

Short Communication

Collection and preliminary evaluation of heirloom beans in the Marayoor dry hill agro ecological unit of Kerala

Jalaja S. Menon*, A.C. Asna and Ashni Vargheese

Cashew Research Station, Kerala Agricultural University, Thrissur 680 651, Kerala, India.

Received 04 February 2021; received in revised form 28 November 2021; accepted 29 November 2021

Abstract

The high range mountain landscape of Vattavada and Kanthalloor panchayaths of Idukki district, in the Marayoor dry hill agroecological unit 17, is the cool hub of Kerala with common bean (*Phaseolus vulgaris* L.) as a subsistence crop. The landraces conserved by the inhabitants especially *muthuva* tribes were known by various local names based on pod and seed characters and their growing habits. In the field survey conducted at tribal hamlets and provinces of Vattavada and Kanthalloor, morphologically distinct beans were collected. The shelled or dry grain bean types, PVJ 17/1 and PVJ 17/2 were highly preferred by villagers and are locally known as 'butter beans'. PVJ 18/3 was a variant of *butter beans* with striations on pod. PVJ 18/1 and PVJ 18/6 were 'arakkodi' beans with pink coloured pods and maroon coloured seeds. The landrace called 'Koru butter' (PVJ 18/5) with striations on both pod and seeds was also collected. PVJ 18/2 was *mithai beans* with green pods and red seeds. PVJ 18/4 was the native snap bean type called 'Muringa beans' with wavy green pods and white coloured seeds. The highest pod weight was observed in PVJ 18/4 (19 g) and hundred seed weight in PVJ 18/1 (66.20 g). The collections, PVJ 17/1, PVJ 17/2, PVJ 18/1, PVJ 18/4 and PVJ 18/5, were identified as large seeded types with hundred seed weight above 40 g. The valuable landraces well adapted to specific geographical areas need to be conserved and can be commercialized after assessing nutritional and gastronomic qualities.

Keywords: Conservation, Heirloom beans, Kerala, Tribal hamlets, Variability.

Common bean (*Phaseolus vulgaris* L.), the most widely distributed species of the genus *Phaseolus*, is the largely consumed legume in the world (Singh, 2001). It is an important component of subsistence agriculture that potentially provide all the essential minerals (Welch et al., 2000) and daily protein requirements of humans (Broughton et al., 2003). In Kerala, commercial cultivation of this crop is restricted to the cool hubs, Vattavada and Kanthalloor panchayaths coming under the agroecological unit 17, "Marayoor dry hills". These serene agricultural uphill villages represent low rainfall region and are virtually rain shadow villages, lying in the eastern side of the Western Ghats, having a tropical sub-humid monsoon climate with an average annual temperature of 18.9°C and a rainfall of 1276 mm.

The unit 17 covers 28,968 ha ,0.75 per cent of the state areas. The area lies between 10° 183' N latitude and 77° 257' E longitude with an average altitude of 1700 m above Mean Sea Level.

Common bean is a sustainable crop in this region as it is well suited to low input systems. A group of inhabitants, especially *Muthuva* tribes cultivate the heirloom varieties of common bean along with food grain crops especially millets and other commercial crops like potato, garlic, carrot and cabbage and they are used in many ethnic food preparations. Boiled rice or *katty*, a porridge from finger millet, along with a spicy dish made up of fresh or dry grains of beans, 'butter beans *kolumbu*' is a delicacy of the tribal people.

*Author for Correspondences: Phone: 9446141724, Email: jalaja.menon@kau.in

Of late, these traditional landraces are being replaced with new improved cultivars to earn more from the market. There are no reports of these diverse landraces of common bean in the provinces and tribal hamlets of Vattavada and Kanthaloer. Consequently, there is a need to collect, conserve, characterize, and evaluate remnant local bean populations before they disappear. Hence, the local genotypes were collected to document and describe the phenotypic diversity of common bean landraces from Vattavada and Kanthallor villages of Kerala through agro morphological traits.

