

Review Paper

Multi-bracted *Bougainvillea* – A Review

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Bougainvillea is an ornamental shrub belongs to the family Nyctaginaceae. It is a native of tropical region of South America. It was introduced in India from Europe in 1860. Its wide adaptability into different agro climatic conditions blended with broad spectrum of recurring blooming habit has made *bougainvillea* commercially important plant in the nursery trade. The plant contains about 14 species. Out of those, only three species namely *B. spectabilis*, Wild. *B. Glabra* Choisy and *B. peruviana* Humb & Bom possess colorful bracts for the ornamental values (Zadoo *et. al.* 1975a). These have a short history of domestication and have been cultivated about 150 years outside their natural habitats (Zadoo *et. al.* 1976). Mutation (Bud sports and induced mutations) has played an important role in the development of many new ornamental cultivars and multibracted *bougainvillea* is no exception (Banerji, 2008b, Banerji, *et. al.*, 2017). In the beginning there are only four cultivars in multibracted *bougainvillea* group which includes 'Cherry Blossom', 'Los Banos Beauty', 'Mahara' and 'Roseville's Delight'. Latter on bud sports and induced mutation created huge diversity among the group. Nurserymen and scientists developed many new cultivars in this group. Gamma ray induced mutant 'Los Banos Variegata' (Banerji and Datta, 1987 Datta *et. al.*, 1990); 'Los Banos Variegata Silver Margin' (Banerji, 2002, Banerji, 2008a, Banerji *et. al.*, 2017); 'Mahara Variegata' (Datta and Banerji, 1994); 'Mahara Variegata Abnormal leaf mutant' (Banerji, 2002); and 'Pallavi' (Banerji *et. al.*, 1987, Banerji and Datta, 2008) and one chemical mutagen (0.02% EMS) induced mutant namely 'Los Banos Variegata-Jayanthi' (Jayanthi *et. al.*, 2008) has been released from Floriculture Section, CSIR-NBRI, Lucknow. All newly developed variegated *bougainvilleas* have been registered with International *Bougainvillea* Registration Authority, IARI, New Delhi and IAEA (International Atomic Energy Agency) Vienna, Austria. These variegated cultivars can be used for pot culture, bedding purpose, soft landscaping and topiary work. The chlorophyll variegated *bougainvillea* adds new dimension to the nature by exhibiting their multicolored leaves which breaks monotony

of the green surrounding especially during the off season when the plant is out of blooms. The entire group of multibracted *bougainvillea* is sterile due to absence of flowers. Hybridization is not possible. Mutation remains the only alternative method for their further improvement. Therefore, majority of multibracted *bougainvillea* developed all over the world are either by spontaneous mutation or by induced mutations by using chemical and physical mutagens. They are generally propagated vegetatively by stem cuttings or by air-layering method. In the present review paper an attempt has been made to review the description of various multibracted *bougainvillea* developed by various institutes/ individuals/ nurserymen in different parts of the world. Details of multibracted *bougainvillea* are given below:

'Archana': The cultivar 'Archana' was developed as a bud sport of *B. x buttiana* cultivar 'Roseville's Delight'. Dr. G.S. Srivastava (1975) reported it from National Botanical Research Institute, Lucknow, India. Plant growth is intermediate. Thorns are small and straight. Leaves are variegated. Variegation gradually becomes yellowish and finally changes to milky white. During winters newly produced leaves have pink shades which changes to yellowish and finally pale white. Variegation spread all over the surface of lamina in patches of uneven size. Leaf surface is glabrous. Leaf size is medium and its shape is ovate. It is a profuse flowering cultivar, blooms during October to April. Inflorescence clustered at the end of the branch. Bract shape, size and colour are same as in cultivar 'Roseville's Delight'.

'Aussie Gold': Looks like 'Roseville's Delight'. Bract colour is yellow. All the characters are same like 'Roseville's Delight'. Leaves are green. Bracts are persistent. Cultivar is available with Yvonne Mamaril Peralta, co-owner Oat Family Natures Garden, San Juan, La Union and Rolita Vijandre Spowart of Philippines (Fig. 7).

