



## Ten New Cultivars of *Capsicum* (Solanaceae) from India

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### ABSTRACT

The genus *Capsicum* L. (Solanaceae) are considered to be originated in the South America and extended throughout the continent with about 41 species. The members of the genus *Capsicum* are widely used as a spice and vegetables with great economic value. The present study aims at the intra specific classification of genus *Capsicum* from Kerala state of India and naming the cultivars according to ICNCP rules and regulations. It was identified that 10 new cultivars under 2 species such as *Capsicum annuum* L. and *Capsicum frutescens* L. from India. They are described with notes.

**Key words:** *Capsicum*, Cultivars, Kerala, Solanaceae

The genus *capsicum* L. (Solanaceae) comprises about 41 species in the world (Barboza *et al.* 2020), including most economically important species such as *C. annuum* L., *C. baccatum* L., *C. chinense* Jacq., *C. frutescens* L., and *C. pubescens* Ruiz & Pav. (Perry *et al.* 2007, Barboza *et al.* 2019). Tournefort (1719) first used the name *Capsicum* to the genus which was later taken up by Linnaeus (1753). The origin of the genus was along the Andes of western to north-western South America and expanded in a clockwise direction around the Amazon basin, towards central and south-eastern Brazil, then back to western South America, and finally northwards to Central America (Garcia *et al.* 2016). The pungency of fruits is due to a mixture of components known as 'capsaicinoids' which contains capsaicin, 6,7-dihydrocapsaicin, nordihydrocapsaicin, homodihydrocapsaicin, and homocapsaicin as their major chemical entity (Fathima 2015), and the pungency is controlled by a single dominant gene (*Pun1* or *C*) in the *Capsicum annuum* complex. The wild species of *Capsicum* can be divided into two distinct evolutionary lines based on chromosome number, i.e. one with  $2n=2x=24$  and another with  $2n=2x=26$  (Moscone *et al.* 2011).

There has been number of works on evaluation, tissue culture, phytochemistry, breeding techniques, pharmacognacy, gene expression, etc. carryout in India (Sarpras *et al.* 2016, Nag *et al.* 2017, Bora *et al.* 2018, Pathy

*et al.* 2019). More recently, different molecular, cytogenetic, enzymatic studies have been carried in the intragenetic classification of *Capsicum* (Barboza 2011). There is currently no comprehensive taxonomic work on *Capsicum* in India. So, in this paper, we attempt to describe the genus *Capsicum* from Kerala along with 10 new cultivars as the first part of the work.

### MATERIALS AND METHODS

The present study mainly based on the specimens collected from 14 districts of Kerala, India, during 2018 and 2019. The vegetative and reproductive characters were observed in the field itself and materials were brought to the laboratory for further analysis. The collected plants were cultivated in the Botanical garden of Sri Vyasa NSS College, Wadakkancherry, Thrissur. Photographs were taken with the help of Nikon DSLR (30X) camera. Descriptions were made from 3-5 accessions and photo micrographs were taken with the help of digital camera attached to a stereomicroscope (Leica Z4 HD). Voucher specimens were prepared following standard technique (Bridson and Forman 1998) and deposited at the herbarium of SVNSS College, Wadakkancherry, Thrissur, and the type materials deposited in CALI. Terminology for the descriptions was used from the IPGRI, AVRDC and CATIE (1995). Nomenclature details were prepared by using International Code for

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Nomenclature of Cultivated Plants - ICNCP (Brickell *et al.* 2016).

Kerala geography is wedged between Arabian Sea in the West and the Western Ghats in the East with a cover area of 38,863 km<sup>2</sup>. It consists of 14 districts and located between 8° 17' 30" N and 12° 47' 40" N and east longitudes 74° 27' 47" E and 77° 37' 12" E. It includes many hills, high mountains and valleys, dense forests, many back waters, lakes and blessed with 44 rivers. Normally the climate of Kerala has hot and humid, offering cold climate in December- January, and hot climate in April-May, followed by the south west monsoon from June which continue till September. The forested region with area 9,400 km<sup>2</sup> comprises tropical wet evergreen, partially evergreen forest in the middle altitude and subtropical, temperate forest in precipitous hills. Soil types existing in Kerala are red, ferruginous, sandy, black, peat and loamy soil.

## RESULTS AND DISCUSSION

### *Taxonomic treatment*

*Capsicum* L. Sp.Pl.188.1753; Hook. f. Fl. Brit. India 4:239.1883; Gamble, Fl. Madras 2: 941 (661).1923; Matthew, Fl. Tamil Nadu Carnatic 277.1981; M.D. Dassanayake, Fl. Ceylon 395.1987.

