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RESEARCH ARTICLE

A Novel Grafting Technique: Tender Twig Grafting (TTG) in *Bougainvillea* Comm. ex Juss.

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ABSTRACT

Bougainvillea Comm. ex Juss. attracted much attention all over the world due to its ornamental, medicinal and commercial importance. In India, many national research institutes has carried out research for development of different varieties. As a result, a large number of new cultivars have been developed in India. Hybridization, chemical mutagens and tissue culture are common methods of propagation and variety development in *Bougainvillea* but unfortunately, scientist have not paid much attention towards grafting methods for multicolour *Bougainvillea* flowering on a single plant. The author have working since many years on multicolour *Bougainvillea* with Tender Twig Grafting (TTG) with more than 75% success rate. This paper dealt with the practical approach and technique used for the development of ornamentally much demanded multicolor flowering of *Bougainvillea* on single stock.

Keywords: *Bougainvillea*, Tender Twig Grafting (TTG), Multicolour *Bougainvillea*

INTRODUCTION

The *Bougainvillea* is native to South America. The name comes from Louis Antoine de Bougainville, a French navigator and military commander who was the first European to take note of the plant, in Brazil, in 1768. The genus *Bougainvillea*, belongs to Four-o'clock family (Nyctinaginacea) having total 18 species, out of which three species are horticulturally important: *B. spectabilis* Willdenow, *B. glabra* Choisy, and *B. peruviana* Humboldt and Bonpland. The generic name *Bougainvillea* Commers. was first published by A. L. De Jussieu in his work *Genera Plantarum* in 1789 (Jussieu, 1789). Many crosses among the various species have produced new hybrid species and important horticultural cultivars (Kobayashi et al, 2007). *Bougainvillea* has received much attention due to its ornamental and commercial importance. *Bougainvillea* also known for its antiviral properties. Leaf extracts of *B. spectabilis. B. glabra*, *B. peruviana* and *B. xbuttiana* exhibited almost 80-100 % virus inhibitory activity (Narwal, 2000). Many national research institutes in India has taken up research for development of different varieties. As a result, a large number of new cultivars have been developed in India. Considering the contribution made by India, the international registration authority for new cultivars lies in the Indian Agricultural Research Institute (IARI), New Delhi, which is an international recognition conferred upon by International Society for Horticultural Science (Salam et al., 2017).

Hybridization, chemical mutagens and tissue culture are common methods of propagation and variety development in *Bougainvillea* all over the world. Six new cultivars of *Bougainvillea* have been named and released A colchicine-induced mutant with bright magenta bracts has been isolated from cv *Zakariana. Chitravati*- A hybrid of Lalbaugh X Red Glory, released in 1979. A hybrid of 'Trinidad' x 'Formosa'. bracts violet purple, medium to big, cordate, released in 1977. *Jawaharlal Nehru*'. A spontaneous mutant of cv 'Lalbaugh'. Leaves variegated; moderately floriferous; bracts claret rose fading to orange red, released in 1975. *Purple Wonder*- A hybrid of Formosa X Trinidad, bracts violet purple, medium, ovate to elliptic and persistent, released in 1979. *Sholay*- A seedling selection of cv Red Glory- bracts delft rose, medium-size, hairy and elliptical, borne all along the branches, released in 1977. *Usha*- A seedling selection of cv Lady Hope, flowering profuse, bracts magenta fading to mandarin red, hairy, borne all along the branches, released in 1977 (Chadha & Chaudhury, 1986). Furthermore, the evolution of *Bougainvillea* 'Shubhra' has fulfilled. After this *Tetra Mrs Mc Clean, Begum Sikander, Mary Palmer Special, Chitra, Archana, Shweta, Parthasarthy, Surekha, Nirmal, etc.* also developed (Chadha & Chaudhury, 1986).

