrida* and *P. lycioides*) that is sited in wide area from Mesopotamia up to Indo valley. The species have variable characteristics but mainly are adapted to extremely xerophytic condition. The plants have small size (1 - 1.5 m tall) Nuts mature early (June) and are small and very pointed and recurved.

Although the wild species of almond are many in the areas of Asia and grow there since millennia , the species have been subjected to much devegetation by grazing goats, the harvest of firewood thus the rage of genotype is narrow; hence the local cultivars cultivated in the gardens or small orchards represents important germplasm resources.

In these sites the introduction of imported cultivars from developed countries likely reduces this important genetic reserve. To save these genetic resources a Network of nut species has been arranged in the Mediterranean Area.

Almond represents the main species for arid areas of tropics and subtropics because it presents the species with low-chilling requirements varieties or landraces. Moreover the soil problems for the rootstocks are limited due to the high tolerance to calcium and drought.