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A report on new chromosome number of three *Dioscorea* species

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Abstract

Chromosomal study conducted in nine species of *Dioscorea* from different forest belts of Tripura revealed that their somatic chromosome number ranged from 2n=40 to 2n=60. The record of 2n=40 chromosome in the sexual phenotypes of *Dioscorea hamiltonii*, *Dioscorea glabra* and *Dioscorea pubera* are the first time report from Tripura, North East India. Moreover the somatic chromosome counts of 2n=60 in *Dioscorea pentaphylla* would be attributed as a new cytotype. However at the respective ploidy level no difference in somatic chromosome count was observed between their sexes.

Keywords: First report; chromosome number; ploidy level; *Dioscorea*

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Introduction

The genus *Dioscorea* commonly known as yam, a perennial climber belongs to the family Dioscoreaceae is highly economically important tuberous crop (1). *Dioscorea* tuber secure fourth rank as a tuber crop after potato, cassava and sweet potato (2). The taxon is mostly dioecious in nature although few monoecious species were also recorded (3-7). Interestingly, the male and female plants of *Dioscorea* species produced morphologically distinct tuber. Because of small chromosome sizes *Dioscorea* is considered as one of the most challenging genera with respects to cytotaxonomic and cytogenetic perspectives (8-11). However, the occurrence of polyploidy in cultivated *Dioscorea* species is common possibly due to the usage of tubers or bulbils for multiplication. Previous cytological investigation expounded *D. alata* somatic chromosome number ranged from 2n=30 to 2n=80 (12-15). Lack of sex specific chromosomal information prompted us to evaluate the chromosome number of two different sexual phenotypes of nine *Dioscorea* species collected from different forest belts of Tripura.

Materials and Methods

For chromosomal study, healthy root tips were collected from tuber of male and female plants of all the *Dioscorea* species from the experimental garden of Tripura University campus. The collected healthy fresh root tips were carefully washed and pre-treated in saturated solution of Para-dichloro benzene (PDB) at 4°C for 5 min and finally at 12°C

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Table 1: Chromosomal profile of the male and female plant of nine *Dioscorea* species found in Tripura

Name of plant species	Sex specific chromosome number		Established Reports	
	2n	2n	2n	References
	Male	Female		
Dioscorea alata	60	60	30, 40, 50, 60, 70, 80	Sundara Raghavan 1958, Essad 1984
Dioscorea bulbifera var. *bulbifera*	40	40	36, 40, 54, 60	Miege 1954
Dioscorea glabra	40	40		***
Dioscorea hamiltonii	40	40		***
Dioscorea hispida	40	40	40	Sundara Raghavan 1958, Essad 1984
Dioscorea oppositifolia	40	40	40	Smith 1937, Essad 1984
Dioscorea pubera	40	40		***
Dioscorea pentaphylla	60	60	40, 80, 70	Sundara Raghavan 1958, 1959, Essad 1984
Dioscorea wallichii	40	40	40	Sundara Raghavan 1959, Essad 1984