During 2017-19, field surveys were carried out in Vattavada and Kanthaloer panchayaths of Marayoor dry hills agro ecological unit of Kerala to locate the heirloom varieties of beans cultivated and conserved in the provinces and tribal hamlets. Tribal hamlets like Melvalsapetty, Keezhvalsapetty, Swamiyarala kudi, Koodallar kudi and provinces of Kovillor, Kottakombur, Vattavada and Chilanthiyar in Vattavada panchayath and provinces like Kanthaloer, Keezhanthoor, Puthur, Perumala and

tribal hamlets like Ollavayal, Kulachuvayal and Thirthamala in Kanthaloer panchayath were visited during major cropping season, May to September, and indigenous French bean genotypes were collected (Table 1). The collections were made from farmer’s field, threshing yards and farm store. Collected samples were evaluated for different qualitative and quantitative characteristics using the IBPGR descriptors for *Phaseolus vulgaris* (IBPGR, 1982). Qualitative traits like seed coat colour, hilum colour, coat pattern, brilliance, shape and veining were observed visually. The quantitative traits viz. pod length (cm), pod breadth (cm), pod beak length (cm), pod weight (g), 100 seed weight (g), seed length (cm) and seed width (cm) were evaluated in completely randomized design at research laboratory of Cashew Research Station, Madakkathara and analyzed in R based software GRAPES (Gopinath et al., 2020) to distinguish different strains.

Wide variability was noticed among the common bean landraces collected from Vattavada and Kanthaloer panchayaths of Kerala. *Muringa beans*, *kodi butter*, *koru butter*, *kuthu butter* and *arakkodi* were the major morphologically distinct heirloom beans cultivated in this locality (Fig. 1). These landrace names indicated a specific pod morphological trait and growing habit. Other folk landraces were *vella butter* (white grains), *kakki butter* (brown grains), *chembor butter* (red stripes on green pods), *Karimbor butter* (black stripes on green pods), *choya* (red grains) and *mithai beans* (dry grain or Rajmash type). These different types

Table 1. Details of common bean germplasm collections from Marayoor dry hill agroecological unit of Kerala

Sl. No.	Coll. No.	Landrace name	Locality/ source of collection
1	PVJ 17/1	Butter beans	Kanthaloer
2	PVJ 17/2	Butter beans	Vattavada, Kanthaloer
3	PVJ 18/1	Arakkodi	Vattavada, Kanthaloer
4	PVJ 18/2	Mithai beans	Vattavada
5	PVJ 18/3	Butter beans	Vattavada, Kanthaloer
6	PVJ 18/4	Moringa beans	Vattavada, Kanthaloer
7	PVJ 18/5	Koru butter	Kanthaloer
8	PVJ 18/6	Arakkodi	Vattavada, Kanthaloer



Figure 1. Common bean landraces cultivated in the Marayoor dry hills agroecological unit of Kerala (a) *Muringa beans* (b) *Butter beans* (c) *Koru butter* (d) *Chembor butter* (e) *Arakkodi*

of folk varieties indicate the genetic diversity of common bean in the study area. The beans were used as tender pod (snap bean), shelled beans (beans were harvested at physiological maturity and fresh grains were used) and dry beans (seeds were collected at complete maturity, dried and conserved for year round use). The characters that are most commonly used by the inhabitants to differentiate the landraces include the shape and size of pods, the seed colour and seed coat pattern, their use and growing habit. The tribal farmers of Kolli Hills, India also classify landraces of millets on the base of the morphological, gastronomic, and functional characteristics (Rengalakshmi, 2005).

The qualitative morphological characters of heirloom beans collected from Vattavada and Kanthaloorth panchayaths of Idukki district are presented in Table 2 and Figure 2. Each collection had a distinct pod colour at physiological maturity and at fully expanded immature stage. The collections, PVJ 17/1, PVJ 17/2, PVJ 18/3 and PVJ 18/5, were shelled or dry grain bean types locally

known as “*butter beans*”, highly preferred by the villagers. Great variability was observed in the pods and seeds of these landraces. PVJ 17/1 and PVJ 17/2 had pale yellow to white coloured pods with different seed coat colours. These seed beans can be bushy or trailing, called as ‘*kuttu butter*’ and ‘*kodi butter*’ respectively. The landrace, PVJ 18/5, with striations on both pod and seeds are known as ‘*Koru butter*’. A variant of *butter bean* with green to olive coloured seed coat and with red striations on pod was also located (PVJ 18/3) at Vattavada.

