BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, NEW DELHI

Original Application No. 1071/2024

AFFIDAVIT ON BEHALF OF RESPONDENT NO. 2

(KSCSTE-Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Kerala)

REGARDING STATUS AND CONSERVATION OF *Strobilanthes kunthiana* (NEELAKURINJI)

DATED: 08.04.2026

I, Dr. Sreekumar Sivanandan, Director (i/c), Jawaharlal Nehru Tropical Botanic Garden & Research Institute (JNTBGRI), Kerala, do hereby solemnly affirm and state as follows:

1. PRELIMINARY SUBMISSION

This affidavit is filed in compliance with the directions of the Hon'ble National Green Tribunal in OA No. 1071/2024. The contents are based on scientific data, field observations, and institutional records.

2. PROFILE OF RESPONDENT NO. 2

Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), functioning under the Kerala State Council for Science, Technology and Environment (KSCSTE), Government of Kerala, is a premier research institution with established expertise in plant taxonomy, phytochemistry, ethnobotany and ethnomedicine, conservation biology, biotechnology and bioinformatics, microbiology, biodiversity conservation, and sustainable resource utilization.

Established in 1979, the Institute has, for over four decades, been actively engaged in the conservation and sustainable utilization of plant genetic resources, with particular emphasis on the Western Ghats, one of the world's recognized biodiversity hotspots.

JNTBGRI is also recognized by the Department of Biotechnology, Government of India, as one of the four National Gene Banks for Medicinal and Aromatic Plants, underscoring its national importance in safeguarding and promoting valuable plant genetic resources.

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3. ECOLOGY AND DISTRIBUTION

Strobilanthes kunthiana (Neelakurinji) is an endemic shrub predominantly restricted to the montane shola–grassland ecosystems of the higher elevations of the Western Ghats, with limited and fragmented occurrences reported from parts of the Eastern Ghats (Amitha Bachan and Devika, 2024). This ecosystem, characterized by a mosaic of evergreen shola forests and interspersed grasslands, provides highly specialized microhabitats essential for the species' survival.

The species typically occurs on open grassland slopes, forest margins, and rocky terrains at altitudes ranging from 1,500 to 2,600 m above mean sea level. Its distribution is highly localized and patchy, reflecting strict habitat specificity and ecological sensitivity. As an endemic taxon with a narrow geographical range, the persistence of *S. kunthiana* is intrinsically dependent on the integrity and continuity of this fragile montane ecosystem, which is increasingly subjected to anthropogenic pressures.

4. CONSERVATION STATUS

Strobilanthes kunthiana (Neelakurinji) has been assessed by the International Union for Conservation of Nature (IUCN) and categorized as "Vulnerable" under Criterion A2c of the Red List of Threatened Species. This status indicates an inferred and continuing population decline primarily due to reduction in the extent and quality of its habitat.

The principal threats include habitat loss from conversion to plantations (e.g., tea and Eucalyptus spp.), habitat degradation from infrastructure expansion and tourism-related activities, invasion by exotic species, and emerging impacts of climate change.

The "Vulnerable" classification highlights the urgent need for targeted in situ and ex situ conservation measures, along with scientifically guided habitat restoration, to prevent further population decline and ensure long-term survival of the species.

5. BIOLOGICAL CHARACTERISTICS

Strobilanthes kunthiana exhibits a 12-year gregarious (mass) flowering cycle, a pleietesial (monocarpic synchronized) adaptation wherein populations flower, set seed, and subsequently senesce. This episodic abundance does not reflect long-term population stability. Regeneration during inter-flowering periods is contingent upon critical ecological factors, including

pollinator availability, seed viability, suitable soil conditions, and absence of disturbance, grazing, and invasive species. Anthropogenic pressures such as trampling, unregulated collection, and habitat alteration during both flowering and non-flowering phases significantly impair recruitment and hinder population recovery, thereby increasing the species' vulnerability.

