

Distribution *Boswellia sacra* in Dhofar Mountains, Sultanate of Oman: Economic Value and Environmental Role

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Abstract: *Boswellia sacra* from Burseraceae family, grows wild in dry hot lands of southern part of Oman (Dhofar), where the water is limited and the land unsuitable for traditional agriculture purpose. *Boswellia sacra* is a multipurpose tree, but more famous for its high value olibanum. The olibanum is used for ritual and in church ceremonies worldwide, traditional medicines, pharmaceutical, perfumery, cosmetics, chewing, painting, food flavouring. In addition to this, the species has other numerous environmental, historical, and socio-economical benefits. This study is based on literature reviews, and on the interview local people, as well as on personal field experiences. The objective is to introduce the importance of the species and to study the native habitats, the distribution, and the harvesting techniques. The soil is carbonitic, isohyperthermic, lithic torriothent, poor in mineral elements. The olibanum produces when the tree tapped by making a thin vertical slicing into the tree trunk. Initial size should be about 18 cm² (3 × 6 cm) and 1-2 mm in depth and the diameter tree trunk should be not less than 10 cm. Tree tapping should be stopped 2-3 weeks before the rain season. The method of tree tapping and olibanum collection need to be revised for long-term tree protection.

Key words: Olibanum, frankincense, tree tapping, soil, carbonitic, isohyperthermic, lithic torriothent.

1. Introduction

Olibanum is an oleo-gum resin obtained by tapping Frankincense trees of the genus *Boswellia*, species *sacra* and family Burseraceae (Fig. 1). *B. sacra* Flueck is a deciduous multipurpose perennial tree to 8 m tall. The olibanum (derived from Arabic word “Laban” meaning milk) of the Dhofar mountains were described by Ptolemy in his geography and the national epic poet of Portugal, Luis de Camoes, of the sixteenth century BC, as the main source of olibanum [1]. The olibanum has been in use since at least 1700 BC [2], in the international market. The gum and its products were used in many sectors along with incense burning, in church. Moreover the olibanum oil has an excellent fragrances and serves as the base

ingredient in perfumes and after shaves.

Olibanum is also associated with pharmaceutical, antimicrobial, anti inflammatory (for the treatment of infection and cough) and antihelminthic properties plus it can also be used as skin cosmetics, hair care products, aromatherapy and aids, aromatherapy, clear breathing thus serving the dual purpose of medicine and meditation [3, 4].

Frankincense trees occur in limited region consisting southern Oman, Yemen, Somali and Western India, between the latitudes of 5° and 25° north and 40° to 80° east longitude this area is generally frost free and subject to annual monsoon rainfall from June to through August [5]. In Oman only one species *B. sacra*, is found in Dhofar province in location between the western border of Oman (55° east latitude and 16° to 17° north longitude).

In Dhofar frankincense were the main source of

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Fig. 1 Adaptation *B. sacra* to different orographic Edaphic factors.

1: *B. sacra* grow coastal plain alluvia soil. 2: *B. sacra* grow in Mountain deserted landscapes of Dhofar 2000 m asl. 3: *B. sacra* grow near the sea level.

income and the only exported production [6]. The tree was of great importance, as source of the valuable oleo-gum resin, and for its foliage, bark, paste, fruit and flowers. Too surprisingly in Arabia there are myriad ways of using olibanum. However it is not possible to present all the usages within the scope of this paper. Only the predominant usages have been considered. *B. sacra* is the most famous plant of Dhofar and indeed is of vital economic importance within living memory [1]. The objective is to introduce the importance of the species and to study the native habitats, the distribution, and the harvesting techniques.

2. Material and Method

2.1 Study Area

The province of Dhofar, is an historical region in southern Oman, extending Ashar bathat on the coastal of Arabian sea south westward to Oman-Yemen border on the west, Saudi Arabia on the north and the Indian Ocean on the south, covers an area about 99,210 square kilometers between approximately latitudes 16° North to 21° North, and longitudes 51° East to 56° East. The region is separated from the rest of Oman by a huge stretch of open desert, stony plain and sand dunes, Dhofar is the largest of the eight provinces of Oman. It represents about 32 percent of Oman's total area and consists of nine administrative districts, six of which are concentrated in the three mountain ranges along the southern coastal area of the

province.