'Aussie Gold Marble': It is a bud sport of 'Aussie Gold'. Bract colour is same like parent. Mutation has taken place in two directions i.e. on leaf colour and bracts shape. Green leaves have become variegated, which adds beauty to this

cultivar. Leaf Lamina is creamish-yellow in colour and has dark green and light green dots and patches spread throughout the lamina and giving the mosaic marble effect. The original bract shape is mutated. Length and width ratio is disturbed due to formation of narrow asymmetrical bracts. It looks peculiar and the bud sport can be visible from a distance. Julie Andrew of Intai Intai Bougainvillea reported it.

'Aussie Gold Batik': The bract shape has transformed as bud sport effect while bract colour remains same as in 'Aussie Gold'. Bract shape is changed and gives new look to this cultivar. Length of the bract is not changed but its width significantly reduced. This is clearly visible in young bracts at different developmental stages of the bract. Only few matured bracts look like 'Aussie Gold' in shape while majority of them get mutated. Leaf shape remains unchanged and look like 'Aussie Gold'. Length and width ratio of the bract is changed. Leaves are variegated. Variegated leaves have mosaic type of variegation, which looks very attractive due to combination of various shades of dots and small patches of green tissue on creamish-green background of the leaf lamina. (Fig. 13)

'Feijin Zouyu': the variety was developed as bud sport from *B. x buttiana* 'Carlson Gold'. It is also known as 'Aussie Gold Variegata'. Reported by Mr. Xiong (2017) from his Bougainvillea Nursery in Foshan City, Guangdong Province, China. Mr. S.Z. Hualao gave the name of this new cultivar. This multibracted bougainvillea cultivar very closely resembles with 'Aussie Gold' but its bract size is smaller, narrower and its development is asymmetrical. Leaves are variegated. Lamina background is creamish-white and very small green dots spread all over the surface makes the plant very attractive.

'Carmencita': Appeared as a bud sport from 'Mahara' under the name 'Carmencita'. The cultivar originated at Philippines and Patented at USA under the name 'Carmencita' by R.E. Holttum (1970). Recorded in the Book "Flowering Vines of the world" edited by Edwin A. Meninger (pp 233-245). Bract and foliage morphology is same as 'Mahara' but mutation has taken place in bract colour is carmine which differentiates it from Mahara. (Fig. 5)

'Cherry Blossom': (Syn. 'Bridal Bouquet', 'Double White', 'Mahara Off White')

Cultivar developed as a bud sport of *B. glabra* cv. 'Los Banos Beauty'. It is reported by Dr. J.V. Pancho in (1967) from College of Agriculture Laguna, Philippines. Bract colour is light mallow purple. Flowers are completely absent. Blooming is very floriferous. Flowers are totally absent. Cultivar is vegetatively propagated through cuttings and air layering

method. (Fig. 10)

'Cherry Blossom Variegata': This cultivar was released from India in the name of 'Godrej Cherry Blossom' (Syn. 'Godrej Centenary'). Bract colour is same as 'Cherry Blossom'. It is a bud sport of 'Cherry Blossom' with variegated leaves. Variegation pattern and colour is similar to 'Los Banos Variegata'. Central portion of the leaf Lamina has green colour (combination of various shades of green tissues) which is surrounded by contrast creamish-white colour. Mr. S.Z. Hualao and Wong Ki from China also reported it. (Fig. 9)

'Cherry Blossom White': This new cultivar is recently developed as a bud sport and also known as 'Aussie White' and 'Donia White'. Younger bracts are green in colour which turns white as the bracts mature. In mid stage, most of the bracts look like greenish-white. It is reported by Lita Bangangga, owner of a Lita Flower House Sabah, Malaysia on January, 2019.

