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NOMENCLATURE

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Taxonomic and nomenclatural puzzles in Indian *Curcuma*: the identity and nomenclatural history of *C. zedoaria* (Christm.) Roscoe and *C. zerumbet* Roxb. (*Zingiberaceae*)

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The identity of *Curcuma zedoaria* (Christm.) Roscoe and its nomenclatural history are explained. Roscoe wrongly interpreted the basionym of this name and applied his combination to a different taxon, which is not even involved in Christmann's protologue. The first lectotypification applied the name to the species upon which Rheede's description of *Kua* was based. Study of living material reveals that the name *C. zedoaria* (Christm.) Roscoe is currently applied to several superficially similar taxa in different parts of India and SE Asia and there are no grounds to propose conservation of the name with a different type. To avoid more confusion, the identity of the plant representing *C. zedoaria* in the sense lectotypified by Burt (1977) is explained here and a colour plate depicting its morphology is provided. The plant described and depicted by Roxburgh as *Curcuma zerumbet* Roxb., a name usually cited among synonyms of *C. zedoaria* (Christm.) Roscoe, is found to represent the taxon that Roscoe had in mind while publishing his combination *C. zedoaria* (Christm.) Roscoe. *Curcuma zerumbet* Roxb. is illegitimate, however, and as there is no other name available for this taxon it is described here as *Curcuma picta*. The nomenclatural history of *Amomum zerumbet* J. König nom. illeg. and *Erndlia subpersonata* Giseke, names which are involved in the illegitimacy of *C. zerumbet* Roxb., is explained.

KEYWORDS: *Amomum zerumbet*, *Curcuma officinalis*, *Curcuma picta*, *Curcuma speciosa*, *Curcuma zedoaria*, *Curcuma zerumbet*, *Erndlia subpersonata*, nomenclature, new species, typification, *Zingiberaceae*

INTRODUCTION

The genus *Curcuma* L. (*Zingiberaceae*) is economically important, yet taxonomically rather difficult. It is naturally distributed throughout S and SE Asia, with a few species extending to China, Australia, and the South Pacific, while economically important species are cultivated elsewhere in the tropics and ornamental species can be found practically worldwide. The highest diversity is in India and Thailand, with at least 40 species in each, followed by Burma, Bangladesh, Indonesia and Vietnam. Since the most recent comprehensive taxonomic revision is over a century old (Schumann, 1904), there is little

consensus upon the total number of species that should be recognized. Estimates vary from about 50 (Smith, 1981) to 80 (Larsen & al., 1998) or 100 species (Sirirugsa, 1996), while Škorničková & al. (2004) suggest that detailed botanical exploration of India and SE Asia may well bring their number to 120 in the near future.

Several problems have hindered a satisfactory systematic treatment of the genus. The original descriptions of many *Curcuma* species are vague and inaccurate, and type specimens are often lacking or fragmentary, which leads to ambiguous assignment of names and usage. Almost all early accounts established synonymies based on descriptions and plates only, rarely citing herbarium material and it has to be plainly admitted that this approach does not give a reliable result. Furthermore, differing levels of variation between seed-setting species and those which reproduce vegetatively by well-branched rhizomes have triggered an enduring dispute concerning species concepts and the boundaries between taxa (Leong-

This paper is dedicated to Brian Laurence ("Bill") Burt (27 Aug 1913–30 May 2008) in recognition of his important contributions to our understanding of the genus *Curcuma* and the family *Zingiberaceae*—along with that of very many other groups of plants.

Škorničková & al., unpub.). In addition, some species may hybridize in the wild resulting in progeny that naturalize (Škorničková & Sabu, 2005b; Leong-Škorničková & al., 2007). As a result, species have been described repeatedly under different names and names have been applied to different taxonomic entities.

The difficulties of making herbarium specimens which preserve the taxonomically important morphological features and the need to study gingers from living material have been pointed out several times (e.g., Burt & Smith, 1976; Williams, 2004; Škorničková & Sabu, 2005b). In the genus *Curcuma*, in particular, the colour of the rhizomes, position of the inflorescence, the colour and shape of the bracts and flower parts are important characters for species determination (Škorničková & Sabu, 2005a), but they are rarely seen in herbarium specimens. Thus, living material including flowers and rhizomes is of crucial importance.

During the course of a revision of Indian *Curcuma* it has become clear that the names of most taxa have no types or these are lost or have deteriorated and that the typification and interpretation of all names in the genus is an exacting but essential task. Indeed, the typification of certain species names is so complicated that its explanation deserves more space than could reasonably be given to it in a revision. Two such examples are discussed here in detail. Our results are based on four years of intensive fieldwork throughout the Indian subcontinent, studies of living collections and of the relevant herbarium material in Indian and European herbaria, libraries and archives.

The name *Curcuma zedoaria* (Christm.) Roscoe is and always was used for more than one currently recognized taxon. The publication of the combination *C. zedoaria* (Roscoe, 1807) involved only five words, which do not adequately describe the plant, though Roscoe amplified this description in his later works (Roscoe, 1816, 1825) making it clear what he intended. Nevertheless, Roscoe soon realized (1816, 1825) that the taxon for which he intended to publish the combination *C. zedoaria* (Christm.) Roscoe was identical with that described by Roxburgh (1810) and depicted by him (1811) as *Curcuma zerumbet*.

Our revision of herbarium material, treatments and descriptions in various floras and accounts has revealed that the name *C. zedoaria* is applied to about ten taxa in India and other parts of Asia, which all produce the inflorescence laterally and have a more or less prominent red patch on the leaf, as depicted on the widely accessible colour drawing in Roscoe's *Monandrian Plants* (Roscoe, 1825) (Leong-Škorničková, unpub.). In South India *C. zedoaria* was among several names long misapplied to plants recently determined as *Curcuma zanthorrhiza* Roxb. (Škorničková & Sabu, 2005b) and was also misapplied to *Curcuma aeruginosa* Roxb.

Burt (1977) selected as the lectotype the reference to Rheede's Kua from several original elements listed

in the protologue of the basionym, *Amomum zedoaria* Christm. He did not, however, mention that (1) the original elements cited in the protologue of *A. zedoaria* are heterogeneous, nor did he notice (2) that Rheede's Kua and the plant that Roscoe had in mind when publishing the combination *C. zedoaria* (Christm.) Roscoe are different taxa! Rheede's Kua is a taxon in which the red patch on the leaves is not so prominent and its taxonomic identity has not been well understood.

