

INDIGENOUS ROOTSTOCK FOR WOOLLY APHID RESISTANCE IN APPLE

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Abstract: Wild fruit plants have been an important source of food for mankind since early times. As man developed through the ages so did the utility of these fruits. For example, there is a gradual trend for declining productivity in temperate fruit crops. The most urgent need today is to enhance the production, productivity and quality of nutritious food in an eco-friendly manner so as to improve farm income to ensure household food and nutritional security. Low-density standard plantations need to be converted to high-density plantations to reduce the juvenile period and increase productivity per unit area. Apple is the most important fruit of the temperate region and its cultivation is confined to 5 states in India. It is the high time to find out new rootstock and pollinizers for apple crop improvement.

All the crab apples exhibited a considerably less chilling hour requirement as compared to the standard apple rootstocks M 9 and MM106. Thus, these crab apples are likely to improve the productivity of apple varieties in areas where the chilling requirement is not being fully met. The germplasm that holds promise for using rootstock is *Malus baccata* (Shillong) or in breeding programme for disease and pest (woolly aphid) resistance or as pollinizers has been identified for the improvement of apple. An ideal rootstock should possess uniformity in vigour, resistance to diseases and pests without impairing the productivity and quality. The wild sources are important source for resistant/ elite traits & are used for crop improvement programmes.

INTRODUCTION

The challenge is for every country to develop an implemental strategy to save rare, endangered and threatened species through education, social mobilization and regulation and their utilization for future use. The entire north-west Himalayan region comprising of Jammu Kashmir, H.P & Uttarakhand is very rich in temperate fruits plant diversity. Among temperate fruits, commercially grown are apple, pear, peach, apricot, plum, cherry, almond, walnut, pecan, hazelnut, chestnut, persimmon & Chinese gooseberry. These become cash crops for hill people. This biodiversity could be of different fruits species or of different varieties of the same species or of various rootstocks. In case of apple approximately 2500 cultivars are

existing all over the world but only 25 cultivars are commercially grown which mainly includes Delicious cultivars. It represents extremely narrow genetic base of cultivated apple. The most urgent need today is to enhance the production, productivity and quality of nutritious food in an eco-friendly manner so as to improve farm income to ensure household food and nutritional security. Low-density standard plantations need to be converted to high-density plantations to reduce the juvenile period and increase productivity per unit area. Apple is the most important fruit of the temperate region and its cultivation is confined to 5 states in India. It is the high time to find out new rootstock and pollinizers for apple & temperate fruit crop improvement.

Wild fruit plants have been an important source of food for mankind since early times. As man developed through the ages so did the utility of these fruits. Valuable information was historically passed on from generation to generation until the dawn of the era of systematic documentation. The Himalayas are abundant in wild fruit species that are distinct from the tropical types found elsewhere in India.

Apple, the premier table fruit of the world, has been under cultivation since time immemorial. The selection of suitable rootstock of apples for a certain tract has been an important investigation. All successful apple rootstocks, either seedling or clonal, are of the genus *Malus*. In early days, French crab seedlings (*Malus sylvestris*) were widely used in the USA as rootstocks. Some of the Asiatic species of apples are apomictic and bred true from seeds even when pollinated by other species. These apomictic species have been used as rootstocks for commercial apple cultivars with the hope that they might be of value in controlling tree growth and age of fruiting. Thus, the crab apples can play a pivotal role for the improvement of apple through proper utilization of their potentiality. A number of crab apples have been found growing wild in the Himalayas. Botanically only two species of *Malus* have been identified viz. *Malus baccata* and *Malus sikkimensis*. However, this botanical classification does not clearly reflect the existing genetic variability. At the IARI Regional Station for Horticulture at Shimla, India seven types of *Malus baccata* and two types of *Malus sikkimensis* from different agro-climatic regions have been collected. Significant differences for their botanical and horticultural traits have been observed. The crab apples collected from Shillong exhibited a very good propagation potential, showed a high degree of resistance to woolly aphid and produces semi vigorous trees when used as rootstock. All the crab apples exhibited a considerably less chilling hour requirement as compared to the standard apple rootstocks M 9 and MM106. Thus, these crab apples are likely to improve the productivity of apple varieties in areas where the chilling requirement is not being fully met. The germplasm that holds promise for using rootstock viz., *Malus baccata* (Shillong) or in breeding programme for disease and pest

resistance or as pollinizers has been identified for the improvement of apple. An ideal rootstock should possess uniformity in vigour, resistance to diseases and pests without impairing the productivity and quality.

