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Air layering of *Lophira lanceolata* Van Tiegh. ex Keay (Ochnaceae) in the Guinean savannah highlands of Adamawa in Cameroon

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Abstract

Lophira lanceolata is a species of socio-economic interest in the Guinean savannah highlands of Adamawa. The objective of this study was to multiply this species by air layering. The work consisted in making a ringing of 6 to 7cm on orthotropic branches so the diameter was between 2.54cm and 5.73cm; then a sleeve was laid. Two types of substrates (black soil-sawdust mixture and sphagnum) were used and half of the sleeves were covered with aluminum foil. The rooting rate of layers varies from 80.92±1.75% in the black soil-sawdust mixture to 82.22±0.65% in sphagnum. Layers covered with aluminum foil showed a success rate of 84.81±0.65% against 78.33±1.39% for layers not covered with aluminum foil. Covering with aluminum foil contributed significantly to the rooting of layers (0.0197 < 0.05). The simplicity and low cost of this multiplication technique could promote its dissemination to rural communities. Air layering is a technique adapted to the local context and can contribute to safeguarding this species while allowing its sustainable use in local agroforestry systems.

Keywords: Acclimatization, Air layering, Domestication, Guinean savannah highlands, *Lophira lanceolata*.

Introduction

The forest formations of the Guinean savannah highlands play an important role in meeting many basic needs of local populations. They provide wood and energy while contributing to the coverage of nutritional needs. They represent the main source of medicinal products in rural areas. However, this reservoir of forest genetic resources is threatened by a series of human and natural factors (clearing, bush fires, overgrazing, agricultural exploitation, drought, etc.) whose effects increasingly restrict the field of possibilities for future generations[1].

Lophira lanceolata has very diversified uses in its area of distribution. The parts used of the plant are: fruits, roots, bark, twigs, flowers and wood[2]. Oilseeds give after extraction a yellowish, odorless and tasteless oil (mene oil), used in cooking in West Africa[3]. This oil was characterized by Lohlum et al. 2010[4]. Edible caterpillars are harvested from its leaves[5]. The roots are used to treat wounds, amenorrhea, sterility, constipation, diarrhoea, jaundice, vomiting. The bark is used to treat kwashiorkor[6]. Phytochemical analyzes of the extract from the leaves of *L. lanceolata* contain several compounds which are carbohydrates, tannins, saponins, terpenoids, steroids, anthraquinones and flavonoids[7]. *L. lanceolata* bark extract is an aphrodisiac[8]. The wood is used in the manufacture of works of art and the production of charcoal in the Guinean savannah highlands. The leaves constitute litter which restores the fertility of the soil. The regeneration of this species in the natural conditions of the Guinean savannah highlands is negatively influenced by bush fires and animal browsing. Propagation by air layering is an effective and inexpensive method. Plants obtained through air layering have many advantages which are the production of faithful copies of the genotype, early fruiting, low cost and technicality that rural populations can master quickly[9]. The objective of this study is to evaluate the effect of substrate and cover on the rooting of marcots of the species.

Materials and methods

Description of the study site: The investigations were carried out in the Guinean savannah highlands of Bini-Dang (LN: 7°24'; LE: 13°32'; Alt: 1079 m) (Figure-1). The climate is of the Sudano-Guinean type with two seasons including a rainy season from April to October and a dry season from November to March. The monthly average precipitation is 105.75mm, the monthly average temperature is 22.32°C, the monthly relative humidity is 66.95% and the monthly evaporation is 164.47mm. Two main winds blow in the region, notably the monsoon during the rainy season from the south and the harmattan from the north, which is responsible for the drought. The vegetation is diverse. It is composed, among other things, of meadows, grassy savannahs, shrubby and woody savannahs. This shrubby and/or woody savannah is marked by the predominance of *Daniellia oliveri* and *Lophira lanceolata*. The density of these species has fallen sharply under the influence of various anthropogenic actions. The local population is made up of herders (Bororo and Peulh) and farmers (Mboum, Dii and Gbaya). Agriculture and breeding occupy a prominent place in the region.

Methodology: The laying of the ducts took place at the beginning of the rainy season. Using a sharp knife, rings were made on the chosen orthotropic branches so the diameter was between 2.54 cm and 5.73cm. Girdling the branch consisted of removing the bark over a length of 6 to 7cm[10]. Then the cambium was well scraped and the bast well removed in order to stop the flow of descending elaborate sap. The bead of the substrate is held around the incised area using a transparent polyethylene film and firmly tied at the ends with a string. Half of the sheaths of each substrate were covered with aluminum foil which was well tied at the ends to protect the layer from excessive temperatures in the event of direct sunlight.

