



## Sustainable Harvesting of Bark of *Alstonia Scholaris* (L.) R. Br. And *Crataeva Nurvala* Buch.-Ham.

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**ABSTRACT:** Unsustainable bark harvesting practices can result in severe consequences, ranging from partial damage to the complete mortality of trees. Standardizing species-specific, non-destructive bark harvesting techniques that facilitate bark regrowth and recovery is therefore critical for conserving these valuable non-timber forest resources and safeguarding their long-term viability. A study was carried out to evaluate bark regrowth for deciding sustainable harvesting procedure in *Alstonia scholaris* and *Crataeva nurvala*. Bark regrowth (regeneration) after extraction in partial strips was recorded at six month intervals over a 24 month period. Wound healing was evident in both species one year after harvest. However, in *A. scholaris*, the regenerated bark exhibited marked differences in appearance compared to the unextracted portion. In contrast, *C. nurvala* demonstrated faster regrowth, with complete bark regeneration achieved within 12 months, although the regenerated bark was approximately half the thickness of the original. A similar pattern was observed in *A. scholaris*, where regeneration occurred after 18 months. By the end of the observation period, the regenerated bark showed no discernible differences in thickness or quality compared to the original bark—after two years in *A. scholaris* and 18 months in *C. nurvala*. We recommend strip harvesting of bark (15 cm × 15 cm) from opposite sides of the trunk in alternating years as a sustainable practice for *A. scholaris* and *C. nurvala*.

**KEYWORDS:** Bark, Regrowth, Strip harvesting, Sustainability, Wound

### INTRODUCTION

Tree bark has long been recognized as a valuable source of medicinal compounds, owing to its diverse bioactive properties<sup>[1]</sup>. Consequently, the utilization of bark has become a cornerstone of traditional healthcare practices across many regions of the World<sup>[2]</sup> and<sup>[3]</sup>. However, bark extraction is considerably more damaging than the collection of flowers or fruits, as it often compromises tree survival and regeneration<sup>[4]</sup>. The intensity of harvesting is a critical determinant of impact: even moderate debarking can disrupt physiological processes, rendering bark removal highly injurious and a serious threat to tree survival<sup>[5]</sup> and<sup>[6]</sup>. Thus, the increasing demand for medicinal bark, coupled with its commercialization and the prevalence of destructive harvesting practices, poses a significant threat to forest species with high medicinal value. Many bark harvesters employ destructive techniques such as girdling, removing bark from the entire trunk and upper branches, or even

felling trees solely to obtain bark. These unsustainable bark harvesting practices can result in severe ecological consequences, ranging from partial damage to the complete mortality of trees within relatively short timeframes. The unregulated extraction of bark for medicinal purposes has already led to overexploitation and, in some cases, the local extinction of valuable native species [7] and [8].

Tree species exhibit differing responses to bark stripping, both in their capacity for wound closure and in their vulnerability to insect infestation and fungal infection. Patterns of bark regrowth vary considerably among species, and for certain taxa, regeneration does not occur, ultimately causing plant death [9], [10] and [11]. Within a particular tree species also, bark recovery after the extraction is not uniform, as it can differ from tree to tree. Factors such as tree age, harvesting method, and season of harvest have been shown to strongly affect regeneration dynamics [12]. These variations underscore the need to develop and standardize species-specific harvesting protocols to mitigate overexploitation and ensure the sustainable use of bark as a non-timber forest resource.

*Alstonia scholaris* (L) R. Br. (Family: Apocynaceae), commonly known in India as Saptaparni or the Devil's tree, possesses considerable commercial and medicinal importance, particularly due to its bark, which is a rich source of alkaloids utilized in both traditional and modern medicine. In Ayurveda, Unani, and Siddha systems, the bark is highly valued for its therapeutic applications [13] and has been reported to treat ailments such as malaria, diarrhea, and dysentery [14], [15] and [16]. The species is notably rich in indole alkaloids, with echitamine being of particular interest for its antimicrobial properties and potential as a candidate for cancer chemotherapy. However, the concentration of echitamine primarily in the bole bark presents a significant conservation challenge, as large-scale bark harvesting can cause irreparable damage to the tree [17].

*Crataeva nurvala* Buch.-Ham. (Family: Cappariaceae), commonly known as Varuna, is a well-established medicinal plant in traditional Indian healthcare, particularly valued for its efficacy in treating urolithiasis. Although all plant parts—including roots, stems, bark, leaves, and flowers—possess therapeutic properties [18], the stem bark contains the highest concentrations of the bioactive compound lupeol [19]. Stem bark extracts have been widely incorporated into formulations recommended for the management of kidney stones, prostatic enlargement, and various bladder and urinary disorders [20]. Rising demand, coupled with commercialization, has intensified destructive harvesting practices, resulting in severe damage to wild populations and contributing to substantial genetic erosion.

