



# Pollen micro-morphometry of two endangered species of *Rauvolfia* L. (Apocynaceae) from the Indo-Gangetic Plains of Central India using LM, CLSM and FESEM

Swati Tripathi<sup>a</sup>, Arti Garg<sup>b</sup>, Achuta Nand Shukla<sup>c</sup>, Anjum Farooqui<sup>a</sup>, Arya Pandey<sup>a</sup>, Tusha Tripathi<sup>d</sup> and Veeru Kant Singh<sup>a</sup>

<sup>a</sup>Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, Uttar Pradesh, India; <sup>b</sup>Central Regional Centre, Botanical Survey of India (BSI), Allahabad, Uttar Pradesh, India; <sup>c</sup>Botanical Survey of India (BSI), Kolkata, West Bengal, India; <sup>d</sup>CSIR-National Botanical Research Institute, Lucknow, Uttar Pradesh, India

## ABSTRACT

*Rauvolfia* belongs to the family Apocynaceae and encompasses herbs or shrubs with leaves in whorls of three or four. It is an endangered plant of the tropics and subtropics. We present a preliminary study and analysis of the morphological details of the pollen of two extant species of *Rauvolfia* (*R. serpentina* (L.) Benth. ex Kurz and *R. tetraphylla* L.) from the Ganga Plain using light microscopy (LM), confocal laser scanning microscopy (CLSM) and field emission scanning electron microscopy (FESEM). The critical point drying method (CPD) was adopted to test the pollen size difference from the conventional acetolysis method (ACE). The pollen morphology of *R. tetraphylla* differs from that of *R. serpentina* in several specific traits. Its pollen grain is 3-colporate; it is oblate to oblate-spheroidal; sexine is punctate to obscure and mostly as thick as nexine; and a distinct thickening is present around the ectocolpi. The study shows that *R. serpentina* can be distinguished from *R. tetraphylla* by its pollen shape, size, sexine ornamentation (particularly the presence and absence of punctae/perforations in the mesocolpial region) and length of the ectocolpi thickening. The pollen shape and aperture number are more or less common features in *Rauvolfia* spp., but the presence and absence of a punctate pattern at the mesocolpial position marks the primary difference between the two species. The *t*-test was applied to determine the statistical significance of pollen morphological data of both species. This study provides a source of information for systematic and conservation purposes and provides a baseline to facilitate palynological studies of past vegetation and palaeoenvironments.

## KEYWORDS

pollen morphology; *Rauvolfia serpentina*; *R. tetraphylla*; endangered; Ganga Plain India

## 1. Introduction

Botanical investigations of the reproductive parts of endangered plant species are of significance in adopting propagation measures for long-term survival (Garg and Rao 1996). Pollen morphology is directly correlated with the pollination mechanism (Garg and Rao 1997; Rao et al. 1999) as ornamented pollen tends to be more easily trapped on pollinating insects' body parts, compared to smooth pollen grains. Similarly, pollen germination on the stigmatic surface is directly dependent on pollen wall thickness and the number of apertures (Walker and Doyle 1975). The investigation of pollen morphology in endangered species of *Rauvolfia* (*R. serpentina* and *R. tetraphylla*) is therefore significant in providing insight on pollination limitations, if any, during vector transfer of pollen to the stigma. This is critical for successful germination and reproduction for species and their long-term survival or may be one of the possible causes of a species' rarity. Pollen strata and the surface pattern are indicative of the pollen trapping (sticking) and loading capacity of the vectors; the germinal apertures are regions of pollen

tube growth on the stigma and provide information on germination success and/or failure.

Pollen micro-morphometric analysis under light microscopy (LM) and field emission electron microscopy (FESEM) is crucial for accurate identification and critical for detecting the fossil counterpart in the sediment for the reconstruction of palaeoflora vis-à-vis past climatic changes. Pollen micro-morphometric characters can also aid in facilitating the conservation, or establishment and multiplication (through plant reproductive processes), of species of *Rauvolfia ex situ* and/or *in situ* as well as aiding in the authentication and standardization of drugs prepared from them.

In developing countries, medicinal plants are attaining greater importance in the primary health care of individuals and communities. For the proper identification and standardization of crude drugs, accurate anatomical and morphological description of the botanical sources of these drugs is necessary, and this description must take into account all the diagnostic features for a correct species identification, including the pollen micro-morphometry (Fazal et al. 2013). Despite the high interest in the two endangered species