***Bougainvillea* Comm. ex Juss.**

Vernacular Names- English: Great Bougainvillea, Hindi: Booganbel, Manipuri: Cherei, Bengali: Baganbilas, Marathi: Booganvel, Konkani: Bouganvila, Telugu: Kagithala

Bougainvillea is thorny climber best admired for its beautiful flowering almost throughout the year. *Bougainvillea* is distributed in a tropical and subtropical zones of world. It is woody, evergreen, shrubby lianas with multi-trunked or with clumping stems. The plant has spreading, round plant habit with a height and spread of up to 20-30 feet. The plant can climb with its stiff curved, slightly hooked thorns. Leaves are alternate, simple, ovate to somewhat elliptic, up to 10 cm long. Leaves petiolate. Leaf blade elliptic or ovate, base rotund. Flowers arise in leaf axils, in clusters of threes. Petaloid bracts found variously coloured and last long with a charming look. Bracts dark red or light purple-red, elliptic-ovate, 2.5-6.5 × 1.5-4 Cm, base rotund to cordate. Perianth tube green, narrowly tubular, rounded, 1.6-2.4 cm, densely pubescent, apex 5-6-lobed, lobes spreading, yellow, 3.5-5 Mm, hairs copious, spreading, to 1 mm. Stamens 8. Ovary stipitate. Fruit 1-1.5 cm, densely hairy. Fruit is an achene, elongate, 5-ribbed.

Bougainvillaea has quick hardening and drying, brittle stem with thin bark, which poses difficulty in grafting. Only a few varieties can produce roots. Application of IBA at the concentration of 15,000 ppm had significantly produced better rootage L and subsequent survival and growth of *Bougainvillea spectabilis* var. *thimma* (Parihar, 1993).

Bougainvillea grow best in full sun. High light intensity is required for good flowering. Low light and shady areas are not suitable, as the plants will drop their bracts. *Bougainvillea* does best at elevations from 10 to 2500 feet (Kobayashi et al, 2007).

METHODS OF PROPAGATION

Bougainvillea commonly propagated by obtaining cuttings of matured stem pieces of 7-10 inches in length. Stem cutting of 1 cm in girth with at least 5-7 swollen buds. Leaves mostly removed. Rooting media or hormone such as IBA (3-indolebutryic acid) at 2000–6000 ppm is used. Cutting should be protected from intense lights and dry situations. Cuttings need 80-100% humidity for better growth.

Grafting

Grafting method of propagation is also commonly used all over the world, mostly when cultivars are difficult to grow from cuttings and need to be grafted onto a vigorous rootstock. Grafting is found useful when cultivar unable to produce roots properly. This is also useful when one can wish to graft multiple cultivars on one stock.

The ultimate care while selecting the scion must be taken. Various kinds of grafts can be used, including wedge, whip or tongue, or approach graft. But it is observed that these methods require more time with very little success. To overcome these practical difficulties, continuous efforts were made. While trying many existing grafting methods, accidentally Tender Twig Grafting (TTG) was invented. It is delicate swift and almost sure method suitable for all horticulturists and nurserymen. It can be practised

throughout the year. Only one has to follow proper sequence and timing to enjoy one's own multicolour *Bougainvillea*.

Requirements at Hand

Root Stalk- A prime requirement detained root stalk by cutting the required branch. The cutting needs to be done twice a year. First in July and second as per our requirement. After cutting straight, upright, fleshy, thick shoots are produced from the plant. Cut sturdy shoot having a diameter more than 3mm are suitable for TTG. Stock must invariably be tender.

Scion- Scion is the material – a branch young or mature or even tender having swollen buds, two or three and having diameter 3mm.

Tape- It is prepared from a 20-micron polyethene sheet. The width of the tape depends upon the thickness of stalk. It may be from 5 mm to 15 mm or sometimes even more. Cutting instruments viz. a knife, the blade must be clean and sharp enough.

Tools- Sharp and clean knife or blade is required to cut the twig. Moderately strong thread is necessary to tie the tape over graft.

Time- TTG should be performed in the evening (4 -5 pm) cloudy weather is most suitable. TTG done in the month of August produce more vegetative growth whereas TTG in the month of September- October bears flowers shortly. Grafting can be done throughout the year provided it must be protected from direct sunlight, heavy rains or winds. Leaf cover must be sufficient.

Alert- As tender twigs are fragile, they do not tolerate bending. Therefore, during grafting, root stock must be kept straight. Cut surfaces untouched. Placement of prepared scion into root stock cavity should be very quick, to resist drying of cambium tissue. Tender twig grafting performed in August produces more vegetative growth. If grafting performed in late September, bears flowering easily. In this case, first sprouting is of inflorescence.

Aftercare- when grafting is complete it should be retained as it is for first 10 days. On the 11th day, a portion of the branch 3 leaves above grafted site should be bend downwards or hide inside the nearby branches to induce sprout, so that healthy sprouting takes place. After a week it takes more time. So long as the grafted twig is green, it should be regarded as successful. When a sprout attains 5cms height the bent branch should be cut off. Grafting can be performed throughout the year, provided it must be protected from direct Sunlight, rain and winds. Leafrole around the graft serves the purpose to protect the graft many time.

