



## Vocal for local: Diversity of local cucurbits cultivars in East Siang, Arunachal Pradesh

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Laying more and more importance on mere edible yield through introduction of high-yielding, uniform cultivars is leading to compromising on nutritional quality of crops coupled with loss of biodiversity. In spite of this scenario, there are still many local cultivars, which are indigenously grown for long time approximately for more than five decades, and have its own heritage which is sustained by family groups, regions and ethnicity. The traditional names, unique appearance, uses, and historical significance give recognition to these local cultivars. In the present study, 15 morphologically diverse local cultivars of cucurbits with numerous landraces have been documented from the sample area. Of these, seven species especially in pumpkin, ash gourd, bottle gourd and *Cucumis melo* spp. are produced by the *Adi* tribe of East Siang. These traditional cultivars have been cultivated for many generations, particularly for their attributes such as superior flavor and its high adaptability under biotic and abiotic stress. Other traits such as productivity, nutritional and nutraceutical properties of traditional cultivars of these cucurbits are to be well understood. However, such information is not organized available, and therefore the purpose of this study was to capture some of the unique traits of local cultivars. Such information may help designing breeding programs for developing locally adapted, high-value cultivars.

**Keyword:** Cucurbitaceous vegetables, East Siang, Heirloom cultivars, Morphological diversity, Mainstreaming

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For sustaining crop diversity, it is crucial to create awareness about the value of local crops amongst farmers, communities, businesses, policy-makers and general public. Local crop varieties—also referred as landraces or farmers' varieties—are very useful for smallholder farmers and farming communities in rural and marginal areas for safeguarding their food, nutrition and economic security. In parlance, heirloom cultivars are open-pollinated and considered older cultivars or traditional cultivars because they are handed down in families or passed on from gardener to gardener, and they are not grown in large-scale agricultural enterprises<sup>1</sup>. The term heirloom does not carry precise scientific designations and therefore variation in defining heirloom. Open-pollinated nature or non-hybrid are typical characteristics of heirloom and can be from self-pollinated species, however, later if the crop species is cross-pollinated, then the heirloom is treated as open-pollinated. Therefore,

there are considerable variations in certain heirloom cultivars, and that is why heirlooms may not found suitability within the framework of modern agricultural systems which lay substantial emphasis on uniformity. A scholar opined that it is natural to refer back on simpler times whenever there is occurrence of technological and social change<sup>2</sup>. He further added that due to the phenomenon of idealizing the past, there is growing interest in heirloom cultivars. Also, for some people, the gardens represent a sort of retreat from the stress arising due to modern life and as a result, there is heightened earning for simplicity. Thus, the consumer or gardener is getting an opportunity to reconnect with a different age through heirloom cultivation. In addition, the unique flavors and culinary qualities of the heirloom cultivar are valued by the people over the generations. Lack of such qualities in modern cultivars of modern cropping systems, creates a yearning for the heirloom. Also, yet another defining features of an heirloom is transfer of heirloom seed

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from generation-to-generation. In the context of considerable challenges being posed by climate change for food production and food security, heirloom cultivars which have been cultivated by indigenous people around the world as local food may be an immensely useful option for ensuring sustainable food supply<sup>3</sup>. Any food that is cultivated, sold and consumed within a limited geographical area is called local food<sup>4</sup>. Certain factors drive consumers to buy locally produced food. Locally produced foods are perceived by people as richer in minerals and vitamins, tastier, fresher and safer in comparison to nonlocal food. Also, it is valued that instead of purchasing food from global markets, consuming locally produced food is more environmentally sustainable<sup>5</sup>.

Cucurbits, one of the largest groups of vegetable crops is widely cultivated in all the Northeastern states of India. Fifteen genera of this group of vegetables are found in this region and many of them are lesser known<sup>6</sup>. The highest number of species is known from the Northeast and peninsular India<sup>7</sup>. “Cucurbits” is a broad term that refers to all taxa of the highly diverse family known as Cucurbitaceae, which includes at least 950 species in over 90 genera that are mainly distributed in the tropics and subtropics<sup>8</sup>. Cucurbits are of enormous economic importance to smallholder farmers, particularly in Asia which accounted for 83% of this production<sup>9</sup>. Phylogenetic analysis reveals that origin of this group of vegetables is Asia<sup>10</sup>. Also, traditional system of medicine followed in Asia uses many vegetables belonging to cucurbitaceae family<sup>11</sup>. Various plant parts of neglected and underutilized species such as leaves, buds, fruit, and seeds contain important pharmacological compounds and therefore can be consumed for the treatment of different diseases. Therefore, assessment of genetic diversity and population structure of heirloom cucurbit cultivars will be of great help as declining use and eroding knowledge about traditional vegetables has been observed in many places around the world, which threatens their persistence in the future and limits the accruing of their benefits to society<sup>12,13</sup>. With this endeavor, the present study aimed to shed light on the diversity of local cucurbitaceous vegetables in East Siang, Arunachal Pradesh and to highlight opportunities to leverage neglected and underutilized species for more nutrition-sensitive agriculture.