Annual, biennial or rarely perennial herbs or shrubs, erect, prostrate or intermediate, 10cm to 2 m tall, stem cylindrical or angled, purple patches on axils and lateral branches. Leaves simple, alternate, ovate- lanceolate, estipulate, 3-15cm × 2-8 cm, base cuneate, apex acute, entire, usually green and rarely pigmented. Inflorescence solitary, axillary cyme. Flower ebracteate, pedicellate, pentamerous or hexamerous, actinomorphic, complete and hypogynous, pendent or erect. Corolla, petals 5-6, usually white occasionally violet or purple. Calyx companulate with or without conspicuous teeth, sepals 5, rarely more or less fused. Stamens 5, epipetalous, 1 - 1.5mm long; anther blue or purple, rarely yellow, bithecus, basifixed, dehiscence through longitudinal slits. Gynoecium bicarpellary, syncarpous, bilocular, superior ovary with many ovules on axile placentation; Style simple; stigma capitate. Fruit pendent or erect, berry, triangular, almost round, elongate or blocky, bilocular to tetralocular, white, purple, red. Seeds many, usually disc-shaped, creamy yellow, endospermic.

### *Key to the species*

1. Fruits pendent, flowers one or two per axil, mostly fruit longer than pedicel, .....1. *C. annuum*
1. Fruits and flowers upright, mostly one per axil, pedicel equal or more than longer than fruit.....2. *C. frutescens*.

1.*C. annuum* L. Sp. Pl. 188. 1753; Gamble, Fl. Pres. Madras 941(661). 1923; Matthew, Fl. Tamil Nadu Carnatic. 276.1981; M. D. Dassanayake. Fl. Ceylon. 395. 1987.

*Type:* Habitat in America meridionali, BM-000558022 (Lectotype, BM, Digital image!)

Annual or rarely biennial herbs. Height up to 1 m. Stem terete, sometimes angled, green- bluish purple. Roots branched. Leaves simple, alternate, exstipulate, pedicellate,

lanceolate -ovate, 2.0-11 × 3.0-18cm, green, occasionally pigmented, entire, apex acuminate, base acute, veins reticulate. Inflorescence solitary cyme. Flowers mainly single per axil or rarely in pairs, pendant, and usually pentamerous, rarely hexamerous, ebracteate, pedicellate, dichlamydeous, actinomorphic, complete, and hypogenous. Corolla white, sometimes purple. Calyx green or dark pigmented, cup shaped or disc-shaped; Calyxteeth short or sometime lacking, rarely exceeding 0.5mm. Stamens usually 5, epipetalous, 1.0-1.5mm long, bithecus, basifixed, dehiscence through longitudinal slits, anther usually blue or purple. Gynoecium bicarpellary, syncarpous, bilocular, superior ovary with many ovules on axile placentation; style simple; stigma capitate. Fruit berry, pendent, variously coloured (green, creamy white, purple, red, orange, yellow, etc.). Seeds disc shaped, 0.8-1.5cm, endospermic,>50 per fruit.

Common name: Pachamulaku, Karimulaku

Flowering and Fruiting: Throughout the year.

Distribution: All over Kerala

2. *C. frutescens* L. Sp. Pl. 189. 1753; Hook. Fl. Brit. India. 4:239. 1885; Gamble, Fl. Pres. Madras. 941(661).1957; Matthew, Fl. Tamil Nadu Carnatic 277. 1981; M. D. Dassanayake, Fl. Ceylon Vol.6 397. 1987.

*Type:* Habitat in India, A. van Royen No. 908.244-150 (Lectotype, L, Digital image!)

Annual or biennial herbs, tree like habitat, height 0.85 to 2.0 m, stem terete to angled with many branches. Leaves simple, alternate, exstipulate, broadly ovate-cordate, 3-8×5-12 cm, green, reticulate venation. Inflorescence solitary cyme. Flowers erect, white or greenish white, small, 0.5-1.2cm long, pentamerous, pedicellate, dichlamydeous, ebracteate, actinomorphic, hypogenous. Calyx sepal 5, cup shaped with inconspicuous teeth. Stamens 5, epipetalous 0.8-1.2mm long, bithecus, basifixed, dehiscence through longitudinal slits; anther blue or purple. Gynoecium bicarpellary, syncarpous, bilocular, superior ovary with many ovules on axile placentation. Style simple; stigma capitates. Fruit upright berry, soft, fleshy, smooth, mainly elongate and sometimes varying in shape. Seeds disc shaped, endospermic, <50 seeds per fruit.

Common name: Kappa mulaku, Kandarimulaku, Arimulaku, etc.

Flowering fruiting: Throughout the year.

Distribution: All over the Kerala.