*** First report of chromosome number

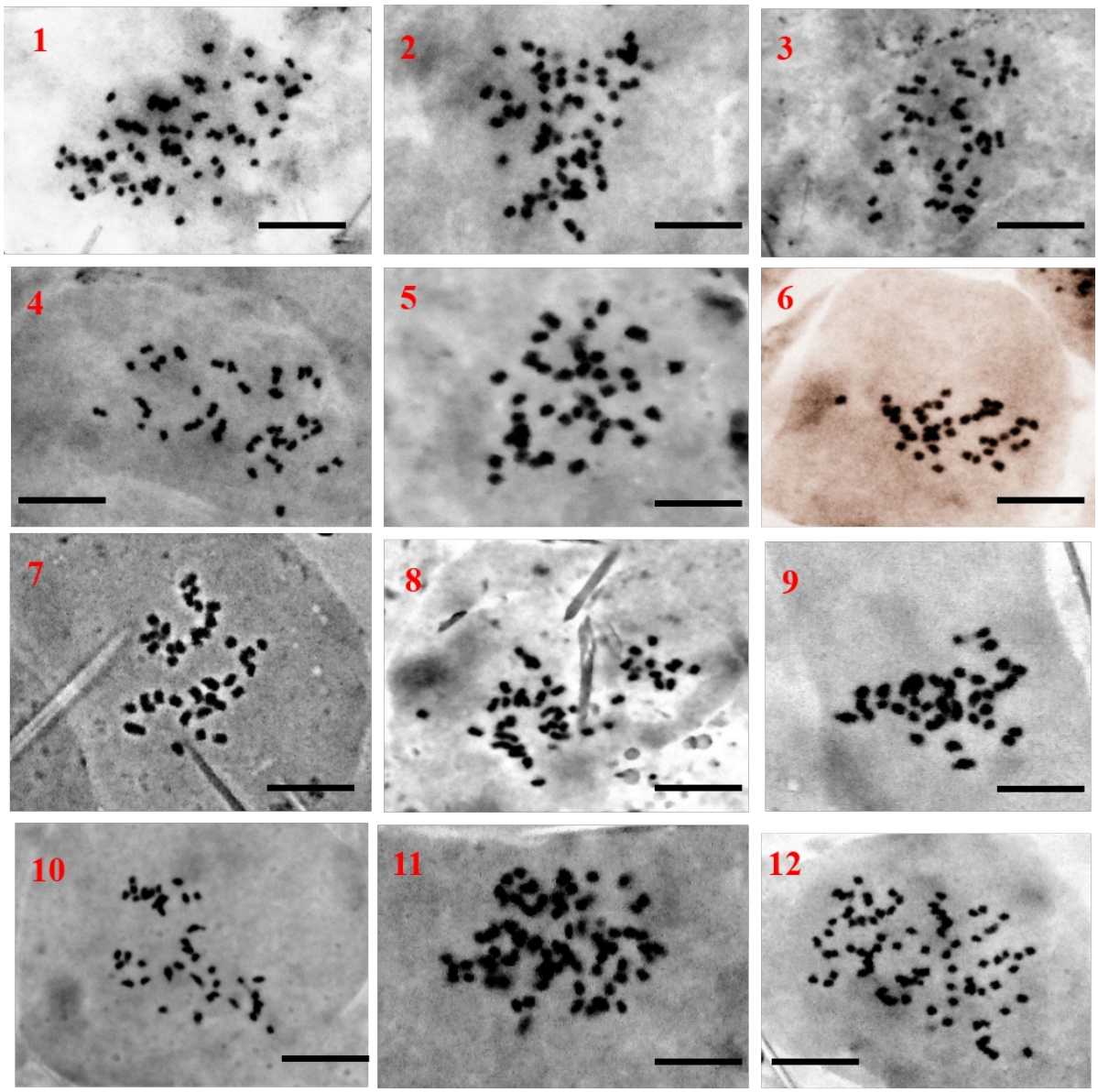

Fig. 1: Microphotographs of chromosomes of *Dioscorea* species 1-*D. alata* (male), 2n=60; 2. *D. alata* (female), 2n=60; 3. *D. bulbifera* var. *bulbifera* (male), 2n=40; 4. *D. bulbifera* var. *bulbifera* (female), 2n=40; 5. *D. glabra* (male), 2n=40; 6. *D. glabra* (female), 2n=40 7. *D. hispida* (male), 2n=40; 8. *D. hispida* (female), 2n=40; 9. *D. pubera* (male), 2n=40; 10. *D. pubera* (female), 2n=40; 11 *D. pentaphylla* (male), 2n=60; 12. *D. pentaphylla* (female), 2n=60; Scale bars=(1, 3 ,10 & 12)=200µm; (4,6&8)=250 µm; (2,5,7, 9&11) =300 µm.

