VL Cherry Tomato 1: a nutritionally rich cherry tomato cultivar

VL Cherry Tomato 1 is a cultivar with high vitamin C content released for India's agro-ecological zones (I, III and VII) and developed by the pure line selection method from the introduced Asian Vegetable Research and Development Center (AVRDC) line, i.e. EC 461693. Its small, attractive, bright red, oval, juicy and sweet fruits are well suited for consumption. Fruits with high vitamin C content (75.6 mg/100 g) help strengthen the human immune system. The cultivar gives a high fruit yield of 25–30 t ha^{-1} (90–120 fruits plant^{-1}) under open field conditions, propelling its cultivation to be highly suited to vertical, terrace and urban gardening.

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is an important and economical crop as it fetches high price due to its taste and nutrition. It can be cultivated during the spring–summer season, i.e. March–July under open fields and spring–autumn season, i.e. April–October under poly-house conditions[1]. So far, no cherry tomato cultivar has been released through the All India Coordinated Research Project on Vegetable Crops (AICRP-VC) for cultivation in the country. Therefore, private sector hybrids are being cultivated by the farmers resulting in problems like seed dependency and high seed price. Here, we report on the release of VL Cherry Tomato 1 from AICRP-VC, an open-pollinated cultivar suitable for polyhouse as well as open-field conditions with better horticultural traits such as attractive red, oval fruits (15–20 g), high vitamin C content (75.6 mg/100 g) and TSS (7° Brix) with thick pericarp, as well as long storage life. This cultivar can be easily multiplied as well as maintained by the farmers and is suitable for cultivation in inorganic as well as organic conditions. It has been released in three different agro-ecological zones of India, viz. zone I (Northwest Himalaya), zone III (Northeast Himalaya, Andaman and Nicobar Islands) and zone VII (Madhya Pradesh, Maharashtra, Goa), showing wide adaptability. It can also be easily cultivated in other tomato-growing regions of the world having similar agro-climatic conditions.

The major objective of the cherry tomato breeding programme was to develop indeterminate, autogamous, high-yielding genotypes with attractive fruits (small, red, oval fruits having thick pericarp, long storage life, high nutrition and resistant to major biotic stresses). Thirty-one accessions were evaluated at the Experimental Farm, ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand, India (lat. 79°39′E; long. 29°35′N; altitude 1250 m amsl). Among the three accessions, VT 95 was found promising in fruit yield and other important horticultural traits. This accession was derived from an exotic collection introduced from AVRDC, Taiwan, through ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi, as EC 461693 (CH 154). In order to obtain uniform plants with desirable traits, the pure line selection method was practised. After two generations of rigorous selection, uniform plants were observed and finally named 'VT 95'.

During 2005–06, station replicated trials (pre-varietal trials) were conducted with three promising accessions, namely VTG 91, VTG 96 and VTG 97. The findings indicated that the fruit yield of VT 95 (20.34 t ha^{-1}) was significantly higher than those of popular cultivars (Table 1). Since VT 95 was found superior in the pre-varietal trials, it was proposed for State Varietal Trials Vegetable Crops (SVT-VC) of Uttarakhand. This cultivar is comparable with other popular open-pollinated cultivars available in the market to be grown in the region for its important horticultural traits such as fruit shape, size, colour, pericarp thickness and taste.

Further, VT 95 along with checks was evaluated in SVT-VC during 2007–09 at three different locations, namely Experimental Farm, Hawalbagh, Almora (1250 m amsl), Lohaghat (1700 m amsl) and Majhera, Nainital (900 m amsl) under organic conditions (Table 2). Based on a three-year evaluation under SVT-VC, VT 95 was found suitable for the mid-hills of Uttarakhand (900–1700 m amsl) under organic conditions. It was released for the state by State Variety Release Committee (SVRC) (Horticulture) on 18 May 2011 at Dehradun. Later, this cultivar was proposed for multi-location testing under AICRP-VC trials of cherry tomato in 2015. During 2015–16 to 2017–18, VT 95 along with the checks was evaluated in AICRP-VC at different testing centres in different agro-ecological zones of India. The trials were conducted in the spring–summer season in