### *Key to the capsicum cultivars in Kerala*

- |   |     |
|---|-----|
| 1. Flower and fruits upright                            | - 2 |
| 1. Flower and fruits pendant                            | - 3 |
| 2(1). Colour of the fruit creamy-white, pros - 6.       |     |
| <i>C. frutescens</i> 'Manamnokki'                       |     |
| 2. Colour of the fruit dark green, intermediate         | - 5 |
| <i>C. frutescens</i> 'Kunjan'                           |     |
| 3(1). Growth habit erect                                | - 4 |
| 3. Growth habit intermediate, prostrate                 | - 7 |
| 4(1). Fruit triangular, wrinkled, petals greenish white | - 4 |

## Ten New Cultivars of *Capsicum* (Solanaceae) from India

4. Fruit elongate - 5  
 5(1). Calyx and young fruits white, smooth, pointed apex, obtuse base - 10  
*C. annuum* 'Vellan'
5. Calyx and young fruits green - 6  
 6(1). Apex of fruits bifid, fruits up to 6 cm - 1  
*C. annuum* 'Bullet'
6. Apex of fruits pointed, not bifid, fruits up to 10 cm - 7  
*C. annuum* 'Neelan'
- 7(1). Petals purple, young fruit purple, elongate - 8  
*C. annuum* 'Purple'
7. Petals white - 8  
 8(1) Shape of the fruit almost round, apex round and sunken - 9  
*C. annuum* 'Samabri'
8. Shape of the fruit otherwise - 9  
 9(1) Young fruit creamy white, blocky, sunken with pointed apex - 3  
*C. annuum* 'Fancy'
9. Young fruit creamy green, elongate, pointed apex - 2  
*C. annuum* 'Eriv'

1.5cm. Petals 5, white. Calyx companulate with inconspicuous teeth. Stamens 5, epipetalous, 1-1.2cm long, anther purple, filament white. Ovary superior, style simple; stigma capitate. Fruits pendent, 4-6 × 3-4 cm, berry, elongate, truncate, apex pointed, bifid, smooth, dark green at young and becomes dark red at maturity, bilocular, mostly one per axil. Seed 0.1-0.3mm, no. >50, straw yellow (Fig 1).

Habitat: Cultivated.

Flowering and Fruiting: Throughout the year.

Distribution: Kozhikode, Thiruvananthapuram, Ernakulam and Malappuram districts.

Etymology: The name 'bullet' is derived from the shape of the fruit which looks similar to that of a bullet.

Notes: This chilli has been used as a spice in Kerala for long time. It is similar to *C. annuum* 'neelan' by its pigmentation on axils and growth pattern, but differs in fruit shape (short and broad), bifid fruit apex, and thick fruit wall. Immature stem pubescent, but leaves glabrous. Purple pigmentation is present at the axils of branches when it grows in sun light. Calyx bell shaped and one or two fruits arise from the axils. Nomenclatural standard: India, Kerala, Kozhikode (Dist.), Koyilandi, 7<sup>th</sup> October 2018, A R Anuroopa 544 (SVNSS). Additional specimens examined: India, Kerala, Thiruvananthapuram (Dist.), Attingal 11<sup>th</sup> October 2018, A R Anuroopa 517 (SVNSS); Ernakulam (Dist.), Perumbavoor 17<sup>th</sup> October 2018, A R Anuroopa 515 (SVNSS); Malappuram (Dist.), 20<sup>th</sup> October 2018, A R Anuroopa 512 (SVNSS).



Fig 1 *Capsicum annuum* 'Bullet'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

### Descriptions

#### 1. *Capsicum annuum* L. 'Bullet'

Erect herbs, 66-85 cm tall. Stem irregularly angled, green, purple pigmentation on the axils, glabrous. Leaves, simple, alternate, ovate, apex acute, base cuneate, margin entire, 5-11 × 4-6 cm. Inflorescence solitary, axillary cyme. Flower pendent, complete, pentamerous, 1.5-2.5 × 0.8-



Fig 2 *Capsicum annuum* 'Eriv'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

## 2. *Capsicum annuum* L. 'Eriv'

Prostrate herbs, 50-85 cm tall. Stem cylindrical, green, purple pigmentation on the axils of branches. Leaves ovate, 8-15 × 4-8 cm, apex acute, base cuneate, glabrous, entire. Inflorescence solitary, axillary cyme. Flower pendent, pentamerous, 1.5- 2.5 × 0.6-1.3 cm. Calyx bell-shaped, green, teeth 5, inconspicuous. Corolla petals 5, white. Stamens 5, epipetalous, 1.2 - 1.5cm long, anther purple, filament white. Ovary superior, ovules on axile placentation; style simple; stigma capitate. Fruit pendent, berry, 6-9 × 2-3 cm, elongate, slightly wrinkled, base truncate, apex pointed, bilocular, greenish white in immature stage and red at maturity, mostly two per axil. Seeds 0.1-3mm, no.> 50, pale yellow (Fig 2).

Habitat: Cultivated

Flowering and Fruiting: Throughout the year.

Distribution: Wayanad and Thrissur districts.

Etymology: The name 'Eriv' is derived due to the excessive hotness of the fruit.

Notes: This is not a widely cultivated chilli in Kerala. It is mainly used for culinary purposes and known to be used as a medicine among Katunayakan tribes in Kerala. Fruits are pendant, greenish white (young stage), elongate and slightly wrinkled. One or two fruits are arising from each axil. Purple pigmentation is seen on the axils of branches.

Nomenclatural standard: India, Kerala, Wayanad (Dist.), Thirunelli 20<sup>th</sup> July 2018, *A R Anuroopa* 516 (SVNSS).