Each sheath laid bears the following inscriptions allowing the type of layers to be easily identified: date, name of the species, nature of the substrate and sheath number. The experimental protocol involved two types of substrates (black soil-sawdust mixture in which the sawdust is previously decomposed in the respective proportions of 1/3 and 2/3 and the sphagnum). The trial was monitored monthly and the sleeves were sprayed using a 10ml syringe. The rooted layers were weaned seven months after their production; then transferred to the nursery for acclimatization. Acclimatization consisted of putting them in 12cm X 20cm pots with topsoil and then they were introduced into the rehabilitation propagator for 6 weeks; they were taken out to spend 2 weeks under the propagation shed before being transferred to the fields.

The experimental device used was a split-plot with three repetitions. The experimental unit consists of 30 layers. A total of 360 layers (30 x 3 x 2 x 2) are laid.

The data collected related to the root layers and these data were the subject of variance analyses; the statistical program used was Statgraphic 5.0.

Results and discussion

L. lanceolata has a good aptitude for air layering and the factors studied favored the rooting of layers.

Influence of the substrate on the rooting of layers: *L. lanceolata* was favorable to both studied substrates. The layers were followed for seven months. The first roots were obtained one month after laying the layers. The rooting of layers is increasing until the fifth month for both substrates. In the seventh month, a saturation plateau is observed which has formed. The rooting rate of layers varies from 80.92±1.75% for the black soil-sawdust mixture to 82.22±0.65% for sphagnum (Figure-2). The substrate did not significantly influence layer rooting (0.732 > 0.05). Layers of *L. lanceolata* show a dense root bundle (Figure-3) after seven months of observation.

Effect of the type of exposure on the rooting of layers: The type of layer exposure is variable. The rate of development of root layers increases until the fifth month then follows a saturation plateau until the seventh month (Figure-4). The rooting rate varies from 78.33±1.39% for layers not covered with aluminum foil to 84.81±0.65% for layers covered with aluminum foil. The analysis of variance shows a significant difference (0.0197 < 0.05) for the exposure effect.

Influence of the interaction substrates *type of layer exposure: The rooting rate of layers varies from 77.77±5.09% in layers made with sphagnum moss and not covered with aluminum foil to 86.66±3.33% for those covered with aluminum foil (Table-1). In general, layers covered with aluminum foil have a high rooting rate compared to those made with the black soil-sawdust mixture. Sphagnum has a higher rooting rate than that of the black soil-sawdust mixture. Despite the variability observed, the analysis of variance does not show any significant difference (0.1210 > 0.05).

Table-1: Substrate interaction and type of layer exposure

Treatments	Sphagnum	Black soil-Sawdust mixture	Means
Layers covered with aluminium foil (%)	86.66±3.33	82.96±3.39	84.81±3.36
Layers not covered with aluminium foil (%)	77.77±5.09	78.88±4.90	78.32±4.99
Means	82.21±4.21	80.92±4.14	81.56±4.17

L. lanceolata layers have a dense root network, which is an important asset in their acclimatization (Figure-5). In order to introduce them into the gardens of huts.

Discussion: Air layering is a vegetative propagation technique that makes it possible to produce many plants in a short period of time, while retaining all the genotypic characteristics of the mother plant[11-13]. The production of identical individuals by vegetative means makes it possible to select interesting mother trees for their socio-economic values. The study took place at the start of the rainy season. Many authors show that the period during which the sleeves are laid would have a significant influence on rhizogenesis in certain species[9,11,14-16]. Adventitious roots on *L. lanceolata* layers become visible from the second month. The sleeves are not opened during the layering monitoring period, so as not to disturb rooting. According to Hartmann et al.[17], the rooting process of layers is influenced by endogenous and exogenous factors. The rooting of layers could be explained by the quantity of carbohydrate contained in the tissues of the branches, the physiological state and the age of the tree[16,18]. The layers were weaned nine months after their production period considered sufficient because the adventitious roots were sufficiently developed. The number and quantity of newly formed adventitious roots in the sleeve are decisive for the survival of the future tree[9]. Acclimatization in the rehabilitation propagator is an essential step that prepares young plants to withstand the difficulties they may encounter in the field. This step brings together all the conditions likely to guarantee them a sufficient emission of roots more adapted to the conditions of the weaning substrate.

