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Karyology of *Jatropha* (Euphorbiaceae) in Thailand

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ABSTRACT. The karyology of five species of *Jatropha* (Euphorbiaceae) in Thailand was investigated. Chromosomes of the microsporocytes of *Jatropha* were well stained with propionocarmine. Most of them were paired as bivalents at first metaphase and separated to 11:11 at first anaphase. Chromosomes of the taxa studied are of very small size. Bivalent length ranges from 1–3.67 μm. Most species have chromosome numbers of 2n = 22 and a base number of x = 11. *J. curcas* is chromosomally similar to *J. multifida.* Both of these taxa have a meiotic configuration of 7ringII + 4rodII. *J. integerrima* 'Red flower' and 'Pink flower' have the same meiotic configuration of 6ringII +5rodII. *J. podagrica* has a meiotic configuration of 8ringII + 3rodII. The karyology of *J. gossypifolia* was determined from first anaphase cells: the chromosomes separated to 11:11. *J. curcas* and *J. multifida* and, perhaps, *J. gossypifolia* appear closely related to each other based on their meiotic configuration and morphological similarity.

INTRODUCTION

Jatropha L. is a diverse and widespread genus of 175 species (Airy Shaw, 1972). It is particularly common in Tropical America and Africa, with a few species native to Southwest Asia. Asia and one species in Madacascar. None are native to Southeast Asia, Australasia or Oceania. *J. curcas* L., the Physic Nut, yields a powerful purgative. The bark of *J. dioica* Sesse is used for tanning and dyeing. Several species are cultivated, mainly in the tropics (Smith, 2001).

There are five species of *Jatropha* cultivated in Thailand. *J. curcas* L. and *J. gossypifolia* L. are used as medicinal plants, whilst *J. integerrima* Jacq., *J. multifida* L. and *J. podagrica* Hook. are attractive ornamentals (Chayamarit et al., 2001). *Jatropha curcas* has potential as a source of a combustible organic oil.

There are many previous records of chromosome numbers in *Jatropha* as shown in Table 1. Here we report the karyology of the five species present in Thailand.

MATERIALS AND METHODS

Jatropha curcas, *J. gossypifolia*, *J. integerrima* 'Red flower' and 'Pink flower', *J. multifida* and *J. podagrica* (Fig. 1) were collected from naturalised populations. Flower buds were fixed in Carnoy's solution and stored in 70 % ethyl alcohol under refrigeration. Slide preparations were made using the propionocarmine squash technique.

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Karyological observations were made from well spread chromosomes at stages of pollen mother cell development. Chromosome numbers were determined approximately from 25 cells viewed under a light microscope (Olympus model BHA). The best cells were photographed at 100x using an oil immersion objective. Voucher specimens were made for all samples and placed in the Department of Plant Science Herbarium at Mahidol University, the Department of Biology Herbarium at Khon Kaen University and the Royal Garden Suanluang, Rama IX, Bangkok.

RESULTS AND DISCUSSION

The chromosomes of the microsporocytes of *Jatropha* were well stained with propionocarmine. Most of them were paired in bivalents at first metaphase and separated to 11:11 at first anaphase (Table 2, Fig. 2). The chromosomes of the *Jatropha* taxa studied are of very small size. Bivalent length ranges from 1–3.67 μm. The results suggest that *Jatropha* is fully fertile and stable in its naturalised habitat. Most of the taxa have chromosomes number of 2n = 22 and a base number of x = 11 respectively. These results agree with previous studies (Table 1).

The meiotic configuration of *Jatropha* is as follows: *J. curcas* is similar to *J. multifida*. Both of them have meiotic configurations of 7ringII + 4rodII. *J. integerrima* 'Red flower' and 'Pink flower' show the same meiotic configuration of 6ringII + 5rodII. *J. podagrica* has a meiotic configuration that is different from the others of 8ringII + 3rodII. *J. gossypifolia* was determined in first anaphase cells: the chromosomes separated to 11:11 respectively. *J. curcas* and *J. multifida* and, perhaps, *J. gossypifolia* appear closely related to each other based on their meiotic configuration and morphological similarity.

