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# Cytology of woody members of Rosaceae

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**Abstract.** Meiotic counts have been made on 16 woody species of the family Rosaceae from Indian forests. Of these, *Photinia notoniana* (n = 17), *Rubus gardnerianus* (n = 28) and *Sorbus foliolosa* (2n = 68) are counted for the first time. Besides, the Indian populations of *Chaenomeles japonica* (n = 17), *Cotoneaster acuminata* and *Eriobotrya japonica* (n = 17) are also worked out for the first time. Intraspecific polyploid cytotypes are recorded in *Pyrus communis* (2x, 3x) and *Rosa leschenaultiana* (2x, 4x). On the basis of chromosomal associations, the tetraploid cytotypes of *Sorbus foliolosa* appears to be alloploid in nature whereas the triploid of *Pyrus communis* show autoploid behaviour. Variation in chromosome number and some pollen sterility in pollen mother cells of meiotically normal diploid individuals of *Cotoneaster acuminata* (n = 17), *Prunus domestica* ssp. *insititia* (n = 8) and *Rosa leschenaultiana* (n = 7) seems to be due to chromatin transfer during cytomixis.

**Keywords.** Alloploid; autoploid; cytology; cytomixis; Rosaceae.

## 1. Introduction

Rosaceae, a large family with 100 genera and 2,000 species (Airy Shaw 1973), is cosmopolitan in distribution. However, its members are relatively more abundant in the north temperate regions of India. Most of the 200 Indian species (Hooker 1879) are distributed in various forests. The family is best known for its ornamental value and edible fruits. Besides, some species provide timber of commercial importance and local use. Due to its immense economic importance and large size, the chromosome counts of several species are known today (see Fedorov 1969). However, the chromosome survey has mainly been from the temperate regions and large number of species from the tropical regions remains still uncovered. This is particularly true of the woody species from Indian forests. Some work on the cytology of Indian woody species has been carried out by Malik (1965) and Mehra *et al* (1973) but attention has mainly been on the taxa of western and eastern Himalayan forests. The present communication which covers 16 woody species from the forests of central and southern India, and the Garhwal Himalaya is the part of the project on the cytogenetics of Indian trees. Some cultivated taxa growing in these areas have also been included.

## 2. Materials and methods

For meiotic studies, appropriate sized flower buds were fixed in Carnoy's fluid with acetic acid component saturated with iron acetate. Anthers were squashed in 1% acetocarmine and desirable preparation were made permanent in euparal. Pollen fertility was estimated with glycero-acetocarmine mixture (1 : 1).

## 3. Results and discussion

### 3.1 *Chaenomeles*

*Chaenomeles*, an exotic genus, is represented by 3–4 species. *C. japonica* with brick-red flowers is counted to have n = 17 which is a new record for India. The same chromosome number is known to occur elsewhere (Moffett 1931a) and other 3 cytologically known species of the genus.

### 3.2 *Cotoneaster*

*Cotoneaster acuminata* a large shrub is best represented in the temperate forests of north-west Himalaya. The chromosome number of the species is not known earlier from india and the present findings of 2n = 34 substantiate the earlier report by Sax (1954). Some pollen mother cells (PMCs) in the presently studied population show cytomictic channels involving chromatin transfer. Both hypo- and hyperploid PMCs are resulted. Existance of some pollen sterility (11%) and pollen grains of variable sizes (32–44 × 30–40 $\mu$m) in this taxon might be the consequence of such a chromatin migration.

### 3.3 *Eriobotrya*

*Eriobotrya japonica*, a native of China is cultivated in various parts of India for fruits. During meiosis, 17 bivalents are regularly constituted at diakinesis and M-I. In spite of normal bivalent formation and cytokinesis high pollen sterility (38%) is existent in this taxon. The present count of n = 17 which is new for India agrees with earlier reports (Morinaga *et al* 1929; Moffett 1931a, b; Sax 1931; Gadella *et al* 1969). As the other 3 cytologically known species of the genus are also diploid with 2n = 34, the intraspecific cytotype of *E. japonica* with 2n = 32 (Evreinoff 1930) would be an aneuploid derivative of 2n = 34.

### 3.4 *Photinia*

The genus *Photinia* is distributed in south-east Asia and north America. *P. notoniana* a commonly distributed species in the forests of Nilgiri, Palni and Annamalai hills is counted to have n = 17 which is the first chromosome count for the species.

### 3.5 *Prinsepia*

*Prinsepia* is a small genus with 3–4 species, distributed from Himalaya to north China and Formosa. *P. utilis*, the only Indian species is distributed in the forests of Himalaya from 1,200–2,700 m is counted to have n = 16 which agree with the earlier reports. However, an aneuploid cytotype with 2n = 28 exists in south India (Subramanian 1979). The proposal of x = 8 as the base number for the genus (Darlington and Wylie 1955; Mehra *et al* 1973) does not sound well because so far

n = 8 has not been recorded in any of the species of the genus. Provisionally, x = 16 is taken as the base number on the basis of which the species is diploid.

### 3.6 *Prunus*

*Prunus*, a genus of 466 species, is well known in horticulture. Of the 19 species represented in india, *P. cerasoides* (*P. puddum*) and *P. cornuta* are the only two commercial timber species of the family in India. *P. puddum*, a small to moderate sized tree is distributed in the Himalaya between 700–2,100 m chiefly in the open forests and on barren slopes. The species is also cultivated in several parts of India. The present count of n = 8 from the Himalaya and Kodaikanal hills agrees with earlier reports.

