

Morphological Diversity for Fruit Characters in Bottle Gourd Germplasm from Tribal Pockets of Telangana Region of Andhra Pradesh, India

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Abstract

Bottle gourd (Lagenaria siceraria) is a cucurbitaceous vegetable for which India is the secondary center of diversity and endowed with rich variability especially in the fruit characters. The Regional Station of the National Bureau of Plant Genetic Resources (NBPGR), located at Hyderabad, India has conducted several expeditions in the Telangana region of Andhra Pradesh and collected the available diversity in the bottle gourd germplasm including its cultivated and wild forms. This paper documents the available fruit diversity in the bottle gourd germplasm collected from the tribal communities, viz., Koyas, Gutti Koyas, Lambadas, and other primitive tribal groups living in the Telangana region. The collected germplasm (54 accessions) showed immense variation in the qualitative characters of fruit such as shape, luster, blossom-end, ridges, etc. Wide range of variability was also recorded in the quantitative traits for several fruit and seed characters, viz., fruit length (13.3–83.9 cm), fruit width (7.9–34.4 cm), fruit circumference (20.5–98.0 cm), seed length (11.3–21.0 mm), seed width (5.8–9.2 mm), seed thickness (2.5–3.7 mm), and 100-seed mass (7.6–31.8 g). Ethnobotanical information pertaining to the utilization of bottle gourd by different tribal groups is also presented.

Bottle gourd (*Lagenaria siceraria*) is one of the most popular cucurbitaceous crops grown in India and other parts of the world. Human utilization of this genus was reported as early as 12000 and 15000 years in the Old World and New World, respectively. Even though substantial evidence confirms its African origin, good amount of diversity has been reported from India. The Telangana region of the state of Andhra Pradesh in

India is endowed with rich variability in bottle gourd germplasm having many shapes and sizes. Hence, an attempt has been made to compile the diversity status of the bottle gourd germplasm from this region. This paper deals with the variability in fruit and seed characters of the germplasm collected from the Telangana region of Andhra Pradesh.

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It (bottle gourd) is variously called alabu in Sanskrit, kaddu, lauki, and tumri in Hindi, sorakaya in Telugu, shorakkai in Tamil, sorekayi and halagumbala in Kannada, lau in Bengali and Assamese, and ghiya in Punjabi.

History

Bottle gourd or calabash gourd has been reported to be the only cultigen most widely dispersed and common both to the Old World and New World since ancient historic times. It is variously called *alabu* in Sanskrit, *kaddu*, *lauki*, and *tumri* in Hindi, *sorakaya* in Telugu, *shorakkai* in Tamil, *sorekayi* and *halagumbala* in Kannada, *lau* in Bengali and Assamese, and *ghiya* in Punjabi. Archaeological reports on the occurrence of this pantropical species were recorded from several regions of the world, viz., Ocampo cave, Tamaulipas (7000 BC), Coxcatlan cave, Tehucan valley (5000 BC), sites near Ancon, Peru (2700 BC), Njora river cave, East Africa (1000 BC), a fifth dynasty Egyptian tomb (2500 BC), Spirit cave, Thailand (7000 BC), and China (2000 BC) (Leakey and Leakey, 1950; Cutler and Whitaker, 1967; Chang, 1968; Gorman, 1969; Pickersgill, 1969; Harlan, 1975). According to Decker-Walters *et al.* (2001), molecular analysis suggested the dispersal of bottle gourd fruits from Africa to Asia and the Americas during pre-Columbian times, followed by independent domestication on all three continents.

Characteristics of the collected area

Telangana region includes the districts of Adilabad, Karimnagar, Khammam,

Mahbubnagar, Medak, Nalgonda, Nizamabad, Ranga Reddy, and Warangal districts. The average annual rainfall is 750–1150 mm. The air temperature ranges from 13°C (minimum) to 38°C (maximum). Red soils are predominant in this region, which has *chalkas* and red sandy loams and some areas with deep black cotton soils.

