



Karyomorphological studies in three species of the genus *Phlogacanthus* Nees occurring in Assam

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(Received: September 2018; Revised: January 2019; Accepted: March 2019)

Abstract

The genus *Phlogacanthus* Nees belonging to the family Acanthaceae is an important ethnomedicinal genus of North Eastern part of India. The present study was undertaken to study the karyomorphology in the genus *Phlogacanthus* Nees comprising of three species of this taxon from Assam viz., *Phlogacanthus thrysiflorus* Nees, *Phlogacanthus curviflorus* (Wall.) Nees and *Phlogacanthus jenkinsii* C.B. Clarke. The amitotic preparations were done following the standard procedure for preparing of chromosomes. Cytotaxonomical features and karyomorphology were studied karyotype and counting of *P. curviflorus* and *P. jenkinsii* have been done.

Key words: *Phlogacanthus* Nees, titaphool, ethno-medicinal, karyotype, karyomorphology

The genus *Phlogacanthus* is medicinally important genus of North-East India. Throughout the world there are about forty-nine scientific names for the species rank of this genus and out of these only three are accepted. Earlier, eight species had been reported from North-East India (Kanjilal et al. 1939). Recently, a total of nine species have been reported from Assam alone (Dutta et al. 2016). *P. thrysiflorus* popularly known as titaphool is found throughout the state of Assam have terminal and pubescent inflorescence, flowers displaying orange color and fruit capsule. *P. curviflorus* possess densely pubescent inflorescence with dense flowered thyrse bearing light rose or pink coloured flower. *P. jenkinsii* have inflorescence axillary raceme type and yellow corolla.

Cytological investigations in *Phlogacanthus* are

limited to chromosome counts only in *P. thrysiflorus* as $2n=42$ (Mehra et al. 1968 and $2n=50$; Bedi et al. 1980). The present study was therefore conducted to study cytotaxonomical features and karyomorphology in three species of *Phlogacanthus*.

The saplings of *P. thrysiflorus* was collected from Kamrup (Metro) district and that of *P. curviflorus* from Morigoan and Nogoan and Kamrup (Metro) district. *P. jenkinsii* has been collected from Recreation Park, Diphu and few parts of Karbi Anglong district. For karyotype study, root tips were collected between 7:30-8:05am, pretreated with aqueous saturated solution of p-dichlorobenzene at $4^{\circ}\pm 2^{\circ}\text{C}$. After pretreatment, fixation was done in Carnoy's fluid I (1:3 glacial acetic acid and absolute ethanol, v/v) in room temperature. Root tips were then stored in 70% ethanol. For preparation of slides hydrolysis was done before staining; in 0.1N HCl at 60°C for 10-12 minutes. After washing the root tips, these were kept in 45% acetic acid for 5-7minutes, then, transferred to 2% aceto-carminne or aceto-orcin and heated gently over a spirit lamp. Subsequently, root tips were kept in stain for 2-3 hours. Slide was prepared using squash technique by gently warming. Good metaphase stage obtained were observed under oil immersion (10x100x) magnification of trinocular microscope with image analysis system. The microphotograph was taken using CMOS camera. Measurement was done with the help of Scopelsmage 9.0 software. Camera lucida diagram, ideogram and karyotype table was prepared. The parameters that was taken for the preparation of

