

# SILKY OAK

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Received: [Submission date] / Accepted: [Date revisions due]\* Editors to complete – authors please do not delete this line

**Abstract.** The purpose of the study was to investigate how Silky Oak grows in different conditions such as location near the road, near the water resource, and in a botanic garden and prove or disprove the theory of its resistance to temperature, frost and, excess moisture. In particular, the researcher was tasked with finding dependence between these factors and the growth, the time of flowering, seed formation, the state of leaves, and flowers. The research methods used include observation, description, and experiment. Observation of *Grivellea* was done in the Botanic Garden during the period from 2009.10.13 till 2013.03.08, with response to seasonal events such as temperature increases or decreases, rainfall patterns, or changes in day length; with focus on how similar species time their breeding and flowering. It has been found in a result of the experiment that *Grivellea* is a plant which tolerates not very harsh changes in a regime of temperature and light on the territory of Australia. This type of tree is well-settled in the territory of Australia due to its specific climate, which ensures hot and humid summers and mild winters; however, the silky oak behaved well in a colder weather. The better growth was fixed in such areas where summers are hotter and wetter than in the remaining part of the continent. Besides, the tree has been found to flower in a good weather from October till December. Finally, it has been found that the plants in one area that have grown in the same conditions could develop different look.

# 1. Introduction

Grevillea large, commonly known as the Australian Silky Oak or White Oak, is the largest species in its genus. This tree is endemic to the eastern coast of Australia and, therefore, tolerates dry subtropical and tropical climates. Grevillea is a rapidly growing high (18-35 m) evergreen tree with elegant dark green large leaves (15-30 cm), resembling the branches of fern. Its flowers are of a golden-orange color and are shaped like flowers of horsetail, reaching a length of 15 cm (Harwood 1989). Flowers of Grevillea are popular among beekeepers because of their nectar which enables them to obtain delicious honey. Grevillea is ubiquitous in Australia and is widely used as an ornamental plant and as a raw material for industrial needs. Before the advent of plastic glass, most of the window frames on the continent were made of silky oak wood because it is resistant to decay. Besides, most furniture was made of it. Currently, wild landings of silky oak are protected by law, as after the arrival of Europeans that the tree was felled for permanent human needs (ClimateWatch 2012). That is why studying plant is of vital importance. We can increase the number of Grevilleas in the world if we study thoroughly how Silky Oak responds to climate change.

This research aims at demonstrating how Silky Oak responds to seasonal changes such as temperature increases or decreases, rainfall patterns, or changes in day length. This information will be presented in our table and analyzed. The selected methodology will enable the researcher to find out how similar species time their breeding, flowering, or migration. These data will allow us to form an expectation about Silky Oak.

## 2. Materials and Methods

In this research, the following methods are used: observation, description, and the experiment. The key part of the research was an experiment, where the

researcher observed the *Grivellea* in the Botanic Garden from 2009.10.13 till 2013.03.08.

The first part of the research work was done as a background observation of the literature on this topic. Here, the qualitative approach was used. In other words, one of the most common research methods, review of academic literature, was used in order to generate enough information and provide a description of the Silky Oak. The researcher used different data from numerous sources located through a library guide for the Journal Project (link on the LMS), articles on each species, some information from older books and journals, research theses, and web sites. All these sources helped the author to interpret the results of the observation.

Another part of the research is the research experiment. Before the experiment, a hypothesis was formulated, and, on its basis, the experiment was designed, and done. The results were interpreted accordingly. The experiment was analyzed using quantitative methods. The researchers used the data obtained in a result of a four year long observation of the growing patterns and behavior of the Silky Oak. The data concerning the location, season changes such as temperature and moisture level, flowering, and growth was gathered and analyzed for the purposes of providing a complete understanding on how species are responding to climate change. In this qualitative research, data is categorized into patterns as the primary basis for organizing and reporting results. It relies on the foregoing methods to gather information as observation, reflexive journals, and analysis of documents and materials.