Materials and methods

The Regional Station of the National Bureau of Plant Genetic Resources (NBPGR), located at Hyderabad, Andhra Pradesh, has conducted several crop germplasm surveys in the Telangana zone. Fifty-four accessions of bottle gourd germplasm sampled during the collection missions have been used in this study. The germplasm comprised cultivated and wild types. The collection site included cultivated fields, natural wild habitats, farm store, farmers' backyard, and kitchen gardens. Random and biased sampling methods were followed for the collection of fruits from population/individual plants. Distinct morphotypes were collected from 37 tribal villages covering 32 *mandals* and six districts in the Telangana region of Andhra Pradesh (Table 1). Select qualitative and quantitative characters of fruit and seed were recorded using standard descriptors.

Seed characters were analyzed using Mitutoya digimatic caliper (Mitutoya Corporation, Japan).

Results and discussion

Bottle gourd, a monoecious annual climber, is widely grown in Telangana region as a vegetable crop. It is usually grown near farmers' houses and kitchen gardens on well manured soil and the stem is provided with support such as roof of huts, hedge plants, trees, etc. The bottle gourd flowers are borne on the axils of the leaves, the males on long peduncles and the females on short peduncles. Fifty-four accessions were analyzed for fruit and seed morphological characters.

The collected germplasm showed immense variation in fruit shape, stem-end fruit shape, blossom-end fruit shape, fruit length (short/intermediate/long), peduncle persistence, fruit circumference, and seed length, width, and thickness (Fig. 1; Tables 1 and 2). Generally, the fruits of the wild forms are goose-necked or dumbbell or pyriform in shape and very bitter in taste.

Interestingly, the accession IC-249164 had the longest fruit length (83.9 cm) and IC-249650 had the maximum fruit circumference (98 cm) among the germplasm collected and studied. IC-249657 possessed maximum seed length (21 mm), seed width (9.2 mm), and 100-seed mass (31.8 g). The summary of fruit and seed morphological values of the germplasm accessions is presented in Table 3.