The native snap bean, PVJ 18/4 (Fig. 2), cultivated in these regions are locally called as “*Muringa beans*”, having root nodules and better field tolerance. This trailing bean types has high yield potential and good market demand in the neighbouring state, Tamil Nadu and are characterized by green coloured long wavy pods both at fully expanded immature and physiological maturity stage, with white seeds.

PVJ 18/1 and PVJ 18/6 were landraces with pink

Table 2. Variability in qualitative characters of common bean landraces collected from Marayoor dry hill agroecological unit of Kerala

Coll. No.	Category based on use	Colour of immature pod	Colour of mature pod	Pod cross section	Pod curvature	Seed coat pattern	Seed coat colour	Brilliance of seed	Seed shape	Presence of colour around hilum	Apparent seed veining
PVJ 17/1	Shelled bean	Normal green	Pale yellow to white	Round elliptic	Straight	Absent	Brown - pale to dark	Medium	Oval	Present	No
PVJ 17/2	Shelled bean	Normal green	Pale yellow to white	Round elliptic	Straight	Absent	Green to olive	Shiny	Oval	Present	Yes
PVJ 18/1	Shelled bean	Pink	Pink	Round elliptic	Straight	Absent	Maroon	Matt	Kidney shaped	Absent	No
PVJ 18/2	Shelled bean	Normal green	Pale yellow to white	Round elliptic	Straight	Absent	Red	Shiny	Cuboid	Present	No
PVJ 18/3	Shelled bean	Green with striations	Pale yellow with coloured mottling or stripes	Round elliptic	Straight	Absent	Pale, cream to buff	Medium	Oval	Present	No
PVJ 18/4	Snap bean	Normal green	Persistent green	Pear shaped	Recurving	Absent	Pure white	Matt	Kidney shaped	Absent	No
PVJ 18/5	Shelled bean	Green with striations	Pale yellow with coloured mottling or stripes	Round elliptic	Straight	Rhomboid spotted	Whitish	Medium	Cuboid	Present	Yes
PVJ 18/6	Shelled bean	Pink	Pink	Round elliptic	Straight	Absent	Maroon	Shiny	Cuboid	Absent	No

coloured pods and maroon coloured seeds which was either used as shelled or as dry beans. The folk community used to produce flour using large grained PVJ 18/1. The pod colour of PVJ 18/2

resembled *butter beans*, but seeds were red in colour (Fig. 2). It is locally known as *mithai* beans in Vattavada and used like dry bean rajmash.



Figure 2. Common bean landraces collected from Marayoor dry hill agroecological unit of Kerala

Pod beak position and orientation were uniform in all the collections, marginal and downward, respectively. In all the collections, pod cross section was round elliptical except in the snap bean type, PVJ 18/4, where it was pear shaped. The pod curvature was recurving in PVJ 18/4 whereas straight curvature was observed in other collections (Table 2).

Though white coloured seeds were observed in the snap bean type, PVJ 18/4, wide variability was observed in the seed colour of other shelled bean landraces. Seed coat colours identified include pure white, whitish, pale-cream to buff, green to olive, brown- pale to dark, red, and maroon. Stoilova et al. (2013), Bode et al. (2013), Kanwar and Mehta (2017) also reported different seed colours in common bean.

Seed coat pattern was absent in most of the collected samples, except in PVJ 18/5, where the coat pattern was rhomboid spotted as pinto beans. Four collections had medium seed brilliance, whereas three were shiny and two were matt type. Colour was present around hilum in most of the samples collected except in three (PVJ 18/1, PVJ 18/4, PVJ 18/6). Apparent seed veining was present in PVJ

17/2 and PVJ 18/5. As reported by Kanwar and Mehta (2017), the seeds were mostly cuboid, oval and kidney shaped (Table 2). Farmers used to collect the seeds depending upon the colour and size of grains, but at certain times, they harvest it in bulk and conserve them. The heirloom beans cultivated in this hill regions of Kerala have high yield potential and can be commercialized. Dhakal et al. (2020) also reported considerable variation in the pole type beans of Nepal for most of the morpho physical traits.

