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Research Note

Inheritance of flower colour in *Desmodium gangeticum* (L.) DC.

Harshwardhan R. Nandanwar* and P. Manivel

Directorate of Medicinal and Aromatic Plants Research (DMAPR), Boriavi, Anand- 387 310, Gujarat, India
Email: harsh.genetics@gmail.com

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Abstract
The present experiment was conducted with the aim to study the inheritance pattern of flower colour in *Desmodium gangeticum*. Populations of two parental lines having two different flower colours, white (DDG 18) and pink (DDG 8) were used for study. The results indicated that flower colour was under monogenic control of dominant gene with pink colour indicating the mendelian inheritance pattern exhibiting the monohybrid ratio of 3:1. The data was confirmed by χ^2 test which showed non-significant chi-square value for flower colour.

Key words: *Desmodium, dasamoola, a*yurvedic, flower colour, inheritance.

Desmodium gangeticum (L.) DC. (commonly called as *'Shalaparni'*) is an important ayurvedic medicinal plant belonging to Fabaceae family. It is an under shrub of tropical region which has been used in Indian systems of medicine (ISM) as a bitter tonic, febrifuge, digestive, anti-catarrhal and anti-emetic in inflammatory conditions of the chest and other organs. It is also used in the treatment of typhoid, piles, asthma, bronchitis, dysentery and biliousness. Root possesses antibacterial, antifungal, anti-inflammatory, analgesic, antileishmanial, immune modulatory and Central Nervous System (CNS) depressant activities (Mishra *et al*., 2005). Mostly roots are used for preparation of medicines. The roots are one of the main ingredients of famous ayurvedic preparations *Dasamoolarishta, Dashmulkwath* (Kirtikar and Basu, 1935; Chopra*et al*., 1956), *Chitrak Haritika, Dashmula Kadha, Brahma Rasayan, Dashmula Ark, Dashmul Tailum* and several other ayurvedic formulations. It is found throughout the forests and in shaded spots along road sides and railway lines in India. Indian subcontinent is a vast repository of medicinal plants that are used in traditional medical treatments (Chopra *et al*., 1956), which also forms a rich source of knowledge. Apart from India, *Desmodium* is also found in Bhutan, Cambodia, Laos, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam, Australia, Pacific islands and in naturalized in the West Indies. It is also found in Ceylon, Burma, Malay Peninsula and Islands, China, Philippines and Tropical Africa (Anonymous, 1952; Hooker, 1973; Cook, 1967).

Desmodium gangeticum(L.) DC. Is a tall (30-120 cm)under shrub, erect branched and grey-downy in younger parts. Leaves are foliolate, variable in shape and size. Inflorescences in racemes are axillary and terminal or sometimes panicles, slender, 10-40 cm long, 2-6-flowered at each node. Corolla white or pink in colour, 3-4 mm long; standard obovate; wings oblong, base auriculate, shortly clawed; keel narrowly obovate and not auriculate. Pods 2.3-4.5 cm long, falcate, 4-6 jointed, compressed, clothed with hooked hair. The chromosome number of *D. gangeticum* (L.) DC. is 2*n*=22. Genetic studies of flower colour have not been reported in *Desmodium gangeticum* but some studies in other *Desmodium* species have shown a monogenic inheritance pattern. Park and Rotar (1968) studied inheritance of flower colour and stem colour of *Desmodium sandwicense* and found that the flower colour was under monogenic control with a dominant gene for colour and follows the mendelian inheritance pattern in F_2.

Flower colour is considered to be an important component of flower development. It has been used for genetic studies since Mendel. It is known that anthocyanins are mainly responsible for imparting the flower colour, but actual colour can also be affected by the factors such as other pigments, metal ions and vacuolar pH (Martin and Gerats, 1993). Geissman and Mehlquist (1947) and Lawrence and Sturgess (1957) suggested that genetic studies of flower colour, gene function in colour variation might be connected with the amount of anthocyanin and anthoxanthin pigments.

Flower colour can be a useful morphological marker (Kumar *et al*., 2000) not only for easy identification and maintenance of germplasm and variety, but also useful in development of high yielding varieties with distinct flower colour marker. Hence, the present investigation was taken up to study the genetics of two flower colours, white and pink in *Desmodium gangeticum*.

The inheritance of flower colour in *D. gangeticum* (L.) DC. was studied at the Directorate of Medicinal and Aromatic Plants Research (DMAPR), Anand, Gujarat, India. The institute lies in latitude of 22.5^o North and longitude 73.0^o East and have an average rainfall of 800 mm, maximum and minimum temperature ranges between 12.7^o and 42^o C. Two parental lines of *D. gangeticum* (L.) DC. having white (DDG 18 collected from Kerala, India) and pink (DDG 8 collected from Gandhinagar, Gujarat, India) flower colours were used to study the inheritance of flower colour. In the year 2009, two accessions DDG 18 and DDG 8 (Fig. 1) were crossed to generate the F_1 generation. Emasculation of white flowers was done a day before pollination in the evening and the emasculated buds were tagged so that they can be easily identified. The next day early morning, pollination was done with the pollens from pink flowers. In the year 2010, F_1 hybrids were raised and the observation of flower colour was recorded. In the following year, a total of 963 F_2 plants were raised using selfed seeds of F_1 and total number of plants having white and pink flower colour was recorded. Chi square test was used for testing the ratios for inheritance of flower colour studies.

This experiment was conducted to study the inheritance of flower colour in *Desmodium gangeticum*. Two parents DDG 18 with white flowers and DDG 8 with pink flowers (Fig. 1), their F_1 and F_2 generations were used in the study. The data obtained from the cross of white and pink flowers showed that F_1 was pink which indicated that pink flower colour was dominant over white colour. A total of 963 F_2 plants were obtained, out of which 732 plants were bearing pink colour flowers and 231 plants were with white colour flowers, indicating the Mendelian inheritance pattern giving the monohybrid ratio of 3:1. The data was confirmed by χ^2 test which shows non-significant chi-square value for flower colour (0.52) (Table 1). The gene symbols **PP** for pink and **pp** white flower are proposed.

Park and Rotar (1968) reported in genetic studies in *Desmodium sandwicense* for petal colour that two petal colour classes were observed and segregated into 3 coloured and 1 white genetic ratio which are in confirmation with the present study. So, it can be confirmed from the above study that the pink flower colour in *D. gangeticum*(L.) DC.is governed by a single gene with mendelian inheritance pattern. In flowering plants, dominant gene is generally responsible for the flower colour when it is controlled by a single pair of genes (Donnelly, 1958; Odland, 1960).

The monogenic inheritance pattern in *D. gangeticum*(L.) DC.is of significant importance in plant breeding. It is helpful in the germplasm characterization. Morphological variants with distinct phenotypic expression can be used to establish linkages and for indirect selection if found associated with useful traits. Being monogenic, the expression of flower colour is independent of environment and therefore, can be used effectively as phenotypic tags in marker-aided selection. They also aid in identification of cultivars for their distinctness, uniformity and stability (DUS) in the era of plant variety protection and plant breeder rights.

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Table 1. Segregation for flower colour in *Desmodium gangeticum*

Generation	Pink flower	White flower	Expected χ^2 ratio	Obtained χ^2 value	P value
P1 (DDG 18)	0	90	-	-	-
P2 (DDG 8)	132	0	-	-	-
F1	30	0	-	-	-
F2	732	231	3:1	0.52	0.05

Figure 1. A and B are close up of white and pink flower; C and D are panicles of DDG 18 and DDG 8, respectively in *Desmodium gangeticum*