Additionally, this research involves making a table with results and a map. The data analyzed has covered the following issues:

1. The location;
2. Botanical description;
3. Temperatures – summer, winter;

4. Lightening;
5. Humidity;
6. Reproduction;
7. Transplantation;
8. Feeding;
9. Cropping;
10. Pests and diseases;
11. Control.

## 3. Description Part

### 3.1. General description

Grevillea is a genus of evergreen shrubs or trees of the Proteaceae family. There exist about 250 species of this plant, mostly in East and West Australia, and Tasmania, and on the island of New Guinea, Sulawesi. The plant grows in subtropical evergreen sclerophyllous forests, scrub, and sandy wastelands. Also, the Silky Oak is grown in gardens and parks of the southern hemisphere; several species are cultivated in southern Europe (in open field), in California, and Hawaii. The two species of Grevillea are majorly used for planting.

Grevillea robusta is also known as the Silk Oak. It is known to be the largest tree of the genus (up to 30 meters) that grows in the humid subtropical forests of Australia. At some instances, Grevillea robusta may reach the height of 40 meters and a diameter of 2 meters. (Elliot, Jones & Blake 1990)

In Australia and other countries, the plant has many local names and synonyms - Grevillea, Grevillea powerful, River Oak, Australian Silky Oak, Silk Oak, Silky Oak, Southern Silky Oak, Northern Silky Oak, Silver Oak, Southern silky-oak, Silky-Oak, Grevillea, Lacewood, Kawilia, Grevilea, Grevilaire, Helecho, Pinot Rojo, Roble de pelota, Roble de Sede, Roble redoso, and Oak Fishtail.



Grevillea is one of the first colonizers of disturbed areas. It is widely used for soil remediation of disturbed areas since it provides a generous amount of leaf mulch which can be accumulated to a depth of 30-40 cm. This layer protects the soil and keeps the temperature of the soil. The leaves and branches are rich in elements belonging to the aluminum (copper, magnesium, manganese, silicon, and zinc). The majestic height of the tree, its attractive shape, and beautiful foliage make Grevillea a perfect tree for landscaping private and public areas.

### 3.2. Botanical description

*Grevillea robusta* is a tree with bisexual flowers in hands and fruits, whose leaflets contain 1 or 2 flat seeds. In Hawaii, it blooms from March to October, with the peak bloom in June. The tree begins to bloom at the age of 10 years. Before flowering, *Grevillea* partially sheds its leaves. Beautiful yellow and orange flowers appear on its long racemes (8-18 cm); they are gathered in panicles (Boland et. al. 2006).

The Silky Oak has an interesting means of pollination. The top of the column (in the bud) is flattened and extended in the form of direct, oblique, or lateral disc-centered stigma in the shape of a small bulge. Anthers open in the bud, and the pollen deposits on top of the disk-column, including the area of the snout. At this stage, men are quite receptive to it. For some time, discoid tip column remains clamped at the top of the pop-yet fully perianth (Dorthe Jøker 2000).

In some Proteaceae, for example, in the *Proteus* genus, the disc is not released before the pollinator touches this part of the flower. Yet, at the slightest touch, this amazing mechanism gets immediately triggered. At once column acts as a spring bending, and a CD with the power pulls from the embrace of the perianth and spreads pollen accumulated on it, showering the body of a pollinator. This twofold mechanism releases pollen disc and protects from the vagaries of the

outside world, and its sudden release facilitates dispersal of pollen. (Elliot, Jones & Blake 1990)

After the liberation of the disc, a female stage begins - a tiny finger in the center of the disc increases in size and becomes ready to accept pollen brought from other flower pollinators. Pollinating agents include bees, birds, and arboreal marsupials that collect nectar and pollen from flowers. The period from fertilization to ripening fruit is about 2 months. Rounded fruits, 20 mm in diameter, are slightly flattened and bent (boat-shaped). Ripe dark-brown (black) fruit opens late in autumn; at this time, 1 or 2 seeds (10-13 mm long) crash outside. The fruit is hanging on the tree (up to 1 year). The seeds are about 10 mm long; they are flattened and have lionfish which ensures their expansion (Elliot, Jones & Blake 1990).