'Coconut Ice': The cultivar is originated as a bud sport of 'Mahara' off white. Chlorophyll mutation has taken place which resulted in to development of variegated cultivar. It is reported by Jane Iredell in 1986 from Brisbane, Australia. Plant growth is erect and vigorous. Thorn size is medium and its orientation is curved. Leaf shape is elliptical. Leaves have green center which is surrounded with creamish-white tissues. It is totally sterile due to absence of flower. Plant is propagated by stem cuttings and air-layering method.

'Thai Cherry': It is a bud sport of *Bougainvillea x buttiana*. Plant growth is vigorous. Young stem is coppery green which turns in to brown with age. Leaves are green and its shape is ovate. Leaf lamina is 6.5 x 4 cm. Thorns are slightly curved in tip and its length is 1.0 cm. Cultivar is a profuse bloomer. Bracts develop at the end of branches. Bract size is 2.3 x 1.2 cm, elliptical to ovate. Bract colour is yellow-white. Bracts are persistent; flowers absent.

'Doubloon': This free flowering bougainvillea cultivar originated as a bud sport of *B. x buttiana* var. 'Mrs. Butt'. Evolved in Philippines and patented in U.S.A. under the name 'Doubloon'. The cultivar was mentioned by R.E. Holttum. The detail description is available in a book entitled "Flowering Vines of the World" written by Holttum (1970). The book was edited by Edwin A. Meninger (pp. 233-245). Plant is vigorous growing with green ovate shape leaves. The colour of this double bracted bougainvillea is apricot-orange to vinacious orange.

'Los Banos Beauty': The cultivar developed as a bud sport of *B. glabra*. It is reported by Dr. J.V. Pancho in 1967 from College of Agriculture Laguna, Philippines. Bract colour is light mallow purple. Flowers are totally absent. Plant is

propagated vegetatively by stem cuttings and layering method. (Fig. 15).

‘Los Banos Variegata’: It is a gamma ray induced mutant of multibracted bougainvillea cultivar ‘Los Banos Beauty’. Banerji and Datta (1987a,b) reported the mutant from floriculture Section, CSIR-NBRI, Lucknow, India. Leaves are variegated and has excellent pattern of colour combination. It looks very attractive due to presence of green irregular centre and white margin which is more than 1cm. Bract colour remains the same *i.e.* mallow-purple. In extreme cases few albino shoots are emerged in old plant with pink stem. Very old plant produces few branches with rhodamine-purple bracts, which are similar to ‘Mahara’. These branches have green leaves. The cultivar has been registered with International Bougainvillea Registration Society, New Delhi and FAO/IAEA (International Atomic Energy Agency) Vienna Austria, Registration Number 1959. (Fig. 8)

‘Los Banos Variegata Silver Margin’: It is a gamma ray induced mutant of multibracted bougainvillea cultivars ‘Los Banos Beauty’. Banerji (2002) reported the mutant from floriculture section, CSIR-NBRI, Lucknow, India. Leaves are variegated and have combination of green and silver margin. It looks very attractive due to presence of green regular center and silver white margin width of which is 1-2 mm. Variegated leaves are slightly incurved and in extreme cases leaves are spoonshaped. Mutant is not clearly visible from a long distance as its variegation is not very contrast like ‘Los Banos Variegata’. Bract colour is mallow-purple just like ‘Los Banos Beauty’ and ‘Los Banos Variegata’. It is registered with FAO/IAEA (International Atomic Energy Agency) Vienna, Austria. Registration Number-4462. (Fig. 14).

‘Los Banos Variegata Jayanthi’: This is a chemical mutagen (Ethyl Methane Sulphonate {EMS} 0.02% aqueous solution) induced chlorophyll variegated mutant of bougainvillea cv. ‘Los Banos Beauty’. The mutant differs from original variety only in foliage colour without in any change in bract colour. Mutant showed two types of variegated leaves. One type was mosaic which, has four visible colours *i.e.* olive green (Yellow Green Group 146B, Fan-3), Pale yellow (Yellow Green Group 146D, Fan-3), deep green (Yellow Green Group 146 A, Fan-3) and light yellow (Yellow Green Group 154D, Fan-3), mixed with different shades of green. The second type of leaf have green centre with creamish-white margin. Foliage of this type has three major colour combinations *i.e.* Light Yellow (Yellow-Orange Group 19C, Fan-1) Green (Green Group 147B, Fan-3) and Light Green (Yellow-Green Group 148C, Fan-3) (Jayanthi and Datta, 2006, Jayanthi *et al.* 2007 and Banerji, 2008). Bract colour is mallow purple just like ‘Los Banos Beauty’ and ‘Los Banos Variegata’ and ‘Los Banos Variegata Silver Margin’. This cultivar is registered