2.2 *B. sacra* Habitats

In Dhofar, *B. sacra* is found in ecological zones on the arid leeward side of the Dhofar mountains known to the locals as Nejd [7]. *B. sacra* is also endemic to pockets of fragmented habitat in the coastal plains, and in isolated sections of seaward facing slopes south of the Kharish and Harkak mountain passes in Jabal Samhan and in Fzayh Jabal Alqamar. These mountain passes were prominent in the ancient frankincense caravan routes to the coastal ports of Mirbat and Sath and Fzayh, and they are still in use and serve as the primary access routes for human and animal migration. *B. sacra* habitats are predominantly found in arid areas beyond the reach of monsoon rains [1], and tend to be limited to the wadi channels that drain the higher, moister mountains.

3. Result and Discussion

3.1 *Boswellia Sacra*: Importance Resources of Dhofar

3.1.1 Historical Importance

Dhofar Mountains were described by Ptolemy in his geography as, Mountains of ophir, are now thought to be the mountains of Saphar and it refer to be Dhofar, Recent excavation around the lagoon near Taka confirmed that there was old frankincense trade [1]. Last century India were the main exported Omani olibanum estimated 100-150 tons of crude olibanum per year exported from Oman to Bombay.



Fig. 2 Stages of tapping *Boswellia sacra* and getting olibanum.

1: Cut first time which call altawqi (signature); 2: One day after the third recut; 3: Olibanum ready for harvesting.

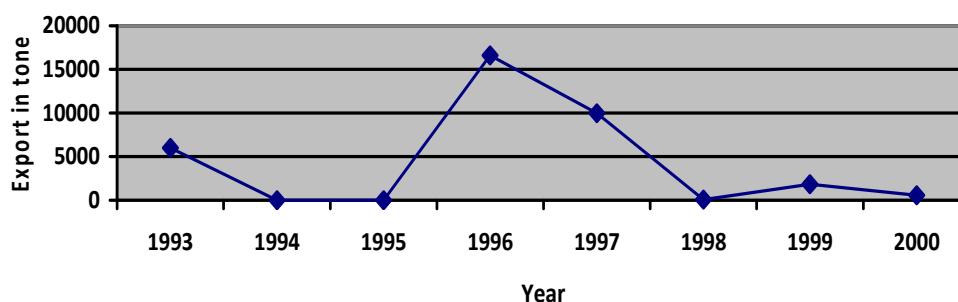


Fig. 3 Oman export olibanum from 1993-2007 [7].

3.1.2 Uses in International Markets

Olibanum uses as fragrance, an embalming compound, a household repellent for insects such as mosquitoes, and for religious ceremonies, oil extract uses in perfumery, traditional medicine, pharmaceuticals, in food industry.

3.1.3 Local Sales

Omani market consume 40-50 ton per year it uses as an orient from celebration.

3.1.4 Livestock Feed and Bee Fodder

B. sacra is a drought resistant plant, which produce leaves and flowers even at time of drought. Its long flowering period is very helpful in bee colony maintenance and boosts honey production, leaves and seeds are highly valued as fodder for goats, camels. the succulent stem is also used as fodder during dry season.

3.1.5 Source of Income

In Dhofar frankincense were the main source of income and the only exported production.

3.1.6 Environmental Role

B. sacra grows in dry and rocky sites where other

trees plants can't grow, in Dhofar mountains olibanum tree found in steep slope with an average gradient range of 10-70%, the soil is shallow from no soil to 80 cm depth. The tree makes income from the marginal land which other plants can't grow. Olibanum tree provide cover and produces good biomass and protect the soil and makes shade. Olibanum tree is economically and socially attractive, it increases the attention the abundant sites.

3.2 Tapping and Harvesting

In Dhofar olibanum tree shaved very thin layer of the bark (1 mm deep and an area 18- 20 cm²) up to a total of nine to eleven times annually at an interval 14-23 days before another one or two millimeter slice is taken from the same tap to re stimulate resin production. This rotation is followed thought the warm weather; no collections are made during the monsoon season. At every stage, the resin comes as milky juice and hardens on exposure to air in to globular, pear, or club-shaped tears. Three kg of



Fig. 4 Proper & improper tree tapping.

1: proper way of cutting size & depth not harm the tree. 2: improper way of tree cutting.