Additional specimen examined: India, Kerala, Thrissur (Dist.), Mullassery 16<sup>th</sup> July 2018, *A R Anuroopa* 518 (SVNSS).



Fig 3 *Capsicum annuum* 'Fancy'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

## 3. *Capsicum annuum* L. 'Fancy'

Prostrate herbs, 46-65 cm tall. Stem irregularly angled, light green. Leaves simple, ovate, 5-11 × 3-4 cm, apex acute, base cuneate, entire, sub glabrous. Inflorescence solitary, axillary cyme. Flower pentamerous, 1.5 - 2.5 × 1 - 1.5cm, pendent. Calyx companulate, light green, teeth 5, inconspicuous. Corolla petals 5, creamy white. Stamens 5, 0.8 - 1.5cm long, anther pale blue, filament white. Ovary superior; style simple; stigma capitate. Fruit pendent, berry, 3 - 5 × 3 - 4 cm, blocky, truncate, wrinkled, sunken with pointed apex, bilocular, creamy white in immature stage and red in mature stage, mostly two per axil. Seed 0.2 - 0.6 mm, no.< 50, pale yellow (Fig 3).

Habitat: Cultivated

Flowering and Fruiting: Throughout the year.

Distribution: Wayanad and Kozhikode districts.

Etymology: Since this cultivar is used for ornamental decoration purpose and multiple colours on a single fruit during different stages of maturation, the name 'fancy' has been given.

Notes: This cultivar is commonly seen as ornamental plant. Plants are usually small and prostrate type of growth habit. Fruits are comparatively bigger and heavily wrinkled. Immature fruit is creamy white and red when ripe. Epicarp is very thin. There is no pubescence and colouration on the plant body.

Nomenclatural standard: India, Kerala, Kozhikode (Dist.), Nadakkavu 24<sup>th</sup> June 2018, *A R Anuroopa* 505 (SVNSS).

Additional specimen examined: India, Kerala, Wayanad (Dist.), Kuppadi 20<sup>th</sup> July 2018, *A R Anuroopa* 509 (SVNSS).

## 4. *Capsicum annuum* L. 'Jimikki'

Erect herbs, 50-85 cm tall. Stem irregularly angled, purple pigmentation on axils, green. Leaves ovate, 5-12 × 2-6 cm, apex acute, base cuneate, entire, glabrous. Inflorescence solitary, axillary cyme. Flower pentamerous, 1.5-2.5 × 0.8-1.7cm, pendant. Calyx companulate, dentate, teeth 5, conspicuous. Corolla petals 5, greenish white. Stamens 5, 1.3-1.5 cm long, anther pale blue, filament white. Ovary superior; style simple; stigma capitate. Fruit pendent, berry, 3-5 × 6-8 cm, triangular, wrinkled, cordate, sunken with pointed apex, trilocular, green in immature stage and red in mature stage, one per axil. Seed 0.2 - 0.3 mm diameter, no. <50, pale yellow (Fig 4).

Habitat: Cultivated

Flowering and Fruiting: Throughout the year.

Distribution: Kozhikode and Palakkad districts.

Etymology: The name 'jimikki' derived from the shape of the fruit, which resembles Kerala's traditional ear ring.

Notes: This plant is mostly cultivated for ornamental purpose. It is quite distinguished cultivar having beautiful, triangular fruits. Its fruit has pungent smell and pericarp is thick and fleshy.

Nomenclatural standard: India, Kerala, Palakkad (Dist.), Thrithala 13 June 2018, *A R Anuroopa* 548 (SVNSS).



Additional specimen examined: India, Kerala, Kozhikode (Dist.), Mukkam 15 July 2018, *A R Anuroopa 550* (SVNSS).

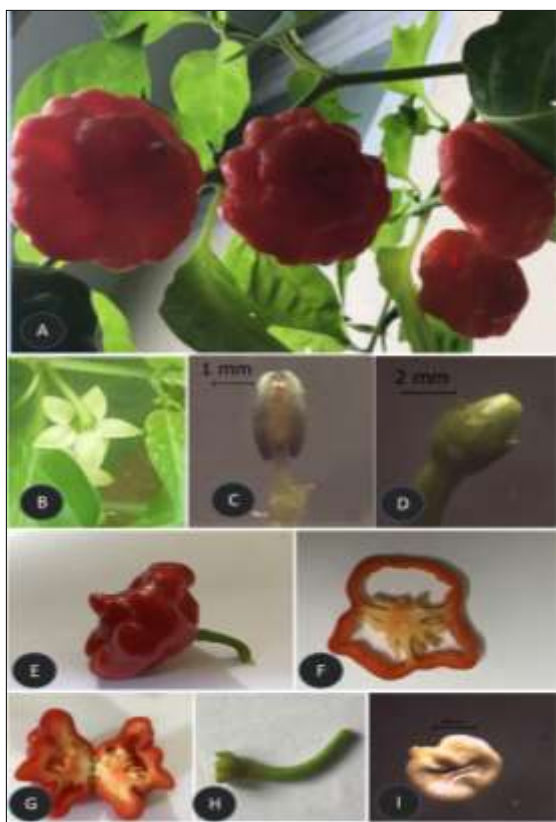


Fig 4 *Capsicum annuum* 'Jimikki'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed



