

Supplementary Material

1

2 **Table S1.** Distribution of qualitative traits

| Qualitative Traits and category | Proportion of each category in the germplasm (%) | Qualitative Traits and category | Proportion of each category in the germplasm (%) | Qualitative Traits and category | Proportion of each category in the germplasm (%) |
|---------------------------------|--|---------------------------------|--|---------------------------------|--|
| Crown shape | | Petals color | | Kernel shape | |
| Broadly pyramidal | 0.5 | Light yellow | 99.3 | Abortive | 1.6 |
| Oblong | 3.9 | Purpleish red | 0.2 | Ellipsoid | 66.1 |
| Semicircular | 3 | Yellow | 0.5 | Oblate | 0.7 |
| Spherical | 92.6 | Anther color | 0 | Oblong | 30 |
| Leaf blade shape | | Bright red | 6.9 | Oval | 0.2 |
| Elliptic | 28.8 | Light purple | 82.3 | Reniform | 0.2 |
| Lanceolate | 65.2 | Light yellow | 0.5 | Subcircular | 1.2 |
| Oblong | 6 | Purple | 0.2 | Type embryos | |
| Leaf surface | | Purpleish red | 10.1 | Abortive | 1.6 |
| Entire | 32.3 | Fruit shape | | Monoembryo | 55.6 |
| Twisted | 1.8 | Elliptic | 46.1 | Polyembryony | 42.9 |
| Wavy | 65.9 | | | Fruit aroma | |
| Leaf texture | | Ivory | 4.4 | Absent | 22.8 |
| Leathery | 55.5 | Long oblate | 1.6 | Coconut flavor | 5.8 |
| Membranaceous | 4.4 | Oblate | 40.3 | Faint scent | 56 |
| Thick leathery | 40.1 | Oblong | 2.5 | Papaya aroma | 1.8 |
| Leaf apex shape | | Ovoid | 3.9 | Refreshing fragrance | 3.2 |
| Acuminate | 97.7 | Reniform | 0.2 | Rosin | 10.4 |
| Acute | 1.8 | Spheroidal | 0.9 | Fruit flavor | |
| Obtuse | 0.5 | Fruit beak type | | Acid | 4.6 |
| Leaf margin | | Absent | 26.3 | Fresh and sweet | 3.7 |
| Entire | 14.3 | Mammiform | 0.9 | Sour and sweet | 51.6 |
| Twisted | 3 | Pointed | 72.6 | Sweet | 33.9 |
| Wavy | 81.3 | Prominent | 0.2 | Sweet and sour | 4.6 |
| Wavy | 1.4 | Fruit sinus type | | Thick sweet | 1.4 |
| Inflorescence shape | | Absent | 16.6 | Very acid | 0.2 |
| Broadly pyramidal | 8.5 | Deep | 3.2 | Tree growth habit | |
| Narrowly pyramidal | 3 | Shallow | 80.2 | Erect | 4.4 |
| Pyramidal | 88.5 | Pericarp color | | Medium | 86.5 |
| Type flower | | Dark orange | 0.5 | Spreading | 9.1 |
| Pentamerous | 0.2 | Green | 22.4 | Quantity fiber pulp | |

| | | | | | |
|-------------------------|------|---------------------------------------|------|--------------------------|------|
| Pentamerous | 59 | Greenish yellow | 7.1 | High | 58 |
| Hexamerous | 0.7 | Orange yellow | 1.2 | Low | 20.6 |
| Mixed | 6.2 | Yellow | 53.5 | Medium | 21.5 |
| Pentamerous-hexamorous | 10.8 | Yellow with red blush | 8.1 | Fiber length pulp | |
| Tetramerous | 0.2 | Yellowish Green | 7.4 | Long | 53.3 |
| Tetramerous-pentamerous | 22.8 | Flowering habit | 0 | Medium | 23.5 |
| Flesh color | | Early | 7.1 | Short | 23.2 |
| Creamy yellow | 4.1 | Late | 3.5 | Edible quality | |
| Dark orange | 9.2 | Medium | 88.9 | Good | 10.6 |
| Deep yellow | 3.7 | Fruit maturity characteristics | | Medium | 75.9 |
| Golden yellow | 47.9 | Early | 10.6 | Poor | 13.5 |
| Light yellow | 9.2 | Late | 3.5 | | |
| Milky white | 3.9 | Medium | 85.8 | | |
| Orange yellow | 21 | | | | |
| Yellow | 0.9 | | | | |

