P.ISSN: 0971-8184 II E ISSN: 0976-1926
DOI: https://doi.org/10.56093/ijpgr.v39i1.175903

Indian Journal of Plant Genetic Resources

RESEARCH ARTICLE

Yellow Nana–A Dwarf Pomegranate (*Punica granatum*) Variety for Ornamental Purposes

P Shilpa[1]*, SH Jalikop[2], KD Babu[1], R Kumar[2], P Roopa Sowjanya[1], AR Girme[1], TH Daphale[1] and RA Marathe[1]

Abstract

The genus *Punica* to which pomegranate belongs also has a miniature pomegranate 'Nana', which produces orange red flowers with pink pigmentation in the new foliage and it is often used for decorative purposes. We developed a yellow variant of 'Nana' by introgressing the gene for yellow pigment from edible 'Kabul Yellow' variety. "Yellow Nana" was evaluated for 46 characters, including morphological and physico-chemical traits in comparison with Nana. The results showed the morphological similarity between 'Yellow Nana' and 'Nana' except for flower, fruit and aril colour. Most distinguishable characters of the 'Yellow Nana' are the dwarf plant stature (0.8 m), miniature leaves, profuse yellow flowers with white petals, small yellow fruits (9.45 g weight) with tiny light yellow highly acidic arils (5.19%) and hard seeds in comparison to 'Nana'. 'Yellow Nana' can grow as a new ornamental pomegranate variety as it is phenotypically similar to 'Nana' variety except for flower and foliage colour.

Keywords: Morphological traits, Ornamental pomegranate, Physico-chemical traits, Variety

[1]ICAR-National Research Centre on Pomegranate, Solapur, Maharashtra, 413255, India.

[2]ICAR-Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru, Karnataka, 560089, India.

***Author for correspondence:**
shilpa9193@gmail.com

Received: June 25, 2025

Revised: October 6, 2025

Accepted: October 13, 2025

How to cite this article: Shilpa P, SH Jalikop, KD Babu, R Kumar, PR Sowjanya, AR Girme, TH Daphale and RA Marathe (2026) Yellow Nana–A Dwarf Pomegranate (Punica granatum) Variety for Ornamental Purposes. *Indian J. Plant Genet. Resour.* 39(1): 20-24.

DOI: https://doi.org/10.56093/ijpgr.v39i1.175903

Introduction

Pomegranate (*Punica granatum* L.) is known to be one of the most versatile commercial fruit crops widely grown for fresh consumption as well as processing purposes (Pal *et al*., 2014). It belongs to 'Lythraceae' family with two species in the genus *Punica* (Graham *et al*., 2005). *P. granatum* L. is the only cultivated species found in the genus *Punica* with two sub-species *viz.,* chlorocarpa (green ovary) and porphyrocarpa (red ovary) (Rana *et al*., 2010). *P. granatum* L. has the wild ancestor of *P. protopunica* Balf. found endemic to the remote archipelago of Socotra, Yemen (Shilkina, 1973; Guerrero-Solano *et al.,* 2020). Wild forms of pomegranate are also known to grow in Iran, Afghanistan, Pakistan, Turkmenistan and North India (Holland *et al*., 2009).

In addition to cultivated and wild pomegranates, two ornamental types *viz.,* 'Double flower' and dwarf 'Nana', have also been reported (Jalikop, 2010). 'Double flower' types produce large, attractive double flowers wherein numerous stamens are modified into petals, resulting in no fruit set or few fruits. 'Nana' is a natural dwarf pomegranate which grows to a height of 50-70 cm, produces miniature leaves, flowers, fruits and arils (Nath and Randhawa, 1959; El-Moghazy *et al*., 2015). Several attempts have been made to exploit the ornamental pomegranates in breeding for moisture stress, bacterial blight resistance, understanding the genetics of fruit acidity, and

developing new ornamental pomegranates (Jalikop *et al*., 2003; Jalikop *et al*., 2006).

The commercially grown pomegranate develops into a tall shrub, bearing large red flowers and sizable fruits with red pigmentation. In contrast, 'Nana' is a miniature bonsai-like compact shrub and grows to a height of about 2 feet. It is regarded as an ornamental plant and grows well as a potted plant. The tiny flowers, fruits and petiole base of Nana have a red pigment, as in several cultivated pomegranates. 'Kabul Yellow' is a rare pomegranate variety that has yellow pigmentation in flowers, fruits, and foliage. With the objective of developing a yellow coloured miniature pomegranate, 'Nana' and 'Kabul Yellow' were hybridized and further by repeated backcrossing to 'Nana', segregants akin to 'Nana' with yellow pigment were isolated. The selected yellow plants were multiplied and evaluated for their performance under field conditions.