Fig 5 *Capsicum frutescens* 'Kunjan'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

##### 5. *Capsicum frutescens* L. 'Kunjan'

Intermediate herbs, 46-65 cm tall. Stem angled, green, no purple pigmentation. Leaves ovate, 6-11 × 3-6 cm, apex acute, base cuneate, glabrous, light green. Inflorescence solitary, axillary cyme. Flower usually pentamerous, 1.5-2.5 × 0.7-1.8 cm long, erect. Calyx campanulate, teeth 5-6, inconspicuous, green. Corolla petals 5, white to greenish white. Stamens 5-6, 0.8-1 cm long, anthers purple, filaments white. Ovary superior, style simple, stigma capitate. Fruit upright, berry, elongate, 3-6 × 1.5-3 cm, slightly wrinkled, base obtuse, apex pointed, bilocular, green in young stage and red in mature stage, one or two per axil. Seed 0.1 mm, no. <20, yellow white (Fig 5).

Habitat: Cultivated

Flowering and Fruiting: Throughout the year.

Distribution: Kozhikode, Kollam and Kannur districts.

Etymology: The name 'Kunjan' is derived from the small size of the fruits. In Malayalam word kunjan means small.

Notes: This is one of the common cultivars in Kerala. It has been used as a spice since long ago. It is closely similar to *C. frutescens* 'Manamnokki' by its upright and elongate fruits, but differs by prostrate growth habit and white fruits at young stage.

Nomenclatural standard: India, Kerala, Kollam (Dist.), Kottarakkara 1<sup>st</sup> October 2018, *A R Anuroopa 538* (SVNSS).

Additional specimens examined: India, Kerala, Kozhikode (Dist.), Kuttiyadi 6<sup>th</sup> October 2018, *A R Anuroopa 539* (SVNSS); Kannur (Dist.), Cherupuzha 18<sup>th</sup> April 2019, *A R Anuroopa 540* (SVNSS).

##### 6. *Capsicum frutescens* L. 'Manamnokki'

Prostrate herbs, 50 - 85 cm tall. Stem irregularly angled, green, purple patches absent. Leaves simple, ovate, 3-8 × 3-5 cm; apex acute, base cuneate, sub glabrous, green. Inflorescence solitary, axillary cyme. Flower pentamerous, 1-1.5 × 0.5-1 cm, erect. Calyx campanulate, teeth 5, inconspicuous, white to greenish white. Corolla petals 5, white. Stamens 5, 0.5-0.8 cm long, anthers purple, filaments white. Ovary superior, style simple; stigma capitate. Fruit upright, berry, bilocular, 4 -5 × 1-2 cm, elongate, slightly wrinkled, base obtuse, apex pointed, creamy white in immature stage and red in mature stage, single per axil. Seed 0.1 - 0.2 mm, no. <20, pale yellow (Fig 6).

Habitat: Cultivated.

Flowering and Fruiting: Throughout the year.

Distribution: Kasargode and Idukki districts.

Etymology: The position of fruit is pointed straight up to the direction of the sky, hence the name 'Manamnokki', which means looking towards the sky in Malayalam.

Notes: In recent years, this cultivar has become more common in the home gardens of Kerala. This is used for

both culinary purpose as well as ornamental use. It is similar to *C. frutescens* 'kunjan' by its leaf shape, elongate and upright fruit, but differs in having immature green fruit, intermediate growth habit, calyx colour. The Colour of the calyx is white to greenish white in *C. frutescens* 'Manamnokki', whereas green in *C. frutescens* 'kunjan'. It has short petiole length and inter-nodal length in lateral branches which gives the dense bushy appearance.



Fig 6 *Capsicum frutescens* 'Manamnokki'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

Nomenclatural standard: India, Kerala, Kasargode (Dist.), Kanhangad 20<sup>th</sup> March 2019, A R *Anuroopa* 541 (SVNSS). Additional specimen examined: India, Kerala, Idukki (Dist.), Thodupuzha 3<sup>rd</sup> October 2018, A R *Anuroopa* 542 (SVNSS).

#### 7. *Capsicum annuum* L. 'Neelan'

Erect herbs, 66-85 cm tall. Stem angled, green, branches and axils with purple patches. Leaves ovate-lanceolate, 5-12 × 3-4 cm, apex acute, base cuneate, margin entire, glabrous. Inflorescence solitary, axillary cyme. Flower pentamerous or hexamerous, pendent, mostly one per node, 2.0-2.5cm × 1.5-2cm. Calyx campanulate, dentate, teeth 5-6, inconspicuous, green. Corolla petals 5-6, white. Stamens 5, 1-1.2cm long, anther pale blue, filaments white. Ovary superior; style simple; stigma capitate. Fruit pendent, berry, 5-10 × 2-4 cm, elongate, obtuse, smooth, apex pointed, green at young stage and red at maturity, bilocular, one per axil. Seed 0.1-0.2 mm, no. >50 pale yellow (Fig 7).