In order to come to a resolution which will be nomenclaturally correct, as well as taxonomically acceptable, it is necessary: (a) to investigate the original elements of *A. zedoaria*, try to trace their taxonomic identities, assess whether any of the original elements match Roscoe's interpretation of *C. zedoaria* and decide whether Burt's choice of lectotype is acceptable under current rules; (b) to attempt to trace the identity of Rheede's Kua among some 20 *Curcuma* species growing near its type locality and to find out what names are in current use for this taxon; (c) to decide on the application of the name *C. zedoaria*; (d) to discuss the identity of the plant interpreted by Roscoe as *C. zedoaria* and described and depicted by Roxburgh as *C. zerumbet*, and check on the availability of names for this taxon.

RESULTS

The taxonomic identities of the elements cited in the protologues of the names involved in the complex nomenclatural history of *C. zedoaria* and *C. zerumbet* are tabulated in Table 1.

The original elements of the name *Amomum zedoaria* Christm. — Burt (1977) made clear that the binomial *A. zedoaria* Christm. was, contrary to his previous notes on nomenclature of *C. zedoaria* (Burt, 1972: 226), validly published in *Vollständiges Pflanzensystem* by Christmann & Panzer (1777–1788). This work was chiefly based on Houttuyn's *Natuurlijke Historie* (1773–1783, identical with Houttuyn's *Handleiding tot de Plant- en Kruidkunde*, for details see Merrill, 1938) but with numerous newly published binomials. The arrangement of genera and species in *Vollständiges Pflanzensystem* followed that of the 12th edition of Linnaeus's *Systema naturae* (1767). Many authors have confused Christmann & Panzer's work with that of Houttuyn as both were illustrated by the same plates (Merrill, 1938). Burt (1977) correctly linked the facts and concluded that the combination *C. zedoaria* should be attributed to Roscoe (1807), as he cites Willdenow (1797), who, in turn, refers to "Houttuyn Linn. Syst. 5. p. 12", the German edition of this work, namely Christmann & Panzer's *Vollständiges Pflanzensystem* vol. 5: 12 of 1779, where *A. zedoaria* was first published as a valid binomial.

The original elements of *Amomum zedoaria* Christm. (Christmann & Panzer, 1779) included:

- (1) *Amomum scapo nudo spica laxa truncata*. Bergius Mat. Med. p. 4 (Bergius, 1778: 4);
- (2) *Kua*, Rheede Hort. Mal. 11: 13 t. 7 (Rheede, 1692);
- (3) *Tommon Itam*, Rumphius, Herb. Amb. 5: 169 (Rumphius, 1747);
- (4) *Zedoaria officinarum*, Petiver, Gazoph.: t. 23. f. 1 (Petiver 1704–1706 [cf. Burt, 1977]);
- (5) *Zedoaria seu Indorum Tamogcansi*, Kamel, Herb. Philipp. 23 (Kamel [Camellus], 1704).

These elements include heterogeneous material (see Table 1.). Bergius (1) cites the other four references (2–5) in his *Materia Medica*. In his short description he deals only with the characteristics of the rhizome, the part used in medicine. He refers to a plant from “India Orientalis” with an ash-grey rhizome when young and bluish-white “parenchyma” which is likely to be *C. aeruginosa* Roxb. This is a common species in the western part of S India, NE India, and W Bengal and is widespread and cultivated in many parts of Asia (e.g., Valetton, 1918; Holttum, 1950; Sabu, 2006). Rheede (2) refers to a plant from the Malabar region with horizontally running rhizomes, inwardly of white colour, and with leaves of which the inner part is of darker and the outer of paler colour. Here Rheede probably refers to the fact that the adaxial side of the leaf is dark green while abaxially the leaf is much paler, a character common to most *Curcuma* species. It is important to note that there is no explicit mention of any red patch around the midrib. Considering how long and detailed Rheede’s description is, such a conspicuous character is likely to be mentioned. Rumphius’s description (3) of “*Tommon Itam*” (“*Tommo iran*”, “[*Tommo*] *iram*” in other local languages) clearly points to a taxon from Amboina (now Ambon, Moluccas) with a bluish-greenish rhizome and a red patch on the leaves. Three closely related taxa all with blue, bluish-greenish or bluish-violet rhizomes can be considered, namely *Curcuma caesia* Roxb., *C. aeruginosa* and *C. phaeocaulis* Valetton. While Hasskarl (1866) thought that “*Tommon Itam*” referred to *C. caesia*, Valetton (1917) was convinced that *C. aeruginosa* matched Rumphius’s description better. *Curcuma phaeocaulis*, described from Java, cannot be ruled out either, since Rumphius’s description is incomplete. In Indonesia and the Malay Peninsula the vernacular names *Temu hitam*, *Tomon itam*, *Temoe itam*, *Temu ireng*, *Temu erang* and a few other similar spelling forms of the same name are still applied to *C. aeruginosa* (Heyne 1927: 495; Burkill, 1966: 715) but, according to Valetton (1918: 68), some of these names are also used for *C. phaeocaulis*. Petiver (4) briefly mentions that his plant is distinguished chiefly by its leaves having a brownish streak along the midrib and as a reference he cites Kamel [Camellus] (5). Kamel (5) describes a plant from Luzon with a red patch along the midrib and a rhizome, which is blue (when young) to whitish. This also points to a taxon close to *C. aeruginosa* (see Table 1.).

Burt (1977) pointed out that “Christmann cites a number of authors under *Amomum zedoaria*: Bergius, Rheede, Rumphius, Petiver and others. It is the description by Rheede under the name *Kua* which gives the most detailed and reliable account of this plant: this was cited by Bergius at the head of his references and formed the basis of Lamarck’s *Amomum latifolium* and it is Rheede’s illustration of it that was re-drawn for Plenck’s plate. There is every reason for taking this reference as the ‘lectotype’ of the name *Amomum zedoaria* Christm., and this I accordingly propose.” Even though this choice conserved a somewhat different sense of this name than was usually applied, i.e., for several species with a prominent red patch along the midrib resembling the plant depicted by Roscoe (1825: Tab. 109) as *C. zedoaria* (e.g., Baker, 1890; Ridley 1899, 1907, 1909, 1924; Holttum 1950), Burt’s decision is to be preferred, since the remaining elements clearly point towards taxa with bluish rhizomes, such as *C. aeruginosa*, *C. caesia* and *C. phaeocaulis*, which are all names with rather unambiguous application. Changing the typification to one of these other elements would necessitate a much larger alteration in nomenclature. It must also be said that none of the elements involved in the protologue fits Roscoe’s (1825: Tab. 109) plant. The *Kua* of Rheede is the only element with a somewhat obscure identity but, from Rheede’s description, it is obvious that there is no conspicuous red patch around the midrib. Moreover, no *Curcuma* species reported from South India would fit Roscoe’s description of 1825 (Tab. 109), which amplified his earlier publication of the combination *C. zedoaria* (Roscoe, 1807). It has to be concluded, therefore, that Roscoe himself attached the name *C. zedoaria* to a taxon that is not involved in Christmann’s protologue.