RESULTS

Superior edible types have gradually evolved through ages of conscious selection; this has often been at the cost of features such as resistances to diseases and pests or tolerance to adverse environmental conditions. Such characters were not of immediate concern, and hence got systematically discarded and are now facing extinction. The crab apples form the bulk of the germplasm available to mankind for affecting further improvements in the cultivated apples.

Crab Apples

Malus species growing in the wild are collectively called crab apples. Crab apple fruits are usually small sized, green or brightly coloured and sub-acidic sweet in taste. These plants have characters of immense significance for apple cultivation. Besides some of these are also of unique ornamental value. The crab apples have been classified into a number of *Malus* species: *Malus sikkimensis*, *Malus floribunda*, *Malus zumi*, *Malus seiversii*, *Malus sylvestris*, *Malus baccata*. The *Malus baccata* types available at our Research Farm are *M. baccata* [Srinagar], *M. baccata* [Shillong], *M. baccata* [Khrot], *M. baccata* [Rohru], *M. baccata* [Giabung], *M. baccata* [Dhack], *M. baccata* [Lahaul], *M. sikkimensis*. There are two species of *Malus* indigenous to the Himalayas viz. *M. baccata* var. *himalaica* and *M. sikkimensis*. However, a number of distinct biotypes of both these species have been observed growing wild in different agro-climatic regions of the Himalayas. Studies on these at the IARI Regional Station (Horticulture), Shimla indicate their entitlement to a separate taxonomic status for these biotypes. Six biotypes *M. baccata* and two biotypes of *M. sikkimensis* have been identified. The noteworthy features of *Malus baccata* (Shillong) are given below.

Malus baccata (Linn.) Borkh (Shillong)

It was collected from Shillong (Meghalaya), where it is locally known as *Soh-sheur*. It was found growing wild at an altitude of 1300 m

ASL (Randhawa, 1987). In the wild it grows as a small low branching tree producing small scarlet red fruits. Leaf stomata counts indicate that it may be as dwarfing as the M 9 apple rootstock (Table 1). However, overall growth of apple scions (cvs Golden Delicious and Spur Types of Red Delicious) on this rootstock is more than that on M 9, but less than that on MM 106. Development of root rot (c.o. *Dematophora necatrix*) and powdery mildew (*Podosphora leuhotricha*) significantly delayed. It has shown field resistance to apple scab (c.o. *Venturia inaequalis*) and is completely resistant to woolly aphid (*Eriosoma lanigerum*) (Plate-1). It has a very good propagation potential. The chilling requirement of this species is less than that of M 9 and MM106 (Table 1).



Plate 1: Differential reaction to woolly aphid exhibited by different Rootstocks including *M. baccata* (Shillong)

Most of the North-Western Himalayan region is entirely mountainous and in elevation ranges from the foot hills to high snow covered mountains. Varied plant genetic resources are recognized as the future building blocks.

Indian Himalaya that comprised the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, and parts of Meghalaya, Assam, Manipur, Mizoram, Nagaland, Darjeeling district of West Bengal and Nilgiri hills supports wide range of native and introduced temperate horticultural crops where apple is the most important fruit of the temperate region. In the present context, horticultural crops have special significance when we have attained

self-sufficiency in food grain production and now aiming at nutritional security. Thus, the cultivation of temperate horticultural crops has a vast potential and is a step toward enhanced food and nutritional security, employment, poverty alleviation, diversification of agriculture and sustainable development. Effective utilization of the vast range of temperate horticultural genetic resources thus require their proper deployment which may include (i) use as a breeding material and/ or rootstocks, (ii) directly as variety through introduction or after selection, and (iii) as new crop through domestication. Conservation, characterization and utilization of these species is an important objective.

Table 1: Horticulture Traits of Himalayan Crab apples

Species	Propagation Potential	Vigour	Reaction to Woolly Aphid	Reaction to Powdery Mildew	Reaction to Apple Scab
MM 106	G	SV	R	S	S
M 9	P	D	S	S	S
<i>M baccata</i> (Shillong)	VG	SV	R	R	R

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