J. curcas is the only species which was found to be both diploid and tetraploid. As with many genera, such as *Bauhinia, Cassia, Crotalaria, Desmodium* and *Vigna* (Leguminosae), all members of *Jatropha* have the same chromosome numbers within a ploidy level. *J. integerrima* 'Red flower' and 'Pink flower' have the same chromosome number and meiotic configuration. Chromosome numbers of most of the studied species of *Jatropha* are in accordance with those of previous studies and are stable over a wide geographical range.

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Table 1. Previous records of chromosome numbers of *Jatropha*.

Species	Chromosome number		References
	G	S	
1. *Jatropha capensis* Sond.	-	22	Dehgan (1984)
2. *J. cardiophylla* Arg.	-	22	Missouri Botanical Garden (2003)
3. *J. cathartica* Teran & Berland	-	22	Missouri Botanical Garden (2003)
4. *J. cordata* Arg.	-	22	Missouri Botanical Garden (2003)
5. *J. curcas* L.	11,-	22;44	Darlington & Wylie (1965); Missouri Botanical Garden (2003); Moore (1973); Somboonsarn (1983); Soontornchainaksaeng & Chaiyasut (1999)
6. *J. glandulifera* Roxb.	-	22	Sinpatananon & Hongthongdaeng (1993)
7. *J. gossypifolia* L.	11	22	Darlington & Wylie (1965); Missouri Botanical Garden (2003); Moore (1973); Somboonsarn (1983); Soontornchainaksaeng & Chaiyasut (1999)
8. *J. hetrophylla* Heyne	-	44	Missouri Botanical Garden (2003)
9. *J. integerrima* Jacq.	-	22	Missouri Botanical Garden (2003)
'Red flower'	11	22	Soontornchainaksaeng & Chaiyasut (1999)
'Pink flower'	11	22	Soontornchainaksaeng & Chaiyasut (1999)
10. *J. macrorhiza* Benth.	-	22	Missouri Botanical Garden (2003)
11. *J. multifida* L.	11	22	Darlington & Wylie (1965); Missouri Botanical Garden (2003); Soontornchainaksaeng & Chaiyasut (1999)
12. *J. pandurifolia* Andrews	11	22	Missouri Botanical Garden (2003)
13. *J. podagrica* Hook.	-	22	Moore (1973); Soontornchainaksaeng & Chaiyasut (1999)

G = gametophytic count
S = sporophytic count

Table 2. Chromosome number and meiotic configurations of *Jatropha* in Thailand.

Species	Chromosome number			Meiotic configuration	Locality	Coll. no.
	2n	n	x	s		
J. curcas L.	22	11	11	11II	Nakhon Pathom	041
J. gossypifolia L.	22	11	11	11:11	Nakhon Pathom	042
J. integerrima Jacq.	22	11	11	11II	-	-
'Red flower'	22	11	11	11II	Bangkok	194
'Pink flower'	22	11	11	11II	Bangkok	195
J. multifida L.	22	11	11	11II	Nakhon Pathom	196
J. podagrica Hook.	22	11	11	11II	Nakhon Pathom	197

Coll. No. = P. Soontornchainaksaeng et al. collection number
II = bivalent

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Figure 1. Morphological variation of *Jatropha* (Euphorbiaceae) in Thailand: A. *J. curcas* L.; B. *J. gossypifolia* L.; C. *J. integerrima* Jacq. 'Red flower'; D. *J. integerrima* Jacq. 'Pink flower'; E. *J. multifida* L.; F. *J. podagrica* Hook.

