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Is *Faurea rochetiana* a potential candidate for Dendroclimate studies? Wood samples from semi-arid woodlands of southern Ethiopia

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Sustainable management of economically and ecologically important tree species such as *Faurea rochetiana* merely depend on acquiring reliable information on growth dynamics and structure in response to the changing climate. Formation of the growth ring boundaries is pre-requisite for conducting several denroclimatology studies. Hence, the objective was to verify the formation of growth ring boundaries of *F. rochetiana.* Fifteen sample discs were examined for macroscopic and microscopic wood anatomy features and compared with IAWA list of microscopic features of hardwood identification for wood anatomy characterization. The result revealed that the studied tree had indistinct growth ring boundaries. Consequently, the studied tree is not a potential candidate for further denderoclimate studies.

Key words: Wood anatomy, growth ring, South Omo, *Faurea rochetiana.*

INTRODUCTION

Ethiopian dry forests are habitats for many endemic plants and animal species which has a varied ecological, social and economic importance (Lemenih and Bongers, 2011, Worku et al., 2011). Despite, these forest resources are being highly destroyed due to agricultural expansion, human-made fire and illegal harvest of woods, over grazing and climate change related threats (Atmadja et al., 2019, Lemenih and Kassa, 2011). For instance climate change has a considerable effects on includes growth rates and dynamics of many plant community, composition, and distribution of plant populations (Siyum, 2020). Moreover, human induced activities such as free grazing and fire can also cause recruitment failure and emerged seedlings suppression (Tolera, 2013; Tsegaye et al., 2009). As a result several measures have begun to restore the degraded forest land of the country Lemenih and Kassa (2014) through sustaining the remnant forest and planting of ecologically and economically important tree species such as *Faurea rochetiana.* Side-by-side conserving and adopting regulated use of the existing forest with appropriate silvicultural practices such as: planned logging, maintaining the health and quality etc. are urged critical (Lemenih and Bongers, 2011). Despite, for devising successful strategies for these forest resources, acquiring reliable data on for instance growth rates, population structure and, the climate-growth relationship is important (Rozendaal and Zuidema, 2011; Worbes et al., 2003).

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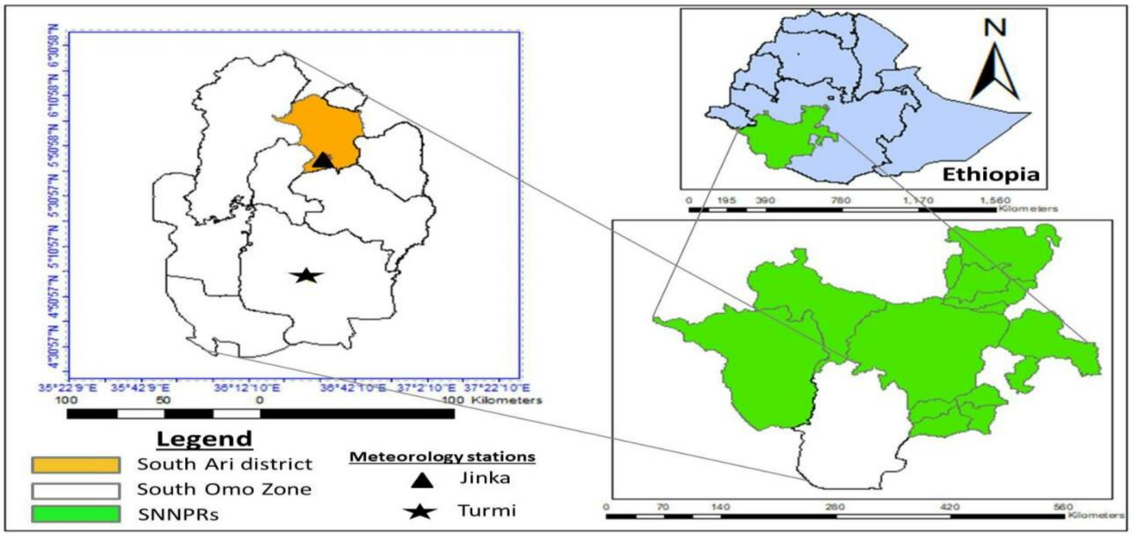

Figure 1. Location of the study area.

Despite, annual growth ring boundaries is a pre-requisite, tree rings can generate reliable data and useful information that helps to sustainably manage forest resources (Gebrekirstos et al., 2008). Thus, a study was conducted to verify whether *F. rochetiana* form annual growth ring boundaries. The objective of this study is to characterize the macroscopic and microscopic wood anatomic features of *F. rochetiana*, so that it is potential for further dendroclimate studies can be checked out?

METHODOLOGY

The study species

F. rochetiana is a tree which belongs to the family Proteacea, it is an untidy small tree up to 8 m in height (Orwa et al., 2009; Raynes, 2007). *F. rochetiana* well known in the study area with the local name called "Qelshi" (local language-Arigna). It is distributed in the scattered fashion along the stream banks of the south-western periphery of the Kure natural forest. The wood is hard and durable for making different farm implements, furniture and house construction (Raynes, 2007). The charcoal and firewood from this tree are highly preferred by the surrounding community due to high calorific potential. Consequently, the tree population has been declined drastically during the last three-to-four decades.

