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Cytogenetic studies and taxonomic considerations in some taxa of *Mallotus* (Euphorbiaceae) in Thailand

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ABSTRACT. An investigation into the cytogenetics of Thai *Mallotus* (Euphorbiaceae) indicated that all plants have highly distinctive chromosomes at diakinesis and first anaphase. Bivalent length is 1.33–6 μm in pollen mother cells of 160–286.67 μm. The chromosome numbers of *Mallotus* can be divided into three groups, viz: 2n = 20 (10II), 22 (11II) and 24 (12II). Chromosome numbers of 11 species are recorded for the first time. The basic numbers of *Mallotus* are x = 10, 11 and 12. These dysploid numbers may have evolved through a decrease from 2n = 22 to 2n = 20. *M. oblongifolius* is taxonomically conspecific with *M. peltatus* but their chromosome numbers are different with 2n = 20 and 2n = 22 respectively. Therefore, these two species should be maintained as distinct taxa.

INTRODUCTION

Mallotus Lour. is a paleotropical genus and comprises 150 species ranging from Africa and Madagascar through Southeast Asia and Malesia to Australia and the western Pacific. There are 35 species in Thailand of which two are new records and three newly described. They are used as medicinal plants (*M. barbatus*, *M. floribundus*, *M. macrostachyus*, *M. paniculatus* and *M. philippensis*), for wood (*M. miquelianus*), for dye (*M. philippensis*) and as ornamental plants (*M. floribundus*) (Chayamarit et al., 2001). Cytogenetics have played an active part in the understanding of hereditary mechanisms of plant diversity. They also represent one of the numerous disciplines that plant improvement relies upon. The data from this study will be useful for future taxonomic work on *Mallotus*.

MATERIALS AND METHODS

Chromosome counts were made from 13 species of *Mallotus* collected at various locations in Thailand (Table 1). The chromosomes were isolated from young flowers which were fixed in Carnoy's solution for 24–48 hours. The anthers were squashed and stained with propionocarmine and the chromosomes then examined using 100x magnification through an Olympus-BHA light microscope. Counts were made from 20 well-spread cells from each species at various stages of meiois. Voucher specimens are deposited at the herbaria of Department of Plant Science, Mahidol University, Department of Biology, Khon Kaen University and the Royal Garden Suanluang, Rama IX, Bangkok.

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RESULTS AND DISCUSSION

Chromosomes of the microsporocytes of *Mallotus* were very well stained with propionocarmine. Most of them were identified at diakinesis with a bivalent length 1.33–6 μm in cells of 160–286 μm. Chromosome numbers and meiotic figures could be divided into three groups. Group I had 2n = 20 (10II) and comprised *M. oblongifolius* and *M. pallidus*. Group II had 2n = 22 (11II), and comprised *M. barbatus*, *M. macrostachyus*, *M. miquelianus*, *M. montanus*, *M. peltatus*, *M. repandus* and *Mallotus* sp. Group III had 2n = 24 (12II) and comprised *M. paniculatus*, *M. resinosus* and *M. spodocarpus* (Table 1; Figs. 19–33). Most species studied showed balanced first anaphase cells. Chromosome numbers of 11 species were recorded for the first time. The results revealed that *Mallotus* has basic numbers of x = 10, 11 and 12. These agree with the findings of other workers. Perry (1943) reported that *M. japonicus* has 2n = 36, Soontornchainaksaeng & Chaiyasut (1999) and Missouri Botanical Garden (2003) reported that *M. babatus* has 2n = 22 and *M. apelta* and *M. philippensis* have 2n = 11, respectively. These dysploid numbers may reflect ploidy level variation combined with hybridisation in species or cytotypes during evolution. Dysploidy is of relatively frequent occurrence among seed plants within populations or genera.

Airy Shaw (1972) accepted both *M. oblongifolius* and *M. peltatus* as distinct species. However, van Welzen et al. (2000) reduced *M. oblongifolius* to a synonym of *M. peltatus*, suggesting that the only difference between them was the absence or presence of a peltate leaf base. However, specimens (referred to *M. peltatus*) with peltate leaves often have non-peltate ones and specimens (always referred to *M. oblongifolius*) with non-peltate leaves often have peltate ones. Our cytological investigation showed that the chromosome numbers of these two species are different, suggesting that the two taxa should be maintained as distinct. Further study is needed to confirm their status.