Tracing the identity of Malabar *Kua*. — Interpretations of the plants in the *Hortus Malabaricus* have been attempted by many botanists but the lack of herbarium specimens often makes correct identification difficult, especially because the descriptions are not as scientifically accurate as would be required today (Manilal, 1984). Manilal (1997) mentioned that Rheede sent many of the dried plant specimens he described to Europe. Unfortunately, in spite of the efforts of Manilal (1997), Johnston (1970) and others, it is still not known where they are.

When tracing the identity of Rheede’s *Kua*, the original description and plate, the way in which the *Hortus Malabaricus* was produced and all possible taxa available in the area have to be taken into account.

Hendrik (Henrik, Heinrich) Adriaan Van Rheede tot Drakestein (Draakenstein), the Dutch Governor of Cochin, spent many years of his life in the Malabar region. The twelve volume *Hortus Malabaricus* was published from 1678–1693, arising from his desire to document the rich plant diversity of Malabar as accurately as possible. Rheede employed over 200 local collectors in different

Table 1. Taxonomic interpretations and inclusion of various elements involved in the complex nomenclatural history of *Curcuma zedoaria* (Christm.) Roscoe and *C. zerumbet* Roxb.

Names involved in the taxonomic history of <i>Curcuma zedoaria</i> (Christm.) Roscoe and <i>C. zerumbet</i> Roxb.	Elements cited and their taxonomic interpretation as understood from the description or other indices	<i>Zedoaria officinarum</i> , Petiver, Gazoph. (1704-1706)	<i>Amomum scapo nudo spica laxa truncata</i> , Bergius, Mat. Med. (1778)	<i>Amomum zedoaria</i> Christm., Christmann & Panzer Vollst. Pflanzensyst. 5: 12 (1779) = German. ed. of Linn. Syst. Naturae	<i>Amomum zerumbet</i> J. König in Retz., Observ. Bot. 3: 55 (1783), non L., Sp. Pl. (1753), nom. illeg. (Vienna Code, Art. No. 53.1)	<i>Amomum latifolium</i> Lamarck, Encycl. 1: 134 (1783)	<i>Erndtia subpersonata</i> Giseke, Prael. Ord. Nat. Pl.: 252 (1792)	<i>Amomum zedoaria</i> sensu Wildenow, Sp. Pl., ed. 5., 1: 7 (1797)	<i>Curcuma zedoaria</i> (Christm.) Roscoe in Trans. Linn. Soc. London 8: 354 (1807)	<i>Curcuma zedoaria</i> sensu Roxb. in Asiat. Res. 11: 332 (1810)	<i>Curcuma zerumbet</i> Roxb. in Asiat. Res. 11: 333 (1810) nom. illeg. (Vienna Code, Art. No. 52.2a)	<i>Curcuma officinalis</i> Salisb. in Trans. Hort. Soc. London 1: 285 (1812), nom. illeg. (Vienna Code, Art. No. 52.1)	<i>Curcuma speciosa</i> Link, Enum. Hort. Berol. Alt. 1: 3 (1821), nom. illeg. (Vienna Code, Art. No. 52.1)	<i>Curcuma zedoaria</i> (Christm.) Roscoe sensu Roscoe, <i>Mondrian Plants</i> (1826)	
		*	*	*	*	*	*	*	*	*	*	*	*	*	*
				*	*	*									
				*	*	*									
				*	*	*									
				*	*	*									

<i>Zerumbet</i> , Rhumphius, Herb. Amb. (1747)	cf. <i>C. euchroma</i> , <i>C. colorata</i> & <i>C. purpurascens</i>																	*	*	*	*	*
<i>Amomum scapo nudo spica laxa truncata</i> , Bergius, Mat. Med. (1778)	<i>C. aeruginosa</i> aff.	*																				
<i>Amomum zedoaria</i> Christm., Christmann & Panzer Vollst. Pflanzensyst. 5: 12 (1779) = German. ed. of Linn. Syst. Naturae	<i>C. zedoaria</i> (= <i>C. rakatakanta</i> , <i>C. malabarica</i>) sensu lectotype									*												*(2)
<i>Amomum zerumbeth</i> J. König in Retz., Observ. Bot. (1783), non L., Sp. Pl. (1753)	cf. <i>C. euchroma</i> , <i>C. colorata</i> & <i>C. purpurascens</i>									*												*(3)
<i>Amomum latifolium</i> Lamareck, Encycl. 1: 134 (1783)	<i>C. zedoaria</i> (= <i>C. rakatakanta</i> , <i>C. malabarica</i>)														*							
<i>Erndlia subpersonata</i> Giseke, Prael. Ord. Nat. Pl.: 252 (1792)	cf. <i>C. euchroma</i> , <i>C. colorata</i> & <i>C. purpurascens</i>																					*(4)
<i>Amomum zedoaria</i> , sensu Willdenow, Sp. Pl., ed. 5, 1: 7 (1797)	<i>Curcuma</i> sp.																			*	*	
<i>Curcuma zerumbet</i> Roxb. in Asiat. Res. 11: 333 (1810) nom. illeg.	<i>C. picta</i> sp. nov. (named here)																					*(4)
<i>Curcuma zedoaria</i> Roxb., illustration & description in Curtis's Bot. Mag. No. 1546 (1813)	<i>C. aff. aromatica</i>																					*
<i>C. zedoaria</i> Roscoe in Trans. Linn. Soc. London 11: 275 (Roscoe, 1815)	<i>C. picta</i> sp. nov. (named here)																					*
<i>C. zerumbet</i> Roxb., as accepted by R. & S. in Syst. Veg., ed. 15 (Roemer & Schultes, 1817)	<i>C. picta</i> sp. nov. (named here)																					*

Notes: * Element cited; (1) designated by Burtt (1977); (2) cited as "*Curcuma zedoaria* Roscoe in Trans. Linn. Soc. London XI. (Roscoe, 1816); (3) cited as "*Curcuma zerumbet* Roxb. in Syst. Veg., ed. 15 (Roemer & Schultes, 1817); (4) implicitite includes both elements of *Erndlia subpersonata* Giseke; (5) cites also Roxb. 1811 & 1820).

seasons to bring him whole plants or their twigs bearing flowers, fruits and seeds. Related information on these plants was given by local physicians in Malayalam and Konkani, and was translated first into Portuguese and from that into Latin, in which the descriptions finally appeared printed. Each description was accompanied by a plate with the name inscribed in Malayalam, Roman and Arabic scripts, while the Konkani name was inscribed in Devanagari (Nagari) script. Four soldiers from the Dutch Army were asked to execute the illustrations, to which the descriptions were added in Rheede's presence (Manilal, 1984; Mohan Ram, 2005). It is necessary to keep in mind that mixed collections could occur, especially when plants were collected at different seasons and that mistakes could be made through the process of double translation.

