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# Supplementary material

Multivariate analysis of genetic divergence reveals an apparent separation between fruit quality and yellow vein mosaic virus response in okra (*Abelmoschus esculentus* (L.) Moench) genotypes

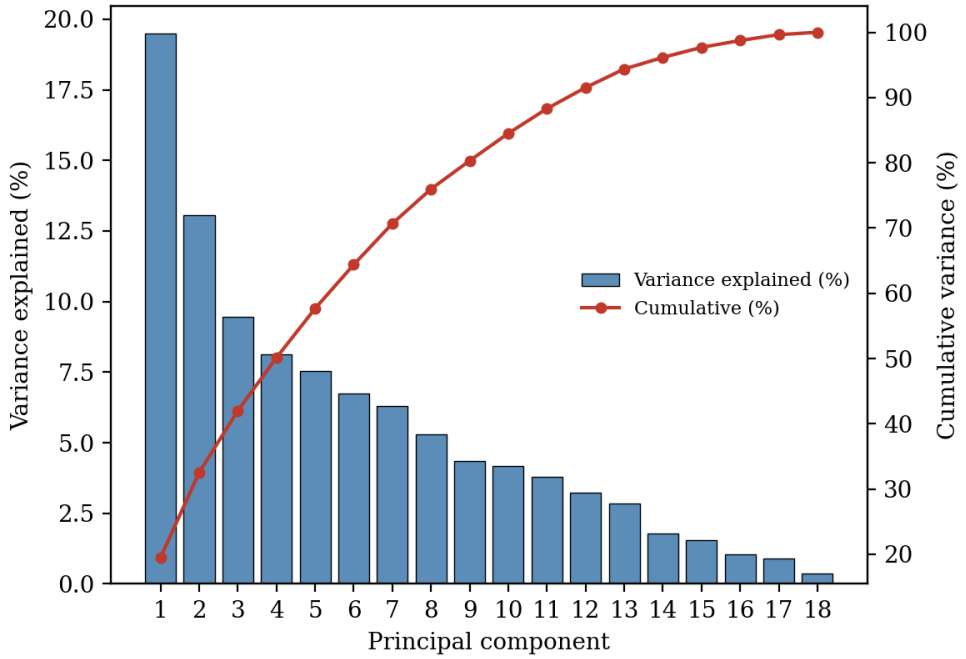
**Supplementary Table 1.** Genotype means for vegetative and flowering traits of 52 okra genotypes (18)