Silky Oak well propagates both with the help of seed (seed) or vegetatively (cuttings, shoots from the stump). Pre-treatment of seeds is not required. The optimal temperature for germination is 25 degrees Celsius. Germination rate is 20-28 days. Hermetically isolated in air-dry medium vigor, seeds remain there for two years (Dorthe Jøker 2000).

## 4. Results and Discussion

The plants that were under observation are located near a natural water source, near a road, in Botanic Garden. Typically, these evergreen trees are 20-30 meters high; in our case, they are about 22 meters in height. The trees that are grown in the streets have silvery green and fern-like leaves. They are of green color on the upper surface and something paler underneath. They are rather long (10-34 cm) and wide (9-15 cm). Leaves consist of 11 – 31 segments that can be either narrow-elliptic or triangular in shape. These segments are 1.5–5 cm long and 2-10 mm wide, which gives the leaf an extremely divided appearance.

The leaves of the Silky Oak, which is grown at home or in Botanic Garden, are bipinnate, lobed (resemble fern branch), and are 15-30 cm in length. The upper surface of leaves is shiny, bald, and dark green in color; at the bottom, the leaves have silky white-grayish fluff. Because of a gentle presence of pubescence on the underside of the leaves, the tree is also known as "Silk Oak." Its bark is dark grey or dark brown; it is fissured. It grows quickly and is capable of withstanding severe droughts. Silky oaks can be planted in wastelands. They are honey plants.

Flowers of the Silky Oak are golden yellow or orange. They are about 2 cm long and are arranged in pairs along the flowering stalk that gives an overall length of 12 – 15 cm. Fruit/seeds are presented as a dark-brown, oval, and smooth seed pods, each being 2 cm in length.

We expected plants to start shooting and flowering much earlier this year, owing to climate warming outcomes on the Earth. However, the period of flowering had been stable for some years. It was fixed to take place during summer months (here in Australia, the period of flowering was in October-November). September through to January is a fruitful period for the researchers as flowers appear in spring (generally from September to November); in cooler areas, this may come a bit later. As to mature seed pods, the period of their appearance is December and January.

There is a hypothesis that the Silky Oak “may also start appearing in new areas, as warmer temperatures enable them to live in environments that were previously too cold for them” (Boland et. al.2006).

We investigated that the ordinal optimal temperature for this plant is 18-2 degrees in summer and 8-12 in winter. Besides, these plants need special lighting: direct sunlight and bright diffuse penumbra. If it is linked with decorative plants, the environment must be from light to half-shaded; it is also

recommended to move the plant into the air, yet it must be protected from direct sunlight in the afternoon.

In the Botanic Garden, the tree is watered, and near the water source, the necessary level of moisture is reached naturally. Watering of a young tree and a home plant should undergo such rules:

- Abundant from spring to autumn - the soil should be slightly moist at all times.
- Winter watering is moderate, and its frequency depends on the temperature.
- Grevillea do not tolerate waterlogged substrate.
- Humidity: likes very moist air, so the leaves are regularly sprayed.

During the growing period, Grevillea is watered regularly and moderately, avoiding drying earthen coma. Lack of moisture (even a single drying earthen coma) or long hours of stagnant water in the pot can damage young shoots and roots and cause the death of the plant. That is why when watering the plant, it is necessary to consider the temperature of the room, the season, and the state of the plant. In winter, watering should be reduced, depending on the air temperature. Spraying in the heat in summer is useful, especially the increased humidity is required: dry air Grevillea tolerated well (Boland et. al. 2006).

A few words need to be said about Grevillea's cultivation. When the plant is young, the Silky Oak can be grown as a houseplant. In this case, the tree can tolerate light shade; however, it prefers full sun. If planted outside, it is necessary to protect young trees on frosty nights. They tolerate temperatures down to  $-8^{\circ}\text{C}$  ( $18^{\circ}\text{F}$ ). In the street, the tree needs occasional water since it is fairly drought-resistant.