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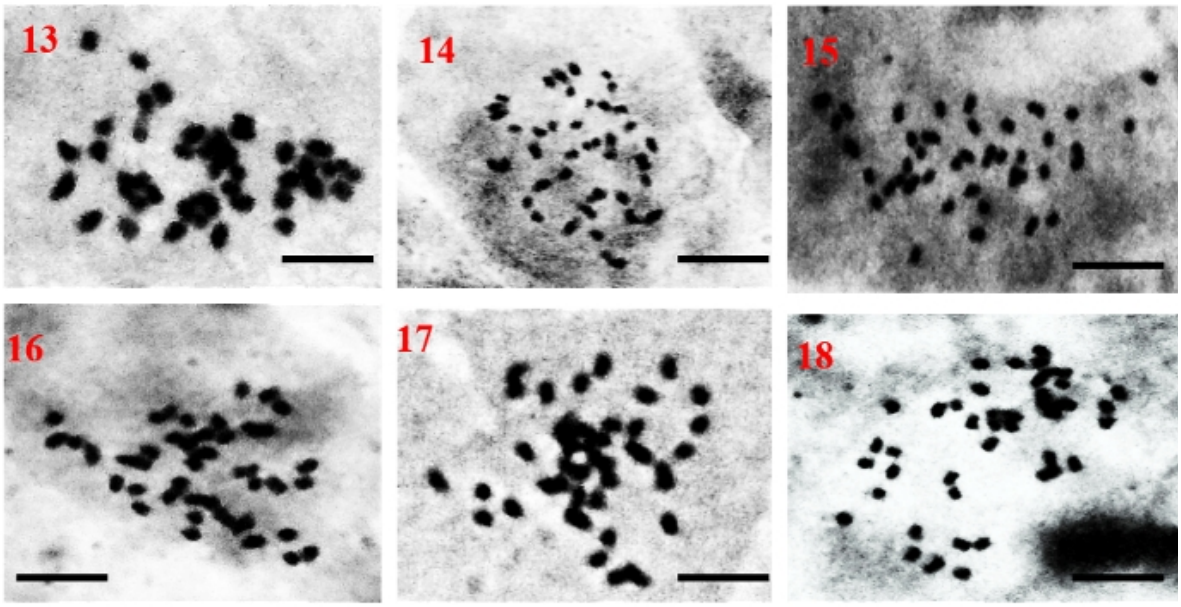

Fig. 2: Microphotographs of chromosomes of *Dioscorea* species. 13. *D. oppositifolia* (male), 2n=40; 14. *D. oppositifolia* (female), 2n=40; 15. *D. wallichii* (male), 2n=40; 16. *D. wallichii* (female), 2n=40; 17. *D. hamiltonii* (male), 2n=40; 18. *D. hamiltonii* (female), 2n=40, Scale bars= (13 &17) =300µm; (14) = 250 µm; (15, 16 & 18) =250 µm.

for 3 h followed by fixation in acetic acid: ethyl alcohol (1: 3) for 24 h. Then root tips were treated with 45% acetic acid for 10 min and stained in 2% aceto-orcein and 1(N) HCl (9:1) mixture for overnight. After staining the root tips were squashed in 45% acetic acid and studied under a compound microscope (16).

Results and Discussion

In the present study the somatic chromosome count of both the sex forms of nine *Dioscorea* species was determined and it was found that their somatic chromosome count ranged from 2n=40 to 2n=60 (Table 1, Fig. 1 & 2). It was also observed that the male and female plant of *Dioscorea bulbifera* var. *bulbifera*, *D. glabra*, *D. hamiltonii*, *D. hispida*, *D. oppositifolia*, *D. pubera* and *D. wallichii* had a chromosome count of 2n=40. In comparison to these the diploid chromosome number of the sex forms of *D. alata*, and *D. pentaphylla* were recorded as 2n=60 chromosome. Curiously the diploid chromosome number of each sex form of three *Dioscorea* species viz. *D. hamiltonii*, *D. pubera* and *D. glabra* also had a chromosome count of 2n=40 and thus no difference was observed between the sexes at chromosome number level. This study also revealed that the most of the *Dioscorea* species found in Tripura have diploid chromosome number 2n=40 and two species viz. *D. alata* and *D. pentaphylla* have somatic chromosome count 2n=60 in their respective phenotypes as was reported by earlier researchers (8,17-20). The present study also depicts at the basic chromosome number, is indeed X=10 in all the dioecious species studied in this exploration. Similar such results were also recorded in previous findings (9,22). However, basic number X=8, 9 and 12 (8) reported by the earlier worker was not exposed in this investigation. The Ploidy level of *Dioscorea* species is an important trait for the utilization of these species in breeding programme as well as in the enhancement of ploidy manipulation in inter- and intra-specific crosses.

Conclusion

The present study embodies the first time chromosomal report (2n=40) in three dioecious species of *Dioscorea* viz. *D. hamiltonii*, *D. glabra* and *D. pubera* carried out from the forest belts of Tripura. In general no difference was observed in somatic chromosome number in relation to sex in all the species studied. The detail analysis of their karyotype is essential for further exploitation of germplasm conservation.

Authors' contributions

CP carried out the experiment and wrote the manuscript. BD conceived of the presented idea. Both the authors contributed equally to the final manuscript.

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