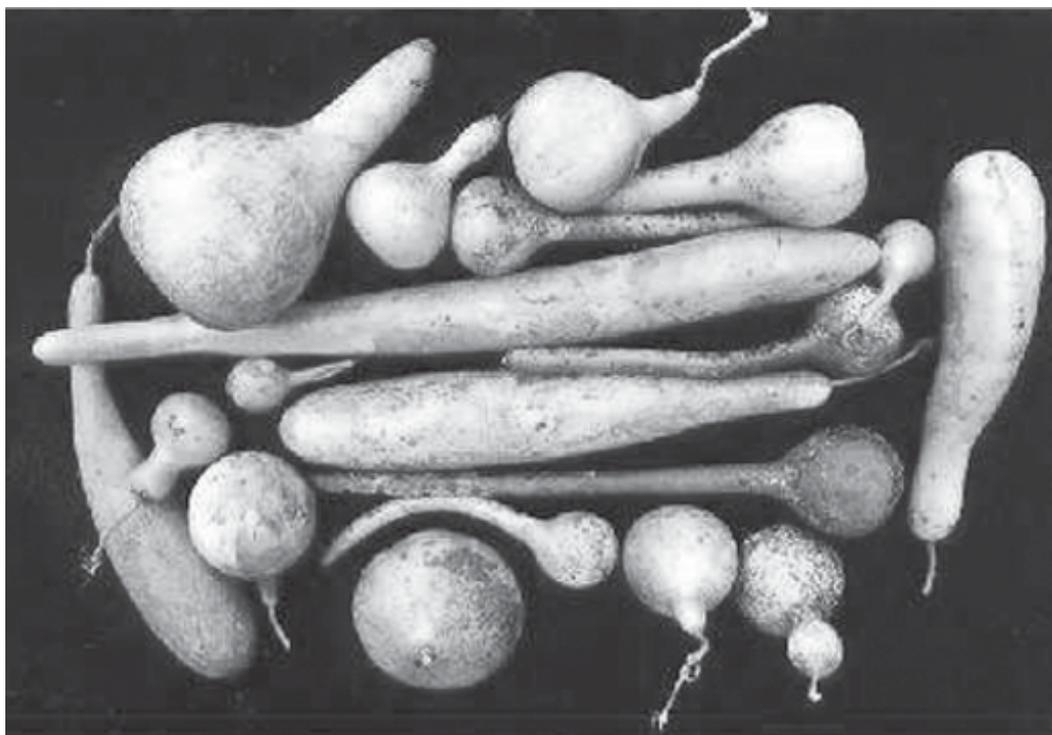


Figure 1. Variability in bottle gourd.

Table 1. Bottle gourd germplasm collected from the Telangana region of Andhra Pradesh, India.

| District | No. of villages | No. of mandals | No. of accessions collected | Vernacular name | Source | Cultivar status | Tribal group |
|-------------|-----------------|----------------|-----------------------------|--|----------------------------------|---------------------------------|--|
| Khammam | 13 | 12 | 21 | <i>Burrakaya, sorakaya, tota anapa</i> | Farm store and garden | Landrace and wild | Gutti Koya, Koya, Lambada, and PTGs ¹ |
| Mahbubnagar | 4 | 2 | 4 | <i>Anapakaya</i> | Garden | Landrace | Lambada |
| Medak | 6 | 6 | 10 | <i>Tummi</i> | Garden, wild, and disturbed wild | Landrace and wild | Lambada |
| Nalgonda | 8 | 6 | 11 | <i>sorakaya, anapakaya</i> | Farm store and garden | Landrace and primitive cultivar | Lambada |
| Nizamabad | 2 | 2 | 2 | <i>Sorakaya</i> | Farmer's field | Landrace | PTGs |
| Ranga Reddy | 3 | 4 | 5 | <i>Anapakaya</i> | Garden and disturbed wild | Wild and landrace | Lambada |

1. PTGs = primitive tribal groups.

Ethnobotanical information and utilization

The tribal communities (Koyas, Gutti Koyas, and Lambadas) located in the northern Telangana zone use the dry hard shells of

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bottle gourd fruits for various purposes. Bottle gourd is variously referred as *sorakaya*, *anapakaya*, *anamgapkaya*, *burrakaya*, and *tumri* in the vernacular language by the tribal communities. Domestic utensils like bottles, bowls, milk-pots, spoons, and containers of several types are made out of the dried shells. It is a common sight everywhere in the tribal-dominated pockets of Khammam district that the ethnic groups are mainly using the dry shells for carrying country liquor (*mahua* drink, toddy), honey, and water. In some of the pockets it is being used for making

Table 2. Diversity in fruit characters of bottle gourd germplasm collected from the Telangana region, Andhra Pradesh, India.

| Character | No. of accessions | Frequency (%) |
|--------------------------------|-------------------|---------------|
| Fruit shape | | |
| Club-shaped | 16 | 29.6 |
| Globular | 5 | 9.2 |
| Goose-necked | 6 | 11.0 |
| Top-shaped | 4 | 7.4 |
| Dumbell-shaped | 4 | 7.4 |
| Elongate | 8 | 14.8 |
| Oblong | 4 | 7.4 |
| Pyriform | 3 | 5.6 |
| Spindle-shaped | 1 | 1.9 |
| Flattened | 1 | 1.9 |
| Conical | 1 | 1.9 |
| Elliptical | 1 | 1.9 |
| Fruit luster | | |
| Matt | 20 | 37.0 |
| Intermediate | 14 | 26.0 |
| Shiny | 20 | 37.0 |
| Stem-end fruit shape | | |
| Flattened | 18 | 33.3 |
| Depressed | 24 | 44.4 |
| Round | 12 | 22.3 |
| Blossom-end fruit shape | | |
| Depressed | 21 | 38.9 |
| Flattened | 8 | 14.8 |
| Pointed | 17 | 31.5 |
| Round | 8 | 14.8 |
| Peduncle persistence | | |
| Highly persistent | 54 | 100.0 |

stringed and wind musical instruments and pipes. At few places, the natives use the dried shells as floats on waterbodies as well.