## Methodology

### Study area

East Siang district is located at 28.07°N 95.33°E in the central part of Arunachal Pradesh and the district is a part of the Middle Himalayas and the Siwalik ranges (Fig. 1). The Pasighat town, the headquarter of the East Siang District, is the oldest town in Arunachal Pradesh – established in 1911 A.D. Pasighat is included in the Smart Cities Mission development scheme by the Government of India in June, 2017. Pasighat is predominantly inhabited by the *Adi* tribe who are known for their colorful *Ponung* dance and war dance called *Taapu*. Agriculture is the main occupation of the people in the district. Out of total cropped area (26,904 ha) of the district, the vegetable crops occupy only 1,469 ha area<sup>14</sup>. Thus, crops grown on Jhum land (under shifting cultivation) and in-home gardens remain unaccounted. The present study was conducted during August, 2019 in the main vegetable market of Pasighat town wherein on an average 57 local vendors (mainly tribal women) daily arrives from different corners of the district. An area in the market is earmarked for them and they sell their local vegetable produce (Fig. 2) during break of day.

In this study, the level of species diversity in cucurbits was captured by assessing the number of species (i.e., species richness) within a particular area or ecosystem<sup>15</sup>. Also, absolute number of species present in the population of interest is expressed as the richness of species. Participatory research which focuses on local perspectives emphasizing on mutual learning is found to be comparatively better approach for studies on agricultural biodiversity<sup>16</sup>. In view of

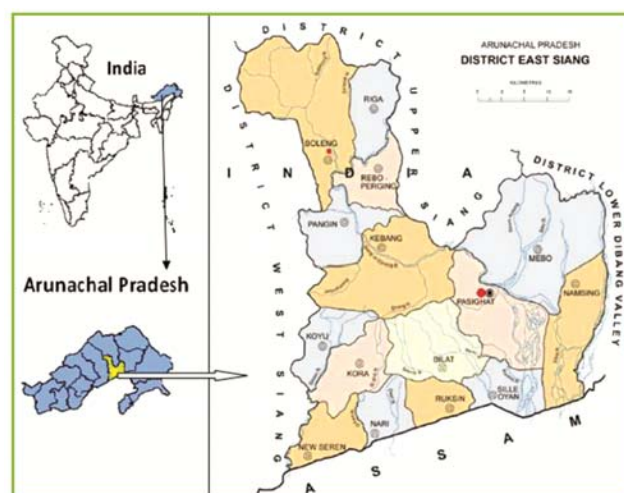


Fig. 1 — Arunachal Pradesh state map showing the study area (Pasighat)

this, discussions were carried out with venders as respondents for Free Prior Informed Consent (FPIC) agreement. Structured survey schedule was administered with 57 local venders for collecting information on cucurbit diversity. Based on the checklist<sup>7</sup> of “Cucurbitaceae of India”, the information on the documented cucurbits was revalidated.

Further, to document historical account by capturing the sequence of remembered historical



Fig. 2 — Local vegetable market at Pasighat, East Siang

events with respect to origin/domestication and cultivation of traditional cucurbitaceous crops by the *Adi* community and their corresponding significance, the ‘Timeline’ tool of Participatory Rural Appraisal technique was used. Actually, the ‘Timeline’ tool captures the chronology of events as recalled by local people. The important point to note here is that it is not history as such but sequence of past events as perceived and recalled by the people themselves. In addition, farmers’ preferences for cultivation and selection of cucurbits local varieties was documented which was further triangulated with key informants.

### Results and Discussion

The results emerged from this study confirm the existence of a large diversity of cultivated/wild cucurbitaceous vegetables with wide range of ethno-botanical uses in East Siang district of Arunachal Pradesh. The list of the documented cucurbits with their corresponding features is presented in [Table 1](#). From Pasighat local market, 15 local cucurbit species were documented ([Table 1](#)) along with many landraces of pumpkin, bottle gourd, ash gourd and cucumber ([Fig. 3](#)). Based on fruit morphology, maximum landraces were recorded in pumpkin

Table 1 — List of the documented cucurbits from East Siang, Arunachal Pradesh

Documented cucurbits species, landraces, historical account and Farmers’ preferences for cultivation