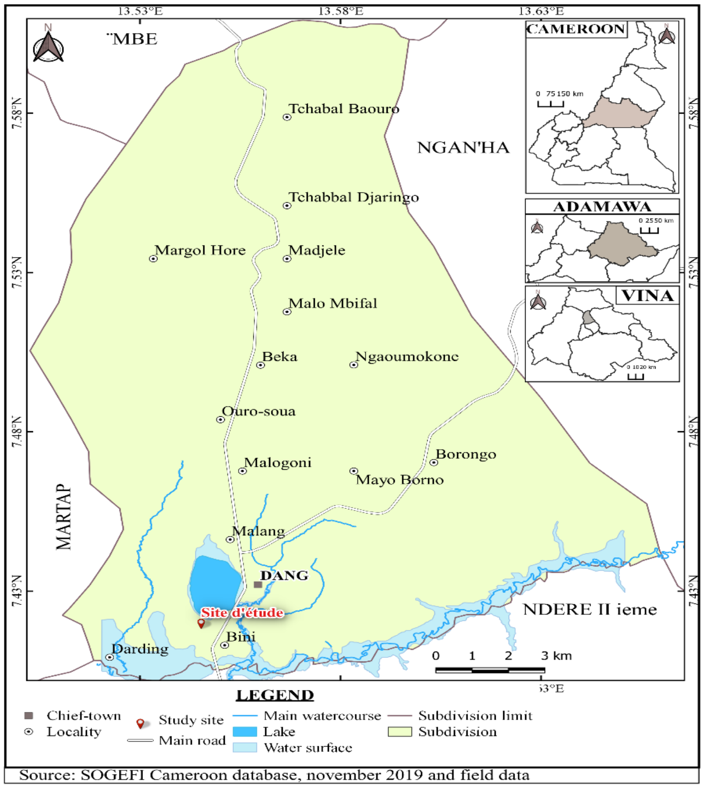

Figure-1: Location map of the study site.