Though it is nutritionally less calorific, tribals prefer bottle gourd as a vegetable for preparation of curries and pickles. The Koya community uses the fruits of the wild types for medicinal purposes (purgatives).

Probably, the bitter principle found in the wild bottle gourds is responsible for the purgative property. The Gutti Koya tribals use the

The pulp of the fruit is considered cool, diuretic, antibilious, and useful in coughs and as antidote to certain poisons.

Table 3. Fruit and seed morphological values of bottle gourd germplasm collected from the Telangana region, Andhra Pradesh, India.

| Variable | Range | Mean Value (Mean±SE) | SD | CV (%) |
|--------------------------|-----------|-------------------------|------|-----------|
| Fruit length (cm) | 13.3–83.9 | 38.7±2.8 | 20.5 | 51.7 |
| Fruit width (cm) | 7.9–34.4 | 19.3±1.0 | 7.4 | 38.3 |
| Fruit circumference (cm) | 20.5–98.0 | 42.2±2.3 | 16.5 | 39.1 |
| Seed length (mm) | 11.3–21.0 | 16.7±0.2 | 1.8 | 10.7 |
| Seed width (mm) | 5.8–9.2 | 7.42±0.1 | 0.7 | 9.6 |
| Seed thickness (mm) | 2.5–3.7 | 3.1±0.04 | 0.3 | 9.7 |
| 100-seed mass (g) | 7.6–31.8 | 17.9±0.7 | 4.8 | 26.8 |

bottle gourd as a cure for headache (external application) by mixing the seed oil with castor oil. The pulp of the fruit is considered cool, diuretic, antibilious, and useful in coughs and as antidote to certain poisons (Watt, 1890).

Acknowledgments

The authors thank Dr B S Dhillon, Director, NBPGR, New Delhi, Dr R K Khetarpal, Head, Division of Plant Quarantine, NBPGR, New Delhi, and Dr K S Varaprasad, Officer-in-Charge, NBPGR, Regional Station, Hyderabad for extending the necessary help. The authors also thank the farmers who have generously donated the germplasm and shared ethnobotanical information.

References

Chang, Kwang-Chih. 1968. The Archaeology of Ancient China. Yale University Press, New Haven, Connecticut, USA. 68 pp.

Cutler, H.C. and **Whitaker, T.W.** 1967. Cucurbits from the Tehucan caves. In: The Prehistory of

the Tehucan Valley (Byers, D.S., ed.). University of Texas Press, Austin, Texas, USA. pp. 212–219.

Decker-Walters, Deena, Staub, Jack, Lopez-Sese, Ana, and Nakata, E. 2001. Diversity in landraces and cultivars of bottle gourd (*Lagenaria siceraria*: Cucurbitaceae) as assessed by random amplified polymorphic DNA. Genetic Resources and Crop Evolution 48(4):369–380.

Gorman, C. 1969. Hoabinhian: a pebble-tool complex with early plant associations in Southeast Asia. Science 163:671–673.

Harlan, J.R. 1975. Crops and Man. American Society of Agronomy, Crop Science Society of America, Madison, Wisconsin, USA. 295 pp.

Leakey, M.D. and **Leakey, L.S.B.** 1950. Excavations at the Njora river cave. The Clarendon Press, Oxford (England), UK. 50 pp.

Pickersgill, B. 1969. The archaeological record of chilli peppers (*Capsicum* spp.) and the sequence of plant domestication in Peru. American Antiquity 34:54–61.

Watt, G. 1890. A Dictionary of the Economic Products of India. Vol. IV. Cosmo Publications, New Delhi, India. pp. 580–581.