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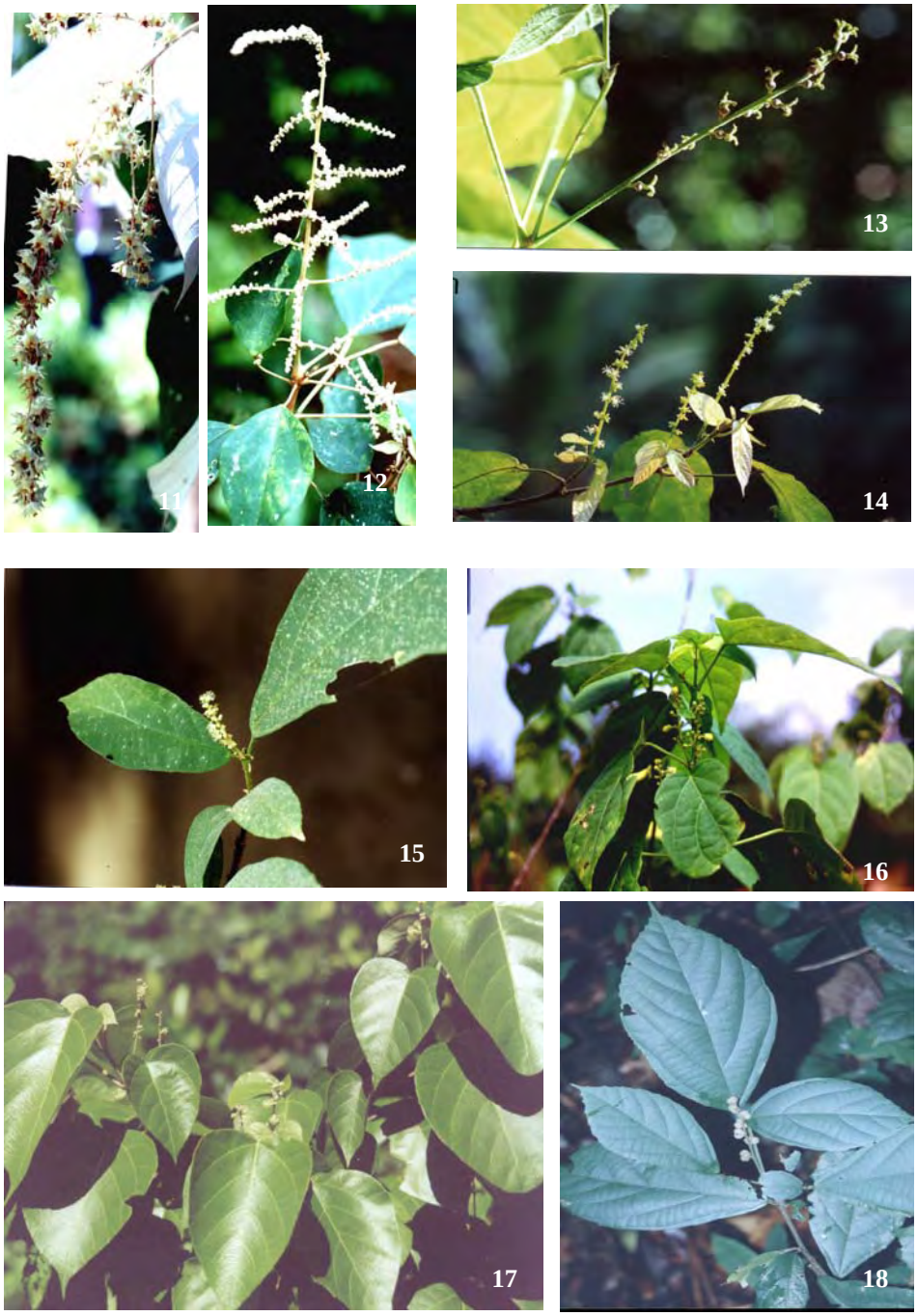
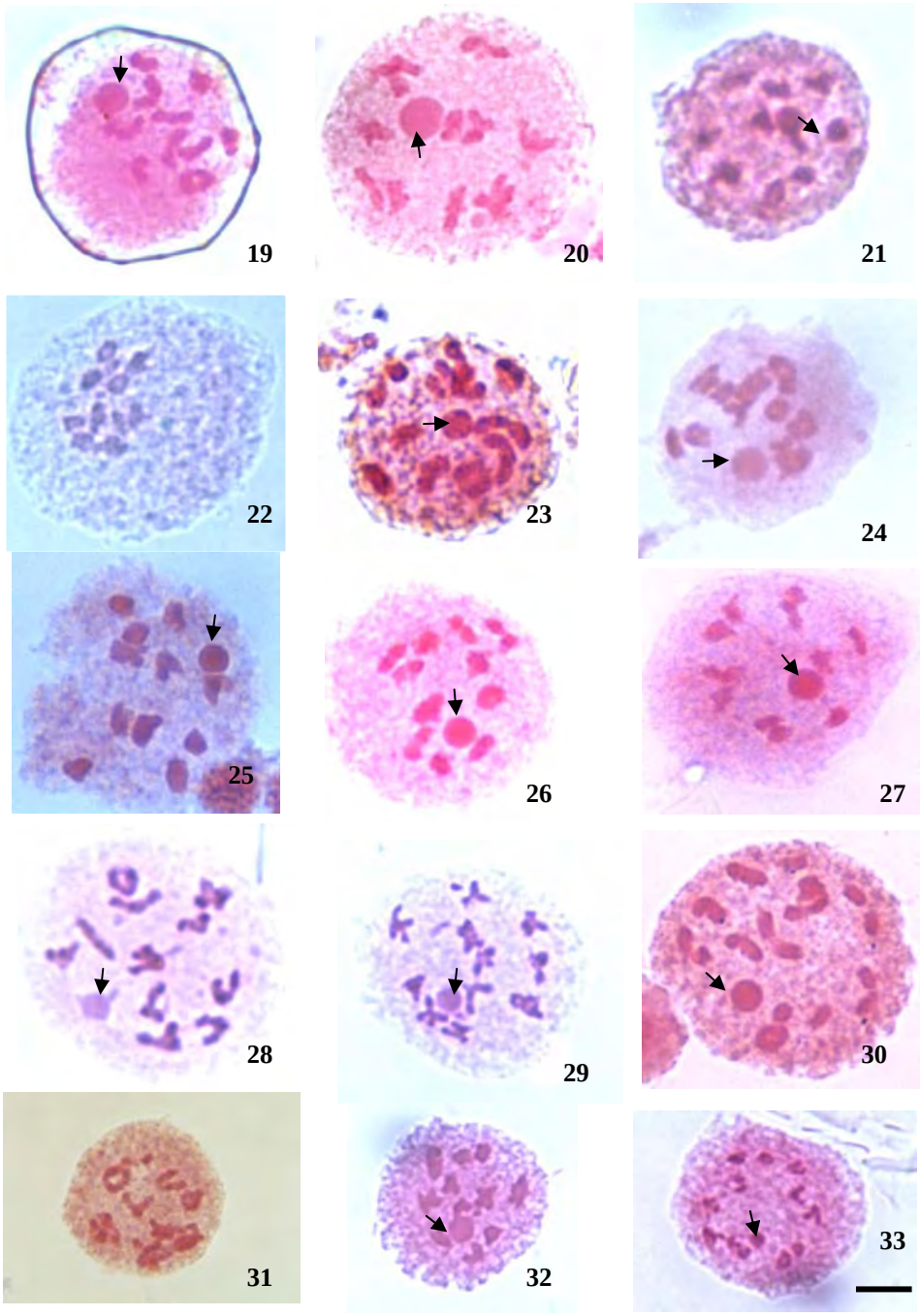
Table 1. Meiotic chromosome counts of Thai *Mallotus* II = bivalent, Ref. = reference number; prev. = Soontornchainaksaeng, P. & Chaiyasut K. (1999); Coll. no. = P. Soontornchainaksaeng *et al*.; *Coll. No. = C. Senakun & W. Tongpubal.