The species is semelparous, completing its life cycle in approximately 12 years, culminating in a single synchronized flowering event followed by death. Historical records from 1832 to 2018 document its occurrence across 34 localities within 14 ecoregions spanning five major landscapes, including the Brahmagiri, Nilgiri, Palani–Kodaikanal, Anamalai, Munnar–Idukki, and Yercaud–Shevaroys regions of the Western and Eastern Ghats. This fragmented distribution evidences high ecological specialization and renders the species particularly susceptible to landscape-level habitat fragmentation and disturbance.

Strobilanthes kunthiana forms part of a highly specialized montane grassland ecosystem comprising endemic and ecologically significant taxa. Dominant grasses such as *Chrysopogon zeylanicus*, *Eulalia phaeothrix*, *Dicanthium polyptychum*, and *Arundinella purpurea* contribute to soil stabilization, moisture retention, and nutrient cycling, thereby sustaining suitable microhabitats. Associated species, including sedges (*Juncus effusus*), orchids (*Habenaria heyneana*, *Satyrium nepalense*), and herbs such as *Peristylus aristatus*, *Eriocaulon dalzellii*, *Brachycorythis splendida*, *Swertia corymbosa*, and *Drosera peltata*, enhance ecological complexity and habitat functionality. Shrubs like *Hypericum mysorense* and *Osbeckia leschenaultiana* further support pollinator interactions and microclimatic stability. Any disturbance to this integrated community structure adversely affects the survival and regeneration of *S. kunthiana*.

6. THREATS

The decline of montane grassland ecosystems essential for the survival of *Strobilanthes kunthiana* is primarily attributable to historical land-use changes. Large-scale conversion of native grasslands into tea plantations and exotic tree estates during the colonial period, based on the erroneous classification of grasslands as "wastelands," has resulted in extensive and largely irreversible habitat loss and fragmentation of the shola–grassland ecosystem.

This degradation was further aggravated by post-independence afforestation programmes (1960s–1990s), wherein exotic species such as *Eucalyptus* spp. and *Acacia mearnsii* w

extensively introduced. The dense canopy and allelopathic effects of these species suppress native grassland flora and eliminate ecologically suitable conditions necessary for the regeneration and survival of *Strobilanthes kunthiana*.

In recent decades, infrastructure expansion, including road development and unregulated tourism, has significantly contributed to habitat degradation and fragmentation. These activities not only reduce habitat extent but also disrupt critical ecological processes such as pollination, seed dispersal, and natural regeneration, thereby adversely affecting population viability.

Fire management practices have undergone considerable alteration. While traditional controlled burning by indigenous communities played a vital ecological role in maintaining grassland structure and promoting regeneration, inappropriate fire regimes in the present context—particularly in terms of frequency and intensity—are liable to adversely affect the species' semelparous life cycle and synchronized flowering dynamics, necessitating strict scientific regulation.

The invasive spread of species such as *Acacia mearnsii*, *Pteridium aquilinum*, and *Ageratina adenophora* poses a significant contemporary threat. These species aggressively colonize grasslands, outcompete native flora, alter soil properties, and transform open habitats into closed systems unsuitable for *Strobilanthes kunthiana*.

Tourism pressure, particularly during mass flowering events, has emerged as an additional stress factor. Unregulated visitor influx leads to trampling, waste accumulation, and construction of infrastructure, resulting in further habitat degradation and interference with natural regeneration processes.

The cumulative effect of these historical and ongoing pressures constitutes a continuing and substantial threat to the habitat integrity and population viability of *Strobilanthes kunthiana*. This necessitates immediate, coordinated, and science-based interventions, including habitat restoration, invasive species control, regulated fire management, and strict oversight of tourism and developmental activities under appropriate statutory mechanisms.

7. CONSERVATION MEASURES

Habitat management measures for *Strobilanthes kunthiana* have been implemented in key protected areas of Kerala, including **Kurinjimala Sanctuary and Eravikulam National Park**, primarily through ecosystem-based approaches such as invasive species control, fire

mearnsii), regulated burning, restriction of grazing, and tourism monitoring. However, these interventions are not species-specific, and there is no comprehensive conservation framework that integrates its semelparous life cycle and 12-year flowering dynamics. Critical aspects such as long-term population monitoring, genetic diversity, seed bank dynamics, and post-flowering regeneration remain inadequately addressed.

