How grafting *Boswellia species* impacts their (resin) Frankincense - Part I

The Eslamieh Center

A Research Center for developing horticultural *Boswellia, Bursera,* and *Commiphora* for their resin efficacy.

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Introduction:

Boswellia is one of 18 genera within the Burseraceae family that consists of 24 species. *Boswellia* species are entirely from the old world covering a vast territory that stretches from India, Pakistan, Iran to Arabia, and east to west Africa.

Boswellia species produce resin called Frankincense that has been used in medicine, incense, and cultural ceremonies for thousands of years. Frankincense has been an export commodity throughout the history in the Middle East and Africa with profound economic and cultural value that connected the East to the West which allowed an exchange of ideas, science, and folklore that no other natural product has ever achieved.

Today, Frankincense is being widely used as an essential oil that has over-taken the globe with a ferocity never before witnessed. This new hunger for essential oil, has brought the species, in most regions, to a dangerously low population due to the over-tapping of trees, human encroachment, and fire. Under these conditions, sustaining this historic treasure will not be possible without horticulturally expanding the population.

The Eslamieh Center has been looking at possible alternatives to growing and propagating these species in cultivation to potentially provide relief to the habitat trees. In the process of possibly meeting the global demand, The Eslamieh Center is focusing on the research and development of new hybrid species, new means & methods of growing, and a range of horticultural experiments to improve and bring about new ideas to safeguard the species.

Abstract:

The significance of grafting *Boswellia species* is in the unique physiological structure of the trees that produces resin running through a series of canals throughout the entire tree. Grafting by selectively pairing two or more species potentially forces the resin, produced by each species, to mechanically mix and run through the canal system shared by the grafted species. Grafting fruit trees or ornamental plants, where the function of the root stock is to produce ample nutrients and a healthier root system, grafting resin trees shifts the objective to the resin production making both, the host tree

and the scion, equally important. This could offer a series of complex opportunities to study the resin resulted from grafting. The intent of this study is to look at the impact of grafting *Boswellia species* in two broad areas:

a. how grafting two species impacts the growing culture of both species.
b. how grafting two species impacts the chemical compounds of the resin produced by the two species through the interconnected resin canal system.

Goals and objectives:

To understand the impact of grafting *Boswellia species* on their physiology, growing culture, and the composition of the resin produced by the two species. To achieve the objective, a series of different *Boswellia species* have been grafted to monitor their growing culture. To test the resin produced by both species, the base plant, and the scion are collected to perform chemical analysis separately to understand the impact of grafting on the resin composition of each species. Result of the chemical analysis will be discussed in the future article part II

Means and methods:

Over the past several years, a dozen grafted trees were studied and compared to the stand-alone species in cultivation with similar growing conditions of the Mediterranean zone of Southern California, USA.

To examine the growing culture, the study looked at the growing rate, flower production, seed production, seed viability, health and disease venerability, and quantitative resin production.

To test the resin produced by a dozen grafted trees, samples have been taken from the host trees and the scions to be compared with stand-alone trees of the same species growing in the same environmental conditions. We will reveal the result in the part II of the article in the future.

Material selection:

The material selected for this study has been based on three primary objectives:

1. improving the growing and cultivation challenges of certain *Boswellia species* in cultivation.
2. improving the resin production of the species.
3. improving the quality and quantity of the medicinal compounds present in volatile and non-volatile form such as incensole and Boswellic Acid.

In this study, the following species have been selected to meet the above objectives. The following list represents the first species as the host, and the second species as the scion.

Boswellia elongata (host) with *Boswellia socotrana* (scion)

Boswellia elongata (host) with *Boswellia popoviana* (scion)

Boswellia elongata (host) with *Boswellia dioscoridis* (scion)

Boswellia elongata (host) with *Boswellia ameero* (scion)

Boswellia sacra (host) with *Boswellia serrata* (scion)

Boswellia elongata (host) with *Boswellia dalzielii* (scion)

Boswellia sacra (host) with *Boswellia frereana* (scion)

Boswellia elongata (host) with *Boswellia serrata* (scion)

Boswellia sacra (host) with *Boswellia papyrifera* (scion)

Boswellia papyrifera (host) with *Boswellia serrata* (scion)

Application:

Considering that the main objective is to line up the resin canals between the host plant and the graft species, I have found that the following grafting techniques are most suited to heal the grafted area faster, while allowing the two species to line up their canals enabling an uninterrupted flow of resin between the two species. All the techniques in Fig. 1 can be perform manually, or with grafting tools, with a relatively high success rate. Please note that this is not an article to show grafting methods nor the process.

