

# Karyomorphology of *Curculigo janarthanamii* (Hypoxidaceae): An Important Medicinal Plant from Maharashtra, India

Avinash Ramchandra Gholave<sup>1</sup>, Rohit Nivas Mane<sup>2</sup>,  
Ramchandra Dnyanoba Gore<sup>1</sup> and Sayajirao Pandurang Gaikwad<sup>1\*</sup>

<sup>1</sup>Department of Botany, Walchand College of Arts and Science, Solapur 413006, India

<sup>2</sup>Department of Botany, Shivaji University, Kolhapur 416004, India

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**Summary** The genus *Curculigo* is represented by 17 species and four varieties distributed in worldwide of which seven species and three varieties reported in India. The genus is well-known for its medicinal property. One Indian species *C. janarthanamii* Gore & Gaikwad was collected in Maharashtra and was investigated its chromosomes for the first time. The mitotic chromosome count was  $2n=18$ . The karyotype was composed of one subterminal, seven submedian and one median chromosomes showing asymmetric feature.

**Key words** *Curculigo janarthanamii*, Endemic, Medicinal, Karyotype, India.

Hypoxidaceae is a small family of herbaceous perennial monocotyledons with approximately 200 species in nine genera. They are mainly found in the Southern hemisphere of the Old World and in North America (Sanchez-Ken 2010). The genus *Curculigo* is represented by seven species and three varieties from India. Recently *C. janarthanamii* was described from Balaghat Ranges of Maharashtra (Gore and Gaikwad 2018). *C. janarthanamii* is an endemic species which grows from swampy margins of seasonally running fresh water stream on black clay soil. It bears rhizomatous roots, raceme inflorescence and polygamous flowers (Fig. 1a, b). It is also being cultivated extensively in India for commercial purpose as *C. orchioides*. Its tuberous roots and rhizomes are slightly bitter and mucilaginous in taste and are used as a tonic, demulcent, diuretic and restorative (Chopra *et al.* 1956). It is also used as a medical cure for piles, asthma, jaundice, diarrhea, colic, and gonorrhoea (Kirtikar *et al.* 1987). *Curculigo* has various medicinal properties like anticancer, anti-diabetic, anti-neurodegenerative and hepatoprotective activities *etc.* (Wang *et al.* 2012). Present communication reported a chromosome count ( $2n$ ) and karyotype of *C. janarthanamii* to provide basic cytogenetic properties for the conservation of this endemic species.

## Materials and methods

Several individuals with rhizomatous roots of *Curculigo janarthanamii* (Fig. 1c) were collected from the

wild resources of Osmanabad district of Maharashtra. After dipping rhizomes in freshwater new roots were developed and four-five young roots were used for chromosome studies. The voucher specimen (ARG-601) was deposited in the Herbarium of Department of Botany, Shivaji University, Kolhapur (SUK).