In addition to the local types, the inhabitants were also cultivating high yielding varieties of common bean for better market. The prevailing bush variety of snap bean, Arka Komal (Selection 9) released from Indian Institute of Horticulture Research, Bengaluru, widely cultivated in this hill region is highly remunerative and has great demand in the metropolitan markets of Kerala.

The analysis of data for all the quantitative characters (Table 3) indicated variability among the collected landraces except for seed width. The pod length, pod breadth, pod beak length, pod weight, number of seeds/ pods, seed length, seed width and 100 seed weight of the collected heirloom beans

Table 3. Variability in quantitative characters of common bean landraces collected from Marayoor dry hill agroecological unit of Kerala

Coll. No.	Pod length (cm)	Pod breadth (cm)	Pod beak length (cm)	Pod weight (g)	No. of seeds/ pod	Seed length (cm)	Seed width (cm)	100 seed weight (g)
PVJ 17/1	12.35	1.20	0.66	7.85	5.55	1.07	0.82	42.76
PVJ 17/2	11.89	1.19	0.63	7.73	6.78	1.14	0.93	48.20
PVJ 18/1	11.43	1.11	0.93	6.80	7.04	1.81	0.88	66.20
PVJ 18/2	11.32	1.27	0.86	6.79	7.26	1.08	0.86	31.40
PVJ 18/3	12.57	1.32	0.54	7.88	6.11	1.06	0.82	37.36
PVJ 18/4	20.27	1.42	0.80	19.00	8.10	1.54	0.86	45.50
PVJ 18/5	13.32	1.36	0.86	9.15	5.10	1.31	0.92	56.00
PVJ 18/6	11.10	1.18	0.92	6.85	7.04	1.35	0.83	36.43
Mean	13.03	1.26	0.77	9.01	6.67	1.29	0.86	45.48
LSD	0.77	0.18	0.07	0.21	0.47	0.20	NS	3.77
CV (%)	3.24	8.33	5.30	1.34	4.12	9.16	7.82	4.79
SE(d)	0.36	0.08	0.03	0.09	0.22	0.06	0.03	1.78
SE(m)	0.25	0.06	0.02	0.07	0.15	0.09	0.05	1.26

ranged from 11.10-20.27 cm, 1.11-1.42 cm, 0.54-0.93 cm, 6.79-19.0 g, 5.10-8.10, 1.06-1.81 cm, 0.82-0.93 cm and 31.4-66.2g, respectively. Length of pod beak was below 1 cm in all the landraces. The length, breadth and weight of pod were the highest in PVJ 18/4. Shelled bean types had higher fresh weight of seeds than snap beans. PVJ 18/1 recorded the highest seed weight (66.20 g). As suggested by Singh et al. (1991), the collections, PVJ 17/1, PVJ 17/2, PVJ 18/1, PVJ 18/4 and PVJ 18/5, with hundred seed weights above 40 g can be classified as large seeded types. High variability was also observed in seed shape and size as reported by many workers (Rodino et al., 2003; Lioi et al., 2012; Rana et al., 2015).

The folk varieties identified in this study differed greatly in size, shape, colour, and fibrousness or tenderness of the immature pods. The regular cultivation, on-farm conservation and due selection by farmers may have resulted in the prevalence of these landraces in the locality. Though most of these landraces do not have market acceptability, the farmers are cultivating and conserving the seeds as a part of hill agriculture to ensure food security.

The travellers attracted to the pleasant climatic pleasure of hill regions of Vattavada and Kanthalloor, near to tourist hot spot Munnar, might have introduced the beans of their choice in this locality in their long term stay. The repeated cultivation and selection by the farmers have resulted in the existence of preferred races of local choice. The production of these heirloom beans by the people in the Devikulam taluk of Kerala reflects the cultural importance and maintenance of this legume in traditional agriculture.

The description of the heirloom beans conserved in the hill regions of Kerala, India has not been reported so far. Exploring the nutritional and biochemical characters of this population is required to expand the interest in new and under-utilized heirloom beans population. The high storability and use as fresh and dry bean offer an opportunity to

capture the niche market to satisfy the needs of emerging dietary trends. Heirloom varieties have the potential to provide unique benefits with regard to nutrition and sensory benefits, but cooking quality is to be assessed to tune to the end use. Hence the accepted heirlooms types can be grown commercially to suit the market demand. Additionally, these beans are relatively well adapted to the specific geographical area in the climate change scenario, require low inputs for cultivation and have both ecological and economic relevance. Moreover, the valuable germplasm well-adapted to the agroclimatic situation of restricted geographical areas is eroding and hence, needs to be conserved.