The useful characters obvious from Rheede's description and plate (1692: 13, t. 7) are:

- (1) Rhizome horizontally running, inwardly white, run through with many whitish threads, aromatic, the scent strong and pleasant as if many aromas were mixed together; stems a foot and a half high [c. 45 cm] (description);
- (2) Coma not conspicuously spreading, flowers as long as the bracts (drawing);
- (3) Leaves glabrous, shining, clear [aqueous], the colour on the inner part dark, on the outer paler (description);
- (4) Flowers yellow and white, 6 petalled, the upper one pellucid, shaped like a helmet, erect (description).

During extensive fieldwork conducted 2001–2005 the first author collected about 20 species of *Curcuma* in the Malabar region. All the seed-setting species of the area can be ruled out as none of them reach the size mentioned by Rheede, most of them possess simple, ovoid rhizome branches, and both positions of inflorescence, flowering laterally at first followed by a central inflorescence later in the season, or have a central inflorescence only. Most of them also lack a brightly coloured coma. For the remaining sterile, vegetatively reproducing taxa, characters such as the shape and colour of the rhizome, presence, shape and intensity of the red patch on the leaf, and position and structure of the inflorescence can be used as they do not vary greatly either within or among populations.

There are only six taxa, which flower laterally at the beginning of the monsoon season and thus have to be considered, namely *C. aeruginosa*, *C. aff. aromatica* Salisb. (*C. aromatica* auct. non Salisb.: Mangaly & Sabu, 1993), *C. haritha* Mangaly & M. Sabu, *C. aff. mangga* Valetton & Zijp. (*C. amada* auct. non Roxb.: Mangaly & Sabu, 1993) *C. raktakanta* Mangaly & M. Sabu (= *C. malabarica*) and *C. zanthorrhiza* Roxb.

Curcuma aeruginosa does not match characters (1), (3) and (4) as it has a deep red patch on the upper half of the lamina, rhizome inwardly aeruginous, and corolla lobes

of deep pink colour. *Curcuma zanthorrhiza* also contradicts (1), (3), and (4) by having a deep orange rhizome, red patch on the lamina and pink corolla lobes. *C. aff. aromatica* has a rhizome which is creamy-white inwardly, but it does not run horizontally and its branches are quite short; the flowers are longer than the bracts (exserted) and the leaves are bright light green and densely velvety pubescent below. *Curcuma haritha* has a conspicuously spreading coma (2) and its leaves are bright light green and densely velvety pubescent below (3). *Curcuma aff. mangga* has a light yellow rhizome with a peculiar smell and taste of unripe mango.

The best fit to Rheede's description and plate is *C. raktakanta*, a common species growing abundantly in sandy coastal areas of Malabar, especially around Cochin. According to Manilal (1997), the original Rheedean specimens were collected there. *Curcuma raktakanta* has rhizomes with long, horizontally running branches of creamy to white colour internally (the younger the whiter) and a pleasant aroma with traces of camphor and menthol. The leaves are glossy, deep green in colour and without a prominent red patch on the upper surface. A slight brownish shade may be seen upon close inspection about 1–3 mm on either side of the midrib in the middle part of lamina but this is conspicuous only on the first two leaves when they are young and soon vanishes completely. The flowers are as long as the bracts and the coma does not spread conspicuously. Burt (1977) provided a useful English translation of Rheede's original Latin description with occasional explanations of some terms placed in square brackets. In his description of the rhizome Rheede mentions that there are many whitish threads, which are interpreted by Burt as "vascular bundles". We should like point out that Rheede was probably referring to the rubbery threads made of a "latex like" compound which are visible when the running branch of the rhizome is broken and pulled apart, a character peculiar to this species. Nicolson & al. (1988) state that the name Kuva is still used for this plant which occurs in the hills adjoining the coastal plains of Kerala and is not cultivated, although the roots are used for medicinal purposes after drying and grinding (also Manilal, 2003). When we collected this species near Cochin (Ernakulam), the local people referred to it unambiguously as Kua or Kuva and mentioned the use of this plant for extraction of starch. It should be noted, however, that the local name Kua is applied all over Kerala for several abundant *Curcuma* species which can be profitably used for extraction of "Kua Podi", a starch known also as East Indian Arrowroot (Sabu & Škorničková, 2003).

Two characters in Rheede's description require further comment. Firstly, the dimensions of the leaf are given as "up to a cubit long [c. 46 cm] and two spans [c. 38 cm] wide in the middle". This must be a typographic error as it would imply that the leaves were close to round. Secondly,

“the seed capsules are small and round, depressed, and contain grey seeds like those of *Tsjana Kua* [*Costus speciosus*], but they are rarely found”. The capsules of all seed-setting *Curcuma* species in India are round or round-ovate and contain ovate, light brown to brown, shiny seeds with a conspicuous, white, lacinate aril. They are often found in species with ovoid simple rhizomes (all $2n = 42$) and, although they are found occasionally in species with branched rhizomes ($2n = 63, 105$), they are not then well developed. It is clear that the seeds mentioned in Rheede’s description must have been collected at a different time and either belonged to a seed-setting species or a plant of another (*Zingiberaceae*?) genus.

The application of the name *Curcuma zedoaria* (Christm.) Roscoe. — The reference of Rheede’s *Kua* (1692) chosen by Burtt (1977) as lectotype is not in conflict with the protologue. It has to be noted, however, that reference of *Kua* as chosen by Burtt includes description and plate. In 1977 both of these elements were eligible to be chosen as the lectotype, but Burtt did not make any specific choice. Burtt’s choice of lectotype has to be narrowed down to a single element and because the description is not eligible under current (and retrospective) rules (Art. 9.2) the plate of *Kua* remains as the only element to serve as the lectotype. Thus there are no grounds for superseding his decision (Art 9.17, McNeill & al., 2006) and the name *C. zedoaria* has to be applied to the plant called *Kua* by Rheede. Moreover, the obvious ambiguity in the application and interpretation of the name *C. zedoaria* does not encourage us to propose conservation of the name with a different type (Art. 14.9 of the *Vienna Code*, McNeill & al., 2006).