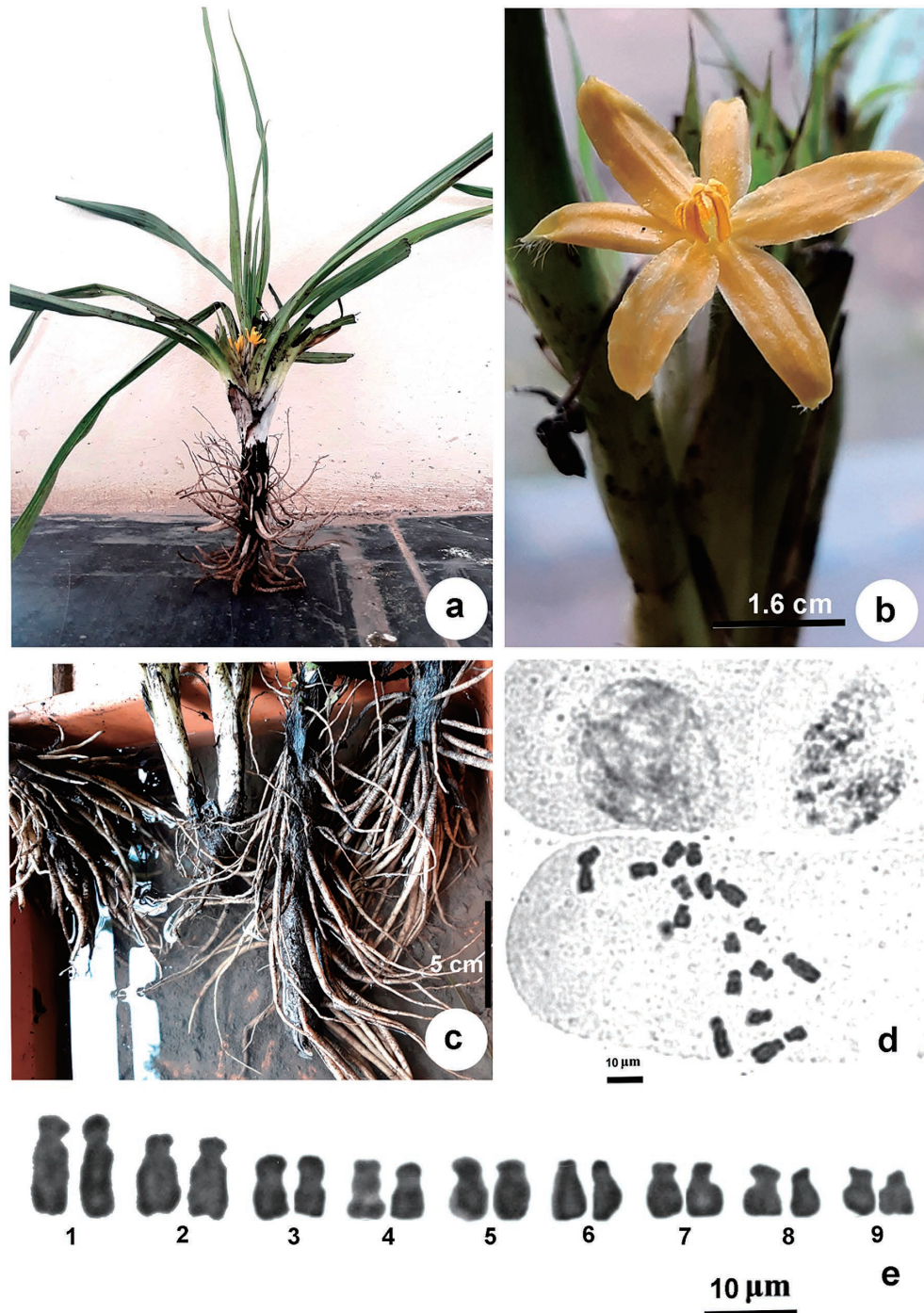
Root tips of 6–10 mm length were obtained from seven individuals and pretreated with a saturated solution of paradichlorobenzene at 8–10°C for 3–4 h. The root tips were quashed in 2% propionic orcein. Ten well-spread somatic chromosome plates were used for karyotype analysis. The somatic chromosome plates were photographed with a Carl Zeiss Axio Imager. Types of chromosomes were evaluated using a centromeric index of Levan *et al.* (1964) and a category of karyotype was determined by following Stebbins (1971).

## Results and discussion

*Curculigo janarthanamii* showed  $2n=18$  (Fig. 1d). The shortest chromosome was  $2.15\ \mu\text{m}$  and the longest one was  $10.98\ \mu\text{m}$ . The mean chromosome length (MCL) was  $9.34\ \mu\text{m}$  and the total haploid chromosome length (TCL) was  $84.09\ \mu\text{m}$ . The numerical values of each parameter for karyotype analysis are given in Table 1. Figure 1e shows the karyogram of *C. janarthanamii* exhibited the formula of  $1m+7sm+1st$  pairs. The karyotype was moderately asymmetrical and fell into the category 3b of Stebbins (1971). The A1 and A2 asymmetry indices were found to be 1.00 and 0.29, respectively.

The cytotaxonomical studies helped the placement of family Hypoxidaceae. Bentham and Hooker (1883) and Engler and Prantl (1930) have placed *Curculigo* under

\*Corresponding author, e-mail: sayajiraog@gmail.com  
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**Fig. 1.** Plant (a), male flower (b), rhizomatous roots (c), mitotic root tip cells (d) and karyotype (e) of *Curculigo janarthanamii*.