Species	Chromosome Number			Meiotic figure	Record /(Ref.)	Locality	Coll. no.
	2n	n	x				
1. *M. barbatus* Müll. Arg.	22	11	11	11II	prev	Prachuap Khiri Khan	148
2. *M. macrostachyus* Müll. Arg.	22	11	11	11II	1st	Trang	375
3. *M. miquelianus* Boerl.	22	11	11	11II	1st	Songkhla	276
4. *M. montanus* Airy Shaw	22	11	11	11II	1st	Songkhla	281, 291
5. *M. oblongifolius* Müll. Arg.	20	10	10	10II	1st	Songkhla	278
6. *M. pallidus* Airy Shaw	20	10	10	10II	1st	Prachuap Khiri Khan	261
7. *M. paniculatus* Müll. Arg.	24	12	12	12II	1st	Songkhla	296
8. *M. peltatus* Müll. Arg.	22	11	11	11II	1st	Chanthaburi	411
9. *M. repandus* Müll. Arg.	22	11	11	11II	1st	Sa Kaeo	386
10. *M. resinosus* Merr.	24	12	12	12II	1st	Prachuap Khiri Khan	*70
11. *M. spodocarpus* Airy Shaw	24	12	12	12II	1st	Lop Buri	203
12. *M. tiliifolius* Müll. Arg.	24	12	12	12II	1st	Chumphon	150
13. *Mallotus* sp.	22	11	11	11II	-	Chachoengsao	138

Figures 1–10. *Mallotus* spp.: 1. *M. barbatus*; 2–3. *M. macrostachyus*; 4–5. *M. miquelianus*; 6. *M. montanus*; 7–8. *M. paniculatus*; 9–10. *M. pallidus*.



Figures 11–18. *Mallotus* spp.: 11–12. *M. paniculatus*; 13–14. *M. peltatus;* 15. *M. resinosus;* 16. *M. spodocarpus;* 17. *M. tiliifolius;* 18. *Mallotus* sp.



Figures 19–33. Diakinesis cells of 13 species of *Mallotus*: Figs. 19–21. 2n = 20; 19. & 20. *M. oblongifolius*, 21. *M. pallidus* Figs. 22–29. 2n = 22; 22. *M. barbatus*, 23. *M. macrostachyus*, 24. *M. miquelianus*, 25. *M. montanus*, 26. *M. peltatus*, 27. *M. rependus*, 28. & 29. *Mallotus* sp. Figs. 30–33. 2n = 24; 30. *M. paniculatus*, 31. *M. resinosus*, 32. *M. spodocarpus*, 33. *M. tiliifolius* Arrows indicate nucleolus. Scale bar = 10 μm.