*P. domestica* is mainly cultivated for fruits in almost all parts of India. All the presently studied individuals from Punjab plains (Patiala) and south India (Kodaikanal) show the same chromosome number (2n = 16) which is a new diploid cytotype from India. The meiotic course in the taxa from Kodaikanal show normal meiosis with cent per cent pollen fertility. On the other hand almost all the individuals studied from Patiala show the phenomenon of cytomixis in more than 50% of the PMCs observed. As a result of chromatin migration PMCs with increased (2n = 32) and decreased (2n = 2, 4) chromosome numbers are resulted. Existence of pollen grains of variable sizes (22–36 × 18–30 $\mu$m) and high pollen sterility (36%) in this taxon seems to be the consequence of cytomixis.

### 3.7 *Pyrus*

Of the 23 species recorded from india majority of them are known in horticulture. *P. communis* which is largely cultivated for fruits in different parts of India is studied presently from various sources in Kodaikanal. Both the diploid (2n = 34) and triploid (2n = 51) cytotypes are detected. The meiosis in the diploid taxa is perfectly normal with regular 17 bivalent formation and cent per cent pollen fertility. On the other hand the meiotic course in the triploid is highly irregular and is characterized by the presence of trivalents and univalents, unequal distribution of chromosomes and laggards. The most common type of chromosome distribution during A-I is 25:26. However, PMCs with 24:27 and 22:29 distribution are also existant. Laggards, the number of which varies from 1–7, occur in about 76·2% PMCs at A-I/T-I and 79·4% PMCs at A-II/T-II. In some of the PMCs at A-I, the chromosomes remain scattered and fail to reach at the poles. Consequential to these meiotic irregularities pollen sterility is very high. The taxon appears to be autotriploid in nature because in majority of the PMCs there is a cent per cent trivalent formation.

### 3.8 *Rosa*

*Rosa* with 100 species is distributed in the temperate regions of the northern hemisphere with a few species within the tropics. *R. leschenaultiana* a thorny shrub is very widely distributed in the forests of Nilgiri and Palni hills. Cytological samplings of the species from the different forests of Kodaikanal reveal the existence

of intraspecific diploid (2n = 14) and tetraploid (2n = 28) cytotypes. Both the cytotypes are common in these forests and are morphologically indistinguishable. Meiosis in majority of the diploid individuals is normal with regular 7 bivalent formation and cent per cent pollen fertility. However, some PMCs in one of the population show the phenomenon of cytomixis. As a result of chromatin transfer both hypo- and hyperploid PMCs are resulted. Majority of the PMCs in the tetraploid cytotype also show normal meiosis with regular 14 bivalent formation and normal segregation during anaphase. In some PMCs however, chromatin bridges are detected during A-I. Pollen fertility however, is quite high.

### 3.9 *Rubus*

The genus *Rubus* with 225 species is cosmopolitan in distribution. Of these, as many as 41 species are reported from Indian forests (Hooker 1879). *R. gardnerianus*, a large straggling shrub is very widely distributed in Indian forests.The presently studied populations from the forests of Kodaikanal are found to have n = 28 which is the first chromosome report for the species. In spite of the high chromosome number (2n = 56) and ploidy level (8x), meiotic course in the taxon is perfectly normal with regular 28 bivalent formation and their segregation during A-I. Pollen fertility is also cent per cent.

*R. ellipticus* a large shrub is also widely represented in Indian forests. The present diploid count of n = 7 for the species agrees with earlier reports.

### 3.10 *Sorbus*

The genus *Sorbus* with 100 species is represented in India by 7 species. *S. foliolosa* a shrub or small tree is very widely distributed in the Himalaya from Kashmir to Sikkim between 1,800–3,600 m. The presently studied population from the Garhwal Himalaya reveal the chromosome number to be 2n = 68. The meiotic course in the taxon is highly irregular due to the presence of multivalents and univalents, and laggards. Of the 23 PMCs analysed the most common configuration is of $7_{IV} + 20_{II}$. Laggards are present in 58·4% of the PMCs at A-I/T-I. Incidence of laggards is slightly higher at A-II/T-II. The species which has not been counted earlier is tetraploid on x = 17. On the basis of analysis of chromosome associations, Gill *et al* (1982) suggested the species to be segmental alloploid in nature.

### 3.11 *Spiraea*

*Spiraea* a genus of ornamental value is represented by 100 species. All the 3 presently studied species, *S. bella*, *S. cantoniensis* and *S. lindleyana* are with the same diploid chromosome number (2n = 18) which is in conformity with the earlier records. Intraspecific polyploid cytotypes exist in *S. lindleyana* (2n = 4x = 36, Malik 1965) and *S. cantoniensis* (2n = 3x = 27, Sax 1936; 2n = 4x = 36, Baldwin 1951, Subramanian 1979).

### 3.12 *Stranvaesia*

*Stranvaesia glaucescens*, the only Indian species of the genus is found to have n = 17 which agrees with the earlier findings. A few PMCs in the presently studied taxon

show two nucleoli with 2–4 bivalents attached to each of them. Further course of meiosis is regular resulting into 100% pollen fertility.

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