

Karyomorphological Analysis of Recently Described Rare Species of *Dipcadi* Medik (Hyacinthaceae) from Northern Western Ghats

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Summary *Dipcadi goaense* A. Prabhugaonkar, U. S. Yadav & Janarth. is so far known from type locality with a single population spread over about 1 sq. km. in south Goa. It is allied to *D. concanense* (Dalz.) Baker but differs in its small flowers and funnel-shaped perianth tube. The present paper describes the distribution, ornamental potential and karyotype analysis and reports on meiotic count in the species. The haploid chromosome number $n=6$, somatic chromosome number $2n=12$ and karyotypic analysis is reported for the first time for the species. The bimodal asymmetrical karyotype represents an advanced nature of the taxon. It has glistening white fragrant flowers of considerable ornamental potential. The species can be best conserved through its utilization as an ornamental bulbous plant by introduction in gardens.

Key words *Dipcadi goaense*, Karyotype, Meiosis, Goa, India.

The genus *Dipcadi* Medik. of subfamily *Ornithogaloideae* Speta of family *Hyacinthaceae* with about 30 species is distributed in the Mediterranean region, Africa and South West Asia (Mabberley, 1997). It is represented by about 9 species and 4 varieties in India (Deb and Dasgupta 1981, Karthikeyan *et al.* 1989) of which 6 species are found in Maharashtra state (Lakshminarasimhan 1996).

Dipcadi goaense (Prabhugaonkar *et al.* 2009), a recently described species, is a very rare, apparently endemic, bulbous herb so far known only from type locality in south Goa. It grows on open lateritic plateau in accumulated gravelly soil. The species is known by a single population restricted to the type locality *viz.* Rivona-Kevan region in south Goa.

Cytology of *Dipcadi* species in India has been studied by several researchers (Kanmani 1975, Dixit *et al.* 1992, Mahabale and Chennaveeraiah 1954, Naik 1974, Jakhi *et al.* 1994). Chromosome number $2n=8$ is reported in *D. serotinum* (Darlington and Janaki Ammal 1945), $2n=12$ for *D. concanense* (Kanmani 1975, Dixit *et al.* 1992) and *D. saxorum* (Mahabale and Chennaveeraiah 1954) while $2n=20, 12, 10$ are reported in *D. montanum* (Mahabale and Chennaveeraiah 1954, Naik 1974), $2n=20$ in *D. ursulae* (Chennaveeraiah and Mahabale 1959) and $2n=22$ in *D. erythraeum* (Jakhi *et al.* 1994).

Materials and methods

The materials for the present studies were collected from type locality *viz.* Rivona–Kevan

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region in Goa state. The bulbs were collected and grown in earthen pots in the departmental botanical garden. Mitosis was studied from healthy water culture roots tips. The root tips of 6–10 mm length were pretreated with saturated solution of Para-dichlorobezene (pDB) for 3 to 4 h at $9\pm 3^\circ\text{C}$. The root tips were squashed in 2% propionic orcein. The well-spread somatic plates were photographed with Coolpix-4500 Nikon camera at $1000\times$ magnification under Jenaval microscope. Twenty well-spread somatic chromosomes plates were analyzed for karyotype analysis (Levan *et al.* 1964). Floral buds were fixed in Cornoy's fluid for meiotic studies and anthers were smeared in 2% propionic-orcein for meiotic count.

Results

This rare bulbous herb has linear leaves and glistening white fragrant flowers. It is worthy for introduction in gardens as an ornamental (Fig. 1a, c) which may help its conservation.

Somatic chromosome number in *D. goaense* is $2n=12$ (Fig. 1b) and haploid chromosome number is $n=6$ (Fig. 1d). The chromosomes of the species could be classified into 4 different types on the basis of chromosome morphology (Table 1). Chromosomes ranged from 7.03 to $2.39\ \mu\text{m}$ in length and centromeric position varied from submedian (sm) to subterminal (st) position. Mean chromosome length was found to be $4.53\ \mu\text{m}$. Total chromosome length of haploid complement (TCLH) was $27.20\ \mu\text{m}$. Range of total chromosome length varied from 25.33–8.89. Gradient Index (GI) was 35.12268 and Symmetric Index (SI) was 31.45698. Total form percentage (TF%) was 23.92948.

