

Apple

Introduction

Apple (*Malus domestica* Borkh.) is a highly remunerative deciduous fruit, grown in temperate regions it is a temperate climate fruit. It can also be grown in tropical areas, but never sets fruits owing to its chilling requirements. It is believed to have originated from the hybridization between *Malus sylvestris* and other *Malus* species, with its original home said to be a region south of the Caucasus. They are native in many parts of Europe and Asia temperate climates and the origin of apple is Central-Asia, and Afghanistan has many areas with native apples. However, it is now grown in almost all continents of the world.

World apple production was 41.24 million tonnes in 1991, in 1997, an amazing 44.7 million tonnes of apple were produced for human consumption. In 2006, production was 44.1million tonnes. The leading apple growing country is China, producing about 41% of the world's apples, followed by the United States. The major apple-producing countries in order of production are the former Russia, Germany, France, Italy, Turkey, Iran, Argentina, Japan, India, Hungary, Poland, Korea, Brazil, Spain and Yugoslavia. Wild apple varieties, such as *Malus pumila*, *Malus sylvestris* and *Malus orientalis* are the most prevalent.

Botanically, apple is a mature or ripened ovary/ovaries fused together with many closely associated parts. In apple, five ovaries of the flower are imbedded in tissue, becomes fleshy and edible. The apple is a pome fruit developed from an inferior ovary, and is derived both from the ovary wall and the floral tube which is composed of the basal parts of the sepals, petals, and stamens. This tube is fused with the ovary wall, becomes fleshy, and ripens with it. The fleshy mesocarp constitutes the main edible portion. The five cavities may each contain two seeds (Fig. 1.1).

The genus *Malus* belongs to the family **Rosaceae** and to the subfamily **Pomoideae**, the genus *Malus* is classified into 25 species, *Malus pumila* (formerly *M. communis* or *pyrus malus*) is considered to be the parent of most of our cultivated apples. Some of the principal *Malus* species include *M. domestica* (cultivated apple), *M. sylvestris* (wild crab apple), *M. floribounda* (flowering crab apple), *M. baccata* (Siberian crab apple), and *M. coronasea* (American crab

apple). *M. sylvestris* and *M. pumila* are considered as the major ancestral species of modern apples.

Horticulturally, the apple is the major deciduous-tree fruit of North America and of the world. Indeed, the term "pomology" the science of fruit production, comes from the apple, a pome. Many different fruits have been known as "apple".

The commercial cultivars of today are far removed from the wild apples from which they developed over a period of many hundreds of years. Several species may have contributed to the development of the modern apple. For this reason the taxonomy of the apple is somewhat confused. Some authorities use *pyrus sylvestris* as the scientific name of the cultivated apple, others use *pyrus malus*, and still others use *malus domestica* (which is preferred in this text). Some prefer to use the genetic name *malus* for the apple and restrict *pyrus* to the pear.