4

5 **Table S2.** Correlation matrix of the quantitative descriptors.

| | Trunk girth (cm) | Blade length (cm) | Blade width (cm) | Leaf shape index | Petiole length (cm) | Storage duration of fruits (days) | Fruit weight (g) | Peel weight (g) | Pulp weight (g) | Fruit length (cm) | Fruit width (cm) | Fruit thickness (cm) | Seed weight (g) | Seed width (cm) | Total soluble solid | Edible Rate (%) |
|---------------------|------------------|-------------------|------------------|------------------|---------------------|-----------------------------------|------------------|-----------------|-----------------|-------------------|------------------|----------------------|-----------------|-----------------|---------------------|-----------------|
| Blade length (cm) | | | | | | | | | | | | | | | | |
| Blade width (cm) | | 0.70*** | | | | | | | | | | | | | | |
| Leaf shape index | | 0.29*** | -0.39*** | | | | | | | | | | | | | |
| Petiole length (cm) | | 0.58*** | 0.43*** | 0.18*** | | | | | | | | | | | | |
| Fruit weight (g) | | | | | | 0.16*** | | | | | | | | | | |
| Peel weight (g) | | | | | | | 0.58*** | | | | | | | | | |
| Pulp weight (g) | | | | | -0.10* | 0.20*** | 0.98*** | 0.42*** | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|----------------------|--|---------|--|--------|----------|----------|----------|---------|----------|----------------|----------|---------|---------|---------|----------|--|
| Fruit length (cm) | | | | | | | 0.26*** | 0.26*** | 0.24*** | | | | | | | |
| Fruit width (cm) | | | | | | | 0.24*** | 0.21*** | 0.24*** | 0.98*** | | | | | | |
| Fruit thickness (cm) | | | | | | | 0.19*** | 0.19*** | 0.18*** | 0.98*** | 0.99*** | | | | | |
| Seed weight (g) | | | | | | | 0.70*** | 0.70*** | 0.55*** | 0.22*** | 0.19*** | 0.17*** | | | | |
| Seed width (cm) | | | | | | | 0.26*** | 0.26*** | 0.25*** | 1.00*** | 0.98*** | 0.98*** | 0.22*** | | | |
| Total soluble solid | | 0.15*** | | 0.12** | 0.11* | -0.15*** | -0.23*** | | -0.27*** | | -0.09*** | | | | -0.10* | |
| Edible Rate (%) | | | | -0.12* | -0.15*** | 0.28*** | 0.69*** | | 0.80*** | 0.19*** | 0.20*** | 0.15*** | 0.14*** | 0.20*** | -0.39*** | |

6 Only significant correlations were reported.

7

8

9

Table S3. Description of the clusters based on proportion (%) of categorical descriptors

| Descriptors | Cluster 1 (%) | Cluster 2 (%) | Cluster 3 (%) |
|----------------------------|----------------------|----------------------|----------------------|
| Region | | | |
| Honghe | 100 | | - |
| Lancang River | 86 | 14 | - |
| Nujiang | 50 | 49 | 1 |
| Leaf blade shape | | | |
| Elliptic | 24.33 | 35.93 | 25 |
| Lanceolate | 68.06 | 60.48 | 75 |
| Oblong | 7.60 | 3.59 | 0 |
| Leaf surface | | | |
| Entire | 43.73 | 13.17 | 75 |
| Twisted | 1.52 | 2.40 | 0 |
| Wavy | 54.75 | 84.43 | 25 |
| Leaf texture | | | |
| Leathery | 42.21 | 77.25 | 25 |
| Membranaceous | 4.94 | 2.40 | 50 |
| Thick leathery | 52.85 | 20.36 | 25 |
| Leaf Margin | | | |
| Entire | 21.67 | 2.99 | 0 |
| Twisted | 2.66 | 3.59 | 0 |
| Wavy | 75.67 | 93.41 | 100 |
| Inflorescence shape | | | |
| Broadly pyramidal | 11.79 | 2.99 | 25 |
| Narrowly pyramidal | 1.52 | 5.39 | 0 |
| Pyramidal | 86.69 | 91.62 | 75 |
| Anther color | | | |
| Bright red | 10.27 | 1.80 | 0 |
| Light purple | 76.81 | 90.42 | 100 |
| Light yellow | 0.38 | 0.00 | 0 |
| Purple | 0.38 | 0.60 | 0 |
| Purpleish red | 12.17 | 7.19 | 0 |
| Fruit shape | | | |
| Elliptic | 66.92 | 13.77 | 25 |
| Ivory | 4.56 | 3.59 | 25 |
| Long oblate | 1.14 | 2.40 | 0 |
| Oblate | 17.49 | 76.05 | 50 |
| Oblong | 1.52 | 4.19 | 0 |
| Ovoid | 6.46 | 0.00 | 0 |
| Reniform | 0.38 | 0.00 | 0 |
| Spheroidal | 1.52 | 0.00 | 0 |