Description of the study area

Sample discs were sampled from Kure secondary forest which laid with elevation ranges of 850-1200 masl. The forest located in *Combretum- Terminalia* woodlands of South Omo Zone, South-western Ethiopia (Figure 1). The study site has a bi-modal rainfall pattern with a shorter rainy season from March-May and longest rainy season from August-November. Twenty years (1996- 2015) of climate data is acquired from Jinka meteorology station. The total annual rainfall recorded was 272.4± 250.7 mm, while the annual mean minimum and maximum temperatures was 16.3± 0.9°C and 27.7± 1.4°C.

Sampling method and sample collection

The field campaign was conducted between January and February of 2016. Systematic random sampling design was employed to choose representative trees from the forest. Hence, three transect lines laid out every 2000 m interval and 400 m^2 quadrants were established every 1000 m along transects. Stem discs deliver more information than increment cores especially while dealing with the new species (Brienen and Zuidema, 2005). Similarly, for the current study fifteen trees were felled, totally fifteen tem discs (that is, one disc per tree and sample plot) were taken above ground at 30- 50 cm from the ground (Therrell et al., 2007). The transverse surfaces of the stem discs were sanded gradually using sandpaper with grit size of (60-600). This process was found enough to reveal the cellular structure of wood under low magnification (Tolera, 2013). Six Micro-thin sections were prepared from the transversal section using a sliding microtome and stained with a mixture of Safranin-astrablue for anatomical investigation. The anatomical investigation was carried out under a light microscope. Samples were investigated both microscopically and macroscopically to detect which wood anatomic feature is responsible for the possible growth ring boundaries (Verheyden et al., 2004). Comparisons of ring boundary anatomical features were conducted with IAWA list of microscopic features of Hardwood identification (Ruffinatto et al., 2015, IAWA Committee, 1989).

RESULTS AND DISCUSSION

Wood anatomy characteristics of *F. rochetiana*

The cross-section of the studied tree had light brown color with fine texture and it is easily visible with naked eyes. Despite, the color variation has occurred especially for untreated wood samples along with the time (IAWA Committee, 1989). The growth ring boundary of *F. rochetiana* was characterized as indistinct. The vessels are solitary and clustered with a tendency of tangential arrangement. The rays were visible with a simple lens from traverse section and relatively wider with aggregates

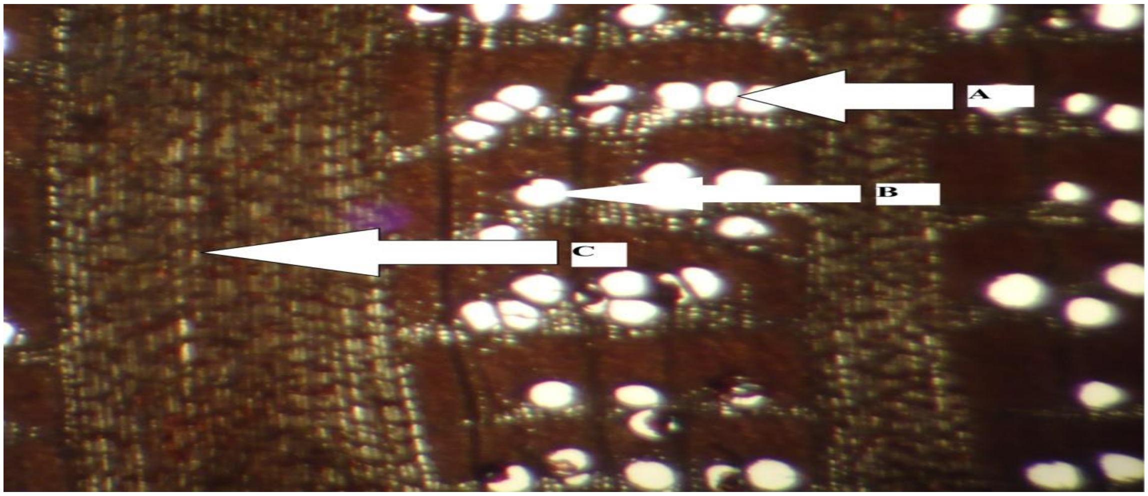

Figure 2. Cross - section of *Faurea rochetiana.* A- Tangential orientations of vessels with the tangential multiple. B- Solitary vessels. C- Radial orientation of rays with an aggregate. The cross-sectional pictured were captured with magnification scales of 20X.

cells. The tree forms multi-seriate axial parenchyma bands sometimes broken or sometimes continuous from ray to ray and it is arranged in arcs perpendicular to the rays (festooned) (Figure 2).

Many genera have similar macroscopic features and hence, easy to establish to which family it likely belongs. Though, more species are distinguished with microscopic features rather than macroscopic ones (IAWA Committee, 1989). Similarly, the present tree shown similar feature with other tree species within the Faurea genus such as *F. discolor*, *F. macnaughtoni*, *F. saligna* and *F. speciosa* (Chattaway, 1948). The observed microscopic features of the current study are showed similarity with the typical characteristics of trees from Proteaceae family.

Conclusion

For successful dendroclimatology studies trees with annual growth ring boundary are desirable. *F. rochetiana* is not a potential candidate for climate-growth relationship studies with annual resolution due to the indistinct growth ring boundaries. However, this study switches further studies that enable the studied tree species used as an environmental proxy through employing different techniques. For instance, Verheyden (2004) had verified *Rhizophora mucronata* as a potential source for investigating environmental changes through characterizing growth rings by considering vessel density in early and late woods.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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