Discussion

Mitosis in *D. goaensis* was found to be normal with somatic chromosome number $2n=12$ (Fig. 1b). Amongst the 6 chromosome pairs, the first pair is very large with a sub terminal constriction, the next 2 pairs are large with sub terminal constriction, the following 2 pairs are small with sub median constriction and sixth pair is a very small with sub median constriction. The karyotype was found to be bimodal asymmetrical type falling under 3b type as per Stebbins' (1971) classification. Karyotype of *D. goaense* is similar to *D. concanense*, which was described by Mahabale and Chennaveeraiah (1954). Meiosis was normal and showed meiotic chromosome number (bivalent) counts *i.e.* $n=6$.

Both the species *i.e.* *D. goaense* and *D. concanense* with their glistening white flowers of similar floral morphology present a species pair and 1 line of differentiation adapted to coastal plains among Indian species of the genus. Both species are narrow endemics and need priority in conservation.

Table 1. Karyotype analysis of *D. goaense*

Chromosome pair	Long arm (l) (μm)	Short arm (s) (μm)	Total length c=1+s (μm)	'd' value l-s (μm)	'r' value l/s (μm)	'i' value s/c X100	Centromeric position	Type
I	5.65 ± 1.02	1.23 ± 0.18	6.88 ± 1.20	4.42	4.59	17.90	St	A
II	5.33 ± 0.78	1.10 ± 0.21	6.43 ± 0.99	4.23	4.85	17.10	St	B
III	4.72 ± 0.68	1.15 ± 0.19	5.87 ± 0.87	3.56	4.09	19.66	St	B
IV	1.87 ± 0.33	1.06 ± 0.16	2.93 ± 0.49	0.81	1.76	36.23	Sm	C
V	1.64 ± 0.28	1.03 ± 0.13	2.67 ± 0.41	0.60	1.58	38.70	Sm	C
VI	1.49 ± 0.23	0.93 ± 0.12	2.42 ± 0.35	0.56	1.61	38.37	Sm	D

