Breeding types in *Nothapodytes nimmoniana* Graham.: An important medicinal tree

Recently, several tree species of the Western Ghats are gaining international importance due to their newly identified pharmacological and curative properties. One such tree is the *Nothapodytes nimmoniana* (*Syn*: *N. foetida*, *Mappia foetida)*. The wood-extract of this tree is used in the treatment of cancer. The active principle of the wood-camptothecin (CPT), is known as a potent drug that breaks single-strand DNA in the mammalian systems and is found to be useful in the treatment of tumours[1–4]. CPT is also known to inhibit retroviruses such as human immunodeficiency virus (HIV) and equine infectious anaemia virus[5]. It is believed that CPT is the third most important alkaloid sought after by the pharmaceutical companies around the world. Perhaps this has led to the large-scale exploitation of the species from its wild habitat in the recent years, despite the ban on green felling[6]. An estimated 20% of the population of this species is believed to have declined over the last decade. Recently, it has been assigned the threat status of 'Vulnerable' (Vu)[7].

N. nimmoniana is reported to be bi-sexual in various floral descriptions, including a recent publication[8]. However, on careful observations of two large populations (n = 60) in Joida and Ulavi forests in Dandeli Forest Division, northern Karnataka, we have identified that the species is polygamous in nature. The species shows a wide array of breeding types with male, female, hermaphrodite, monoecious, andromonoecious, gynomonoecious, trimonoecious at individual level; androdioecious and gynodioecious types at population level (Figure 1). The proportion of individuals into these breeding types is shown in Table 1.

Male flowers, in all breeding types are large, 9.2 mm in length, 9.4 mm in diameter, dull yellowish in colour and have rudimentary pistil. Stamens are large, 6.8 mm in length and five in number. All anthers are functional. Male flowers dehisce during early morning (0600–0700 h) and maximum pollen production is observed during the noon (1200–1400 h). Longevity of male flowers is only two days.

Female flowers are small, 6.2 mm in length, 6.9 mm in diameter, dull yellow-

Figure 1. ***a***, Male; ***b***, Female inflorescence, and ***c***, Close-up of male and female flowers of *Nothapodytes nimmoniana*.

Table 1. Different breeding types observed in *N. nimmoniana*

Flower types borne by the individual plants	Breeding types at individual level	Occurrence (%) $n = 60$
Only male flowers	Male	10
Only female flowers	Female	34
Male and female flowers	Monoecious	2
Only bisexual flowers	Hermaphrodite	12
Male flowers with few bisexual flowers	Andromonoecious	30
Female flowers with few bisexual flowers	Gynomonoecious	5
Mixture of male, female and bisexual flowers	Trimonoecious	7

Table 2. Variation of floral traits in *N. nimmoniana*

Character	Bisexual flower mean ± S.D	Male flower mean ± S.D.	Female flower mean ± S.D.
Flower diameter (mm)	7.2 ± 0.02	9.4 ± 0.05	6.90 ± 0.02
Flower length (mm)	7.4 ± 0.15	9.2 ± 0.31	6.2 ± 0.10
Petal length (mm)	6.5 ± 0.16	7.9 ± 0.02	5.60 ± 0.20
Petal width (mm)	2.4 ± 0.20	2.8 ± 0.24	2.00 ± 0.13
Length of anther filament (mm)	3.0 ± 0.13	6.8 ± 0.24	2.04 ± 0.07
Length of gynoecium (mm)	5.0 ± 0.25	3.5 ± 0.31	5.70 ± 0.40
No. of petals	Four or five	Five	Five
No. of functional anthers	1–2	All	None
Stigma	Active	Rudimentary	Active

Mean of 25 flowers collected from at least five individuals of each breeding type.

ish in colour and with rudimentary stamens that produce no pollen grains. The pistils are 5.7 mm in length. Anthesis of female flowers occurs during early morning (0600–0800 h). Longevity of female flowers varies from two to eight days depending upon their pollination.

Bisexual flowers are intermediate to male and female flowers in size. They are 7.4 mm in length, 7.2 mm in diameter and are dull yellow in colour. Both stamens and pistils are medium in size and are 3.0 mm and 5.0 mm in length respectively. In bisexual flowers, only 1–2 anthers produce pollen grains and stigma is active.

Flowering begins during July to August and most of the early flowering trees are dioecious, whereas late flowering trees are monoecious, hermaphrodite and a mixture of other breeding types. The flowers open mostly on sunny days. The number of flowers per inflorescence in male, female and bisexual plants varies greatly. Male inflorescence carries relatively higher number of flowers (350–530) than those bearing female flowers alone (70–185) and bisexual flowers (90–210). Further, the production of lesser number of flowers per inflorescence in bisexual trees and female trees might be a device to save energy for fruit production, whereas higher number of flowers per inflorescence among male trees may help in pollinator attraction and pollen movement between female and male trees.

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Evolution of *Mycobacterium leprae* towards reduced virulence

Leprosy has been a dreaded disease for at least a few thousand years[1]. After the Dapsone treatment became available in the 1940s (ref. 2) and further, the MDT regime came into practice in the early 1980s (refs 2–4), there has been a substantial reduction in the prevalence of leprosy almost throughout the world[2,3,5,6]. This is not too surprising given the effectiveness of MDT. But it is not only the incidence that is seen changing. A curious anecdote generally noted by all leprosy clinicians is that the 'face of leprosy' is changing. Not only is the proportion of patients with deformities going down, the textbook leonine faces are much less infrequently seen now. While an obvious factor can be early detection of cases and treatment, more subtle processes can lead to reduction in virulence of *Mycobacterium leprae*. Evolutionary changes in the virulence of the pathogen can take place over just a few decades and can significantly affect the clinical as well as epide-