Transplantation can be done every spring. The pot should not be too deep. The soil must be acidic. A mixture of 1 part leaf soil, 2 parts softwood, 1 part peat,

and 1/2 parts sand. Good drainage is required. From March to August, it should be fed with the fertilizer for house plants every two weeks. It needs no cropping.

During our experiment, we had a chance to get know more about pests and diseases of the Silky Oak. The first enemies are spider mites. If the air in the room is too dry, especially in winter, the plant may be affected with mites. The leaves lose some color and get covered with silver-grey grid punctures. The buds are not disclosed; they twist and fall. Pests are very difficult to see: they affect the dimensions within 1mm, but between the leaves of the stems, the practitioner was able to spot a thin cobweb.

It is recommended that in cases like this, a special control is organized, which will include:

- Spraying with acaricides - special preparations to control mites
- Use of neoron, aktellik, and Agravertin.
- Maintaining a high level of humidity in the room.

Observation of the plant allowed making a conclusion that the Silky Oak, which is often referred to as Grenvillea, is not the best option for indoor cultivation. This is explained by the fact that it is a plant that requires a cool winter and humid air. If one does not meet these conditions, its leaves turn yellow, and it gets quickly affected by pests. Secondly, because of people's inability to provide the ideal conditions for Grenvillea, the plant hardly ever blooms indoors.

It is recommended that specific measures be taken in order to make the plant grow:

1. Natural climate should be provided (the Silky Oak's habitual area is Australia).
2. Acidic soil is suitable and may be used.
3. The weed competition should be controlled so that it is not severe.

## 5. Conclusion

The author analyzed the results of the observation and has come to a conclusion that under these circumstances, the annual height and diameter of our plants incremented of at least 2 m and 2 cm.

In the Botanic Garden, the annual height increment reached 3 meters, which can be explained by the positive effect of carefully organized management.

It was found that the Silky Oak was attacked by fungal diseases, such as *Corticium salmonicolor* that caused considerable damage to stems and leaves.

*Grevillea* grows well in Australian climate and soil. However, this kind of tree may well be planted in African and Asian countries, for its exotic wood. In order to make a silky oak grow in unnatural conditions, a series of measures to prepare the ground and provide light and temperature regime are carried out. In our case, all samples were in normal condition and habitat. Growing in the Botanic Garden, the tree under observation even improved. The processes of flowering plants take place almost simultaneously, and where the temperature control gets maintained according to standards - a little earlier.

Plant growth is quite intense, especially near natural water sources, due to a moderate amount of moisture in the soil. We have also noticed that when the weather was too wet, the trees were not flowering, leaves were dark rich green with some light green patches having formed on 60% of the leaves. It was recorded that small orange buds began to form on several sub-branches. The bottoms of leaves were grey and not waxy.

We also investigated some desirable features in the Silky Oak. It tolerates soils that are badly drained, for example, clay, as well as tolerates toxicity in the soil, as discovered by the researcher in the Botanic Garden.