**Table 1.** Numerical values of each parameter for karyotype analysis of *C. janarthanamii*.

Chromosome pairs	Long arm (l) in $\mu\text{m}$	Short arm (s) in $\mu\text{m}$	Total length in $\mu\text{m}$	<i>d</i> value (l-s) in $\mu\text{m}$	<i>r</i> value (l/s) in $\mu\text{m}$	Centromeric position
1	10.98 $\pm$ 3.00	3.58 $\pm$ 0.85	14.57 $\pm$ 3.49	7.41	3.16	st
2	8.89 $\pm$ 3.14	3.36 $\pm$ 0.80	12.26 $\pm$ 3.55	5.53	2.69	sm
3	6.96 $\pm$ 1.70	3.05 $\pm$ 1.14	10.01 $\pm$ 2.65	3.91	2.42	sm
4	6.03 $\pm$ 1.70	3.33 $\pm$ 0.91	9.36 $\pm$ 2.41	2.70	1.85	sm
5	5.77 $\pm$ 1.63	3.09 $\pm$ 0.65	8.87 $\pm$ 2.14	2.68	1.87	sm
6	5.60 $\pm$ 1.54	2.79 $\pm$ 0.41	8.39 $\pm$ 1.91	2.81	1.99	sm
7	4.91 $\pm$ 1.14	2.89 $\pm$ 0.63	7.80 $\pm$ 1.54	2.02	1.74	sm
8	4.73 $\pm$ 1.04	2.47 $\pm$ 0.61	7.20 $\pm$ 1.45	2.26	1.97	sm
9	3.47 $\pm$ 1.17	2.15 $\pm$ 0.77	5.63 $\pm$ 1.91	1.31	1.63	m

tribe Hypoxideae of Amaryllidaceae. On the basis of bimodal length variation in the karyotype of *Curculigo* which was similar in *Ophiopogon* and *Sansevieria*, Hutchinson (1957) placed these genera in a separate family Hypoxidaceae along with *Hypoxis*. Lakshmi (1980) mentioned that the small size of the chromosomes and low chromatin content supported the Hutchinson's arrangement in constituting Hypoxidaceae as a separate family.

The reported cytological details of *C. crassifolia* ( $2n=18$ ) showed karyotype formula of  $2m+5sm+2st$  pairs. Other chromosome numbers *i.e.*,  $2n=18$ , 36 and *ca.* 50 were reported in *C. orchioides* previously (Sato 1942, Sharma and Ghosh 1954, Raghavan 1957, Sharma and Battacharyya 1960). In  $2n=18$  species of *C. orchioides* karyotype formula of length was given  $2L+2M+14S$  by Sheriff (1946).

Eksomtramage *et al.* (2013) studied the karyotype of some Thailand Hypoxidaceae species and reported the karyotypic details of genera *Curculigo*, *Hypoxis* and *Molineria*. In *Curculigo* they reported the karyotypes of *C. ensifolia*, *C. latifolia*, *C. megacarpa* and *C. villosa*. The longest chromosome ( $9.55\ \mu\text{m}$ ) in *C. ensifolia* and the shortest chromosome ( $3.44\ \mu\text{m}$ ) in *C. villosa*. In *C. janarthanamii* chromosome ranges from 10.98 to  $2.15\ \mu\text{m}$ . Karyotype formula of Thailand *Curculigo* species with an asymmetric karyotype including metacentric, submetacentric and subtelocentric chromosomes *i.e.*, *C. ensifolia* ( $4m+8sm+6st$ ), *C. latifolia* ( $2m+14sm+2st$ ), *C. megacarpa* ( $2m+12sm+4st$ ) and *C. villosa* ( $4m+10sm+4st$ ). The *C. latifolia* and our studied species of *C. janarthanamii* shared same karyotype formula *i.e.*, ( $2m+14sm+2st$ ). This might indicate that *C. janarthanamii* and *C. latifolia* shared the cytogenetical affinity with each other.

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