Table 1. On-station performance^{z} of cherry tomato lines for fruit yield (t ha^{-1}), 2005–06

Cultivar	2005	2006	Average mean
VTG 91	16.01	17.25	16.63b^{y}
VTG 95	18.80	21.87	20.34a
VTG 96	14.08	13.21	13.65c
VTG 97	19.88	17.56	18.72a
Pant Cherry 1 (C)	15.03	13.62	14.33c
LSD (0.05)			2.02

^{z}Pre-varietal trials planted in a randomized complete block design with four replications under inorganic conditions.
^{y}Values with different letters are significantly different according to Duncan's test at $P = 0.05$.
Plant density: Row-to-row distance is 75 cm and plant-to-plant distance is 45 cm.
C, Control cultivar; LSD, Least significant difference.

Table 2. Performance^{z} of VL Cherry Tomato 1 (VT 95) at State Varietal Trials Vegetable Crops, Uttarakhand, India for fruit yield (t ha^{-1}), 2007–09

Cultivar	2007 (3)^{x}	2008 (3)	2009 (2)	Pooled mean	Per cent increase of VL Cherry Tomato 1
VT 95 (P)	27.96	10.30	12.68	17.52a^{y}	–
Pant Cherry 1 (Q)	21.58	8.34	9.56	13.61b	+28.71
Pant T 3 (C)	25.06	9.40	10.11	15.45b	+13.38
LSD (0.05)				2.03	

^{z}Trials planted in randomized complete block design over the years under organic conditions and locations (Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora; Govind Ballabh Pant University of Agriculture and Technology Research Station, Nainital and Krishi Vigyan Kendra Farm, Champawat, Uttarakhand).
^{y}Values within columns with different letters are significantly different according to Duncan's test at $P = 0.05$. ^{x}Number of locations in parentheses. P, Proposed entry; Q, Qualifying entry.

Table 3. Performance[z] of VL Cherry Tomato 1 (VT 95) at All India Coordinated Trial in Zones I, III and VII for fruit yield (t ha^{-1}) 2015–18

Cultivar	2015–16 (8)[x]	2016–17 (9)	2017–18 (10)	Pooled mean	Per cent increase of VT 95
VT 95 (P)	302.81	323.58	317.63	315.22a[y]	–
BRCT1 (Q1)	218.91	278.50	234.91	244.70b	+28.82
Panjab Red Cherry (Q2)	207.13	266.82	245.85	241.37b	+30.60
Swarna Ratan (C)	215.55	264.24	241.20	241.28b	+30.64
LSD (0.05)				64.04	

[z]Trials planted in randomized complete block design over the years under the All India Coordinated Research Project on Vegetable Crops and locations (zone I, Northwest Himalaya; zone III, Northeast Himalaya, Andaman and Nicobar Islands; zone VII, Madhya Pradesh, Maharashtra and Goa).
[y]Values within columns followed by different letters are significantly different according to Duncan's test at $P = 0.05$.
[x]Number of locations in parentheses.

Table 4. Biochemical parameters of VL Cherry Tomato 1 (VT 95)

Cultivar	TSS	pH	Lycopene (mg/100 g FW)	β-Carotene (mg/100 g FW)	Vitamin C (mg/100 g)
VT 95	7.03	4.35	7.19a[y]	4.47	75.62a[y]
BRCT1	7.37	4.44	4.79b	4.27	74.38b
SJCT 01	7.60	4.43	2.08c	5.08	73.61b
Swarna Ratan©	6.20	4.21	5.27b	4.33	76.38a
LSD (0.05)	NS	NS	1.29	NS	1.20

[y]Values within columns with different letters are significantly different according to Duncan's test at $P = 0.05$. NS, Non-significant.