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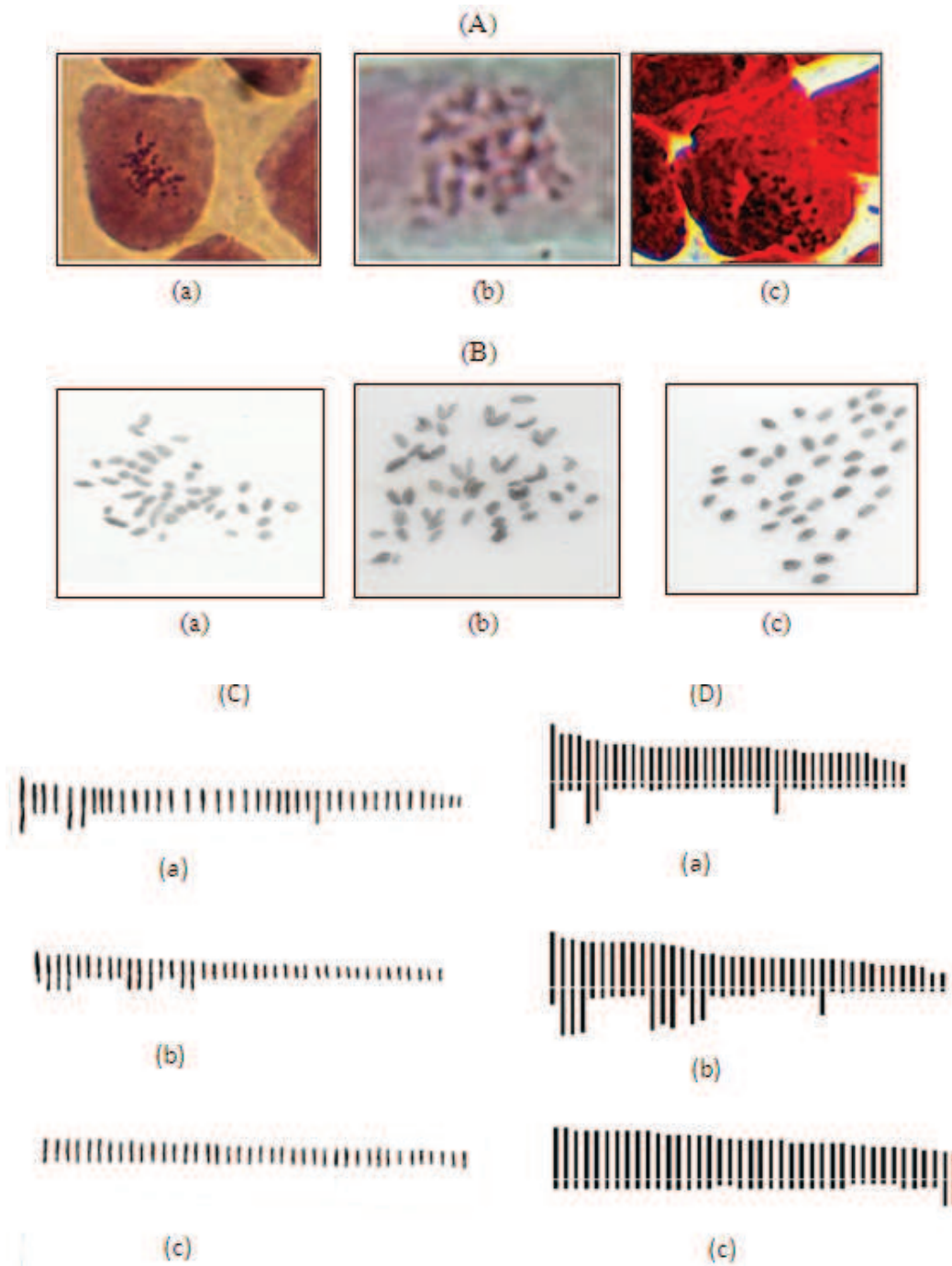


Fig. 1. (A) Microphotograph of somatic chromosomes at metaphase stage (10x100x oil immersion); (B) Camera lucida diagram (10x100x magnification (C) Karyotype and (D) Idiogram; (a) *P. thrysiflorus* Nees (b) *P. curviflorus* (Wall.) Nees (c) *P. jenkinsii* C.B. Clarke

karyotype table were length of short arm(s), and that of long arm(l); total length(h), arm ratio, relative chromosome length, radius(r), volume ($\pi r^2 h$), TF% (Huziwara et al. 1962) and centromeric position (Levan et al. 1964).