Acknowledgement

The authors wish to thank the Kerala Agricultural University for facilitating the research work on collection and preliminary evaluation of heirloom beans in the Marayoor dry hill agroecological unit of Kerala. We are grateful to the traditional farmers and *muthuva* tribes of Vattavada and Kanthalloor who are conserving these beans and who helped us in collecting the diversified samples from every corner. This study was made as a part of field visit conducted for the evaluation studies of hill garlic funded by Department of Agriculture. We thank the funding agency and the support provided by the field level officers of Department of Agriculture. We also thank Dr. Joseph K. John, Scientist, National Bureau of Plant Genetic Resources for his valuable suggestions for identification of plant samples.

References

- Bode, D., Elezi, F., and Gixhari, B. 2013. Morphological characterization and interrelationships among descriptors in *Phaseolus vulgaris* accessions. *Agric. and For.* 59 (2): 175 – 185.
- Broughton, W. J., Hernandez, G., Blair, M., Beebe, S., Gepts, P., and Vanderleyden, J. 2003. Beans (*Phaseolus* spp.)-model food legumes. *Plant Soil*, 252: 55–128.
- Dhakal, M., Shrestha, S.L., Gautam, I.P., and Pandey, S. 2020. Evaluation of French Bean (*Phaseolus vulgaris*

- L.) varieties for summer season production in the mid-hills of central region of Nepal. *Nepalese Hort.*, 14: 48-55.
- Gopinath, P. P, Parsad, R., Joseph, B. 2020. GRAPES: General R Based Analysis Platform Empowered by Statistics. <https://www.coagrapes.com/home>. version 1.14.02.
- International Bureau of Plant Genetic Resources. 1982. Descriptors of *Phaseolus vulgaris*, IBPGR (Biodiversity International), Crop Genetic Resources Centre, Rome, 37p.
- Kanwar, R. and Mehta, D. K. 2017. Survey, collection and seed morphometric characterization of French bean (*Phaseolus vulgaris* L.) landraces of Himachal Pradesh. *Leg. Res.*, 3825-3834.
- Lioi, L., Alberto, N., Bruno, C., and Angela, R. P. 2012. Assessment of genetic variation in common bean (*Phaseolus vulgaris* L.) from Nebrodi Mountains (Sicily, Italy). *Genet. Resour. Crop Evol.*, 59: 455-464.
- Rana, J. C., Sharma, T. R., Tyagi, R. K., Chahota, R. K., Gautam, N. K., Singh, M., Sharma, P. N., and Ojha, S. N. 2015. Characterisation of 4274 accessions of common bean (*Phaseolus vulgaris* L.) germplasm conserved in the Indian gene bank for phenological, morphological and agricultural traits. *Euphytica*, 205:441-457.
- Rengalakshmi, R. 2005. Folk biological classification of minor millet species in Kolli hills, India. *J. Ethno. Bio.*, 25 (1): 1-20.
- Rodino, A. P., Santalla, M., de Ron A. M., and Singh, S. P. 2003. A core collection of common bean from the Iberian Peninsula. *Euphytica*, 131: 165-175.
- Singh, S. P. 2001. Broadening the genetic base of common bean cultivars: a review. *Crop Sci.*, 41: 1659-1675.
- Singh, S. P., Gepts, P., and Debouck, D. G. 1991. Races of common bean (*Phaseolus vulgaris*, Fabaceae). *Econ. Bot.*, 45: 379-396.
- Stoilova, T., Pereira, G., and Sousa, M. T. D. 2013. Morphological characterization of a small common bean (*Phaseolus vulgaris* L.) collection under different environments. *J. Central European Agric.*, 14 (3): 1-11.
- Welch, R. M., House, W. A., Beebe S., and Cheng, Z. 2000. Genetic selection for enhanced bioavailable levels of iron in bean (*Phaseolus vulgaris* L.) seeds. *J. Agric. Food Chem.*, 48:3576-3580.