Karyomorphological Observations in *Desmodium* Desv. and Its Related Taxa of Nepal

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**Summary**  Chromosome number and karyomorphology of some species of the genus *Desmodium* Desv. and its related taxa, viz. *D. concinnum* DC. var. *retusum* (D. Don) H. Ohashi, *D. heterocarpon* (L.) DC. var. *heterocarpon*, *D. laxiflorum* DC., *D. microphyllum* (Thunb.) DC., *D. podocarpum* subsp. *oxyphyllum* var. *mandschuricum* Maxim., *D. podocarpum* DC. subsp. *podocarpum* and *D. triflorum* (L.) DC., *Butea minor* Buch.-Ham. ex Baker, *Crotalaria cytisoides* Roxb. ex DC. and *Piptanthus nepalensis* (Hook.) D. Don collected from different climatic regions of Nepal were observed. The basic numbers of chromosomes in *Desmodium* species was 11. It was recorded to be 9 in *B. minor* and *P. nepalensis*, and 8 in *C. cytisoides*. The chromosomes of the genus *Desmodium* were mostly medium and small in length throughout except in *D. podocarpum*. In *D. podocarpum*, *B. minor*, *C. cytisoides* and *P. nepalensis* chromosomes were large and medium.

*Desmodium* Desv., *Butea* Koen ex Roxb., *Crotalaria* Linn. and *Piptanthus* D. Don. belonging to the family *Papilionaceae* Giseke. show remarkable diversity in morphological characters. Twenty-six species of *Desmodium*, 2 species of *Butea*, 19 species of *Crotalaria* and 1 species of *Piptanthus* are distributed in different geographical areas of Nepal (Press et al. 2000, Anonymous 1986). *Piptanthus nepalensis* is a cold temperate and sub-alpine plant. Remaining 3 genera are widely distributed in tropics and sub-tropics of the world. Economically the plants under study come under one of the most important families of flowering plants. Fourteen species of the family are endemic to Nepal (Shrestha and Joshi 1996). The chromosome counts and/or karyomorphology of some species of the genera under present study have been reported previously (Kurosawa 1971, Gupta and Gupta 1977, Sanjappa and Bhatt 1985, Kumar and Subramanian 1986, Raina and Verma 1979, Verma *et al.* 1984, Bairiganjan and Patnaik 1989, Raghuvanshi and Kesarwani 1989, Kumari and Bir 1990, Kumar and Kuriachan 1990, Mangotra and Kou 1991, Yeh *et al.* 1986, Gao and Zou 1995). Previous literature account the fact that karyotype of 7 out of 10 taxa, viz. *Butea minor*, *Crotalaria cytisoides*, *Desmodium concinnum*, *D. microphyllum*, *D. podocarpum* subsp. *oxyphyllum*, *D. podocarpum* subsp. *podocarpum* and *Piptanthus nepalensis* considered here have been investigated for the first time. The records of Rajbhandari (1994, 2001) show that karyotypes of all of 10 taxa are new records for Nepal.

**Materials and methods**

All plants under present investigation have trifoliate leaves that were collected in different localities of Nepal. Vouchers have been deposited in Central Department of Botany, TU, Nepal. Identification of taxa was done with the help of literature—Hooker (1876), Hara and Williams (1979), Anonymous (1986), as well as from the preserved herbaria of Royal Botanical Garden Herbarium Section, Kathmandu, Nepal.

A brief remarks of the morphological structures of collected plants were worked out. The mi-
 tackled study was made from excised healthy root tips or from the anther wall cells by the methods used by Sakya and Joshi (1990). The categorization of chromosome types has been adopted as large chromosome—more than 2.5 \( \mu m \) in length; medium chromosome—1 \( \mu m \) to less than 2.5 \( \mu m \) in length; small chromosome—less than 1 \( \mu m \) in length. To decide centromeric position, arm ratios (long arm/short arm) were calculated as devised in Levan et al. (1965). Chromosomes are classified based on their length and position of the centromere and accordingly karyotype formulas were prepared. To find out the chromosome symmetry of the taxa, total form percentage (TF\%) is calculated as a percentage of total sum of short arm length over total sum of chromosome length as given by Huziwara (1962).

