Journal of Advances in Plant Biology

Frond emission from pinnae tips in *Nephrolepis cordifolia*

Luigi d'Aquino[1,*]

[1]ENEA (Italian National Agency for New Technologies Energy and Sustainable Economic Development). Portici Research Centre, Piazzale E. Fermi 1 80055 Portici, Italy.

Short Communication

Open Access &

Peer-Reviewed Article

DOI:

10.14302/issn.2638-4469.japb-26-6401

Corresponding author:

Luigi d'Aquino, ENEA (Italian National Agency for New Technologies Energy and Sustainable Economic Development). Portici Research Centre, Piazzale E. Fermi 1 80055 Portici, Italy, luigi.daquino@enea.it.

Keywords:

Polypodiopsida; ferns; leaf morphology; leaf morphogenesis

Received: July 04, 2026

Accepted: July 15, 2026

Published: September 19, 2026

Academic Editor:

Anubha Bajaj, Consultant Histopathologist, A.B. Diagnostics, Delhi, India.

Citation:

Luigi d'Aquino (2026) Frond emission from pinnae tips in Nephrolepis cordifolia. Journal of Advances in Plant Biology - 1(4):20-25. https://doi.org/10.14302/issn.2638-4469.japb-26-6401

Abstract

The emission of completely developed secondary fronds from pinnae tips is described for the first time in a fern belonging to the species *Nephrolepis cordifolia*. The phenotype described in the paper has so far been reported very rarely and only in other *Nephrolepis* species. The phenotype demonstrates that the development of a whole frond from the apex of a secondary leaf is possible and it can be related to an alteration in the meristematic activity of the pinna apex. The stability of the phenotype over time, the occurrence of all the developmental stages of the phenotype in the same frond and the recurring appearance of the phenomenon in plants propagated from the original individual make the germplasm described in this work a plant model suitable for investigating leaf morphological plasticity in plants.

Introduction

A fern from a garden cultivation whose botanical characteristics refer to *Nephrolepis cordifolia* (L.) C. Presl (Cl. *Polypodiopsida*, Ord. *Polypodiales*, Fam. *Nephrolepiadaceae*)[1] showing widespread leaf abnormalities was found in Campania Region (South Italy). No indications were available about environmental conditions and anthropic manipulations that may have caused the onset of the phenomenon and about the primary origin of the plant source. In the aerial part of the plant (Fig. 1), the tips of most of the pinnae in the apical part of the fronds display a 'wavy shape' that evolves as a typical secondary frond when the tip of the mother frond unrolls and the lateral young pinnae become mature pinnae located in the middle of the mother frond itself (Fig. 2-4). The secondary frond, i.e. the 'pinna-derived frond' (PdF), replicates the mother frond morphology, bearing typical secondary pinnae and crosiers. The secondary fronds reach a smaller size compared to the mother fronds they derive from, nevertheless they generate sori in the same period as the primary pinnae (Fig. 5). The PdF is emitted only by the primary pinna tip (Fig. 6), since emission has never been observed from the rachis as well as from secondary pinnae tips. The PdF emission is evident in most of the fronds and occurs throughout the growing period of the aerial part. No detectable abnormalities are evident in stems, runners, rhizomes and tubers. The PdF emission has so far been a stable feature, occurring every year in the new fronds emitted after the old ones had withered during the adverse seasons. Further, emission of the secondary fronds takes regularly place in new

plants propagated from the original individual. No emission of PdFs has so far been observed in common *N. cordifolia* plants grown near the aberrant one. To the best of the author's knowledge, a very similar phenotype was reported in the past in *N. exaltata* var. *bostoniensis*[2,3], in which, however, the occurrence of the wavy pinnae morphology, that is the first stage of the secondary frond emission, was not clearly described. The phenotype reported in the present paper is different from the 'crested fronds' occurring in *Athyrium angustum* var. *cristatum*[4], in which the whole pinnae are transformed in a new fronds. The phenotype described here also differs from the 'forking leaves' phenotype so far described in several fern species not belonging to the genus *Nephrolepis*, that occurs randomly among fronds and plants and at any level of the pinna lamina[5]. The PdF phenotype represents a plastic demonstration of the totipotency of the pinna apex, that can generate a fully developed frond while preserving the pinna structure in its basal part (Fig. 6). This phenotype indicates that an alteration in the apical meristem activity in the pinna may trigger the generation of a primary organ from the apex of a secondary organ. This phenotype can be of great interest in investigations about the mechanisms underlying leaf morphological plasticity in plants, taking advantage of the presence of all the stages of the phenomenon at the same moment in the same genotype. The stability of the phenotype expression in the aerial part of the plant during the growing season and its recurrence in propagated plants, are also remarkable features that can be useful for scientific investigations.

Figure 1. Aerial part of the fern displaying widespread leaf abnormalities shown in major details in the following figures.

Figure 2. Different levels of expression of the phenotype along the fronds, with ‘wavy shaped’ pinnae tips near the apical part of the mother frond and secondary fronds emission at a greater distant from the crosier.

Figure 3. Particular of the frond shown in Fig. 2 showing apparently normal pinnae in the lower part, early stage of secondary frond emission in the middle and pinnae with wavy tips above.

Figure 4. Fully expanded secondary fronds in the middle part of a mother frond.

Figure 5. Fully expanded secondary fronds in the middle part of a mother frond with sori.

Figure 6. Pinna bearing a fully expanded secondary frond (left) compared to a typical pinna of *N. cordifolia* (right).

Declarations

The author received no funding for the submitted work. The author declares no conflict of interests.

References

1. Hovenkamp P. H., Miyamoto F. 2005. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. *Blumea* 50(2):279-322. https://doi.org/10.3767/000651905X623003
2. Benedict R. C. 1922. The Origin of New Varieties of Nephrolepis by Orthogenetic Saltation. II. Regressive Variation or Reversion from the Primary and Secondary Sports of *Bostoniensis*. *American Journal of Botany*, 9(3):140-157. https://doi.org/10.2307/2435486
3. Benedict R. C. 1923. New Bud Sports in Nephrolepis. *Genetics* 8(1):75-95. https://doi.org/10.1093/genetics/8.1.75
4. Hopkins L. S. 1919. A Crested Form of the Lady Fern. *American Fern Journal* 9(3):86-88. https://doi.org/10.2307/1544332
5. Tryon R. M. 1938. The phenomenon of forking in ferns. *American Fern Journal* 28(3):81-90. https://doi.org/ 10.2307/1544868