We also do not favour rejection of *C. zedoaria* under Art. 56 of the *Vienna Code* (McNeill & al., 2006). *Curcuma zedoaria* is far from being the only name in the genus to have been applied to more than one taxon, sometimes more often to a taxon, which does not include the type of the name. A proposal for rejection may open Pandora’s Box and lead to further rejection proposals in *Curcuma*. Moreover, the names, which might be used if *C. zedoaria* was rejected, namely *C. raktakanta* Mangaly & M. Sabu and *C. malabarica* Velay & al., have not been used by anyone but their authors. Rejection of *C. zedoaria* would not, therefore, result in greater stability of *Curcuma* nomenclature.

To support Burtt’s lectotypification and clarify the name, which is based on the Rheedean 1692 drawing, an epitype collected in the Malabar area is designated here. A colour plate based on the epitype collection is also provided (Fig. 1).

***Curcuma zedoaria* (Christm.) Roscoe** in Trans. Linn. Soc. London 8: 354. 1807 \equiv *Amomum zedoaria* Christm., Vollst. Pflanzensyst. 5: 12. 1779 \equiv *Curcuma speciosa* Link, Enum. Hort. Berol. Alt. 1: 3. 1821, nom. illeg.

– Lectotype (designated by Burtt, 1977: 59): [icon in] Rheede, Hort. Malab.: 11, t. 7. 1692 – Epitype (designated here): India, Kerala, Ernakulam Dt., North Paravur City, Terketuruttu island, Chendamangalam village, alt. 70 m, N 10°11.157' E 76°13.102', coconut groves, 10.V.2003, Škorničková 84120 (K!; isoeptypes: CALI!, MH!, SING!, PR!)

= *Curcuma raktakanta* Mangaly & M. Sabu in J. Econ. Taxon. Bot. 12: 475. 1989, syn. nov. – Holotype: India, Kerala, Ernakulam District, Neerickode, coconut groves at sea level, 3.VI.1983, Mangaly CU 10346 A (MH!; isotypes: CALI! [Mangaly CU 10346 B], E! [Mangaly CU 10346 C])

= *Curcuma malabarica* Velay. & al. in J. Econ. Taxon. Bot. 14: 189. 1990, syn. nov. – Holotype: India, Kerala, Trichur Dt., Pavaratty, 1.V.1988, Velayudhan AV 158 (MH!; isotypes: E!, IARI)

Link (1821: 3), under *Curcuma speciosa*, referred to “*C. zedoaria* Rosc. Linn. Transact. XI. 275” (Roscoe, 1816) and to “*C. zerumbet* Roxb. R. S. i. 573” (Roemer & Schultes, 1817), which eventually refers to *A. zerumbet* J. König (in Retzius, 1783) and to the illustration of *Zerumbed* in Rumphius (1747: t. 68). Link thus placed in synonymy two species names older than his *C. speciosa*, which makes it a nomen illegitimum. According to Art. 7.5 of the *Vienna Code* (McNeill & al., 2006) it has to be typified by the type of *C. zedoaria*, which is the name that ought to have been adopted under the rules, because the name *C. zerumbet* Roxb. is both later and illegitimate (see below).

Mangaly & Sabu (1993) treated *Curcuma malabarica* as a synonym of *C. caesia* Roxb., while the name *C. zedoaria* was erroneously applied to *C. zanthorrhiza* (ibid.). Later, Sabu (2006) realized that *C. caesia*, which had earlier been reported to be a new record for S India (Sabu & Mangaly, 1990), was, in fact, a different blue-rhizomed species, *C. aeruginosa* so he placed *C. malabarica* in synonymy with *C. aeruginosa*. Detailed study of the holotypes, their duplicates and living flowering material collected from the type localities of *C. malabarica* and *C. raktakanta* has proven, however, that both *C. raktakanta* and *C. malabarica* are conspecific with *C. zedoaria* (Christm.) Roscoe in the sense of the above lecto- and epitypification so they are treated here as heterotypic synonyms. The protologue of *C. raktakanta* describes the lamina as puberulent below and glabrous above but our study of the holotype, both isotypes and of all other material we have seen in herbaria and in cultivation shows that the leaves are glabrous on both sides.

In 1810 Roxburgh, probably unaware of the existence of Roscoe’s 1807 paper published the combination *C. zedoaria* (Christm.) Roxb. He cited “*Amomum zedoaria* Linn. Sp. Pl., Willd. 1.7” as the only element, which is the same element cited by Roscoe for the same combination published three years earlier. Roxburgh’s C.



Fig. 1. *Curcuma zedoaria* (Christm.) Roscoe: A, original illustration of Rheede's Kua (Rheede tot Drakenstein 1692: Table 7; courtesy of RBG Kew); B, plant habit; C, flower in fertile bract (side view); D, flower in fertile bract (front view); E, flower dissection. B–E Based on Škorničková 84120.

zedoaria should, therefore, be considered an isonym, having no nomenclatural relevance. It is interesting to note that Roxburgh understood *C. zedoaria* differently from *C. zedoaria* sensu Roscoe or from *C. zerumbet* Roxb. (see below). The name “*C. zedoaria* Roxb.” was always treated as a synonym of *C. aromatica* Salisb. as proposed by Roscoe (1816) but this judgement was based solely on the fact that both names refer to taxa with green leaves, which are sericeous underneath. Shedding light on the identity

of the plant treated by Roxburgh (1810) as *C. zedoaria*, however, calls for further investigation as the history of the name *C. aromatica* is obscure and the interpretation of this historical name involves a complex of several superficially similar species.

The identity of *Curcuma zedoaria* sensu Roscoe non (Christm.) Roscoe and the search for its correct name. — The plant described and depicted by Roscoe (1825: pl. 109) as *C. zedoaria* (Christm.) Roscoe

does not agree with Christmann's *A. zedoaria* but agrees well with the short original description of *C. zerumbet* Roxb. (1810) and his amplified description with colour plate (Roxburgh, 1811).