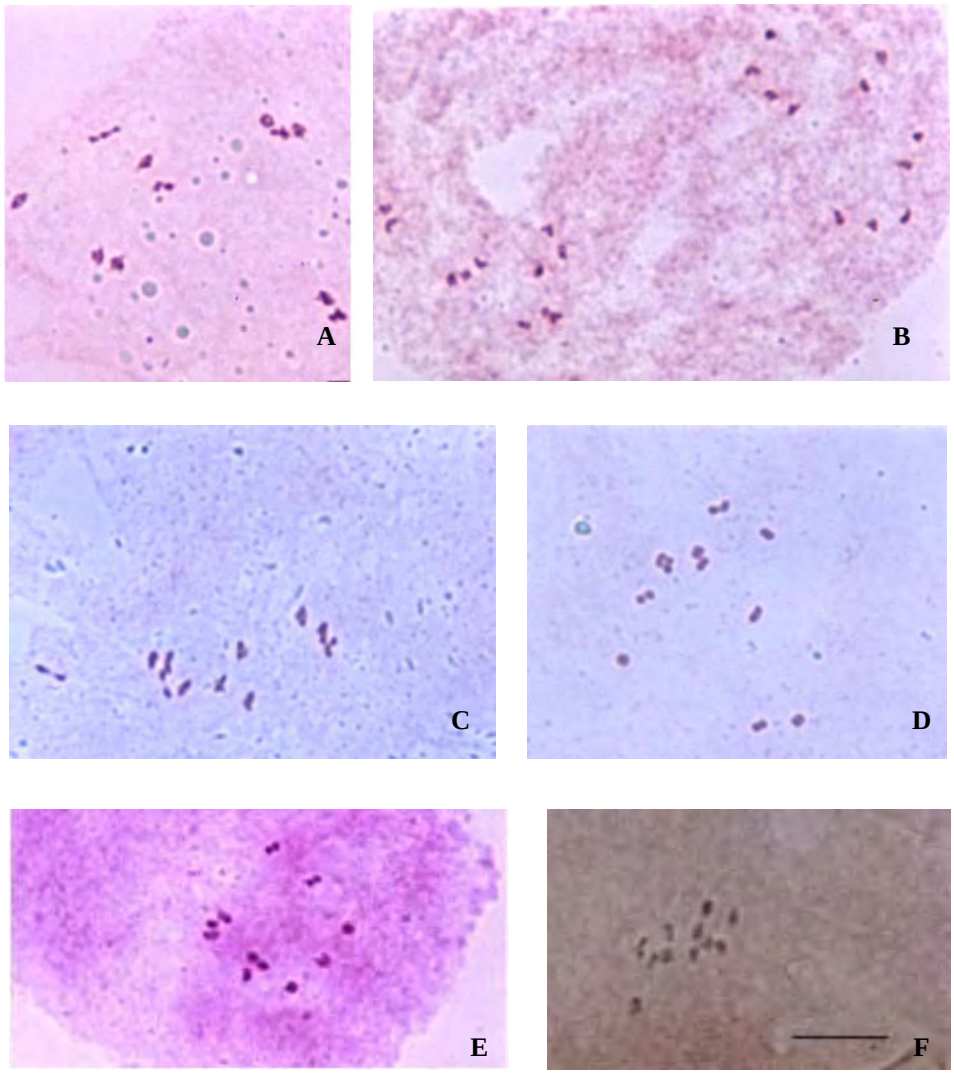


Figure 2. Chromosomes in the pollen mother cells of *Jatropha.*
A. First metaphase chromosomes of *J. curcas* (2n = 22; 7ringII + 4rodII).
B. First anaphase chromosomes of *J. gossypifolia* (n = 11; 11:11).
C. First metaphase chromosomes of *J. integerrima* (cv. Red flower) (2n = 22; 6ringII + 5rodII).
D. First metaphase chromosomes of *J. integerrima* (cv. pink flower) (2n = 22; 6ringII + 5rodII).
E. First metaphase chromosomes of *J. multifida* (2n = 22; 7ringII + 4rodII).
F. First metaphase chromosomes of *J. podagrica* (2n = 22; 8ringII + 3rodII).
Scale bar = 10 μm.