with International Bougainvillea Registration Authority, IARI, New Delhi. (Fig. 11).

‘Mahara’: (Syn. ‘Million Dollar’, ‘Manila Magic Red’, ‘Mahara Crimson’)

Cultivar developed as a bud sport of *B. x buttiana* cv. ‘Mrs. Butt’. It was raised by Mrs. Marietta H. Raymoundo, Malabon ‘Rizal’ Philippines. Dr. J.V. Pancho (1963) from College of Agriculture, Laguna, Philippines reported it. The variety was introduced to India by Lal Bagh Botanic Garden, Bangalore, India. Plant growth is vigorous. Thorns are large and straight. Leaves are green and glabrous. Young leaves are coppery. Bract colour is rhodamine red. Bract shape is elliptical. Flowers are totally absent and cultivar is vegetatively propagated with the help of stem cuttings and air layering method. (Fig. 2)

‘Mahara Variegata’: It is a gamma ray induced mutant of multibracted bougainvillea cultivars ‘Mahara’. Datta and Banerji (1994) reported the mutants from floriculture section, CSIR- NBRI, Lucknow, India. Leaves are variegated and their pattern is not fixed. Variegation varies from leaf to leaf with combination of creamish-yellow and various shades of green overlapped patches. Young leaves are coppery while the old leaves have dull yellow and faded green colour. Bract colour is rhodamine-purple which remains unaltered. It has been registered with International Bougainvillea Registration Society, New Delhi and FAO/IAEA International Atomic Energy Agency, Vienne, Austria. Registration Number - 1976. (Fig. 3).

‘Mahara Variegata Abnormal Leaves’: It is a gamma ray induced mutant of multibracted bougainvillea cultivar ‘Mahara’. Banerji (2002) reported this mutant from floriculture Section, CSIR- NBRI Lucknow, India. Leaves are variegated and are of peculiar type. Margin is unevenly undulated and leaf lamina is asymmetrical in shape. Variegation in various shades of green and light green pattern haphazardly spread all over the surface of leaves giving it a curio look. Old leaf texture is leathery. Bract colour remains unaltered but its shapes and size reduced. Most of the bracts are asymmetrical with acute tip. This is the first mutant of bougainvillea where leaf variegation is associated with leaf and bract shape and size changed. It is registered with FAO/ IAEA (International Atomic Energy Agency), Vienna Austria. Registration Number - 4456. (Fig. 4).

‘Mahara Variegata Abnormal Leaf’: It is a bud sport of Mahara noticed by one of the nursery in Malaysia and reported by Mr. Wong Ki (2019). Variegation pattern is unique and prominent. Leaf shape is asymmetrical and puckering is present in many leaves. Variegation patches comprise of olive green, dark green, light green and green along with

white, creamish-white and yellow patches unevenly distributed throughout the laminar surface. Bract colour is unaltered and remains as 'Mahara' *i.e.*, rhodamine-red. Bract size is significantly reduced and its growth pattern is also changed. Most of the bracts are asymmetrical. Length and width ration is disturbed and majority of the bracts are elongated with reduced width. Size of the bract is also reduced. Stem colour is pinkish and creamish-white. Creamish-yellow colour of the leaves resemble with the leaf colour of 'Thimma'. Mostly the young leaves are prominent colour. Julie Andrew from Kualalampur, Malaysia also informed me that this cultivar is noticed by a nursery man for the confirmation about its origin.