**Observation**

All the collected plants except *Piptanthus nepalensis* show diploid nature. The latter has been reported to be diploid as well as triploid in the present investigation. Karyomorphological details of all the species are given in Table 1.

*Butea minor* Bruch.-Ham. ex Baker (2\( n = 18 \)) Vaucher No. 121.
Locality: Kirtipur (Central Nepal) 1330 m altitude.
The plant is up to 1.5 m high with very large leaves and numerous flame-colored flowers in spike-like clusters. It consists of 2 types of chromosomes with centromere at median point and median region.

*Crotalaria cytisoides* Roxb. ex DC. (2\( n = 16 \)) Vaucher No. 122.
Locality: Nagarjun (Central Nepal) 1520 m altitude.
The plant is an erect much branched shrub up to about 2.5 m high that bear pale yellow flowers in axillary and terminal raceme. It consists of 4 types of chromosomes with centromere at median point, median, sub-median and sub-terminal regions, having 2 pairs of chromosomes with satellites each one on a short arm and 1 B chromosome.

*D. concinnum* DC. var. *retusum* (D. Don) H. Ohashi (2\( n = 22 \)). Vaucher No. 101.
Locality: Nagarjun (Central Nepal). 1600 m altitude.
This species is a tufted pubescent shrub with 2 lateral leaflets comparatively smaller than the middle one. Flowers are dark blue borne in copious lax lateral and terminal raceme. The karyotype consists of 2 types of chromosomes with centromere at median point and median region.

*D. heterocarpon* (L.) DC. var. *heterocarpon* (2\( n = 22 \)). Voucher No. 107.
Locality: Namobuddha (Central Nepal). 1550 m altitude.

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Chromosome length (( \mu m ))</th>
<th>TF%</th>
<th>Karyotype formula</th>
<th>Fig. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shortest</td>
<td>Longest</td>
<td>Mean</td>
<td>Absolute</td>
</tr>
<tr>
<td>B. minor</td>
<td>2.3</td>
<td>4.2</td>
<td>3.46</td>
<td>31.2</td>
</tr>
<tr>
<td><em>C. cytisoides</em></td>
<td>1.6</td>
<td>4.2</td>
<td>2.72</td>
<td>21.8</td>
</tr>
<tr>
<td><em>D. concinnum</em></td>
<td>1.0</td>
<td>2.0</td>
<td>1.40</td>
<td>15.4</td>
</tr>
<tr>
<td><em>D. heterocarpon</em></td>
<td>0.4</td>
<td>1.0</td>
<td>0.69</td>
<td>7.7</td>
</tr>
<tr>
<td><em>D. laxiflorum</em></td>
<td>1.0</td>
<td>2.6</td>
<td>1.68</td>
<td>18.5</td>
</tr>
<tr>
<td><em>D. microphyllum</em></td>
<td>0.8</td>
<td>2.3</td>
<td>1.52</td>
<td>16.8</td>
</tr>
<tr>
<td><em>D. podocarpum</em> subsp. <em>oxyphyllum</em></td>
<td>1.9</td>
<td>6.5</td>
<td>4.05</td>
<td>44.6</td>
</tr>
<tr>
<td><em>D. podocarpum</em> subsp. <em>podocarpum</em></td>
<td>2.3</td>
<td>5.1</td>
<td>3.22</td>
<td>35.5</td>
</tr>
<tr>
<td><em>D. triflorum</em></td>
<td>0.9</td>
<td>1.8</td>
<td>1.29</td>
<td>14.2</td>
</tr>
<tr>
<td><em>P. nepalensis</em></td>
<td>1.2</td>
<td>3.0</td>
<td>1.8</td>
<td>16.2</td>
</tr>
</tbody>
</table>
This species is a small prostate herb or under-shrub with woody gray silky-haired twigs. Leaflets are entire and obovate. Purple colored flowers are borne in axillary and terminal lax raceme. The karyotype consists of 3 different types of chromosomes with centromere at median point, median and sub-median regions.

*D. laxiflorum* DC. (*2n*=22) Voucher No. 103.
Locality: Nagarjun (Central Nepal). 1500 m altitude.