Common Name	Local name	Botanical name	Number of landrace	Perceived historical account (Decade of cultivation)	Farmers’ preferences for cultivation and selection of local cucurbits varieties
1.Pumpkin	<i>Tapa</i>	<i>Cucurbita moschata</i> Duch.ex Poir.	09	09	
2. Ash Gourd	<i>Pao</i>	<i>Benincasa hispida</i> (Thunb.) Cogn.	03	08	• Tastiness,
3. Bottle gourd	<i>Pani Lao</i>	<i>Lagenaria siceraria</i> (Mol.) Standl.	07	06	• good cooking quality,
4. Cucumber	<i>Makung</i>	<i>Cucumis sativus</i> L.	03	07	• (unique flavors and culinary qualities)
5. Smell Melon	<i>Pakumbarey</i>	<i>Cucumis melo</i> var. <i>dudaim</i> Naud.	02	08	• disease susceptibility and tolerance,
6. Snapmelon	<i>Mare/ Makungmari</i>	<i>Cucumis melo</i> var. <i>momordica</i>	03	09	• resilience,
7. Sponge Gourd	<i>Bul</i>	<i>Luffa cylindrical</i> (Roem.)	02	06	• early maturity and
8. Bitter Gourd	<i>Karela</i>	<i>Momordica charantia</i> L.	02	03	• storability.
9. Cho-Cho Marrow	<i>Tupop</i>	<i>Sechium edule</i> (Jacq.) Swartz.	02	02	
10.Ridge Gourd	<i>Jhika</i>	<i>Luffa aculangula</i> (L.) Roxb.	03	02	
11.Snake Gourd	<i>Dunduli</i>	<i>Trichosanthes anguina</i> L.	02	01	
12.Sweet Gourd or Kheksa	<i>Bhat karela</i>	<i>Momordica cochinchinensis</i> Spreng.	01	02	
13.Pointed Gourd	<i>Patal</i>	<i>Trichosanthes dioica</i> Roxb.	01	01	
14.Ivy Gourd or Little Gourd	<i>kunduli</i>	<i>Coccinia grandis</i> (L.) Voigt.	01	02	
15.Watermelon	<i>Kumarah</i>	<i>Citrullus lanatus</i> (Thunb.) Matusm & Nakai	01	01	