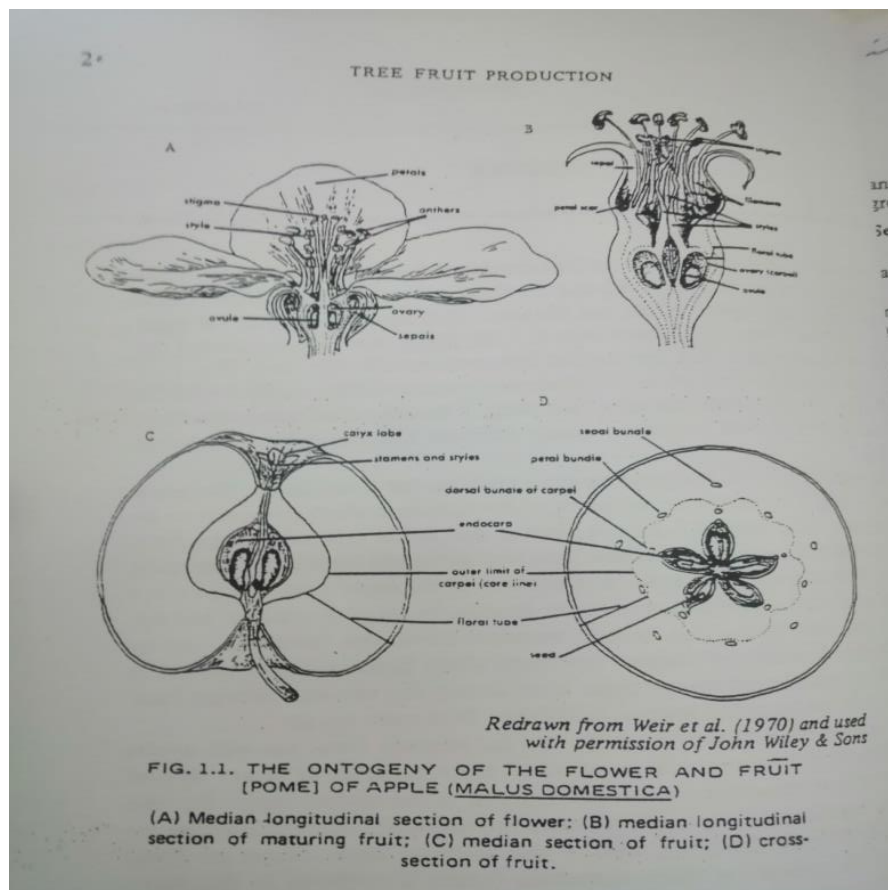
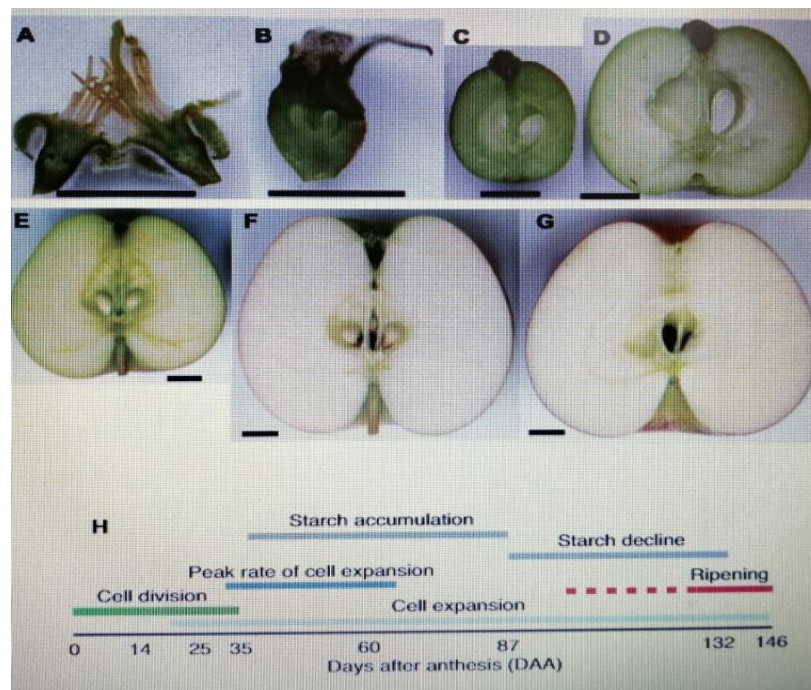


Fig. 1.1. the ontogeny of the flower and fruit (pome) of apple *Malus domestica*

- (A) **Median longitudinal section of flower:** (B) **Median longitudinal section of maturing fruit:**
(C) **Median section of fruit:** (D) **Cross section of fruit.**



Morphology

The tree naturally grows between 5m and 12m tall. The leaves are arranged alternately along the shoot. Their shape is a simple oval. The leaf is 5 to 12cm long and 3 to 6cm wide attaching to a 2-5cm long petiole with an acute tip. The flowers have five petals with a size approximately 3cm. The color of the flowers is white with a pink tinge. The fruit contains five carpals arranged in a five-point star. Each carpal contains 1 to 3 seeds.

Generally apples are grown at high altitude (1600 - 2400) m. above sea level but a few plantations are also reported that can be grow an altitude of (1000 - 1300) m. in fact some cultivar require chilling below (4-5°C) for about 40 – 60 days for the buds to open in spring, to break the rest period. Temperature below (3 °C) inactivates normal metabolic activities of the trees.

Leaf buds generally need a little more cold than the flower buds. In cases where the leaves do not develop simultaneously with the flower buds (as in lower altitudes) fruits do not set in due to lack of proper C/N ratio. Thus the intensity and duration of cold is in a position to set the northern geographical limits for the economic production of apple. Optimum temperature range for growing apples is between (15-21°C). High temperatures and lower C/N ratio affect the crop adversely.