The plant is an erect perennial hairy shrub with entire ovate leaflets. Mauve-colored flowers are borne on long lax racemose inflorescence. The karyotype consists of 2 different types of chromosomes with centromere at median point and median region.

*D. microphyllum* (Thunb.) DC. (*2n*=22) Voucher No. 104.
Locality: Panouti (Central Nepal). 1420 m altitude.
This species is a small glabrous or thinly hairy tufted trailing or erect herb. Leaflets are ovate and small (up to 5 mm). Middle one is much bigger compared to lateral leaflets. Purple blue flowers are borne in lax raceme. The karyotype consists of 3 different types of chromosomes with centromere at median point, median and sub-median regions.

Locality: Namobuddha (Central Nepal). 1660 m altitude.

It is a tall smooth glabrous herb. Usually branches are tufted at the base and alternate above. Leaves emerge directly from main shoot. Leaflets are ovate with acute to acuminate apex. Flowers are bright red to violet with whitish corolla margins that are borne in axillary or terminal panicked raceme. It consists of 4 pairs of chromosomes with satellites. The chromosomes are with centromere at median point, median, submedian and subterminal regions.

Locality: Namobuddha (Central Nepal). 1780 m altitude.

It is an erect undershrub with angular stem. Leaflets are broadly obovate, end ones roundish, glabrous, very often acute. Flowers are pink and borne in axillary or terminal lax, copious panicles. Karyotypes consist of 4 different types of chromosomes with centromeres at median point, median, submedian and subterminal regions. Three pairs of satellited chromosomes are present.
D. triflorum (L.) DC. (2n=22) Vaucher No. 106.
Locality: Dhulikhel (Central Nepal). 1420 m altitude.
This is a small tufted, prostrate hairy annual or perennial herb. The slender stem consists of
rooting nodes. Leaflets are obcordate with notched apex. Small purple flowers are borne in axillary
cyme. The Karyotype consists of 3 different types of chromosomes with centromere at median
point, submedian and subterminal regions. One pair of them have satellites.

Piptanthus nepalensis (Hook.) D. Don. (2n=18) Vaucher No. 131.
Locality: Ghorepani (Western Nepal). 2750 m altitude.
It is a beautiful shining shrub with dark green bark and leaves. Leaflets are narrow pointed.
Flowers are bright yellow in short hairy terminal clusters. It consists of 2 different types of chromo-
somes with centromere at median point and median region. It consists of 2 pairs of chromosomes
with satellites.

Discussion

Different species of Desmodium, under present investigation, with similar chromosome num-
bers (2n=22) indicates their closer relationships. The present investigation of the karyomorphology
of D. triflorum tallies with the previous work of Sanjappa and Bhatt (1985). However, chromosomes
of D. triflorum studied here are shorter and TF% value is high showing higher degree of symmetry
in comparison to previous record. This species is nearer to D. concinnum in consideration of ab-
solute length. Comparative accounts of karyotype in the present study suggest that Desmodium
contain same type of chromosomes having small size except in case of D. podocarpum. In the latter
species chromosomes are large. D. triflorum and D. podocarpum are similar to some extent in that
they contain some chromosomes with satellites. The subspecies of D. podocarpum stand apart from
all investigated taxa of the genus in having higher absolute lengths indicating that the taxa are more
primitive among all (Stebbins 1950, 1968). However, TF% value of D. podocarpum subsp.
podocarpum shows less proximity with other investigated species of Desmodium. The other taxon
Crotalaria cytisoides has the chromosome number 2n=16 indicating basic numbers as x=8. TF
value of this species is less (37.61) indicating more asymmetrical karyotype in comparison to the
other taxa though it is closer to D. podocarpum subsp. podocarpum because the latter is also with
less symmetrical chromosomes having TF value 36.6. The taxa Butea minor and Piptanthus nepalensis, having same number of basic chromosomes, show similarities in karyomorphology to
some extent though the absolute length of the former is more (31.2 μm) than that of latter
(16.2 μm). Both of them have medianly constricted chromosomes with high TF% value indicating
closer link to some extent. Frequent occurrence of medianly constricted chromosomes in all taxa
with the exception of a few subterminal chromosomes in D. podocarpum and C. cytisoides suggests
the karyomorphological primitiveness of all the investigated taxa.

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