Fig 7 *Capsicum annuum* 'Neelan'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

Habitat: Cultivated

Flowering and Fruiting: Throughout the year.

Distribution: Kozhikode, Thrissur, Thiruvananthapuram, Kasargode, Palakkad, Kottayam, Kollam and Malappuram districts.

Etymology: The name of this cultivar is derived from the Malayalam word 'Neelan' which means long due to its elongated fruit size.

Notes: This chilli is exclusively used for culinary purposes. It is the most commonly cultivated and widely used chilli for chilli powder preparation in Kerala. The fruit is much elongated and red at maturity.

Nomenclatural standard: India, Kerala, Kannur (Dist.): Panoor 1<sup>st</sup> August 2018, A R *Anuroopa* 534 (SVNSS).

Additional specimens examined: India, Kerala, Palakkad (Dist.): Malampuzha 2<sup>nd</sup> August 2018, A R *Anuroopa* 535 (SVNSS); Kottayam (Dist.): Pampadi 6<sup>th</sup> August 2018, A R *Anuroopa* 530 (SVNSS); Kollam (Dist.), Kottarakkara 9<sup>th</sup> August 2018, A R *Anuroopa* 529 (SVNSS); Kozhikode (Dist.), Vengeri 28<sup>th</sup> July 2018, A R *Anuroopa* 536 (SVNSS); Thrissur (Dist.), Mullassery 17<sup>th</sup> July 2018, A R *Anuroopa* 537 (SVNSS); Thiruvananthapuram (Dist.), Nemam 5 July 2018 A R *Anuroopa* 528 (SVNSS); Kasargode (Dist.), Manjeswaram 29<sup>th</sup> August 2018, A R *Anuroopa* 523



## Ten New Cultivars of *Capsicum* (Solanaceae) from India

(SVNSS); Malappuram (Dist.), Tirur, 16<sup>th</sup> October 2018, A *R Anuroopa* 522 (SVNSS).

### 8. *Capsicum annuum* L. 'Purple'

Intermediate herbs, 66-85 cm tall. Stem irregularly angled, green, distinct purple pigmentation at the axils of branches, pubescent. Leaves simple, ovate, 3-7 × 2-4 cm, apex acute, base cuneate, entire, glabrous, purple patches present on leaves and half-way to the petiole. Inflorescence solitary, axillary cyme. Flower pentamerous or hexamerous, 1.5-2 × 1-1.5 cm, pendent. Calyx campanulate, teeth 5, inconspicuous, green. Corolla petals 5-6, purple. Stamens 5, 0.8-1.2 cm long, anthers dark purple, filaments white. Ovary superior, style simple, stigma capitate. Fruit pendent, berry, 4-5 × 2-4 cm, bilocular, elongate, smooth, base obtuse, apex pointed, purple at young stage and becomes red at maturity, single per axil. Seed 0.1-0.2 mm, no. <50, creamy white (Fig 8).

Habitat: Cultivated.

Flowering and Fruiting: Throughout the year.

Distribution: Thrissur and Ernakulum districts.

Etymology: The name of the cultivar is derived from the colour of the flower and fruit, which is purple.

Notes: This chilli is mainly used for ornamental purpose. This plant is entirely different from other cultivars due to its purple colour of flower, fruits, petiole, etc. Fruits are small, elongate and pendent.

Nomenclatural standard: India, Kerala, Thrissur (Dist.): Chalakkudi 26<sup>th</sup> November 2018, A *R Anuroopa* 551 (SVNSS).

Additional specimen examined: India, Kerala, Ernakulam (Dist.), Kothamangalam 2<sup>nd</sup> December 2018, A *R Anuroopa* 549 (SVNSS).



Fig 8 *Capsicum annuum* 'Purple'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed



Fig 9 *Capsicum annuum* 'Sambari'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

### 9. *Capsicum annuum* L. 'Sambari'

Intermediate herbs, 66-85 cm tall. Stem irregularly angled, green, purple patches on axils of the branches.

Leaves simple, ovate, 4-8 × 3-6 cm, apex acute, base cuneate, entire, glabrous. Inflorescence solitary, axillary cyme. Flower pentamerous or hexamerous, 1.5-2.5 × 0.7-

1.5cm, pendent. Calyx campanulate, dentate, teeth 5, conspicuous, green. Corolla petals 5-6, white. Stamens 5, 0.5-1.8 cm long, anther purple, filaments white, Ovary superior, simple, stigma capitate. Fruit pendent, berry, 2-3 × 3-5cm, almost round, smooth, truncate, apex round and sunken, bilocular, dark green in immature stage and became red at maturity, one per axil. Seed 0.2 - 0.3 mm, no. <50, creamy yellow in colour (Fig 9).

