BEST: International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS)
ISSN (P): 2348–0521, ISSN (E): 2454–4728
Vol. 8, Issue 06, Jun 2020, 1-8

SILVI CULTURAL PRACTICES AND ECONOMIC ASPECTS OF SHRUBBY TREE – PRO TEA

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ABSTRACT

The core objectives of the study was to conduct silvi cultural practices and field based observation of the shrubby tree protea, to attest the effectiveness of growing in green house condition for transplantation and evaluate the economic and environmental aspects. The methods used for the study was collection of seeds from healthy plants, drying, sewing in pots with soils mixed up with sands and ashes and growing in green house, nurturing and caring for seedlings for propagation of protea trees. Additionally, field based observations of thee co-geographical distribution and ecosystems of the natural conditions favoring the growth of protea were made using climatic climax on altitudinal vegetation cover of contours and differences of composition of landscapes.

As a result, the eco-geographical distribution of the shrubby trees Protea was within the altitudinal ranges of 1000 to 3170 meters that rarely extended distribution to more or less altitudes in respect to species varieties. Protea seeds ensured 91.66% of germination ratio to sown seeds and seeds were germinated within the average period of 22 days in a greenhouse conditions. Protea trees could be grown, cultured and propagated even in areas unfavorable for crops, useful ecosystem stability and economically helpful that the flowers are sold on market.

KEYWORDS: Florescent, Germination, Seedling, Greenhouse & Silvi Culture

1. INTRODUCTION

Protea is a shrub by tree, with evergreen leaves that vary greatly in sizes, shapes and margins. The shrubby tree Protea is both scientific and English name of a flowering plant, commonly called sugar bushes. Legendarily, protea plants were to convey love, sympathy, joy and best wishes to family, very close or intimate friends.

According to Simon and Schuster (1988), the family name **Proteaceae** as well as the genus protea was derived from the name of the Greek god ***Proteus***, a deity that was able to change between many forms so that the same name was given to the plant by C. Linnaeus in 1735 to serve as scientific nomenclature. This name displays appropriate image for the protea plant, known by its surprising variety and diversity of flowers and leaves that changes forms variously, so that the plant was designated to bear the same name with the god Proteus. Weston, et. al. (2006) stated that "the ancestors of the family Proteaceae to which the genus Protea belongs grew 300 million years ago, in the Gondwanaland, and divided into two subfamilies found in Africa, Australia, parts of East Asia (smaller segments)and South America, that was thought to have well diversified species".

Most of the Pro tea plants occur in belt of mountainous and Savannah woodlands of African countries (Ethiopia, Eritrea, Central Africa and South African).The genus Protea is thought to have achieved its present distribution, largely by

the continental drift rather than dispersal across ocean gaps (Weston and Crisp, 1996).The richness and diversity of the floristic species of protea is thought to be caused by the diverse of landscape, where, populations can become isolated from each other through evolutionary changes in time and developed into separate species. Beard (1993) described that protea belongs to the family of Proteaceae is a well-known flowering plant comprising of about 1600 species in 80 genera including of the popular cut flowers king pro tea termed as *Pro tea cynaroides*. According to the National Herbarium of Ethiopia (2000), the protea plant occurring in west Ethiopia (Oromia) ecosystems are mostly the species of *Proteagaguedi* that are closely allied to *proteawelwitschii* and both species have dense pubescent bracts and conspicuously villous limbs and claws. The subject of the research on protea plants dealt with the objective of conducting a systematic study of the species through silvicultural practices for further conservation to save the plants from disappearance and benefit prospective economic and ecological aspects.

2. MATERIALS AND METHODS

The study was conducted in West (Oromia) Ethiopian ecosystems and Addis Ababa University Green House Center for Flora. The methods employed were field survey in different sites, using three major stations of ecosystems and silvicultural practices (growing) the seedlings in green houses.

The field based survey (surveillance) method was employed, using systematic study at various landscapes to investigate the eco-geographical distribution, basic physical characteristics and ecosystems that influence or favor protea plants, naturally.

Three stations of observations of protea 1) Dhidhessa River basin, 2) Mendi and 3) Welel Mountain were selected, and systematic studies were made at various landscape ecosystems including the eco-geographical distribution of the plants, following contour belts on altitudinal differences vertically and landscapes ranges horizontally across River basins, Mountains, lowlands, including the border line of Gambella and the Sudan.