Cytological investigations shows that in the three species of *Phlogacanthus* viz., *P. thrysiflorus*, *P. curviflorus* and *P. jenkinsii* karyotype can be obtained following the original karyotype procedure of Sharma and Sharma (1980) with little modification. On the basis

Table 1. Summary of karyotype analysis in three species of *Phlogacanthus* Nees

Taxa	2n No.	Details of chromosomes				Total genomic chromosome length \pm SE(μ m)	Total genomic chromosome vol. \pm SE(μ m ³)	TF%*	Karyotype formula	Types of chromosomes
		Length (μ m)	Relative length (μ m)	Radius (μ m)	Volume (μ m ³)					
<i>Phlogacanthus thrysiflorus</i> Nees	40	0.752-2.916	1.25-4.8	0.25	0.15-0.57	59.875 \pm 0.07	11.67 \pm 0.136	22.51	$m_2+sm_2+s_{t_{36}}+t_0$	$A_1+B_3+C_{39}+D_{20}+E_1$
<i>Phlogacanthus-curviflorus</i> (Wall.) Nees	40	0.417-2.184	0.97-5.10	0.21-0.25	0.06-0.43	42.789 \pm 0.078	8.28 \pm 0.157	30.95	$m_8+sm_2+s_{t_{30}}+t_0$	$A_0+B_2+C_6+D_{11}+E_{21}$
<i>Phlogacanthus-jenkinsii</i> C.B. Clarke	40	0.373-0.626	1.84-3.09	0.19-0.25	0.04-0.12	20.175 \pm 0.123	3.54 \pm 0.004	20	$m_2+sm_0+s_{t_{38}}+t_0$	$A_0+B_0+C_0+D_0+E_{40}$

of experimentation, pretreatment and fixation period were standardized. The pretreatment period for *P. thrysifloru*, *P. curviflorus* and *P. jenkinsii* are 6 h, 9 h 30 minutes and 8 h 30 minutes and and fixation period were 12 h, 24 h and 20 h, respectively. The chromosome counts of the three species is $2n=40$. The *P. thrysiflorus* shows 2 metacentric, 2 sub-metacentric and 36 sub-telocentric chromosomes, the *P. curviflorus* show 8 metacentric, 2 sub-metacentric and 30 sub-telocentric chromosomes and *P. jenkinsii* shows 2 metacentric and 38 sub-telocentric chromosomes. Different cytological parameters of the three species are given in Table 1. Microphotograph, camera lucida diagram, karyotype and idiogram of the three species are given in Fig. 1.

The somatic chromosome count of *P. thrysiflorus* was found out to be $2n=40$ which is different from earlier reports of $2n=42$ (Mehra et al. 1968) and 50 (Bedi et al. 1980). Karyotypes with chromosomes with same size and median centromeres are symmetric (Levitsky 1931). Ancestral seed plants contain high proportions of acrocentric and/or telocentric chromosomes has asymmetric karyotype (Stebbins, 1971). The *P. curviflorus* show a specialized type of karyotype called bimodal karyotype showing both metacentric (symmetric) and sub-telocentric (asymmetric) chromosome (Stebbins 1971). But the other two species show small chromosomes. The karyotype in each species is asymmetrical since contains more number of sub-terminal centromeres (Stebbins 1971). Hence, the karyotype of three species is leading towards advancement. It implies that *P. curviflorus* showing more numbers of sub-telocentric chromosomes and some metacentric chromosomes may attributing to evolutionary changes which has lead to increasing asymmetry. It is well known that karyotype analysis often plays an important role in determining taxonomic status of a taxon because the karyotype indicates a very stable character specific for each specimen (Das 2018).

Authors' contributions

Conceptualization of research (BND); Designing of experiments (BND, NB); Contribution of experimental materials (NB, BND); Execution of field/lab experiments and data collection (NB); Analysis of data and interpretation (NB); Preparation of manuscript (NB, BND).

Declaration

The authors do not have any conflict of interest.

Acknowledgement

The first author expresses heartfelt thanks to ASTEC for funding a minor research project as a part of the Ph.D. work. The authors are also thankful to Diphu Recreation park for their help in species collection.

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