Habitat: Cultivated.

Flowering and Fruiting: Throughout the year.

Distribution: Pathanamthitta, Palakkad and Thrissur districts.

Etymology: The name 'Sambari' is derived due to the usage of this chilli in the traditional Kerala curry 'Sambar'.

Notes: This cultivar is mainly used for culinary purposes. The leaves are ovate and dark green. Fruits are smooth and almost round. Pedicel and epicarp is thick. Compactly arranged seeds are found inside the fruit. Immature dark green pendant fruits converted into brownish red and then to dark red in subsequent stages of maturity. Lateral branches and axils are slightly violet pigmented.

Nomenclatural standard: India, Kerala, Pathanamthitta (Dist.), Tiruvalla 27<sup>th</sup> October 2018, A R Anuroopa 542 (SVNSS).

Additional specimen examined: India, Kerala, Palakkad (Dist.), Pattambi 23<sup>rd</sup> May 2019, A R Anuroopa543(SVNSS); Thrissur (Dist.), Pavaratty 4<sup>th</sup> October 2018, A R Anuroopa545 (SVNSS).

#### 10. *Capsicum annum* L. 'Vellan'

Erect herbs, 46-65 cm tall. Stem irregularly angled, green, no purple patches on branches. Leaves simple, ovate, 3-7 × 2-4 cm, apex acute, base cuneate, entire, glabrous. Inflorescence solitary, axillary cyme. Flower pentamerous or hexamerous, 0.5-1 × 1-1.5cm, pendent, pedicel greenish white. Campanulate, dentate, teeth 5, conspicuous, white to greenish white. Corolla petals 5-6, white. Stamen 5, 5-8mm long, anther dark purple, filaments white. Ovary superior, style simple, stigma capitate. Fruit pendent, berry, 6-8 × 1.5-2 cm, elongate, smooth, base obtuse, apex pointed, bilocular, white to greenish white at young stage and becomes red at maturity, one per axil. Seed 0.1 -0.3 mm, no. >50, creamy white (Fig 10).

Habitat: Cultivated.

Flowering and Fruiting: Throughout the year.

Distribution: Alappuzha, Ernakulum and Kollam districts.

Etymology: The name is derived from the Malayalam word 'vella' which means white owing to the white colour of fruits, calyx and pedicel at younger stage.

Notes: This is not a commonly cultivated chilli in Kerala. It is mainly used for culinary purposes, but rarely used as ornamental plants. It is similar to *C. annum* 'Neelan' by its elongate fruit and ovate leaves, but differs in having white to greenish white fruits, calyx and pedicel at younger stage and height of the plant. Leaves and fruits are smaller in size.

Fruit is smooth and orange to red at maturity. A comparative morphology of all the new cultivars is provided in table 1.

Nomenclatural standard: India, Kerala, Ernakulum (Dist.), Aluva 11<sup>th</sup> January 2019, AR Anuroopa 555 (SVNSS).

Additional specimens examined: India, Kerala, Alappuzha (Dist.), Mavelikkara 3<sup>rd</sup> February 2019, A R Anuroopa 553 (SVNSS); Kollam (Dist.), Oachira 10<sup>th</sup> February 2019, A R Anuroopa 552 (SVNSS).



Fig 10 *Capsicum annum* 'Vellan'. A. Habit; B. Flower; C. Anther; D. Gynoecium; E. Fruit; F. Fruit C.S; G. Fruit L.S; H. Calyx; I. Seed

The present study of ten cultivars among two species of *C. annum* and *C. frutescens* highlights the morphological diversity of the cultivars using taxonomic descriptors (IBPGR 2016), mainly such as plant life span, plant growth habit, leaf colour, leaf size, leaf shape, stem shape, stem colour, flower colour, flower position, calyx colour, stamens colour, locules, fruit/axil, fruit position, fruit shape, fruit surface, fruit colour, fruit size, fruit apex, fruit pedicel length and no: of seeds/fruit. The cultivar nomenclature has been done according to the ICNCP norms. Among these all ten cultivars shows wide variation in their corolla colour, fruit shapes, fruit colour, leaf shape, leaf colour, calyx shape



### **Ten New Cultivars of Capsicum (Solanaceae) from India**

etc. and least variation observed in the creamy white style and purple blue anther. In capsicum frutescence flowers are slightly greenish white and up right fruits having cup shaped calyx and thin fruit wall. Usually pedicel length is almost equal to the length of the fruit. In capsicum annuum usually fruits are longer than pedicel, fruit wall is comparatively thick and fleshy. One of the most unique characteristics of

all the Capsicum species are showing unstable petal numbers independent of the season. At the time of maturity all green fruits directly converted into red in colour, but creamy white fruits have intermediate colour mostly orange or orange red and finally it attains red colour at maturity. Due to inter specific hybridization and cross pollination most of the plants show many over lapping characters.