Both morphological descriptions, that of *C. zedoaria* by Roscoe in 1825 and *C. zerumbet* by Roxburgh in 1811 represent a *Curcuma* species with a well developed, branched rhizome, which is pale straw-coloured internally (Roxburgh, 1811) or light yellow (Roscoe, 1825). The lamina is green with a prominent red patch running the length of the midrib and glabrous on both sides; the flowers have white corolla lobes. The colour drawings (Roxburgh 1811: t. 201; Roscoe, 1825: t. 109) are remarkably similar to each other. This similarity had already been noticed by Roscoe (1816: 276) who further commented in the description accompanying his plate t. 106, 1825: "at the same time he [Roxburgh] has described the true Zedoary, (the plant figured here,) under the name of *C. zerumbet*, by which name it is also figured and described in the Plants of the Coast of Coromandel, fig. 201". From the general chapter on *Curcuma* in Roscoe's *Monandrian Plants* it is clear that Roscoe obtained from Dr. W. Carey specimens of several native *Curcuma* species preserved in spirit and accompanied by accurate colour drawings of the floral bracts, *C. zerumbet* among them. It is also known that Carey obtained many seeds and plants for his garden at Serampore (near Calcutta) from W. Roxburgh, of whom he was a great friend (Stansfield, 1955).

Roscoe did not explicitly mention the source of his *C. zedoaria* plant in any of his works (1807, 1816, 1825). He says (Roscoe, 1825) that he is "acquainted with upwards of 20 species [of *Curcuma*], nearly all of which are now growing in the Botanic Garden at Liverpool, and about half of which have been figured in the present work [*Monandrian Plants*]"'. It is known that plants were obtained for Liverpool Botanic Garden through several botanists and explorers from different parts of the world, especially from India and the East Indies (Stansfield, 1955; Cullen, 1973). These were sent several times by N. Wallich and W. Carey, both of whom Roscoe acknowledged in the introduction and general chapter on *Curcuma* in *Monandrian Plants*. Close friendship and cooperation are also obvious from the numerous letters of W. Roscoe to N. Wallich and W. Carey (deposited at Liverpool Records Office) but a few Indian plants were also obtained from London nurseries, J.S. Smith and J.D. Hooker. Roxburgh said that *C. zerumbet* is a native of various parts of India, particularly of Bengal where he observed it to blossom in April (Roxburgh, 1811). In his later work (1820) he said that the description of *C. zerumbet* was based on a plant from Chittagong sent by F. Buchanan in 1798 to Calcutta Botanical Garden.

It may be that Roscoe's and Roxburgh's plants were actually part of the same living material, since many

plants sent by Carey or Wallich were of Roxburgh's origin. Even if not, Roscoe could at least compare his living plant of *C. zedoaria* with spirit material of *C. zerumbet*. Under the circumstances mentioned above, Roscoe's statement that *C. zerumbet* as described by Roxburgh is identical with the plant he called *C. zedoaria* seems to be well founded and these two are treated here as the same taxon.

Had Roxburgh not referred to other names and their descriptions in his protologue of *C. zerumbet*, this name would be the first available validly published name suitable for this taxon. Unfortunately, this did not happen and, as already pointed out by Burt & Smith (1972), *C. zerumbet* has to be considered an illegitimate name.

The illegitimacy of *Curcuma zerumbet* Roxb. — Roxburgh (1810: 333), in the protologue of *C. zerumbet* Roxb., referred to heterogeneous elements, which can be listed as follows:

- (1) *Kua*, Rheede Mal. 11: t. 7. (Rheede, 1692);
- (2) *Zerumbed*, Rumph. Amb. 5: t. 68 (Rumphius, 1747);
- (3) *Amomum zerumbeth*, Retz. Obs. 3. 55. [= *Amomum zerumbeth* J. König in Retz., Observ. Bot. 3: 55. 1783, nom illeg. (non *A. zerumbet* L. – for details see Burt & Smith, 1972: 190, 192, 203) referring to Rumphius, Herb. Amboinense 5. p. 68–72 [a typographic error for 168–172], t. 68 as to the only element eligible as a type in the protologue];
- (4) *C. zerumbet* Roxb. (1810) as described in protologue: "Bulbs small, and with the palmate tubers pale straw colour. Leaves green-petioled, broad lanceolate with a purple cloud down the middle. Flowers shorter than their bracts. Flowering time the hot season before the leaves appear. The pale colour of the roots, crimson coma and ferruginous mark down the centre of the leaves, which is a constant mark in this elegant species, readily point it out from every other, which I have yet seen";
- (5) Ind. Pl. 3 No. 201. (= *C. zerumbet* colour plate with description in Pl. Coromandel 3, No. 201), which was printed and distributed in 1811, a few months later than the protologue, but apparently these two works were in press simultaneously and thus Roxburgh cites it here.

The elements that Roxburgh (1810) cited preclude the application of *Curcuma zerumbet* for the taxon he described (4) and depicted (5). *Amomum zerumbeth* J. König (Retzius, 1783) is an illegitimate name being a later homonym of *Amomum zerumbet* L. (Linnaeus, 1753: 1), the basionym of *Zingiber zerumbet* (L.) Sm. which would seem to make Roxburgh's *C. zerumbet* eligible as a new name for it (Art. 58.1). However *C. zerumbet* Roxb. is illegitimate on other grounds. In 1792, Giseke established the genus *Erndlia* based solely on König's *Amomum*

zerumbeth (Giseke, 1792: 209, 229) and with the only species, *E. subpersonata* Giseke, published (p. 252) as an explicit replacement name for it, Giseke citing “*Amomum Zerumbeth* Rumph. amb. 5. p. 68–72 t. 68. Koen. p. 55”. By citing “*Amomum Zerumbeth*, Retz. obs. 3. 55” (i.e., *A. zerumbeth* J. König 1783), Roxburgh (1810) included the type of *Erndlia subpersonata* Giseke, a name that is necessarily homotypic with it (Art. 52.2e, McNeill & al., 2006). Roxburgh should, therefore, have taken up Giseke’s epithet “*subpersonata*”, which was by 1810 a valid and legitimate name, homotypic with *A. zerumbeth* J. König (Art. 52.1, 52.2, McNeill & al., 2006). The name *C. zerumbet* Roxb. is thus a nomen illegitimum, attached to Giseke’s name *E. subpersonata*, and automatically typified by an element from the protologue of *A. zerumbeth* (Art. 7.5, McNeill & al., 2006).

Burt & Smith (1972) have already mentioned that Roxburgh worked mainly with plants that he knew alive and that the citation of *C. zerumbet* Roxb. as a nomenclatural synonym did not necessarily mean that the epithet “*subpersonata*” would be correct for plants described and illustrated by Roxburgh as *C. zerumbet* Roxb. They concluded that the epithet should not be adopted until the identity of the plant had been critically determined.

A close look at the taxonomic identity of the elements included by Roxburgh in his description of *C. zerumbet* reveals that it includes three heterogeneous entities (see Table 1).

