INTRODUCTION

Ber (*Zizyphus mauritiana* Lamk.), a member of family Rhamnaceae, is one of the ancient and common fruits of Indo-China region and has been grown in Indian subcontinent since times immemorial for fresh fruits. The genus *Zizyphus* comprising of about 40 species, is distributed throughout the tropical and sub tropical regions of the world. Ber is known to be indigenous to the area stretching from India to South western China and Malaya (Vavilov, 1951). Some other species of ber, *viz.*, *Z. numularia* and *Z. rotundifolia* are also found growing in the Indian subcontinent. *Z. jujube* is mainly grown in temperate parts of the world. It is now widely naturalized in tropical region from Africa to Afghanistan and China, and also through Malaysia and into Australia and in some Pacific regions. It also exists in wild groves which are widely spread across warmer parts of India, Pakistan, Bangladesh, Sri Lanka, Central and South Africa and in Northern parts of Australia where it has become a serious environmental weed in Northern region. Indian ber trees are small to moderate, spreading with vine like branches. It is the most hardy fruit tree with wider adaptability to adverse soil and climatic conditions as it exhibits xerophytic characters and it can be cultivated successfully in most marginal ecosystem of tropics and subtropics. The tree has a deep tap root system, which responds well to a large number of soil types. Since its cultivation requires least care among fruit plants, the ber trees are suitable to rehabilitate extensive resource poor areas. The wider adaptability of ber can be judged from the fact that it is grown in various countries with contrasting environmental conditions.

Ber is considered as religious fruit of India, grown at various religious places of Hindus, Muslims and Sikhs. The tree is associated with Lord Shiva, whose worship is considered incomplete without offering of jujube fruit, especially during Mahashivaratri. The ber fruit is also associated with Shabari, an old woman, who believed to have tasted the ber fruits first, and then offered only the sweet and ripe ones to Lord Rama. Some very old trees, about 450 years old (Dukh Bhanjan ber, illaichi ber etc.) are still found growing in ‘Golden Temple’, Amritsar (Mankad, 1988).
India ranks first among the ber growing countries of the world with an area of 87,700 ha and annual production of 8.95 lakh MT (Pareek, 2005). The major ber growing states in India are Madhya Pradesh, Bihar, Uttar Pradesh, Punjab, Haryana, Rajasthan, Maharashtra, Assam, Gujarat, West Bengal, Andhra Pradesh and Tamil Nadu. But, it is an ideal fruit for cultivation in the arid and semi-arid zones of Northern India (Bal, 1982). In Punjab, ber ranks fourth among the cultivated fruits and occupies an area of 2673 ha with annual production of 44,170 mt (Anon, 2008). Its cultivation has received a great impetus as a commercial crop in Punjab, Haryana and Rajasthan because of its excellent yield and economic returns (Jawanda and Bal, 1978). It is often mentioned as poor man’s fruit, however, this notion does not fit as now it fetches high prices. Secondly, it showed its value as a highly nutritive fruit. It is mainly grown in Sangrur, Patiala, Bathinda, Ferozepur, Faridkot and Mansa districts of the arid irrigated region due to favourable environmental conditions. The leading cultivar amongst all is Umran, a heavy yielder and maximum area in Punjab is under this cultivar.

Ber tree bears its inflorescence in the axil of leaves on current season’s growth. The flowering period lasts for about two and a half months from Sept to Nov. The fruit setting starts in second week of Oct and continues up to first fortnight of Nov. The fruits reach maturity in about 180 days after fruit setting. The fruit growth in terms of length and diameter follows a ‘double sigmoid’ curve. Indian ber has a chromosome number of 2n = 48. This indicates that these may be polyploid too.

Ber fruits are equally relished by the rural and urban people as well as young and old. Ber is a very nutritious fruit and is rich in vitamin C, A & B complex. On an average, 100 g of fresh fruit contains 81.6-83.0 g moisture, 0.8 g protein, 0.07 g fat, 0.60 g fiber, 17.0 g carbohydrates, 5.4-10.5 g total sugars, 1.4-6.2 g reducing sugars, 3.2-8.0 g non-reducing sugars, 0.3-0.59 g ash, 25.6 mg calcium, 26.8 mg phosphorus, 0.76-1.8 mg iron, 0.021 mg carotene, 0.02-0.024 mg thiamine, 0.02-0.038 mg riboflavin, 0.7-0.873 mg niacin, 0.2-1.1 mg citric acid, 65.8-76.0 mg ascorbic acid, 0.1-0.2 ppm fluoride, 2.2-3.4 per cent pectin (dry basis) and traces of malic acid, oxalic acid and quercitin.

