

# Morphological Diversity of the Underutilised Fruit Species

## Guava (*Psidium guajava* L.) in Kenya

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### 1. Background and Objective

Guava (*Psidium guajava* L.) is one of the most important fruit tree species naturalized and cultivated in many tropical and even some sub-tropical regions. The fruit is consumed fresh or processed and has a great market potential (Gautam et al., 2010). In Kenya, however, the use of guavas for processing and product diversification is limited due to lack of adequate agronomic knowledge, poor integration of farmers into value chains and unawareness on the nutritional and economic potential of the species, among other reasons. Moreover, little is known about intra-specific variation in the available guava germplasm.

**Objective:** To assess the morphological diversity of guava in Kenya.

### 2. Methods

Four diverse regions of Kenya selected and 105 guava trees identified for sampling: Western (n=53), Rift valley (17), Eastern (12) and Coast (23) (Fig. 1).

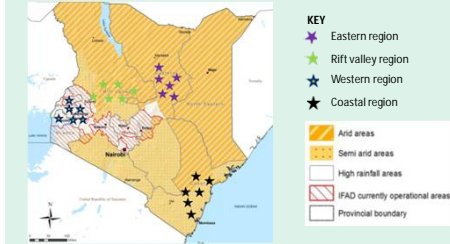


Figure 1: Map of Kenya showing guava sampling regions (every star represents several accessions).

- Passport data and description of each of the sampling sites/accession noted.
- Descriptor list for mango (IPGRI, 2006) modified for guava characterization, including tree, leaf, whole fruit, skin, pulp and seed characters.
- Twenty ripe fruits and 10 leaves (all healthy and undamaged) randomly collected from each sampled tree.
- Steps in fruit characterization performed and documented (Fig. 2), differences of traits among regions tested by ANOVA followed by Tukey test.
- Cluster analysis of 41 z-standardised qualitative and 25 quantitative morphological variables performed (Ward's method) to identify guava types.

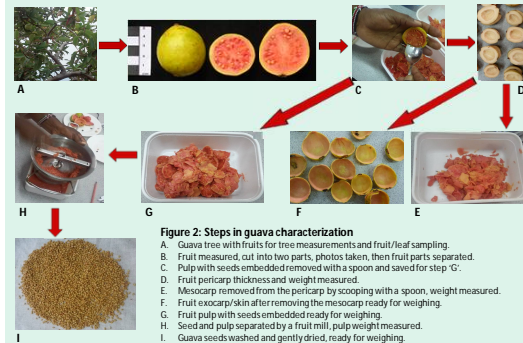


Figure 2: Steps in guava characterization

### 3. Results and Discussion

#### 3. a) Fruit qualitative characteristics

Fruit shapes: 43% round, 25% obovate, 14% ovate, and 18% others.



Pulp colour: 93% yellow-, orange- or reddish, and 7% white.



**Pulp flavor** → important for selecting fruits for fresh consumption and processing, depending on consumer preferences. Our sample: 5% very sweet, 31% sweet, 48% moderately sweet, 16% acidic.

**Pulp juiciness:** 49% slightly juicy, 44% moderately juicy, 8% very juicy.

#### 3. b) Fruit and seed quantitative traits

The mean fruit length was 44 mm (range 30-59 mm), width and thickness about 42 mm (range 25-54 mm) and weight 50 g (range 18-97 g). The whole pericarp had a mean thickness of 4.7 mm and a weight of 29 g, while the exocarp (skin) as part of the pericarp had a thickness of 1.6 mm and a weight of 15 g. The separated pulp had a mean weight of 14.5 g.

No differences among accessions (acc.) from the four regions were detected apart from the traits pericarp proportion (highest in Coast, lowest in Eastern acc.) (Fig. 3a), skin proportion (highest in Coast, lowest in Rift valley acc.) (Fig. 3b) and mean pulp weight (highest in Eastern and Rift valley, lowest in Coast acc.) (Fig. 3c).

Mean seed weight of 50 seeds was 0.7 g with no differences among regions. Seed length with a mean of 3.5 mm was higher in Rift valley than Coast acc. Mean proportion of seed weight from fruit weight was significantly higher ( $p < 0.003$ ) in fruits from the Coast (10.7%) and Western Kenya (10.6%) than from the Rift valley region (8.0%) (Fig. 3d).

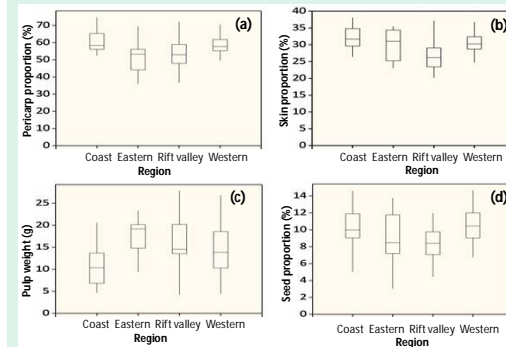


Figure 3: Boxplots of fruit and seed quantitative traits, (a) Fruit pericarp proportion from whole fruit; (b) Fruit skin proportion from whole fruit (%); (c) Pulp weight (g); (d) Seed proportion from whole fruit (%).

#### 3. c) Cluster analysis

Cluster analysis resulted in two distinct clusters (Fig. 4), which differed in:

- Location: most accessions from Coast and Rift Valley found in cluster 2
- Fruit and seed traits: lower values for pulp weight and fruit length, but higher values for seed proportion in cluster 1.

Most discriminant fruit characteristics for cluster formation: seed proportion, seed width, pulp colour, among others.

### 4. Conclusions

- Results are helpful in identifying accessions for certain uses (e.g. fresh consumption or processing) and promising mother trees for future guava breeding programs in Kenya.
- Pulp weight, fruit length and seed proportion contributed most in clustering the accessions, hence these are the most important traits for germplasm selection.
- Selection for future improvement should also target on reducing seed proportion and increasing mesocarp thickness and flesh/pulp proportion.

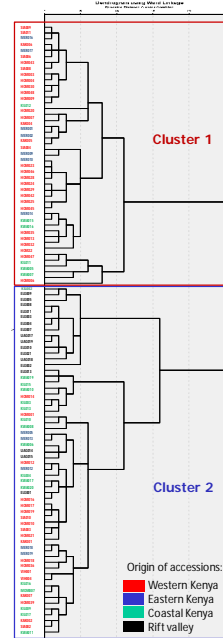


Figure 4: Dendrogram resulting from cluster analysis (Ward method) using morphological traits of 105 guava samples. Accessions' colour codes depict region of collection.

**References:**  
Gautam NI, Singh K, Singh B, Seal S, Goyal A and Goyal VL (2010) Studies on dorsal mal replication of guava (*Psidium guajava* L.) through cutting under controlled condition. Australian Journal of Crop Science. 4(3): 666-669.  
IPGRI (2006). Descriptors for mango (*Mangifera indica*). International Plant Genetic Resources Institute, Rome.

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