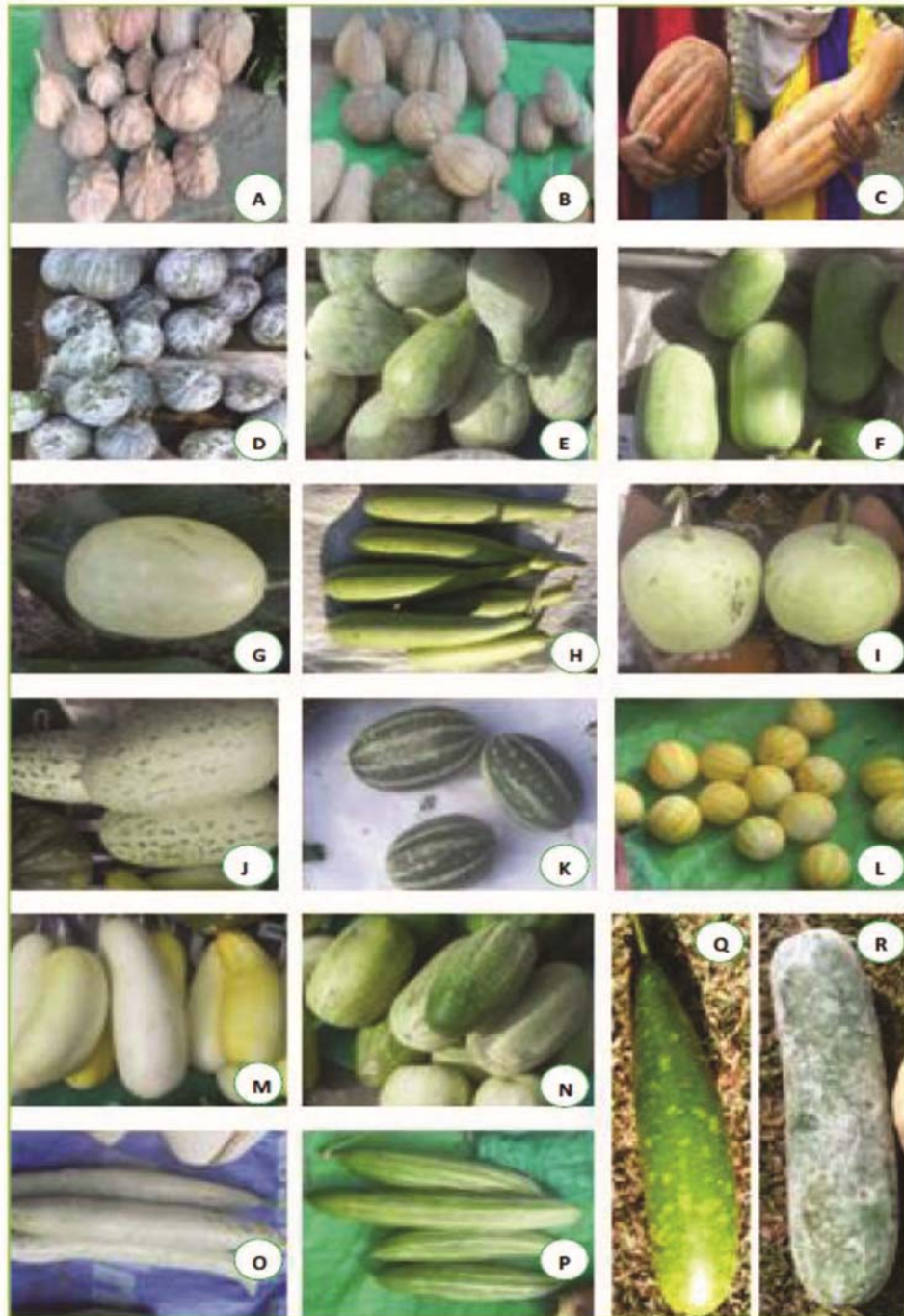


Fig. 3 — Local cucurbit cultivars in Pasighat, East Siang; A to C. *Cucurbita moschata*, D, F & R. *Benincasa hispida*, G to I. *Lagenaria siceraria*, J, L & Q. *Cucumis melo*, M & N. *Cucumis sativus*, O & P. *Trichosanthes anguina*]

followed by bottle gourd. With regard to historical account of cultivation as perceived by the informants, about the documented cucurbit species, seven species were in cultivation for more than five decades by the *Adi* tribe of the East Siang district. The primary purpose of growing cucurbits of local varieties on

small scale in study area was for home consumption and the surplus is sold in the local market. Generally, the reasons reported for production of these cultivars include taste, good cooking quality, early maturity, tolerance to disease, storability and marketability. Based on interaction with local vendors, we could

decipher that these vegetables are mostly grown in rainfed conditions either at homestead gardens/backyards or in shifting cultivation system (pumpkin & squash on *Jhum* land) without using any kind of pesticide. In case of pumpkin, the tribes utilize all parts of the plant apart from fleshy shell as vegetable, including the seeds, tender vine, leaves, and even flowers. However, cucurbits like watermelon, pointed gourd and *satputia* (*Luffa hermaphrodita*) have been introduced recently in the vegetable basket of the *Adi*. Interesting to mention here that, the cucurbits named in *Adi* language were reported to be domesticated by the *Adi* community since long back. The local cultivars enlisted in **Table 1** (Sl. No. 1-7) are grown for more than five decades on small scale, and have unique flavors and culinary qualities with high morphological diversity. Hence, these cultivars/landraces may be a potential candidate to be considered as heirloom cultivars and need special attention for conservation.

Apart from various ethno-medicinal usage of these cucurbits, some of them like *Cucurbita moschata* and *Momordica charantia* are recognized as a functional food around the world, that deliver additional or enhanced benefits over and above their basic nutritional value<sup>17,18</sup>. Of late, with growing importance on naturopathy medicine and natural nutraceutical, greater scope for niche market is also emerging with the sale of seeds of heirloom cultivars of cucurbits, candies, processed dry products from these vegetables at premium value when compared to selling these cucurbits as mere vegetables. In ecological terms, increased richness has been shown to both for enhancing community functionality (i.e., increase productivity) and for stabilizing it in the face of life disturbances concerning food consumption<sup>19,20</sup>. Further, those species having richness in diversity are more likely to contain specific species which have high productive potentials, which can be identified for enhancing further productivity.

## Conclusion

In the study area (East Siang district), many cucurbits species cultivated are non-hybrid, or open-pollinated nature, handed down in families and grown by marginal and small farmers on small scale. Hence, these species qualify to be considered as heirloom cultivars. As our agricultural systems are becoming more industrialized in recent decades, the greater importance of genetic diversity of heirloom cultivars

for our shared food future is being increasingly recognized by several scientists. Genetic diversity in our major crops is reduced due to modern crop breeding though it has immensely improved agricultural productivity. If we have to feed the ever-growing population of the world, especially in the context of more industrialized farming systems, more erratic climatic conditions, rather than shrinking our crop genetic diversity, conserving it will be critical. For mainstreaming local cultivars and heirlooms with many modern breeding efforts, there are recent efforts for characterizing and preserving heirlooms. Hence, the present study is quite timely in providing a good reflection of the diversity of cucurbit vegetables species at local level and trends for their research and conservation.

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## Conflict of Interests

Authors declare no conflict of interest.

## Author Contributions

DKP has conceptualized the study, compiled primary data and prepared first draft of the manuscript. PKS assisted in compiling recent review literature, PA & PK edited the manuscript.

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