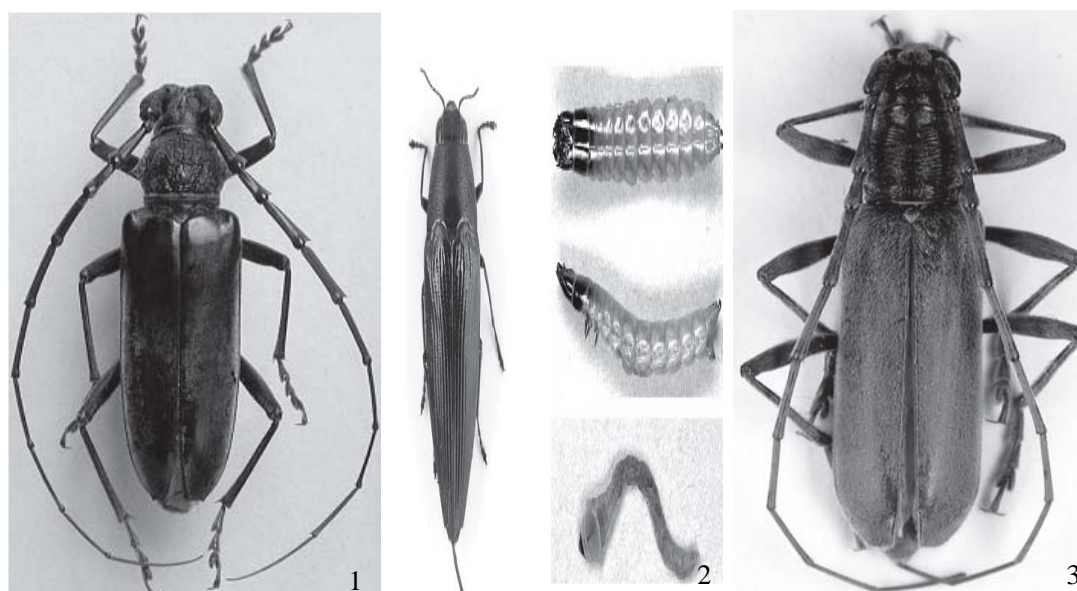


Fig. 5 The most dangerous insects of *Boswellia sacra*.

1: *Sphenoptera chalcichroa* Obenberger. 2: Specimen of *Neoplocaederus atlanticus* (Rungs, 1952), Male. 3: Male of *Derolus martini* ssp. *hayekae* Villiers, 1968.

Olibanum collected from tree per year. Collected olibanum is then sorted and graded in accordance to size, color and purity.

3.3 Oman Supply Potential Olibanum

It is estimated there are 400-500,000 olibanum trees in southern Oman scattered across more than 400 km² [9]. Total annual sustainable production from these trees would be approximately 230 tons [9]. However the possible production is around 70-100 tone

olibanum per year, the main areas are near Mughsayl, Hasik, Thamrit, and Andor.

3.4 Factors for the Decline of *B. sacra* Population

3.4.1 Gravel Mining

Gravel mining effects are far more devastating than any other land-use activity, and land degradation in the distressed area extends to soil removal, and lower soil moisture conditions and nutrient availability. This activity leads to plant mortality because it directly

affects the soil through erosion and earth removal, it deprives the plant of nutrients and water, and increases plant stress that reduces or curtails seed production. Reducing or eliminating the available seed bank disrupts the biological cycle and contributes to diminished plant regeneration potential from seed to mature plant and back to seed.

3.4.2 Improper Tree Tapping Practices

It is not uncommon to see over-tapping and use of inappropriate tapping methods by unskilled laborers. There is little supervision during tapping. More accessible trees are often tapped continuously with no rest periods.

3.4.3 Termite and Insect

Two species of long-horned beetles (Coleoptera Cerambycidae) and one of Buprestidae beetle (Coleoptera Buprestidae), whose larvae develops under the bark and in the into the trunk of living Frankincense trees.

The most dangerous insects of these appear to be one Buprestidae species (*Sphenoptera chalcichroa* Obenberger) and two Cerambycidae (*Neoplocaederus atlanticus* Rungs) and *Derolus martini* ssp. hayekae Villiers [8].

4. Conclusions and Recommendations

Boswellia sacra is an important tree species from economical and ecological perspectives in dry fragile land southern part of Oman. Frankincense trees have adapted to survive the harsh growing conditions of Dhofar mountains, as far as of temperature and water stress are concerned [9]. Oman have wealthy knowledge in *B. sacra* and olibanum management production but this knowledge limited in old generation, as the young generation moves to civil work. The distribution of *B. sacra* in Oman is generally restricted to dry environments on the rain shadow side of Dhofar mountains and some dry spots in sea side. *B. sacra* regeneration threatened by the factors land conversion, frankincense harvesting and

livestock grazing, the most vulnerable zones that easily accessible [10]. As the initial cut size develops into a wider and deeper wound as tapping cycles proceed so initial size should be about 18 cm² (3 × 6 cm) and 1-2 mm in depth and the diameter tree trunk should be not less than 10 cm. Tree tapping should be stopped 2-3 weeks before the rain season [10]. The method of tree tapping and olibanum collection need to be revised for long-term tree protection.

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