Approximately 60% of the populations occur within protected areas, providing partial *in situ* protection. However, the remaining populations outside protected areas, particularly in revenue lands and forest fringes, are highly vulnerable to habitat conversion, invasive species, and unregulated human activities, necessitating targeted conservation measures beyond the protected area network.

8. LEGAL STATUS

The species is protected under the Wildlife (Protection) Act, 1972 (amended 2023), Schedule III, and any destruction, damage, or removal of the species from its natural habitat is punishable under law.

Its cultivation, possession, and handling are regulated, and any propagation, research, or restoration activity requires prior approval and competent institutional supervision.

Notwithstanding existing legal protection, species-specific conservation measures—comprising ecological monitoring, habitat restoration, invasive species control, and scientifically regulated management—are necessary to ensure long-term survival, including in areas outside protected networks.

Under the Eco-restoration Policy (2021), the Kerala Forest Department has initiated removal of invasive species, including *Acacia mearnsii*, to restore native grassland habitats critical for *Strobilanthes kunthiana*.

9. PROPAGATION

Strobilanthes kunthiana, being a pleietesial and semelparous species with an approximately 12-year life cycle, exhibits highly episodic seed production confined to short post-flowering periods, thereby limiting its natural regeneration potential. Further, seed-based establishment is dependent on specific ecological conditions, making it unreliable for immediate conservation and restoration interventions.

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Vegetative and *in vitro* propagation techniques constitute scientifically established methods for rapid population augmentation. Techniques such as stem cuttings and tissue culture enable large-scale multiplication under controlled conditions and are suitable for habitat restoration, population reinforcement, and *ex situ* conservation. It is submitted that JNTBGRI has successfully demonstrated such interventions in species including *Paphiopedilum druryi*, wherein large numbers of plants have been regenerated through tissue culture and reintroduced into their native habitats in the Agasthyamalai hills of the Wesern Ghats, thereby establishing the technical feasibility and applicability of similar approaches for *Strobilanthes kunthiana*.

10.. SUGGESTIONS OF JNTBGRI

- Preparation and implementation of a species-specific conservation action plan integrating life-cycle biology and habitat requirements.
- Establishment of long-term ecological monitoring plots across all major landscapes to assess population dynamics and regeneration success.
- Large-scale propagation through standardized vegetative and *in vitro* techniques under controlled conditions.
- Creation of centralized and regional nurseries for raising planting materials for habitat restoration programmes.
- Restoration of degraded montane grasslands through phased removal of invasive alien species and reintroduction of native flora.
- Scientific management of fire regimes based on ecological studies aligned with the species' phenology.
- Development of seed banks and cryopreservation protocols during mass flowering years.
- Strengthening protection of populations outside protected areas through community participation and co-management approaches.
- Regulation of tourism through carrying capacity assessment, designated pathways, and strict enforcement during flowering seasons.
- Promotion of collaborative research involving national institutions for genetic diversity, climate resilience, and ecological adaptation studies.
- Capacity building and awareness programmes for forest officials, local communities, and stakeholders.

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11. PRAYER

In view of the facts stated above, it is most respectfully prayed that this Hon'ble Tribunal may be pleased to:

(a) Direct the concerned authorities to implement scientifically designed conservation programmes, including *in situ* and *ex situ* measures, habitat restoration, and regulated management practices for *Strobilanthes kunthiana*, under the supervision of competent expert institutions;

(b) Direct the appropriate Ministries and National funding agencies to allocate and sanction adequate financial resources for undertaking research, propagation, and long-term conservation of this vulnerable species;

(c) Pass such other orders as this Hon'ble Tribunal may deem fit and proper in the interest of justice and environmental protection.

VERIFICATION

I, Dr. Sreekumar S, verify that the contents of this affidavit are true and correct to my knowledge and belief.

Place: Thiruvananthapuram

Date: 08.04.2026

DEPONENT

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