

SUMMARY

This thesis is the culmination of my work over six years (2000–2006), carried out mainly in India between 2000–2005. The primary aim of the thesis was to shed some light on taxonomy and nomenclature of Indian representatives of the economically important genus *Curcuma*.

The first part of the thesis consists of a broad general introduction to the subject to reflect current stage of knowledge and to formulate the major problems to be dealt with in the genus. It also presents several new findings, observations and preliminary results. **Chapter 1.** briefly introduces order Zingiberales, family Zingiberaceae, its importance in Indian flora and overview of cytological and molecular studies in the family. **Chapter 2.** focuses fully on the genus *Curcuma*. It covers introductory chapters regarding economic importance, distribution & species richness, ecology & conservation, followed by analyses of major problems hindering satisfactory treatment of the genus and summarizes current knowledge on cytology of ginger with special attention to *Curcuma*. I also incorporated preliminary results from the long-term observation of most of the taxa at their localities as well as in cultivation for several years that provided valuable data on the capability of producing single or two types of inflorescence and level of variability, which correlates with the mode of reproduction and rhizome architecture. **Chapter 3.** deals with *Curcuma* in India. Efforts have been made to understand the structure of the *Curcuma* plant and clarify some issues in morphological terminology. **Chapter 4.** sketches future perspectives and **Epilogue and References** closes the general part.

Papers presented as a second part of the thesis focused mainly on the identities of *Curcuma* species found in India and typifications, which were based on thorough field studies and revision of herbarium materials, in order to stabilize the nomenclature and application of the names. The results of cytology investigations (chromosome counts and genome size) provided useful insights about the genus and generally supported the observed level of variability, which correlated well with ploidy level and mode of reproduction.

The first three papers describe new *Curcuma* species. *Curcuma rubrobracteata* (in **paper I.**) is an interesting species. This is for the first time, that central inflorescence breaking out of a pseudostem through a lateral slit is observed in the genus. This is a feature so far known only in the genus *Plagiostachys* and few species of *Alpinia* within the family Zingiberaceae. **Paper II.** describes *C. codonantha*, a new species discovered in Andaman Islands. **Paper III.** deals with *C. mutabilis*, a seed-setting species endemic to South West India, an area of huge *Curcuma* diversity. Interestingly, this species displays huge intrapopulation variability.

Paper IV. deals with re-circumscription of the genus *Curcuma* to include the only member of the highly endemic monotypic genus of Western Ghats, *Paracautleya*, into *Curcuma*. The generic delimitation of *Curcuma* as drawn by botanists almost 200 years ago is no longer suitable as it was drawn mostly on sterile polyploidy taxa. Characters like single flower per fertile bract, reduction or even lack of the bracteole, fertile bracts not necessarily connate to each other at sides to name a few are also found among several seed-setting species of *Curcuma*. Thus such characters cannot be taken for

delimitation of monotypic genus *Paracautleya*, which was consequently reduced to *Curcuma*. The tiny *C. bhatii* represents probably the smallest *Curcuma* in the world.

Unveiling the identity of imperfectly known species *Curcuma kurzii*, treated as doubtful species by Baker in *The Flora of British India* is the main topic of paper V. In 1984 Balakrishnan & Bhargava have identified this plant as the Burmese species *C. petiolata* and published his finding as a new record for India, followed by other botanists. Only recent recollection from its type locality in Andaman Islands showed that *C. kurzii* represents in fact another Burmese species *C. roscoeana* - one of the most magnificent plants of the genus. As *C. kurzii* and *C. roscoeana* have not been previously typified, lectotypes were designated for both names.

Curcuma zanthorrhiza (in paper VI.) is one of the first historical species described by William Roxburgh from Amboina. It is widely used and also cultivated over the whole S and SE Asia. It is a fairly common species in South India and appears to be native there. Yet it was never reported from India, as the species was misidentified as *C. zedoaria* and *C. aromatica* over the years. These earlier identifications were based perhaps on descriptions, without verification and repeated over several generations. The identity of this taxon is clarified and postulated in the paper - *C. zanthorrhiza* is most likely to be of South Indian origin and have been spread through SE Asia during the early migrations long before Western domination. Investigation of this hypothesis by using molecular markers in the near future is anticipated.

The name *Curcuma zedoaria* is notoriously applied to many *Curcuma* species all over Asia. Paper VII. deals not only with unveiling the identity of the taxon named *C. zedoaria*, but also untangles complex taxonomic and nomenclatorial puzzles around the names *Amomum zerumbet*, *C. zerumbet* and *Erndlia subpersonata*. It also provides a new name *C. picta* for a plant left without a valid name after sorting out the 'historical mess'.

Curcuma longa, the source of turmeric, is a plant of immense economical importance. It is also important from a taxonomic point of view, as it is the type species of the genus. Yet, there is prolonged confusion over its identity. Although *Curcuma* is conserved, with *C. longa* L. as its conserved type, the type of *C. longa* is still uncertain. There were numerous discussions about the identity of *C. longa* as well as several attempts to settle the type. Unfortunately, none of the previous proposals can be upheld due to various reasons. This is discussed in paper VIII. A lectotype selected from original material and epitype collected near the type locality are accordingly proposed.

Only after four years of intensive field work focused on re-collection of species from type or near type localities, together with thorough studies of herbarium sheets from Indian, major European as well as Asian herbaria, it was possible to review the types for all Indian *Curcuma* names, and to designate lectotypes, neotypes and epitypes, wherever needed (paper IX., in preparation).

Paper X. presents results of cytological investigation of 161 plants belonging to 51 taxa. Six different chromosome counts including two representing new generic records were revealed. Three groups of taxa with significantly different homoploid sizes (Cx-values) and distinct geographical distribution were identified. Intraspecific variation in nuclear DNA-content was detected in five species. Chromosome counts and genome sizes of three *Curcuma*-like species (i.e. *Hitchenia caulina*, *Kaempferia scaposa*

and *Paracautleya bhatii*) corresponds well with typical hexaploid ($2n=6x=42$) Curcumas and supported inclusion of these taxa in the genus *Curcuma*.

The huge potential of Curcumas as sources of medicine, spices, food, dyes, ornamentals and other uses is elaborated in chapter 14 'Other economically important *Curcuma* species' in the book 'Turmeric: the genus *Curcuma*' (paper XI).

The stunning beauty of *Curcuma* species is brought to the layman in a short and pictorial way as an article for Gardenwise, the newsletter of the Singapore Botanic Garden (paper XII). Another popular article about Curcumas appeared in 2003 in *Živa*, but is not included here as it was printed in Czech only.