The description and plate of Rheede’s Kua (1) are the lectotype of *C. zedoaria* (Christm.) Roscoe (Burt, 1977) and represents a laterally flowering species with no conspicuous red patch on the lamina, which is distributed in S and NE India, as elaborated above.

Amomum zerumbeth J. König (3) is based on *Zerumbed* of Rumphius (2) and thus both represent the same taxon. König (in Retzius, 1783) cited under *A. zerumbeth*: “*Rumph. Herb. Amb. V. p. 68–72. tab. 68*”. This appears to be a typographic error, which occurred in Retzius (1783) and was repeated by later authors. Pages 68–72 of vol. 5 in *Herbarium Amboinense* refer to “*Funnis Muraenarum latifolium, Funis convolutus, Clompanus funicularis* and *Quis qualis*” followed by t. 35, 36 and 37. The account of *Zerumbed* is on pages 168–172 followed by t. 68. It is appropriate to note here that Rumphius (1747) treated the name *Zerumbed/Tommon* as a group name for several species and on pages 168–172 he described six of them (*Tommon Besaar, Tommon Itam, Tommon Poeti, Tommon Giring, Tommon Dingin, Tommon Manga*). Plate t. 68. is the only element eligible as a type, but it is not cited anywhere in Rumphius’s text and is not unambiguously linked to any of these six taxa. In the legend to plate t. 68 only the name *Zerumbed* appears. König (in Retzius, 1783) also failed to specify to which of the six Rumphian taxa described in Chapter “*Zerumbet*” his name *A. zerumbeth*

refers. Based on the descriptions, however, the first species *Tommon Besaar*, which is according to Rumphius also called simply *Tommon*, is the best match to Rumphius’s plate and both agree well with König’s description. *Amomum zerumbeth* J. König is a species with a branched, yellow rhizome, a red patch on the lamina and central inflorescence.

The plant Roxburgh had in mind when describing *C. zerumbet* Roxb. from living material, i.e., elements (4) and (5), is again, a species with a lateral inflorescence, but it differs from Rheede’s Kua by the very prominent red patch on the lamina. All the names mentioned above are vegetatively reproducing taxa with well-developed, branched rhizomes, in which the position of the inflorescence (lateral or central) is a stable character. Both positions never occur in the same taxon, unlike the case in many of the seed-setting species, of which many produce a lateral inflorescence at the beginning of the vegetative season and another inflorescence in the centre of the leaves later in the season. Thus, elements (1), (2) and (3) are in conflict with the description of *C. zerumbet* as put forward by Roxburgh.

To complete the picture, it is necessary to mention one more name, which is intertwined with *C. zerumbet*. Salisbury (1812) published the name *Curcuma officinalis* and included in its synonymy (1) “*Curcuma zerumbet* Roxb. in As. Res. v. 11, p. 16”, (2) “*Amomum zerumbet* Retz. Obs. fasc. 3. p. 35 [typographic error for p. 55; König’s Descriptiones Monandrorum starts on p. 49]” and (3) “*Zerumbed* Rumph. Herb. Amb. v. 5. t. 68”. Similarly to Roxburgh (1810), Salisbury (1812), by including *A. zerumbeth* J. König cited a name homotypic with *Erndlia subpersonata* Giseke and consequently *Curcuma officinalis* is illegitimate (Art. 52.2e, McNeill & al., 2006) and typified by the type of *E. subpersonata*, i.e., Rumphius’s illustration (Rumphius, 1747: t. 68).

As elaborated above, *C. zerumbet* Roxb. and *A. zerumbet* (with its homotypic synonym *E. subpersonata*) are two different taxa in terms of their descriptions. The epithet *subpersonata* should be adopted for the *Curcuma* species with the yellow rhizome, a central inflorescence and leaves with a red patch on the upper surface of lamina, which now includes *A. zerumbeth* J. König, nom. illeg., *E. subpersonata* Giseke, *C. zerumbet* Roxb., nom. illeg., *C. officinalis* Salisb., nom. illeg. There are several taxa, e.g., *C. euchroma*, *C. colorata*, *C. purpurascens* and some yet undescribed, occurring in Indonesia, which agree with König’s description and plate t. 68 well. The identity and synonymy of König’s plant and the nomenclatural treatment of this complex of taxa are beyond the scope of this paper and will be addressed in the future.

A new name for the red patch-leaved *Curcuma*. — Finally we are left to name the plant with the lateral