Materials and Methods

To develop a yellow miniature ornamental pomegranate, a crossing programme involving diverse cultivars like 'Nana' and 'Kabul Yellow' was carried out in 2009. Red pigment was found to be dominant over yellow, which is governed by a single recessive gene (rr) (Jalikop and Sampath Kumar, 1989). To transfer yellow pigmentation, two populations were developed: (1) (KY × N) and (2) [(KY × N) × N]-F_2 × [KY × N]-F_2 . The (KY × N) cross was preferred due to better fruit set, higher seed count, and improved germination. All 90 F_1 seedlings from this cross were pink, confirming the dominance of pink over yellow. Fifteen hybrids were field-planted, exhibiting compact canopies with normal flowering and fruiting. Poor germination in selfed (2.27%) and open-pollinated (4.12%) seeds limited large F_2 population development. However, hybrid 43H showed better germination (18.04%). Its F_2 progeny segregated in a 75:19 pink to yellow ratio, fitting a 3:1 pattern ($\chi^2 = 1.149$), indicating a single recessive gene (rr) controls yellow pigmentation. Of 94 F_2 seedlings, 20 resembled 'N' in plant habit. To address the issue of poor seed germination and enhance the survival rate of progenies in subsequent generations, the 'Ganesh' variety, known for its excellent seed germination, was incorporated into the breeding program. The following crosses were developed: (1) [(KY × N) × F_1] × [(G × N) × N]-F_4 and (2) N X {[(KY × N) × F_1] × [(G × N) × N]-F_2}- F_2. As a result, several miniature yellow seedlings resembling the 'Nana' variety were obtained, and the most fertile genotypes among them were selected for further evaluation.

The field evaluation was carried out at ICAR-National Research Centre on Pomegranate, Solapur, Maharashtra (17°68' N latitude, 75°91' E longitude; 483.5 m above sea level) for four consecutive years (2019-2024). In 2017, 'Nana' and 'Yellow Nana' were planted at 4.5 m × 3 m and followed the standard management practices including timely pruning, training, weeding, irrigation, fertilizer application etc.

In total, 46 characters, including 10 qualitative and 36 quantitative traits, were recorded in the new variety ('Yellow Nana') along with its parental check variety ('Nana'). The DUS characters were recorded as per the DUS descriptor of PPV&FRA, New Delhi (https://plantauthority.gov.in/sites/ default/files/ dpomegranate.pdf). For the morphological characterization, plant material was randomly sampled from 10 plants. Fifteen mature leaves, 15 hermaphrodite flowers at full bloom, and 30 fruits at maturity were analysed. Tree height, spread, linear dimensions and weight were measured using measuring tape, digital Vernier Caliper, and precision electronic balance. Volume was determined by the liquid displacement method and expressed in ml. Total soluble solids (°Brix) of the arils juice was recorded using a digital refractometer. The titratable acidity of arils juice was measured by titration against 0.1 N NaOH solution using phenolphthalein indicator. Fruit and aril colour were measured by using a colorimeter and expressed in L*, a*, and b* coordinates. The seed hardness (N) was measured using a texture analyzer. Fruit juiciness was estimated on volume/weight (ml/g) basis and expressed in percentage. All seeds were extracted from each fruit and shade-dried under room conditions before taking the count and weight (g) data. Qualitative traits like tree foliage density, precocity, leaf blade shape, leaf apex shape, petiole anthocyanin colour, calyx colour, corolla colour, corolla type, crown neck, nipple/fin were measured on the selected plants of each variety.

The pooled mean data of the recorded quantitative traits were analysed for various descriptive statistical parameters in MS Excel 2016 software. Two-sample T-test was carried out to determine the statistical differences between the genotypes by using Web Agri Stat Package (WASP 2.0) developed by Jangam and Thali (2004).