Growth- No other branch should be allowed to grow simultaneously. Do not remove tape unless it is overly tight. A vertical cut on the winded tape will allow easy removal. It should be re-taped and retained until the graft attains sufficient height and mechanical strength.

As new graft sprout is very fragile due care must be taken to protect it. One branch – one colour, many colours or expected colour compositions can be achieved by tender twig grafting (TTG).

TENDER TWIG GRAFTING (TTG)

The terminal part of every growing branch is tender and can be used as rootstock. Grafting can be done at any height. According to the availability of scion three types can be done.

Tongue grafting- Bottom of about 10 cms long mature or semi-mature stick with swollen buds and short internode shaped as shown in Figure 2, and inserted into the cut on the stock and tape it from bottom to above leaving few buds open.

Groove grafting- Notch should be prepared as shown in Figure 3, a single bud is removed from scion at 10/2 inclined cutting and replaced into the similar grove prepared in the stock and taped leaving the bud open.

Prismoidal grafting- Terminal tender part of Scion can also be grafted by this method. A stock should be thick and taping light leaving terminal portion uncovered (Figure 4).

RESULTS & CONCLUSIONS

1. More than 75% success rate.
2. More chances of Success, even for shy varieties that do not produce roots easily.
3. Quick response in segregation in colours which otherwise very difficult.
4. Easy to perform for a layman, who doesn't have knowledge about grafting, with little efforts.

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PLATE II: Tender Twig Grafing (TTG)

Images I, II, III & IV taken at Author's home resulted after performing Tender Twig Grafting (TTG) on Bougainvillea

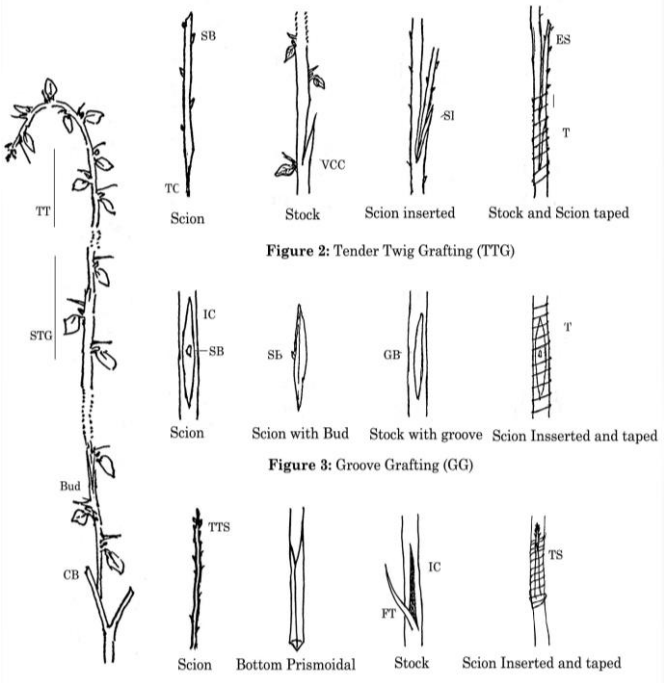

Figure 1: Bougainvillea Twig

Figure 2: Tender Twig Grafting (TTG)

Figure 3: Groove Grafting (GG)

Figure 4: Prismoidal Grafting (PG)

Figure 1: TT- Tender Twig, STG- Suitable twig for Grafting, CB- Cut branch

Figure 2: SB- Swollon bud, TC- Taper cut, VCC- Vertical inclined cut upto center, SI- Scion inserted, Es- Exposed scion, T- Taping to stock inserted scion with 20 micron and 1cm wide Polyethelene tape

Figure 3 : IC- Inclined cut s to develop groove, SB- Swollon bud, GB- Groove for bud (Scion), T- Taping with 20 micron Polyethelen tape keeping bud open.

Figure 4: TTS- Tender terminal stick, IC- Two inclined cuts meeting at center forming a notch, FT- Fleshy and thick stock to receive prismoidal bottom, TS- Tender scion tip open and inserted behind flappy tongue.

PLATE I : Tender Twig Grafting (TTG)

Image I: Selction of stock and scion of one's choice **Image II:** Multiple scions on single stock.
Image III: Tender twig grafting (Close up) **Image IV:** TTG protection and moisture retaintion.