2.1 Field based Survey Methods

2.1.1 Dhidhessa River Basin Station

The Dhidhessa River basin was the first site (station) to assess and take survey notes on the floristic composition. The scenario composes mostly of savannah vegetation, in which protea shrubby tree plants vigorously spread or scattered and seen growing well between the altitudinal ranges of 1000 to 1650 meters above sea level within thickets, bushes, elephant grasses and shrubby woodlands at various landscapes. Protea of these areas grow within various types of woodlands, often on granite, sometimes on crystal soils extending their distributions to higher altitudes of 1830 meter or above. They are structurally smaller shrubby-trees reaching 3 to 7 meters of height that commonly occur in scattered wooded grasslands, typically on rocky ridges and stony red soils. Leaves are leathery, hairless and similar with the rest plants in color or shapes.

The flower heads are stereotypically solitary, or sometimes in clusters with the involucres bracts of a pale red, white or cream color with a densely hairy nut fruit and variable. It tends to be larger in most of its parts, glabrescent and other observed protea have conspicuous brownish hairs persisting on the mature leaves, usually a small tree with leaveso blong to elliptic, often distinctly sickle-shaped, glabrous, light green to blue-green with yellowish midrib and prominent to confirm of being the species of *Protea gaguedi*(Figure1) that have leaves up to 2.8 cm broad, 5 to 9 cm long and tapering to a narrow base. Flower heads are variable, densely hairy, white to pink-tinged, strongly scented; involucres bracts pale

green with silvery hairs, with or without a rusty margins and fruits are hairy to float in the air and fly through wind.

The stems of some protea plants are black, dense and fissured bark in resisting wild fire and capable to re-vegetate conditionally after the wild fire.

Bloom heads are commonly 6 to 12 cm in diameter excluding exerted styles, sometimes recorded as having an unpleasant smell.

Middle bracts are rounded, torments all over or the margins sometimes glabrous, the hairs usually silver or white often grey towards the centre and brown towards margins. Flowers (inflorescence) are 4 to 6 cm long, creamy-white, occasionally with a pinkish tip, glabrous base to brown villous outside with short whitish pubescence at the junction with claw inside, thinly brown villous outside and densely brown villous.

Figure 1: Bloom of *protea gaguedi.*

Photo by Sutuma Edessa (2013)

The Dhidhessa River valley protea flowers carried at the end of leafy twigs, usually single but up to 4 heads may be grouped at the tip, egg-shaped, broad and shallow when fully open, 4 to 8cm in diameter and the base is broad convex to flat. Most species observed are upright shrub to small tree 3 to 10m in height with a definite main stem, crown uneven and spreading and bark black to dark brown with netlike fissures when mature.

Many species of lowland protea have strategies for surviving wild fires and re-sprout by means of thick rootstocks buried in the ground that shoot up new stems. If adult plants are killed by the wild fire, they disperse seeds promptly, stimulated by the chemicals in the smoke to take root and grow whereas others re-seed naturally. However, this character is not constantly correlated with distribution or habitat and taxonomic separation.

2.1.2 Mendi Station

Mendi town and its surrounding was the second station of the field survey to observe the protea stand, found at about 5 Kilo meter east. The stand was growing on stony red soils, spread out with oblong leaves to elliptic, often distinctly lanceolate, glabrous, light green to blue-green with the midrib and prominent at the altitude of 1400 meters.

Flowering heads are variable, densely hairy and white to pink-tinged, strongly scented involucres, bracts and pale green with silvery hairs or without rusty margins (Figure 2) and resembles *protea caffra*.

Figure 2: Protea sp.
Photo by Sutuma Edessa (2013)

2.1.3 Mount Welel Station

Mount Welel was the third station for survey, in which taxonomically unidentified protea species was found at the altitude of 3170meterson the summit of the Mountain ecosystems. The plant (figure 3a) found on the summit was completely different from the other species recorded in the study area.

The tree was about 8-10 meters in height exhibiting large canopy cover, stunted hard stem and thick bark to resists low temperatures.

Protea was densely branched with silvery color leaves, fleshy stiff texture, stretched shapes growing on limestone soils containing humus and loamy substrate of ragged rocky terrains of low temperature and resembles *Protea abyssinica,*

Figure 3a: Protea sp
Photo by Sutuma Edessa (2013).

2.2 Silvicultural Practice Methods

The Silivicultural practice methods was conducted using collection of seeds, sewing in three in green houses, culturing and

nurturing the seedlings for transplantation and propagations of protea. Accordingly, this was employed through collections of healthy seeds from the selected healthy protea found in west Ethiopian (Oromia) ecosystems wild during the field based observation, brought, dried and sawn in green houses. Hence, the silvicultural practice methods of protea dealt with the process of collecting seeds from selected tree through which 20 dried and soaked in water seeds were sown in three potson soils mixed with sands, compost and some ash in small rows in a greenhouse of the Addis Ababa University. All required conditions for the process of germination were provided so that the time taken for germination of protea seeds in three pots put greenhouses was 22 days on average (table 1).Consequently, protea seeds had ensured 91.66% of germination ratio to sown seeds, showing the highest capacity of germination although it depends up on each species that also varies from species to species depending up on temperature, altitude, and soils composition and bioclimatic conditions.