Results and Discussion

'Nana', a natural dwarf pomegranate, differs from the edible variety for its dwarf plant stature, miniature leaves, tiny flowers and non-edible fruits. In warm-temperate climates, it is deciduous, but indoors and in the tropics, it behaves as an evergreen (El-Moghaz *et al*.,

2015; Sánchez-Hernández, 2022). Earlier gene exchange between cultivated (Ganesh) and decorative pomegranates (Nana, Double flower) has been attempted for bacterial blight resistance and drought resistance. Wherein 'Nana', 'Ganesh × Nana' and '(Ganesh × Nana) × Daru' showed a high level of resistance to bacterial blight disease. For drought resistance based on cell membrane stability, 'Nana' has shown as low as 1% in contrast to 16% in Ganesh. Hybrids involving Double flower with Ganesh (5.1%), Kabul Yellow (5.73%) and Nana (4.79%) also had very low CMS values (Jalikop *et al*., 2003). Inheritance of fruit acidity in pomegranate was studied in three sweet and three sour varieties and their progenies. The F_1 and F_2 data of 'Ganesh × Nana' showed that fruit acidity is monogenically controlled, and the sour nature is dominant over the sweet. (Ganesh × Nana) × Daru crossed progenies have produced acidity as high as 71.2 g/l due to the influence of modifying genes derived from the two acidic varieties 'Nana' and 'Daru' (Jalikop, 2007).

In this study, we have compared the performance of selected 'Yellow Nana' with the well-known ornamental variety 'Nana'. Both varieties were found to exhibit a similar phenotype of medium tree foliage density, early flowering, lanceolate leaf blade shape, obtuse leaf apex shape, low petiole anthocyanin colouration, single corolla type, fruits with crown neck and lack of nipple/fin in fruits, traits as per PPV&FRA guidelines. Non-significant similarities were also observed between 'Yellow Nana' and 'Nana' for most of the assessed characters. The most significant distinctive traits were found to be flower colour, fruit colour and aril colour. Wherein, 'Yellow Nana' showed the phenotype of 'Yellow calyx', 'White corolla' and 'Yellow' fruits with light yellow arils similar to 'Kabul Yellow'. Tree height of 'Yellow Nana' (0.80 m) was on par with 'Nana' (0.60 m) and was early (91 days), produced minute leaves, tiny yellow flowers, small fruits (9.45 g) that contained acidic (5.19%) hard seeded arils with very tiny and shorter (0.98 g) seeds (Table 1, Fig. 1). Similar, evaluation and morphological characterization using DUS test guidelines has been carried in different crops like Sweet Cherry (Dangi *et al*., 2021), Mango (Kumar *et al*., 2023) etc. In pomegranate, such morphological and physico-chemical comparison studies have been largely carried out for edible commercial varieties (Shilpa *et al*., 2024). Few molecular studies have been carried out using ornamental pomegranates, like understanding the genomic variation and phenotype in single and double-petal varieties (Huo *et al.,* 2023), and single-nucleotide polymorphism markers from de-novo assembly of the two *P. granatum* accessions *viz.,* 'Nana' (P.G.233–244) and 'Black' (P.G.127–28) transcriptome to reveal the genetic diversity in the 105 ARO germplasm collection (Ophir *et al*., 2014).

'Yellow Nana' was distinct from cv. 'Nana' for its flower colour, fruit colour, and aril colour. 'Yellow Nana' described in this paper can go as a new ornamental variety with decorative value, which can be grown in limited space and in pots as it produces attractive yellow flowers, foliage and tiny fruits, and resembles the established pink pigmented ornamental 'Nana' in respect of miniature plant habit. Large-scale multiplication and selling of plants of this variety will generate income for nurserymen, indoor gardeners and other stakeholders.

Acknowledgments

The authors acknowledge the financial support rendered by the Indian Council of Agricultural Research, New Delhi. The authors are also grateful to the Director, ICAR-Indian Institute of Horticultural Research, Bengaluru, for approval of sharing the breeding materials for evaluation and the Director, ICAR-National Research Centre on Pomegranate, Solapur for providing facilities.