| | | | |
|-------------------------|-------|-------|-----|
| Fruit beak type | | | |
| Absent | 37.64 | 8.98 | 0 |
| Mammiform | 1.14 | 0.60 | 0 |
| Pointed | 60.84 | 90.42 | 100 |
| Prominent | 0.38 | 0.00 | 0 |
| Fruit sinus type | | | |
| Absent | 20.15 | 10.78 | 25 |
| Deep | 3.42 | 2.99 | 0 |
| Shallow | 76.43 | 86.23 | 75 |
| Pericarp color | | | |
| Dark orange | 0.38 | 0.60 | 0 |
| Green | 31.94 | 7.19 | 25 |
| Greenish yellow | 8.75 | 4.79 | 0 |
| Orange yellow | 0.76 | 1.80 | 0 |
| Yellow | 38.02 | 77.25 | 75 |
| Yellow with red blush | 8.75 | 7.19 | 0 |
| Yellowish Green | 11.41 | 1.20 | 0 |
| Flesh color | | | |
| Creamy yellow | 4.94 | 2.99 | 0 |
| Dark orange | 12.17 | 4.79 | 0 |
| Deep yellow | 6.08 | 0.00 | 0 |
| Golden yellow | 34.98 | 67.66 | 75 |
| Light yellow | 12.17 | 4.79 | 0 |
| Milky white | 5.32 | 1.80 | 0 |
| Orange yellow | 23.57 | 16.77 | 25 |
| Yellow | 0.76 | 1.20 | 0 |
| Kernel shape | | | |
| Abortive | 1.90 | 1.20 | 0 |
| Ellipsoid | 68.82 | 61.68 | 75 |
| Oblate | 1.14 | 0.00 | 0 |
| Oblong | 26.24 | 35.93 | 25 |
| Oval | 0.38 | 0.00 | 0 |
| Subcircular | 1.52 | 0.60 | 0 |
| Reniform | 0.00 | 0.60 | 0 |
| Type embryos | | | |
| Abortive | 2.28 | 0.60 | 0 |
| Monoembryo | 77.19 | 20.36 | 100 |
| Polyembryony | 20.53 | 79.04 | 0 |
| Fruits Aroma | | | |
| Absent | 33.84 | 5.39 | 25 |
| Coconut flavor | 5.70 | 5.99 | 0 |
| Faint scent | 39.92 | 80.84 | 75 |
| Papaya aroma | 3.04 | 0.00 | 0 |

| | | | |
|-------------------------------|-------|-------|-----|
| Refreshing fragrance | 1.90 | 5.39 | 0 |
| Rosin | 15.59 | 2.40 | 0 |
| Fruit Flavor | | | |
| Acid | 6.46 | 1.80 | 0 |
| Fresh and sweet | 3.42 | 4.19 | 0 |
| Sour and sweet | 34.60 | 78.44 | 50 |
| Sweet | 49.05 | 9.58 | 50 |
| Sweet and sour | 4.18 | 5.39 | 0 |
| Thick sweet | 1.90 | 0.60 | 0 |
| Very acid | 0.38 | 0.00 | 0 |
| Quantity of pulp fiber | | | |
| Low | 30.42 | 4.19 | 50 |
| Medium | 30.42 | 7.19 | 0 |
| High | 39.16 | 88.62 | 50 |
| Length of pulp fiber | | | |
| Short | 32.70 | 8.38 | 50 |
| Medium | 31.94 | 8.98 | 0 |
| Long | 35.36 | 82.63 | 50 |
| Edible quality | | | |
| Poor | 17.87 | 6.59 | 0 |
| Medium | 75.29 | 76.65 | 100 |
| Good | 6.84 | 16.77 | 0 |