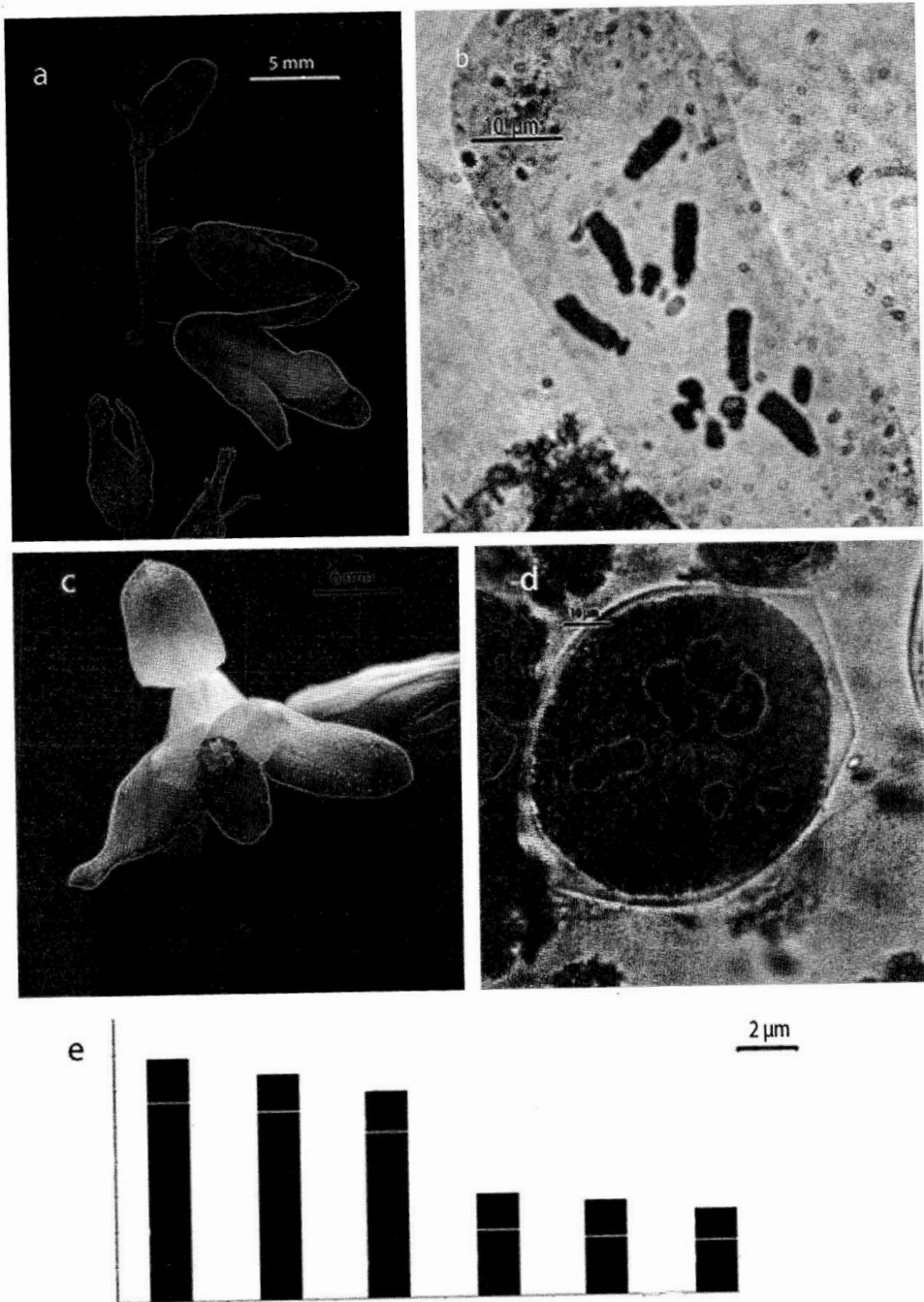


Fig. 1. *Dipcadi goaense* A. Prabhugaonkar, U. S. Yadav & Janarth.: (a) raceme, (b) Somatic chromosome number $2n=12$, (c) flower, (d) meicyte showing haploid chromosome number $n=6$, (e) idiograph

Table 2. Types of chromosome in *D. goaense*

Types of chromosomes	Description
Type A (chromosome I)	A pair of chromosomes very long ($6.88 \mu\text{m}$) with sub terminal centromere (st)
Type B (chromosome II and III)	Two pairs of long chromosomes ($5.87\text{--}6.43 \mu\text{m}$) with sub terminal centromere (st)
Type C (chromosome IV and V)	Two pair of short chromosomes ($2.67\text{--}2.93 \mu\text{m}$) with sub median centromere (sm)
Type D (chromosome VI)	A pair of very short chromosomes ($2.42 \mu\text{m}$) with sub median centromere (sm)

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References

- Chennaveeraiah, M. S. and Mahabale, T. S. 1959. A Note on Sporogenesis in *Dipcadi serotinum* (L.) Medik. *Can. J. Bot.* **37**: 345–352.
- Darlington, C. D. and Janaki Ammal, E. K. 1945. Chromosome Atlas of Cultivated plants. J. and A. Churchill, London.
- Deb, D. B. and Dasgupta, S. 1981. Liliaceae: Tribe Scilleae. *Fasc. Fl. India* **7**: 1–23.
- Dixit, G. B., Yadav, S. R. and Patil, K. S. 1992. Cytological studies in *Dipcadi concanense* (Dalz.) Baker. *J. Cytol. Genet.* **27**: 91–94.
- Jakhi, P. S., Desai, N. S. and Dixit, G. B. 1994. Karyogical studies in *Dipcadi erythraeum*. *J. Cytol. Genet.* **29**: 89–93.
- Kanmani, B. N. 1975. Karyotype study in *Dipcadi concanense* Dalz. *Curr. Sci.* **44**: 278–279.
- Karthikeyan, S., Jain, S. K., Nayar, M. P. and Sanjappa, M. 1989. *Florae Indicae Enumeratio: Monocotyledons*. BSI, Calcutta.
- Lakshminarasimhan, P. 1996. Monocotyledons. In Sharma, B. D., Karthikeyan, S. and Singh, N. P. (eds.) *Flora of Maharashtra State*. BSI, Calcutta.
- Levan, A., Fregda, K. and Sandberg, A. A. 1964. Nomenclature for centromeric position on chromosomes. *Hereditas* **52**: 201–220.
- Mabberley, D. J. 1997. *The Plant Book*. Cambridge University Press, Cambridge.
- Mahabale, T. S. and Chennaveeraiah, M. S. 1954. Karyotype in *Dipcadi* Medik. *Curr. Sci.* **23**: 367–368.
- Naik, V. N. 1974. Cytological studies in two species of *Dipcadi* Medik. from India. *Cytologia* **39**: 591–596.
- Prabhugaonkar, A., Yadav, U. S. and Janarthanam, M. K. 2009. *Dipcadi goaense* (Hyacinthaceae), a new species from the foothills of the Western Ghats. *India Kew Bull.* **64**: 743–746.
- Stebbins, G. 1971. *Chromosomal Evolution in Higher Plants*. Edward Arnold, London.
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