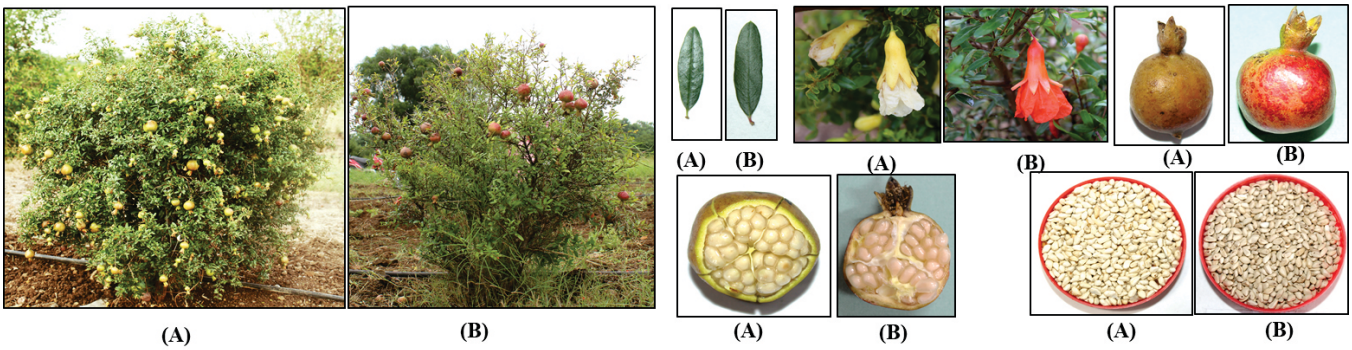

Fig. 1: Morphological features of pomegranate varieties (A) new dwarf variety "Yellow Nana" (B) parental check variety "Nana" for selected DUS characters.

Table 1: Morphological, physico-chemical characteristics of identified ornamental variety (Yellow Nana) and parental check variety (Nana)