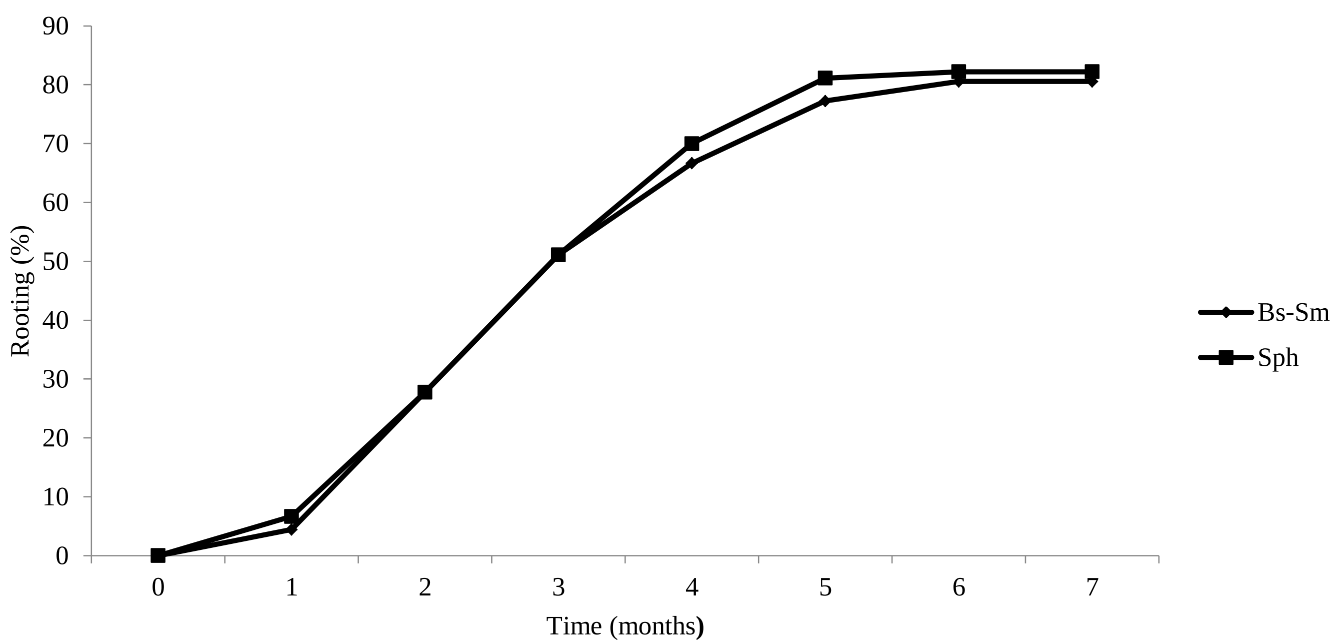

Figure-2: Evolution rate of layer rooting as a function of time. Legend: Bs-Sm: black soil-sawdust mixture; Sph: sphagnum.

Figure-3: Rooted and weaned layer of *Lophira lanceolata* 7 months.

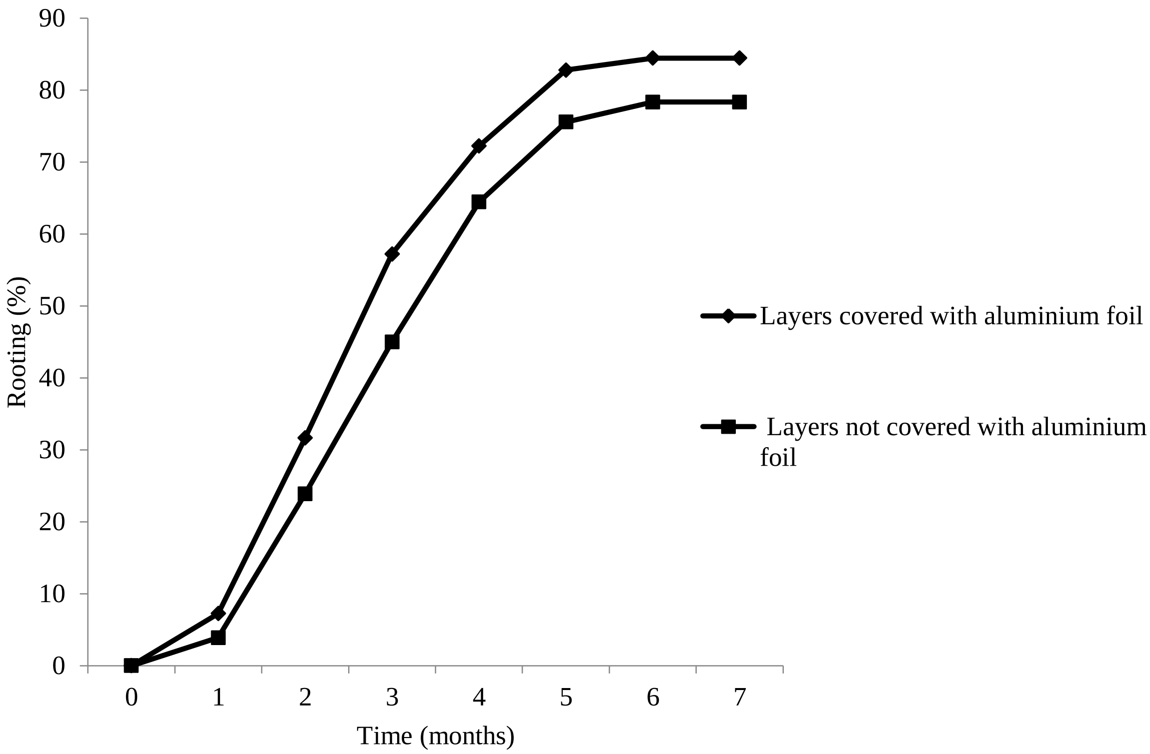

Figure-4: Rate of evolution of layer rooting as a function of time.

(a) **(b)**

Figure-5: Layer after two months of acclimatization (a) and transfer of the layer to the home garden (b).

Conclusion

The vegetative propagation technique developed suggests a real possibility of multiplying *Lophira lanceolata* by allowing conformity of the copies which preserve the genetic characteristics of the trees to be selected. Sphagnum moss showed the highest rooting rate in this species and aluminum foil stimulated rooting rate. This vegetative propagation technique is inexpensive and simple to implement. Its adoption by rural populations would contribute to the domestication and conservation of this species. It would be necessary to carry out additional studies on the position of the sleeve, the diameter of the branches to be layered, the length of the girdling to be carried out.

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