To ensure the sustainable management of medicinal bark species, the adoption of non-destructive harvesting methods that facilitate bark regrowth and recovery is essential. Standardizing species-specific, non-destructive bark harvesting techniques is therefore critical for conserving these valuable non-timber forest resources and safeguarding their long-term viability. In this context, the present study was carried out to evaluate bark regrowth for deciding sustainable harvesting procedure in *A. scholaris* and *C. nurvala*.

## MATERIALS AND METHODS

For each species, 9 healthy trees (no previous bark harvesting and free from infestation of insects and pests) were selected at Prayagraj, Uttar Pradesh, India (25°32'42.3"N, 81°53'28.3"E, elevation 86.7 m above mean sea level). The age of these trees ranged from 15-20 years. For each individual, bark was partially removed in 15 cm × 15 cm strips, 30 cm apart, from one side of the trunk of trees in November, considered the optimal time for bark collection. To minimize infection risk, strips were taken at least 1 meter above ground level.

Data on bark regrowth (regeneration) were collected at six-month intervals over a 24-month period. The physical characteristics of bark regeneration were documented according to the criteria outlined in Table 1. Regenerative capacity was assessed based on the time required for complete bark regrowth and the

thickness of the regenerated tissue, measured using Digital Vernier Caliper once wound coverage was achieved.

**Table 1- Grading of bark regrowth recording**

Grade	Regeneration status
o	Insignificant
*	Wound covered with marked difference from un extracted part
**	Bark regenerated but less in thickness than un extracted part
***	Complete regeneration with no discernible difference

## RESULTS AND DISCUSSION

Tree bark serves critical physiological and protective functions, shielding trees from desiccation and external attack while facilitating the transport of water and nutrients through phloem tissues. Bark removal imposes substantial internal stress and can lead to either progressive decline or immediate mortality, depending on the extent of harvest. In investigation of bark regeneration in 12 medicinal tree species in Benin, sustainable and complete bark recovery was uncommon <sup>[9]</sup>. Among the species examined, only *Khaya senegalensis* and *Lannea kerstingii* demonstrated a high potential for regeneration. Ring-barking, which entails the complete removal of bark around the tree's circumference, typically results in rapid death. Nonetheless, certain species such as *Quercus suber*, *Eucommia ulmoides* <sup>[21]</sup>, *Prunus africana*, *Warburgia salutaris* and *Ficus natalensis* <sup>[2]</sup> exhibit notable resilience to this practice. These observations highlight the necessity of experimentally evaluating diverse bark harvesting treatments to establish species-specific thresholds and define safe harvest limits.

Nondestructive and sustainable bark harvesting depends on periodic extraction that remains within the recuperative capacity of each tree species under its specific growth environment. In the present study, wound healing was evident in all individuals of both species one year after harvest. However, in *A. scholaris*, the regenerated bark exhibited marked differences in appearance compared to the unextracted portion (Table 2). In contrast, *C. nurvala* demonstrated faster regrowth, with complete bark regeneration achieved within 12 months, although the regenerated bark was approximately half the thickness of the original.

**Table 2: Bark regeneration after extraction in *A. scholaris* and *C. nurvala***

Species	Bark regeneration status			
	6 Months	12 Months	18 Months	24 Months
<i>A. scholaris</i>	o	*	**	***
<i>C. nurvala</i>	o	**	***	***

A similar pattern was observed in *A. scholaris*, where regeneration occurred after 18 months. By the end of the observation period, the regenerated bark showed no discernible differences in thickness or quality compared to the original bark—after two years in *A. scholaris* and 18 months in *C. nurvala* (Fig. 1). These findings corroborate earlier reports of highly species-specific bark regeneration following harvesting <sup>[9]</sup> and <sup>[22]</sup>. Despite the minor differential response in regeneration, partial strip harvesting emerged as a suitable technique for both the species. Strip harvesting leaves a relatively smaller wound for closure allowing quick regeneration through wound closure mechanisms initiated in the plant immediately after extraction. Partial bark strip harvesting, as applied to *Garcinia lucida* in the Atlantic humid forests of southern Cameroon, has

demonstrated considerable promise for informing the development of long-term, sustainable harvesting guidelines [23].



**Fig.1. *A. scholaris*- Bole bark, harvesting process and regenerated bark (left to right)**



**Fig.2. *C. nurvala* - Bole bark, harvesting process and regenerated bark (left to right)**

## CONCLUSION

Based on these findings, we recommend partial strip harvesting of bark (15 cm × 15 cm) from opposite sides of the trunk in alternating years as a sustainable practice for *A. scholaris* and *C. nurvala*. This method produced no apparent adverse effects on tree health or bark regeneration. The systematic stripping approach therefore represents a viable and safe option for future periodic harvesting, ensuring benefits for both tree growers and collectors while maintaining tree integrity and long-term sustainability.

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