Character	Yellow Nana					Nana					T-Statistic
	Mean	Range	SD	CV%	SE m	Mean	Range	SD	CV%	SEm	
Tree height(m)	0.80	0.58-0.97	0.12	15.21	0.04	0.60	0.46-0.85	0.10	17.23	0.03	4.30**
Tree spread(m)	0.61	0.45-0.74	0.11	17.81	0.03	0.40	0.25-0.625	0.10	25.34	0.03	4.85**
Shoot thorniness	5.41	3.07-11.80	2.75	50.87	0.80	5.20	3.33-8	1.42	27.27	0.41	0.24
Leaf blade length(cm)	2.40	1.95-3.07	0.38	15.70	0.11	2.19	1.70-2.87	0.40	18.17	0.12	1.32
Leaf blade width(cm)	0.65	0.51-0.77	0.09	13.29	0.02	0.64	0.43-0.90	0.15	22.84	0.04	0.21
Petiole length(mm)	2.07	0.96-2.68	0.52	24.92	0.15	2.42	1.67-3.3	0.55	22.78	0.16	-1.60
Petiole width(mm)	0.45	0.02-0.81	0.22	47.96	0.06	0.51	0.29-0.92	0.22	43.95	0.06	-0.60
Calyx length(mm)	21.32	17.56-26.81	2.69	12.62	0.78	20.24	12.43-24.87	3.49	17.24	1.01	0.84
Calyx width(mm)	6.95	4.23-9.58	1.52	21.88	0.44	6.74	4.71-10.54	1.55	22.96	0.45	0.33
Petal length(mm)	15.91	9.74-18.48	2.96	18.61	0.85	15.46	12.17-20.21	2.48	16.02	0.71	0.41
Petal width(mm)	10.92	6.85-13.65	2.31	21.15	0.67	10.45	6.72-13.67	2.80	26.76	0.81	0.45
No of fruits/plant	38.20	20-75.40	16.62	43.50	4.80	39.32	18.6-72	17.71	45.03	5.11	-0.16
Fruit weight(g)	9.45	3.86-19.96	4.03	42.68	1.16	13.46	9.36-22.75	3.36	24.95	0.97	-2.64*
Fruit volume	5.68	1.40-15.20	3.32	58.50	0.96	9.74	7.00-15.9	2.43	24.96	0.70	-3.41**
Fruit density	1.59	1.33-1.84	0.18	11.40	0.05	1.44	1.17-1.75	0.19	13.37	0.06	1.92
Fruit length (cm)	2.50	1.95-3.35	0.38	15.24	0.11	2.86	2.44-3.36	0.30	10.63	0.09	-2.54*
Fruit diameter (cm)	2.46	1.96-3.28	0.35	14.25	0.10	2.87	2.61-3.43	0.20	7.08	0.06	-3.49**
Crown length (cm)	1.14	1.02-1.31	0.12	10.81	0.04	1.21	0.95-1.48	0.16	13.20	0.05	-1.25
Crown width (cm)	0.72	0.56-0.88	0.09	12.99	0.03	0.87	0.75-1.01	0.09	9.75	0.02	-4.18**
Fruit shape (Ratio of longitudinal and lateral axes)	1.08	1.03-1.14	0.03	3.04	0.01	1.10	1.03-1.40	0.11	10.26	0.03	-0.84
No of arils/fruit	99.61	54.25-216.25	48.51	48.70	14.00	114.48	45.03-215.66	44.82	39.15	12.94	-0.78
Aril %	51.41	31.10-61.56	8.21	15.96	2.37	52.44	44.20-61.11	5.10	9.72	1.47	-0.37100
Aril weight (g)	4.50	3.20-6.31	0.91	20.27	0.26	4.16	3.14-5.55	0.79	18.98	0.23	0.97
Rind thickness (mm)	1.39	1.07-1.68	0.20	14.41	0.06	1.52	1.28-1.96	0.23	15.09	0.07	-1.47
TSS (^{0} Brix)	13.41	10.48-16.78	2.09	15.57	0.60	11.05	8.52-13.26	1.67	15.13	0.48	3.06**
Acidity %	5.19	2.42-6.72	1.57	30.34	0.45	4.73	2.48-.717	1.80	37.99	0.52	0.67
Aril length (mm)	5.93	5.08-6.97	0.54	9.09	0.16	6.38	5.55-7.19	0.53	8.27	0.15	-2.08*
Aril width (mm)	3.37	2.30-4.06	0.55	16.46	0.16	3.69	2.98-4.53	0.48	12.92	0.14	-1.54
Fruit Juiciness %(V/W)	16.53	8.80-39.31	8.21	49.66	2.37	10.65	2.45-20.11	5.25	49.27	1.52	2.09*
100 Seed weight(g)	0.98	0.74-1.48	0.26	26.81	0.08	1.01	0.59-1.26	0.22	21.36	0.06	-0.35
Seed length(mm)	5.13	4.63-5.60	0.31	5.98	0.09	4.85	4.51-5.30	0.31	6.35	0.09	2.21*
Seed width(mm)	2.09	0.82-3.00	0.79	37.56	0.23	1.97	1.12-3.2	0.85	43.11	0.25	0.36
Fruit colour(L*)	31.90	28.15-35.09	2.50	7.83	0.72	24.45	19.53-30.96	3.89	15.89	1.12	5.58**
a*	9.44	8.58-11.31	0.80	8.44	0.23	17.79	11.48-21.77	3.50	19.65	1.01	-8.06**
b*	22.99	18.55-26.42	2.74	11.92	0.79	20.59	15.80-27.97	3.04	14.74	0.88	2.03
Aril colour(L*)	52.38	47.08-55.09	2.73	5.20	0.79	55.94	50.36-59.25	2.85	5.09	0.82	-3.13**
a*	5.07	4.20-6.23	0.70	13.74	0.20	5.74	4.46-6.87	0.66	11.44	0.19	-2.42*
b*	19.92	17.38-22.32	1.50	7.51	0.43	23.42	19.65-25.65	2.02	8.64	0.58	-4.82**
Seed hardiness(N)	59.42	51.28-69.31	6.51	10.95	1.88	57.28	50.76-71.52	6.69	11.68	1.93	0.79
Fruit maturity(days after anthesis)	91.42	77-110	10.47	11.46	3.02	96.83	85-120	9.59	9.90	2.77	-1.32

*significant at 0.05 level of significance; ** significant at both 0.05 and 0.01 levels of significance.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

All data are included in the manuscript.

Authors' Contributions

PS, SHJ, KDB, RK and RSP Conceptualization, methodology, investigation, analysis, interpretation of data; SHJ and RK sharing of experimental material; SP and RSP drafted the work; SP, GAR and TD Data collection, compilation; SHJ, KDB and RAM revised and edited the work; RAM Supervision, funding acquisition and final approval.

References

Dangi G, D Singh, N Chauhan, RK Dogra, P Verma and S Sharma (2021) Characterization of selected sweet cherry (*Prunus avium* L.) varieties using DUS test guidelines. *Indian J. Plant Genet. Resour*. 34(2): 290-294.

El-Moghazy A, A Khalifa, S Bayoumi and H Sayed (2015) Macro- and micromorphology of the leaves, stem bark and flowers of *Punica granatum* (L.) var. nana cultivated in Egypt. *Bull. Pharm. Sci*. 38: 99-125.