Table 1 Silvi Cultural Practice of Pro Tea plants in Green Houses

Pots	Number of sown seeds	Number Germinated of Seeds	Ratio of Germination to sown Seeds
1	20	20	100%
2	20	18	90%
3	20	17	85%
Total	**60**	**55**	**91.66%**

Protea seedlings reached a height of 10cm in the first six months, and kept to grow until for a year in the green house pots. Accordingly, a year old seedling (figure 3b), 38 cm in height with more leaves and increased stem size is taken as an example from among the three pots, which could be transplanted promptly, but better wait until the maturity period of 2 years.

In view of this, the silvicultural practice method in nurturing and producing protea seedlings for transplanting the seedlings using proper reproduction and propagation process was successful. Transplanting protea seedlings to the open natural ecosystems plays the roles ecological stability, conservation and possibly income generations from the sales of cuts of the flowers.

Figure 3b: A year old pro tea seedling
Photo by Sutuma Edessa (2013).

3. RESULTS

Protea shrubby trees of the study site were found to grow in unusual altitudinal ranges between 1000and 3170 meters

above sea levels, whereas some species could extend distributions to more or less altitudes. Protea are hardy perennial shrubby trees that survive low temperatures of -5 degrees Celsius and some species of savannah woodlands resist and survive high temperature of wildfire, even after the barks were burned that re-vegetate the damage.

In silvicultural practices, protea seeds ensured 91.66% of germination ratio to sown seeds, germinated in greenhouse conditions within 22 days on average, well grown and reached for transplantation at the age of one year. The growth of protea plant is variable and blooming takes place after 6 years, when branches are pruned to stimulate the flowering shoots.

4. DISCUSSIONS

Most of the species of protea found in the western parts of the country are Protea gaguedi or Protea abyssinica, whose species are popularly distributed in tropical Africa including Ethiopia, Kenya, Tanzania, Uganda, Burundi, Rwanda, Angola, Malawi Mozambique, Zambia, Zimbabwe as well as in Botswana, Namibia, South Africa and Swaziland (*https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?id=29800and accessed 1 July 2018).*

With the availability of cheaper, larger parcels of land, farming Protea have gained in popularity (Samuel Bayaoa, 2008).Caring for protea cultivars mostly require watering and protections likewise other flowers. The future of protea growing is very exciting for aspirations as well as for economic aspects. The number of growers of proteacultivars is now a day increasing from time to time in many African, American and Asian countries including Oceania to correspond to the market demands. Lawrence Kellar (2008)reported on protea cultivars of USA (California) that the number of growers is estimated over 125 and estimated of protea planted acres are 1200- 1500. Income figures estimated at $8 million dollars. Wax Flower production estimated at 750 acres with income figures of $6.8 million dollars. The markets and marketing of protea shows that the U.S and Canada absorb 95% with 5% overseas. Wholesalers are still the primary source for our flowers and the mass-market bouquet makers, which supply the supermarkets, are starting to use more protea material each year in their designs and have become major players

5. CONCLUSIONS

Many of the lowland species of the genus protea have specialized roots in which masses of lateral roots are hairs forming and a radial absorptive surface produces in the leaf litter layer during seasonal growth and shriveling at the end of the growth season. Protea plants prefer poor, quartic and acidic soils, but equally grow on a wide variety of well-drained soils and even found growing on alkaline dolomite soils. They are adaptive to grow in poor, phosphorus-deficient soils, greatly increasing the plants' access to scarce water and nutrients by exuding carboxylates that mobilize previously unavailable phosphorus. They increase surface absorptions of roots, competition for nutrients against its own root clusters and do not form symbioses.

In general, protea are large bushes growing to tree size high or rarely a shrub or even less, young branches are densely pubescent, but glabrescent, brown, flaking slowly to expose a rusty-brown cortex (Figure 3). Leave sizes are 10 to 18 cm broad and 3to 4cm long, narrowly tapering from above to the middle oblanceolate to linear, rounded base, sub-acute at the apex, pubescent when young, but rapidly glabrescent and glabrous at maturity. Some leaves are line are llipticto linear falcate, narrow to broadly elliptic or narrow to broadly invert lanceolate, occasionally falcate, tips blunt to acuminate; smooth, leathery to thin and papery, light green, have a tendency to clump in each year's growth.

In general,

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