A comparison of nutritive value of ber and apple reveals that the ber is richer in the amount of protein, mineral matter, calcium, phosphorus, carotene and vitamin than that of apple. That’s why ber is referred to as ‘the apple of arid zone’. It is easily digested and has a laxative effect. The tree as a whole has multipurpose uses. The leaves are used as fodder for cattle and
camels and to feed tassar silk-worms. The ber tree can serve as a host to lac insects, bark is used in tanning industry, wood is used for making charcoal etc. The seeds are sedative and are taken, sometimes with buttermilk, to halt nausea, vomiting, and abdominal pains in pregnancy. Moreover, there is huge scope for ber fruit processing, as several products like chutney, dried ber, murabba, ber candy, squash, nectar, beverage and jam can be prepared. The ripe fruit of ber can be canned in sugar syrup.

Besides these, there are some other aspects which make ber cultivation a profitable venture. The ber fruit comes to the market from Jan and continues up to mid April. This is the period when practically no other fresh fruit is available, especially during the months of march-april, the peak of citrus is over and grape and mango are not ready. Only ber is available and that too at cheaper price, therefore it fetches great demand.

Among the fruit trees, ber cultivation requires perhaps the least inputs and care. It can be grown up to a height of 1000 metres above msl (mean sea level). Frost does not have much effect on the tree. It gives good production even without irrigation and can be grown as a rain fed crop in semi-arid and arid regions. It is a quick growing and early bearing fruit which yields a heavy crop every year. Moreover, the tree can tolerate hot and dry weather during May-June as the tree goes to dormant conditions which, in turn, reduce the total water requirements during the period of water scarcity in Punjab. The new growth starts in July with the onset of rains and in Nov, when the cold weather approaches, the growth is inhibited.

In spite of the huge economic, industrial and environmental potential of ber cultivation in Punjab, the area under commercial cultivation of ber is decreasing day by day. Most of the ber orchards have been replaced by kinnow and guava. Various Government and private organizations are promoting these fruits over others like ber. Due to this, ber fruit has acquired the status of ‘minor fruit’ in Punjab. Moreover, the existing ber orchards of Punjab are facing a severe problem of immature fruit drop during initial stages of fruit growth and development. Fruit drop has become the limiting factor in increasing the ber fruit production. The trees normally produce abundant flowers and the early drop of flowers and fruits should not be too severe, if a tree has to produce a regular crop of good size and quality. But in ber, at the time of pollination, a heavy drop of blossoms and ovaries takes place which can be attributed to various factors like hormonal imbalance, abortion of embryo and inclement weather. Thus, a huge amount of fruit is destroyed due to fruit drop during the months of Nov-Dec which, in turn, is
responsible for serious loss in yield and profitability. Secondly, about fifty per cent of the fruits retained on the trees remain very small in size, which adversely affects the yield, quality, market acceptability and profit of the growers. Thus, these are the major obstacles in popularizing ber cultivation in Punjab.

Of late, there is strong evidence that flowering and fruiting of a fruit tree is controlled or activated by the use of various chemicals which play growth regulatory functions in the plant. Hence, there is an immense scope of using various micronutrients and growth regulator treatments which improve the fruit set and fruit quality by helping in flower initiation, fruit set, growth and development. Although the research work on these aspects is being carried out by various research workers throughout India yet the detailed information on the effects of micronutrients and growth regulator sprays on fruit drop and quality of ber is lacking and there is still no recommendation regarding the increase in fruit set, size, improvement in taste, TSS, sugars, quality and yield by the use of various growth regulators and nutrients. Keeping the above facts in view, the present study has been planned with the following objectives:

- To reduce the fruit drop in ber cv. Umran.
- To improve the fruit size, yield and quality of Umran ber.