'Mahara Variegata Masked Variegation': It is a bud sport from 'Mahara'. Mutation took place as variegation in foliage. Variegation pattern is very unique. It is not visible from a distance but clearly visible from near. It is only due to the colour combination of the variegated leaf. Central portion of the leaf lamina is pale green in colour while surrounding colour of the lamina is deep green. Sometimes the variegation looks like a light and shade effect on foliage. (Fig. 6).

'Marietta': It is a bud sport of *Bougainvillea buttiana* var. 'Mahara'. It was raised by Mrs. Marietta H. Raymundo Malabon, Rizal of Philippines and reported by Dr. J.V.Pancho in 1967, college of Agriculture, Laguna, Philippines. The

bract colour is rhodamine-purple, which remains unaltered and just, like 'Mahara' but foliage is variegated. The variegation is a combination of white and green. Margins of young growing leaves are pinkish. Central green and marginal white colour combination is very attractive and charming. Bracts are persistent.

'Roseville's Delight' : (Syn : 'Dona Rosita Delight', 'Doubloon')

The cultivar developed as a bud sport of *B. x buttiana* cv. 'Mrs. McClean'. Mrs. Lolita, Malabon, Rizal Philippines raised it in 1962. Dr. J.V.Pancho (1963) reported it from College of Agriculture, Laguna, Philippines. In India it was introduced by Lal Bagh Botanic Gardens, Bangalore. Plant growth is vigorous. Cultivar possesses green leaves and its shape is ovate. Bract colour is burnt orange. Cultivar is totally sterile due to absence of flower. Cultivar is multiplied vegetatively with the help of stem cuttings and air layering method. (Fig. 1)

Roseville's Delight Variegata' : Bract colour of this cultivar is same as in Roseville's Delight. Leaves are variegated and its pattern is similar to 'Los Banos Variegata'. Central portion of Lamina is green which is surrounded by very contrast creamish-white colour.

'Snow Orange Mahara': It is variegated form of 'Roseville's



Fig. 1-15. Multi-bracted Bougainvillea Cultivars

Delight' with unique variegation features. Bracts colour and shape remains unchanged The variegation pattern and the growth habit very closely resembles with gamma ray induced mutant of Bougainvillea cultivar 'Pallavi'. In younger shoots and leaves variegation is very prominent and visible from a distance but as the shoots and foliage matures, variegation has masking effect and not visible from a distance, It is only due to development of more chlorophyll in lighter green portion of the lamina which is very close to darker green portion of it, resulted in to visibility of snowing effects to the foliage, hence, Snow orange 'Mahara' name is given to this cultivar. It ultimately gives snowing effect to the foliage.

'Roseville's Delight Nova': This cultivar possesses same bract colour as 'Roseville's Delight' but mutation has taken place in bract shape. Length and width ratio of the bract is significantly changed, resulted into new look to this cultivar. Length of the bract is more while its width is highly reduced and in extreme cases it gives appearance of the bougainvillea cultivar butterfly type of look (Julie Andrews). Most of the bracts development is asymmetrical.

'Pallavi : It is a gamma ray induced variegated mutant of 'Roseville's Delight' developed by Banerji and Datta (1986) and Banerji *et.al.* (1987) at Floriculture section of National Botanical Research Institute, Lucknow, India. The Variegated mutant has been released in the name of 'Pallavi'. The mutant has been registered with International Bougainvillea Registration Society; New Delhi. Variegated leaves are having light green, pale green combination in various shades. Variegation is very prominent in young shoots and it masks with age and in older shoots it is not very clear. No Change in bract colour was noticed however in older plants shoot having Mahara types of bract bunches developed which are very common as it is commonly found in the old Roseville's Delight growing plants. Bracts are persistent. Variety is ideal for pot culture and topiary work. The cultivar is registered in 1986 with International Bougainvillea Registration Authority, FAO/IAEA (International Atomic Energy Agency), Vienna, Austria. Registration Number is 1947. (Fig. 12).

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