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Cytology of Two New Species of *Musa* (*Musaceae*) and Their Sectional Relationship

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Abstract

Cytological observations were made on two recently described new Bornean species of *Musa* L., *M. monticola* and *M. suratii*. Both have 2n = 20. Taxonomic and biogeographic implications are discussed.

Introduction

Two new Bornean species of *Musa* (*Musaceae*) were recently described by Argent (2000), *M. suratii* Argent and *M. monticola* [Hotta ex] Argent, both from Sabah, Malaysia.

Their sectional placement, however, was unconfirmed. As cytological information has historically been of major value in helping to determine the sections and relationships in *Musa* taxonomy (Simmonds, 1962), chromosome preparations of these two species were made.

Materials and Methods

Seeds collected in the field were germinated in garden compost under glass at 28°C. Young seedlings were potted up for growing on. Root tips were pre-treated in alpha-bromonaphthalene for 22 h at 4.5°C or in paradichlorobenzene for 4 h at room temperature (c. 20°C), fixed in 3:1 ethanol:glacial acetic acid and stored in this fixative until required. After hydrolysis in 5M HCl at room temperature for 30 min, the roots were transferred to the Feulgen Reagent (prepared according to Fox, 1969) for 2 h. After washing with tap water, roots were placed in an 1:1 enzyme mixture of 2% pectinase and 2% cellulase for 60 min. Squashing was done in 45% acetic acid or in 0.4% aceto-carmine. Permanent slides were prepared according to a modified freezing method outlined in Jong (1997).

Cytological Observations and Discussion

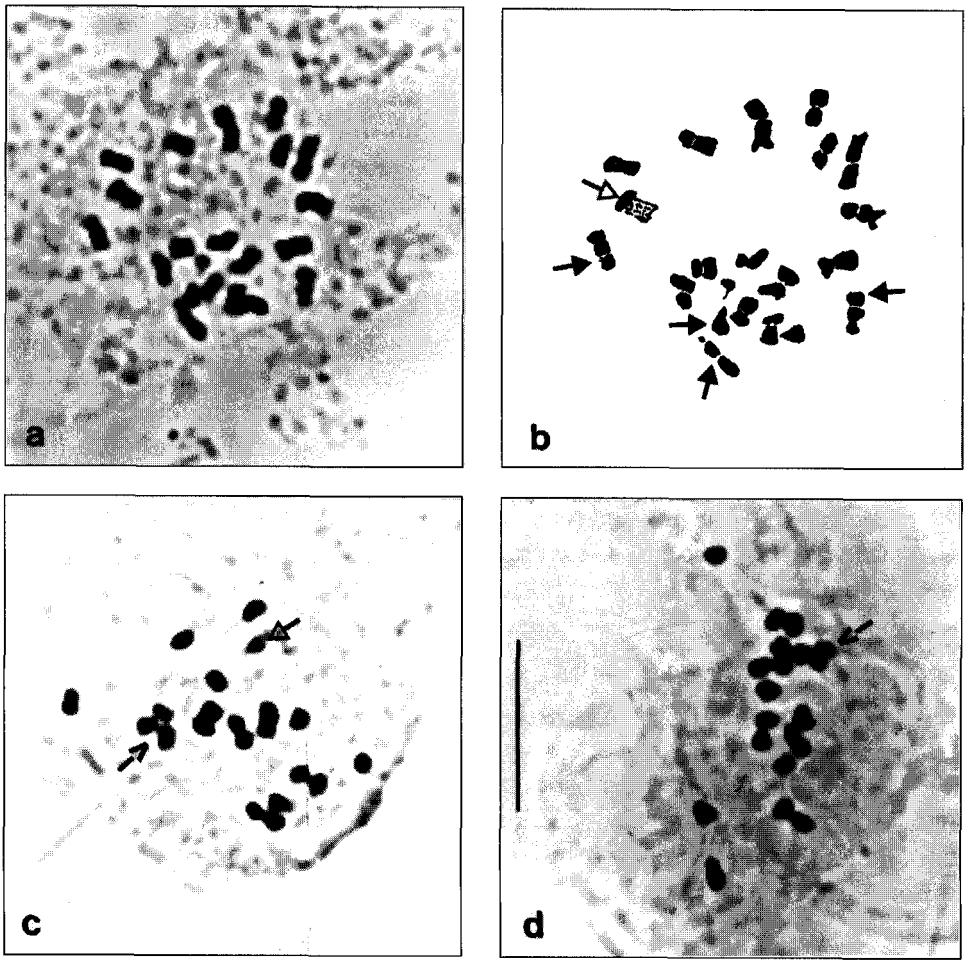
Musa has a range of basic chromosome numbers that is associated with the traditional sections (Stover and Simmonds 1987) as follows:

Section	Basic Number
Musa (formerly *Eumusa*) Baker	x = 11
Rhodochlamys Sagot	x = 11
Australimusa Cheesman	x = 10
Callimusa Cheesman	x = 10
[*Musa beccarii*] *Incertae Sedis* Simmonds	x = 9
Ingentimusa Argent	x = 7

One section, *Ingentimusa* is represented only by a single species, *M. ingens* Simmonds. The genus *Ensete* Horan has a basic number of 9, the same as *Musa beccarii* N.W. Simmonds, although there is no question that that species belongs with *Ensete,* its position within *Musa* is still problematic since molecular and morphological data (Jarret & Gawel 1995) appear to be in conflict. In fact, there has been a progressive tendency to amalgamate sections *Musa* and *Rhodochlamys* (Simmonds 1962, Jarret and Gawel 1995, Shepherd 1999). Further, Jarret and Gawel (1995) imply that *Musa coccinea* Andr. is sufficiently different from the other *Musa* species to be placed in a section of its own. The only basic number missing from this dysploid series of x = 7 to 11 is x = 8.

The somatic chromosome number of both *M. suratii* and *M. monticola* is 2n = 20 (Fig. 1a–1d). There are, however, certain cytological differences between the two species that are worth noting. The chromosomes of *M. suratii* are larger than those of *M. monticola*, and at least two pairs of chromosomes bear satellites. There is also a gradual gradation of chromosome size not obvious in *M. monticola*, where only one satellited chromosome pair is visible. Interphase nuclei are finely granulose, with no distinctively stained chromocentres, in contrast to those of *M. monticola*, where chromocentres are obvious and numerous. Unlike *M suratii*, there is a characteristic tendency for chromosomes in *M. monticola* to associate in twos, often so closely together that they might be mistaken as single chromosomes; quite frequently there is one association of three as illustrated in Fig 1c and 1d.

In terms of chromosome number, both new species fall within either sect. *Callimusa* or sect. *Australimusa* whose basic chromosome number is x = 10. At present we have insufficient evidence to say whether the difference in the chromosome morphology and behaviour noted above are consistent



Figures 1a and 1b *Musa suratii*, metaphase, 2n = 20. 1b is a drawing of 1a, solid arrowheads indicating satellited chromosomes. Open arrow points to chromosome partially out-of-focus. **Figures 1c and 1d** *Musa monticola*, metaphase, 2n = 20 from different roots. Note marked close association of certain chromosomes in twos, and one in a group of three. Open arrow points to out-of-focus chromosome. Scale bar = 10 μm

or taxonomically significant between these two sections.

Section *Callimusa* has distinctive seed morphology with elongated, barrel-shaped seeds that have a large oil store, which is represented in old seed by an air space. Most of the species also have well-developed corrugated, scarious auricles at the apex of the leaf sheath ('shoulder' as defined by Argent 1976). *Australimusa* seeds by contrast are variable from globose to highly angled, the leaves have variable 'shoulders' on the leaf

sheaths, which may occasionally be loosely corrugated but are never expanded into auricles. On these morphological grounds, both species are clearly associated with sect. *Australimusa* rather than sect. *Callimusa*.

Hotta (1987) clearly realised the relationship between *Musa monticola* and the local form of *M. textilis Née* in Sabah and the seed, although slightly larger and more distinctly mammilose, is very similar to that of cultivars of *M. textilis*. *Musa suratii* has the smallest seed recorded in the genus but the morphology is even closer to that of *M. textilis*, which is the type species of sect. *Australimusa*. However, *Musa suratii* has extraordinary morphology with green flowers, orange bracts, a very slender habit and copious wax. All of these characters considerably expand the concept of sect. *Australimusa*. The description of two more species in sect. *Australimusa* from Borneo moves the emphasis of the distribution a little more to the west as previously five of the six known species occurred in New Guinea and the Solomon Islands. Now with the uncertain status of *M. muluensis* Hotta and *M. tuberculata* Hotta, it is looking as if Borneo may actually encompass more variation in this section than is found in New Guinea.

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