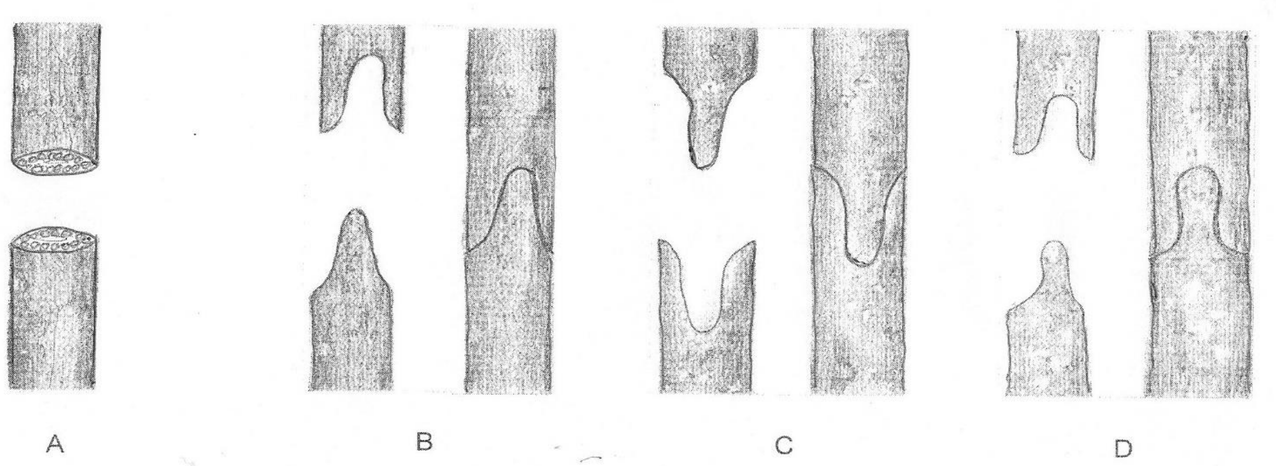

Fig. 1: A. cross section of a branch showing resin canals. B. Reverse “V” graft technique. C. “V” graft technique. D. Omega “Ω” cut technique.

In my experience, most Boswellia species will accept the graft within 3-4 weeks with new growth. The wounds heal relatively quickly, and within a few months’ time the grafts are fully healed around the entire circumference of the cuts. The wounds of grafted trees several years old will frequently become so uniform that it is difficult to find the exact location of the cuts at first glance.

Fig. 2 shows a few samples of grafted Boswellia in the process of healing, as well as fully healed with resin freely flowing through the canals of both species.

A B C D

Fig 2: A. *Boswellia sacra* base with *Boswellia ameero* scion. B. *Boswellia elongata* base with *Boswellia popoviana* scion. C. *Boswellia elongata* base with *Boswellia dalzielii* scion. D. *Boswellia elongata* base with *Boswellia dioscoridis* base.

Physiological and cultural impact of grafting Boswellia species:

A dozen grafted species have shown significant cultural changes in their behavior that makes the grafting practice of *Boswellia species* important for growing and propagation. For example, grafting *Boswellia dioscoridis*, *socotrana, popoviana, sacra,* and *ameero* to *Boswellia elongata* as a host tree, have shown that the vigor and structural stability of Boswellia elongata has conditioned these species to flower faster, increase seed viability, increase vigor and their overall health. Naturally, the grafted trees keep their reproductive parts intact and remain true to their genetic makeup producing the species flower, fruit, and pyrene allowing true seed production.

Other significant advantages to strategic grafting helps to manage some species much easier and grounding for size more practical. Our experiment shows grafting species with soft structure to woodier species improve the weaker species' survival in cultivation. *Boswellia nana* in some zones with winter rain or poor drainage tends to rot, grafting *Boswellia nana* to *Boswellia dioscoridis* have shown a promising combination.

Almost all the grafted species are showing stronger aroma, more resin production, and the hope that, after laboratory testing is performed, perhaps potency of certain chemical compounds have increased. We have selected and paired species with specific objectives hoping that we can control and manage certain chemical compounds. For example, grafting *Boswellia serrata* to *Boswellia sacra*, not only makes it easier and faster to grow *Boswellia serrata* which is notorious for slow growth in cultivation. Considering that *Boswellia serrata* has more Boswellic Acid (an anti-inflammatory compound) in its resin, then potentially, this graft should increase the Boswellic Acid in the new resin of Boswellia sacra, and potentially making some positive changes in the molecular structure of both species. We hope to publish part II of this article after our testing analysis is complete.

Conclusion of the experiments:

The olfactory testing of the resin from each grafted parts, has revealed that grafted species clearly exhibit an aroma different than the resin collected from either of the standalone species. While this is not a scientific test, the repeated test by multiple people confirms the variation in the aroma. A conclusion could be made that if the grafted trees change the aroma, then it could change some, or many, of the incensole formulas by mechanical infusion or become physiologically modified due to forced association. If this proves to be correct, grafting *Boswellia* will give us an added opportunity for selective breeding and propagation to meet specific criteria suited for the perfume industry or for medical research. Part II of this article will show the chemical analysis and discuss the impact of *Boswellia* grafting on the compounds of resin.

References:

Grafting fruit trees, Larry Southwick, 1979, google books