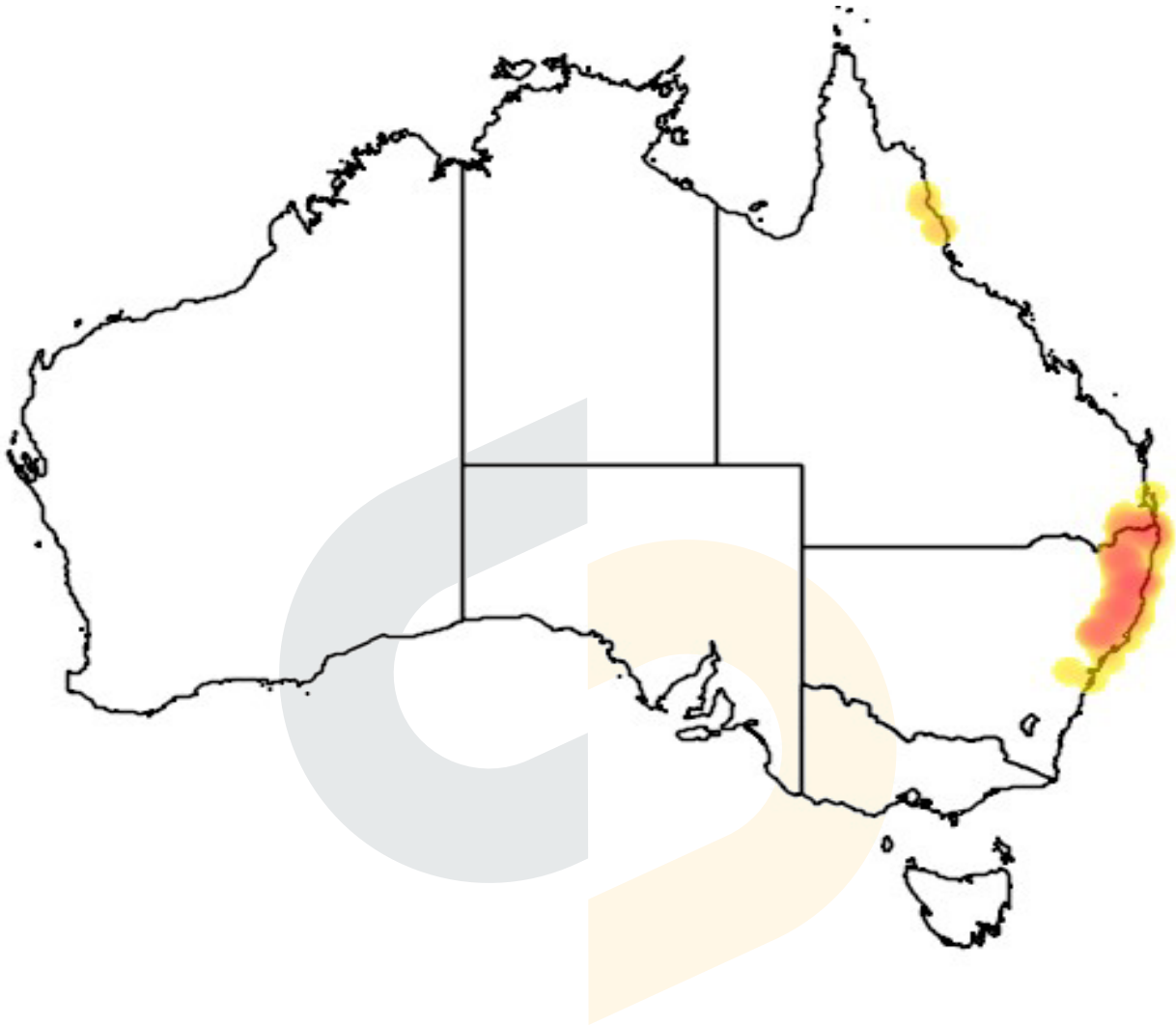


We can also underline that Grevillea, or the Silky Oak, is one of the most adaptable Grevilleas in the context of the Australian areas. It grows naturally in the sub tropics in rainforest soils and near natural water sources such as rivers and streams. Moreover, as it has been found, it can adapt rather well to the much cooler climates of the southern Australia. All these investigations make us think that the Silky Oak is drought- and frost-tolerant and very adaptable.

Our research also confirms that the Silky Oak is a semi deciduous tree which may grow in rather cold areas. It was also found that some of these trees, if planted in cold conditions, look as if they were growing during the warmer months. For example, the Silky Oaks that were observed in Melbourne lost their leaves on the upper branches. Evidently, these trees grow best in hot and dry climate conditions. This can be proved by the fact that trees in central Victoria feel much better. Summers there are a lot hotter and drier than in Melbourne. So, when the temperature and moisture are sustained by the nature, the tree grows much better. The author noticed some Silky Oaks in the streets. They were growing under the same conditions as the Silky Oaks in the garden. However, they were a real mixed bag. Some trees were doing fine while others had defoliated branches that looked quite ugly. Based on the background literature review, the author can explain this phenomenon by the fact that all these trees had grown from seeds. Interestingly, in some cases, the trees grew stronger and more tolerant towards frost or other weather conditions.

# Appendix 1

## The location of Silky Oak in Australia



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