Graham SA, J Hall, K Sytsma and SH Shiz (2005) Phylogenetic analysis of the Lythraceae based on four gene regions and morphology. *Int. J. Plant Sci*. 166: 995-1017.

Guerrero-Solano JA, OA Jaramillo-Morales, T Jimenez-Cabrera, TA Urrutia-Hernández, A Chehue-Romero, EG Olvera-Hernández and M Bautista (2020) *Punica protopunica* Balf., the forgotten sister of the common pomegranate (*Punica granatum* L.): Features and medicinal properties–A review. *Plants (Basel)*. 9(9): 1214.

Holland D, K Hatib and I Bar-Ya'akov (2009) Pomegranate: Botany, horticulture, breeding. In: J Janick (ed) *Horticultural Reviews*. John Wiley & Sons, New Jersey, pp 127-191.

Huo Y, H Yang, W Ding, Z Yuan and Z Zhu (2023) Exploring the relationship between genomic variation and phenotype in ornamental pomegranate: A study of single and double-petal varieties. *Horticulturae*. 9(3): 361.

Jalikop SH (2007) Linked Dominant alleles or inter-locus interaction results in a major shift in pomegranate fruit acidity of 'Ganesh' × 'Kabul Yellow'. *Euphytica*. 158(1): 201-207.

Jalikop SH (2010) Pomegranate breeding. *Fruit Veg. Cereal Sci. Biotech*. 4(2): 26-34.

Jalikop SH and P Sampath Kumar (1989) Use of a gene marker to study the mode of pollination in pomegranate. *J. Hortic. Sci*. 65(2): 221-223.

Jalikop SH, RD Rawal, RH Laxman and R Kumar (2003) Scope for gene exchange between cultivated and decorative pomegranates. Proceedings of National Seminar on 'Advances in genetics and plant breeding– impact of DNA revolution', University of Agricultural Sciences, Dharwad, 103 p.

Jalikop SH, P Sampath Kumar, RD Rawal and R Kumar R (2006) Breeding pomegranate for fruit attributes and resistance to bacterial blight. *Indian J. Hortic*. 63(4): 352-358.

Jangam AK and P Thali (2004) WASP-Web Agri Stat Package 2.0. ICAR Research Complex for Goa, Ela, Old Goa, Goa, India.

Kumar G, M Srivastav, HS Sreekanth, J Prakash, SK Singh and Vinod (2023) Elucidating diversity among mango (*Mangifera indica* L.) hybrids based on morphological characters using DUS guidelines. *Indian J. Plant Genet. Resour*. 36(3): 387-395.

Nath N and GS Randhawa (1959) Classification and description of some varieties of *Punica granatum* L. *Indian J. Hortic*. 16: 191-201.

Ophir R, A Sherman, M Rubinstein, R Eshed, M Sharabi Schwager, R Harel-Beja, I Bar-Ya'akov and D Holland D (2014) Single-nucleotide polymorphism markers from de-novo assembly of the pomegranate transcriptome reveal germplasm genetic diversity. *PLoS One*. 9(2): e88998.

Pal RK, KD Babu, NV Singh, A Maity and N Gaikwad (2014) Pomegranate research in India– status and future challenges. *Prog. Hort*. 46(2): 184-201.

Rana TS, D Narzary and SA Ranade (2010) Systematics and taxonomic disposition of the genus *Punica* L. *Fruit Veg. Cereal Sci. Biotech*. 4(2): 19-25.

Sánchez-Hernández E, L Buzón-Durán, JA Cuchí-Oterino, J Martín-Gil, B Lorenzo-Vidal and P Martín-Ramos (2022) Dwarf Pomegranate (*Punica granatum* L. var. nana): Source of 5-HMF and bioactive compounds with applications in the protection of woody crops. *Plants*. 11: 550.

Shilkina IA (1973) On the xylem anatomy of the genus *Punica* L. *Bot. Zhurn*. 58: 1628-1630.

Shilpa P, VP Bhosale, P Roopa Sowjanya, KD Babu, AR Girme, TH Daphale and RA Marathe (2024) Morphological and physico-chemical characteristics of new pomegranate variety 'Sharad King'. *Agric. Res*. https://doi.org/10.1007/s40003-024-00799-3