**Table 1 Comparative Morphology table of 10 cultivars**

| Serial no            | 1                          | 2                   | 3                   | 4                          | 5                 | 6                  | 7                | 8                          | 9                          | 10                  |
|----------------------|----------------------------|---------------------|---------------------|----------------------------|-------------------|--------------------|------------------|----------------------------|----------------------------|---------------------|
| Characters           | Bullet                     | Eriv                | Fancy               | Jimikki                    | Kunjan            | Manamnokki         | Neelan           | Purple                     | Sambari                    | Vellan              |
| Habit                | Erect                      | Prostrate           | Prostrate           | Erect                      | Intermediate      | Prostrate          | Erect            | Intermediate               | Intermediate               | Erect               |
| Height               | 66-85 cm                   | 50-85 cm            | 46-65 cm            | 50-85 cm                   | 46-65 cm          | 50-85 cm           | 66-85 cm         | 66-85 cm                   | 66-85 cm                   | 46-65 cm            |
| Stem                 | Irregularly angled- purple | Cylindrical, purple | Irregularly angled  | Irregularly angled- purple | Angled            | Irregularly angled | Angled, purple   | Irregularly angled- purple | Irregularly angled- purple | Irregularly angled  |
| Leaves               | Ovate                      | Ovate               | Ovate               | Ovate                      | Ovate             | Ovate              | Ovate-lanceolate | Ovate                      | Ovate                      | Ovate               |
| Flower               | Erect                      | Pendent             | Pendent             | Pendent                    | Erect             | Erect              | Pendent          | Pendent                    | Pendent                    | Pendent, pedi-white |
| Petals               | 5, white                   | 5,-white            | 5,white             | 5,white, greenish white    | 5, white          | 5, white           | 5-6, white       | 5-6, Purple                | 5-6, white                 | 5-6, white          |
| Calyx                | Green, inc                 | Green-inc.          | Green -inc.         | Green-con                  | Green, inc        | White, inc         | Green -inc.      | Green, inc                 | Green -con-                | White, con          |
| Stamens              | purple                     | Purple              | Pale blue           | Pale blue                  | Dark purple       | Dark purple        | Pale blue        | Dark purple                | Purple                     | Dark purple         |
| Fruits –no.          | one/axil                   | two/axil            | two/axil            | one/axil                   | two/axil          | one/axil           | one/axil         | one/axil                   | one/axil                   | one/axil            |
| Position             | Pendent                    | Pendent             | Pendent             | Pendent                    | Erect             | Erect              | Pendent          | Pendent                    | Pendent                    | Pendent             |
| Shape                | elongate                   | Elongate            | Blocky              | Triangular                 | Elongate          | Elongate           | Elongate         | Elongate                   | Almost round               | Elongate            |
| Surface              | smooth                     | slightly wrinkled   | wrinkled            | wrinkled                   | slightly wrinkled | slightly wrinkled  | smooth           | smooth                     | Smooth                     | smooth              |
| Base                 | truncate                   | Truncate            | Truncate            | cordate                    | Obtuse            | Obtuse             | Obtuse           | Obtuse                     | Truncate                   | obtuse              |
| Apex                 | Pointed, bifid             | Pointed             | Sunken with pointed | Sunken with pointed        | Pointed           | Pointed            | pointed          | Pointed                    | Round, Sunken              | pointed             |
| Locules              | Bilocular                  | Bilocular           | Bilocular           | Trilocular                 | Bilocular         | Bilocular          | Bilocular        | Bilocular                  | Bilocular                  | Bilocular           |
| Colour               | green to red               | Green-red           | Creamy white-red    | Green-red                  | green to red      | White to red       | Green-red        | Purple to red              | Green-red                  | White to red        |
| Size                 | 4-6 cm x 3-4 cm            | 6-9 cm x 2-3 cm     | 3-5 cm x 3-4 cm     | 3-5 cm x 6-8 cm            | 3-6 cm x 1.5-3 cm | 4-5 cm x 1-2 cm,   | 5-10 cm x 2-4 cm | 4-5 cm x 2-4cm             | 2-3 cm x 3-5cm             | 6-8cm x 1.5-2 cm    |
| Seeds                | >50                        | > 50                | <20 20-50           | <20 20-50                  | <20               | <20                | >50              | <20 20-50                  | <50 20-50                  | <20 >50             |
| Mature leaf size     | 5-10 x 4-6 cm              | 8-15 x 4-8 cm       | 5-11 x 3-4 cm       | 5-12 x 2-6                 | 6-11 x 3-6 cm     | 3-8 x 3-5 cm       | 5-12 x 3-4 cm    | 3-7 x 2-4 cm               | 4-8 x 3-6 cm               | 3-7 x 2-4 cm        |
| Fruit pedicel length | 2-4 cm                     | 2-3 cm              | 3-4 cm              | 2.5-3 cm                   | 2-3 cm            | 2-2.5 cm           | 3-4 cm           | 1.5-2.5 cm                 | 1.5-2 cm                   | 2-3 cm              |

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