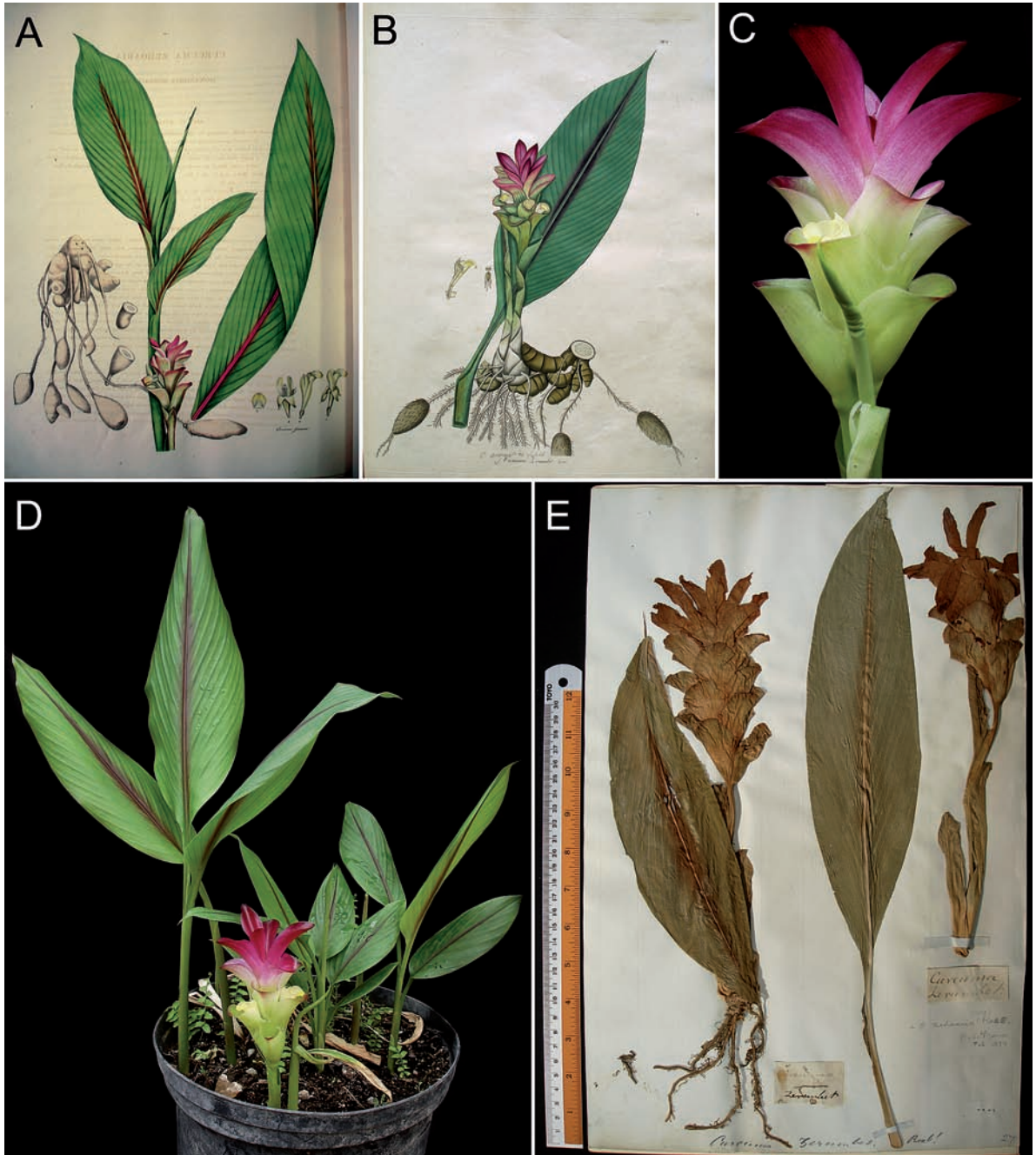


Fig. 2. *Curcuma picta* Roxb. ex Škorničk.: A, Roscoe's illustration of *Curcuma zedoaria* sensu Roscoe non orig. from the *Monandrian Plants of the order Scitamineae* (Roscoe, 1825; courtesy of RBG Edinburgh); B, Roxburgh's illustration of *Curcuma zerumbet* from the *Plants of the Coast Coromandel* (Roxburgh, 1811; courtesy of RBG Kew); C, inflorescence of *Curcuma picta*; D, habit of *C. picta*; E, Roxburgh's specimen (BM; courtesy of the Trustees of the NHM, London) with holotype (left) and paratype (right). C–D based on Škorničková 77028.

inflorescence, a prominent red patch on the leaves and whitish rhizomes, which fits the description and drawing of *C. zedoaria* sensu Roscoe in *Monandrian Plants* (1825) and the description and drawing of *C. zerumbet* sensu Roxburgh in *Plants of the Coast of Coromandel* (1811) (Fig. 2). It is described here as:

***Curcuma picta* Roxb. ex Škorničk., sp. nov.**

- *Curcuma zerumbet* auctt. non Roxb. in *Asiat. Res.* 11: 333. 1810 (reprinted verbatim in *Asiat. Res.* (London, 4to/8vo) 11: 333. 1812) & *Pl. Coromandel* 3: t. 201. 1811. Description and plate only, synonymy excluded.

- *Curcuma zedoaria* auctt. non (Christm.) Roscoe in Trans. Linn. Soc. London 8: 354. 1807 & Monandr. Pl. Scitam.: pl. 109. Mai 1825. Description and plate only, synonymy excluded.

Curcuma aeruginosa Roxb. similis, rhizomate dilute stramineo, corollae lobis lutescentiter albis, macula conspicuissima profunde rubra folii costa tota longitudine currenti infra penetranti (contra *C. aeruginosae* macula penniformi praecipue conspicua in laminae dimidio distali differt).

Type. – India orientalis, *Roxburgh s.n.* (holotype: BM [barcode BM000784099]!; paratype: BM [barcode BM000784100]!).

There is one herbarium sheet at BM, which bears the inscription “Ind. Orient. Dr. Roxburgh” on the reverse and seems to be directly related to Roxburgh’s illustration of *C. zerumbet* in the *Plants of the Coast of Coromandel* (Roxburgh 1811: Table 201). There are fragments of two plants on the sheet (two inflorescences and two leaves), which are likely to belong to two separate gatherings. There are two original labels on the sheet, apparently written in Roxburgh’s hand. The original inscription on the label below the plant to the left (BM000784099) reads, “*Curcuma picta*”. The epithet *picta* was later crossed out and changed by Roxburgh to “*zerumbet*”. The inscription on the label of the plant to the right (BM000784100) reads, “*Curcuma zerumbet*”. Accepting that the plants on the sheet are likely to belong to two separate gatherings we designate the left one as the holotype and the other as the paratype.

Etymology. – *Picta* means painted and refers to the conspicuous deep red patch running along the midrib of the lamina, which looks as if painted with a brush. The name *C. picta* was chosen as it seems to have been the original intention of W. Roxburgh to use it.

Distribution. – Widespread in Asia. We have found it in India (West Bengal, Meghalaya) and a good photograph has been published from Thailand (Apavatjirut & al., 1999: fig. 1). Herbarium materials show that it is found in Sri Lanka, India, Bangladesh, Thailand and Peninsular Malaysia and is introduced into gardens elsewhere in the tropics, e.g., the West Indies.

Full descriptions and a revision of the herbarium materials of *C. zedoaria* (Christm.) Roscoe and *C. picta* will be elaborated in our forthcoming revision of Indian *Curcuma* (Leong-Škorničková & al., in prep.).

CONCLUSIONS

Had Roscoe correctly interpreted the basionym of *C. zedoaria* and had Roxburgh recognized that *A. zerumbet* of König represented a different taxon than his *C. zerumbet* or had both simply described their plants

without attempting to place other people’s names in synonymy under them, we should not have to face the existing level of confusion about these two names. Placing the same elements by the same authors in synonymy under different species set up a reticulate trap, which resulted not only in confusion and very loose application of many *Curcuma* names over many years, but has also resulted ultimately in name changes, now that the rules of nomenclature have been applied retrospectively. Yet, without types for these names, and without clarification of their identities to settle the nomenclature of these historical taxa, it would be impossible to proceed with further work. For nomenclatural reasons, the plant depicted by Roscoe (1825) as *C. zedoaria* and by Roxburgh (1811) as *C. zerumbet* has to be described as new here and is now called *C. picta*, while the name *C. zedoaria* has to be attached to its type—Rheede’s Kua. The first validly published homotypic name for König’s illegitimate *A. zerumbet* is *E. subpersonata* (1792) and this epithet has to be retained when transferring the name to *Curcuma*, where this taxon undoubtedly belongs.

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