Figure 1. Fruits of VL Cherry Tomato 1.

zone I and autumn–winter season in zones III and VII. Trials were planted with recommended agronomic practices (row-to-row distance of 75 cm, plant-to-plant distance of 45 cm); 10 t ha^{-1} farmyard manure with 10 t nitrogen, 5 t P_2O_5 and 5 t K_2O ha^{-1} were applied. Results showed that the fruit yield of VT 95 was significantly higher than the other cultivars (Table 3). During the spring–summer season, trials were conducted in zone I with an average rainfall of 30–40 mm and temperature of 25°–33°C (day) and 15°–20°C (night), whereas in zones III and VII the trials were conducted during the autumn–winter season with an average rainfall of 33–38 mm and an average temperature of 25°–35°C (day) and 18°–22°C (night). Cultivar VT 95 was identified and recommended during the XXXVII Group Meeting of AICRP-VC held at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, in June 2019 for its release in zones I, III and VII based on its performance in the AICRP-VC trials. Finally, cultivar VT 95 was notified as VL Cherry Tomato 1 during the meeting of the Central Subcommittee on Crop Standard Notification and Release for Horticultural Crops[2] and it was held in virtual mode on 28 October 2020.

The plants of VL Cherry Tomato 1 are semi-indeterminate type, 115–130 cm in height, with thin stem having 2–4 primary branches, yellow flowers with non-exerted style position, and 90–120 fruits per plant. Fruits are small in size (15–25 g), oval with a smooth surface, 10–20 fruits per cluster, two locules per fruit, and they are attractive red colour with 2.8–3.0 mm thick flesh (Figure 1). The plant matures early (60–75 days for first picking after transplanting) and 50% flowering takes place 30–40 days after transplanting. Fruits possess high lycopene (7.19 mg/100 g) and high vitamin C (75.62 mg/100 g) contents (Table 4). The suitable transplanting time for its cultivation in the mid-hills conditions (1000–1500 m amsl) of India is the first week of March and April–July under open field and poly-house (naturally ventilated) conditions respectively.

Seeds of VL Cherry Tomato 1 are being multiplied every year and are available to Indian scientists and farmers upon request at the ICAR-VPKAS. The seeds of this variety have also been deposited at ICAR-NBPGR under accession no. IC 584764. Seed requests from outside India may be addressed to the Director, ICAR-NBPGR.

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Sub-alpine Himalayan birch in cold arid Lahaul-Spiti, Himachal Pradesh, India: a proxy of winter/early spring minimum temperature

The recent warming of the earth and its imminent consequences in the form of accelerated climatic variability threatening humankind is the biggest global concern. The IPCC-AR6 report revealed that the global surface temperature had increased faster since 1970 compared to any other 50-year period in the last 2000 years[1]. Recently, the Conference of the Parties (COP26), held in Glasgow from October–November 2021, highlighted the global impact of climate change. The COP countries reaffirmed the Paris Agreement goal of limiting the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C and limit the emission of greenhouse gases to net zero in the future. However, the role of human-induced changes on natural variability in climate is not yet well understood. Human-induced changes have a marked impact on climate change[2–4], and centred manifold in densely populated urban areas relative to the high-altitude regions. Difficult orographic terrains in the Himalayan regions restrict the anthropogenic encroachments and near pristine environments are met in high elevation areas. Observational records from the Himalayan regions and Tibetan Plateau show warming in the minimum/winter temperature[5,6], posing serious concerns for the high-altitude ecology, glaciers and rivers originating from the glaciated regions. Recently, in February 2021, a flash flood due to glacier breakdown occurred in Chamoli, Uttarakhand, India, causing huge socio-economic losses[7,8]. Glacier breakdown during the winter season over the high-altitude Himalayan region could be due to increased minimum/winter temperature and/or increased snow load. Such climatic challenges are crucial for the Himalayan region in terms of ecology, life and sustainable development. However, our understanding of climate variability is limited largely due to the short observational records. Trees growing in the remote high-altitude Himalayan regions have the potential to reveal climate variability in the long-term perspective through annually resolved growth-ring sequences. Therefore, in the present study, we analysed the growth of the high-elevation Himalayan birch (*Betula utilis*) with minimum temperature from Western Himalaya, India.

Himalayan birch, a prominent broadleaf tree, grows mostly in harsh, frigid climatic conditions in the Himalayas. The tree has the unique ability to survive in cold alpine regions and its growth-ring patterns precisely document the ambient environmental changes. The Himalayan birch trees are