Producing nursery seedlings:

After ripening, seeds of apple normally will not germinate directly after harvest. A period of after ripening is essential for certain chemical and other changes to take place in the seed and start the dormant embryo into growth. The length of the after ripening period of seed of domestic cultivars is usually (70 – 80) days at (5 – 10°C); the optimum is (5°C) under moist conditions. Temperatures of (0.5 – 3.3°C) are more favorable than those above (5°C). Seed may become dry before after ripening begins without reducing germination, but during and following after ripening it must be kept moist until sown.

For after ripening, soak dry seeds in water for several hours and place them in mouse-proof containers with a moisture –holding material such as damp peat moss. Bury the containers over winter in the ground in a sheltered place or store them in a cool cellar. Keep the medium, in which the seeds are stored, moist. Polyethylene film envelopes, permitting ready examination of the seed, may be used if they contain some damp peat moss or perlite.

Preparation of Rootstock:

Generally, seed plants were used as rootstock but of late, vegetative rootstocks have become popular.

- A. Seed rootstock. Well washed and dried viable seeds obtained from mature healthy fruits of varieties may be placed in fields with rich well decomposed farm yard manure and superphosphate 25 cm apart at a depth of 1 cm and covered with grass in November. As the seeds germinate in March, the mulch is removed.

It is useful to place the seed, at 4.5°C for 60 days to break dormancy, before sowing.

- B. Vegetative rootstock. Rootstocks are planted in soil 1.5m x 75cm apart. During dormancy in the first year 10cm portion of the root stocks are cut off so that new branches are formed in march lower portion of these new branches are covered with soil upto 20cm. this increases rooting during the rainy season and the new branches are separated out in winter.

For better shooting, ringing at lower end of branches along with exogenous application of IBA solution (0.25%) is recommended. Rooted branches should be removed in December.

Choice of Location and Climate:

When dealing with a long-term enterprise such as apple growing, where a large capital outlay is involved, a grower cannot afford to make serious mistakes. The commercial life of an apple orchard may be 30 – 50 years. Careful planning and preparation is time well spent and results in greater returns in the years to follow. The prospective grower must select with care the district in which he will establish his fruit farm. Certain regions, over a period of years, have become known as particularly adapted to this type of farming.

Apple is a typical temperate fruit crop and can normally be grown in areas experiencing 800-1600 chilling hours (the number of hours during which temperature remains 7°C during the winter season). Extremely cold temperature, on the other hand, may cause freezing injury. Abundant sunshine is important in growing apples, since it is largely responsible for proper fruit color development.

For optimum growth and fruitfulness, apple tree need 100-125cm of rainfall, distributed equally over the growing season. Further, areas exposed to high winds are not suitable for cultivation. Dry winds during bloom desiccate flowers and hamper bee activity, resulting in poor fruit set. The areas should also be practically free from occurrence of hail storms and spring frosts. Inclement weather, particularly temperatures below 10°C at bloom, inhibits bee activity and thus prevents pollen germination. The optimum conditions for pollen germination and fruit setting are between (21.1 and 26.7°C).

Soil Preparation

Apple likes cool and humid conditions. It is not very sensitive for soils. Apple can grow in a wide variety range of soil types. However the best soil texture type is from sandy-loam to sandy clay loam. Soil drainage is maybe the most important factor to be considered. The soil should be well-drained up to 80-100cm depth; slightly acidic acceptable soil pH for apple growth is between 5.7 and 7.6. The best pH range is between 5.8 and 6.5, with good depth and ample quantities of organic matter are considered ideal for apple cultivation. However, loamy soils in shallow soils, the trees are short-lived and produce poor yields. Soils with heavy clay or compact subsoil should be avoided, since these adversely affect the growth of the tree. Slope should not exceed 10%. Slope exposure is important. Southern facing slope warms up to fast and western facing slope tends to be thinner. The recommended slope facing direction is east.

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Site preparation starts with the cleaning of the area. After cleaning the bush, the next step is to level the area and, if necessary, build up the terraces. Carefully avoid the complete removal of the topsoil during the process of leveling and terrace making. However, Orchard located on slopes it need proper surface drainage to prevent soil erosion. A pit of (1x1x1m³) is generally considered ideal for planting apple.