| Sl. No. | Genotype | Plant height (cm) | Plant spread N–S (cm) | Plant spread E–W (cm) | No. of nodes | Internodal length (cm) | Leaf area ($cm^2$) | Days to 1st flowering | Days to 50% flowering |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BO-18-40 | 141.86 | 42.63 | 51.46 | 13.33 | 10.16 | 398.56 | 40.33 | 45.66 |
| 2 | BO-18-57 | 128.46 | 40.90 | 34.20 | 10.00 | 10.90 | 478.66 | 39.33 | 44.00 |
| 3 | BO-18-37 | 144.26 | 29.90 | 27.66 | 9.66 | 8.90 | 487.93 | 40.33 | 45.33 |
| 4 | BO-18-38 | 123.70 | 33.60 | 39.40 | 14.00 | 14.03 | 498.70 | 38.66 | 44.00 |
| 5 | BO-18-7 | 166.03 | 34.56 | 39.13 | 14.33 | 9.36 | 390.70 | 38.66 | 43.00 |
| 6 | BO-18-47 | 157.90 | 34.23 | 32.00 | 11.33 | 6.40 | 509.96 | 36.66 | 41.00 |
| 7 | BO-18-8 | 173.46 | 36.40 | 40.63 | 15.00 | 10.83 | 508.16 | 39.33 | 41.66 |
| 8 | BO-18-5 | 163.70 | 39.66 | 45.66 | 17.00 | 12.30 | 569.96 | 36.66 | 40.66 |
| 9 | BO-18-9 | 181.96 | 39.23 | 42.50 | 15.00 | 11.06 | 486.50 | 38.66 | 43.33 |
| 10 | BO-18-6 | 169.53 | 33.80 | 45.46 | 17.66 | 11.26 | 714.66 | 38.66 | 42.33 |
| 11 | BO-19-7 | 170.90 | 35.16 | 49.90 | 20.33 | 12.53 | 440.00 | 40.33 | 42.33 |
| 12 | BO-19-1 | 153.66 | 36.50 | 38.96 | 17.66 | 7.73 | 674.26 | 37.33 | 44.00 |
| 13 | BO-19-3 | 156.70 | 32.43 | 35.60 | 11.33 | 6.76 | 378.16 | 39.00 | 46.00 |
| 14 | BO-19-4 | 133.33 | 25.16 | 28.96 | 14.66 | 13.83 | 466.30 | 38.00 | 44.00 |
| 15 | BO-19-5 | 156.60 | 25.10 | 28.43 | 14.66 | 4.80 | 434.13 | 39.00 | 43.66 |
| 16 | BO-19-2 | 99.40 | 24.93 | 31.60 | 12.66 | 9.53 | 447.43 | 40.33 | 45.00 |
| 17 | BO-19-6 | 138.16 | 34.83 | 39.00 | 23.85 | 5.20 | 407.03 | 39.66 | 42.33 |
| 18 | BO-19-22 | 141.00 | 33.46 | 36.66 | 15.66 | 13.46 | 557.00 | 38.66 | 42.33 |
| 19 | BO-18-17 | 142.83 | 40.83 | 38.30 | 16.66 | 10.33 | 598.86 | 37.66 | 42.00 |
| 20 | BO-2-14 | 141.56 | 65.53 | 68.63 | 21.46 | 7.33 | 409.40 | 35.33 | 42.33 |
| 21 | BO-19-8 | 134.86 | 36.86 | 42.23 | 12.33 | 9.50 | 570.10 | 39.00 | 43.00 |
| 22 | BO-2-4 | 148.50 | 51.86 | 61.90 | 22.35 | 5.90 | 557.70 | 36.66 | 43.00 |
| 23 | Pusa Sawani | 141.86 | 35.93 | 32.23 | 13.00 | 9.40 | 422.23 | 38.00 | 44.00 |
| 24 | Utkal Gaurav | 95.46 | 30.80 | 24.33 | 14.00 | 8.10 | 485.60 | 38.33 | 43.66 |
| 25 | BO-19-20 | 144.73 | 36.86 | 40.33 | 18.33 | 11.40 | 556.46 | 38.66 | 43.66 |
| 26 | BO-19-21 | 151.53 | 26.96 | 32.96 | 14.66 | 13.56 | 582.90 | 39.00 | 43.33 |
| 27 | BO-19-13 | 146.00 | 36.13 | 41.46 | 16.66 | 11.50 | 554.06 | 38.33 | 42.33 |
| 28 | BO-19-14 | 164.40 | 26.26 | 31.46 | 13.00 | 7.50 | 501.23 | 39.33 | 43.66 |
| 29 | BO-19-15 | 174.65 | 44.46 | 55.70 | 20.85 | 7.90 | 594.56 | 39.00 | 44.00 |
| 30 | BO-19-16 | 144.56 | 36.73 | 40.23 | 18.33 | 7.56 | 552.00 | 40.00 | 45.00 |
| 31 | BO-19-17 | 182.39 | 39.83 | 46.46 | 25.33 | 4.53 | 560.33 | 39.00 | 42.00 |
| 32 | BO-19-9 | 139.30 | 35.73 | 38.96 | 16.66 | 9.16 | 507.10 | 38.00 | 43.33 |
| 33 | BO-19-10 | 144.26 | 33.43 | 39.86 | 12.33 | 12.36 | 496.10 | 39.66 | 45.33 |
| 34 | BO-19-11 | 124.83 | 41.06 | 49.66 | 18.00 | 7.33 | 588.66 | 39.00 | 43.66 |
| 35 | BO-19-12 | 133.53 | 34.33 | 39.50 | 17.00 | 8.33 | 535.13 | 38.66 | 43.00 |
| 36 | BO-2-19 | 73.70 | 26.23 | 30.16 | 11.00 | 6.10 | 399.66 | 40.66 | 44.66 |
| 37 | BO-1 | 137.06 | 39.10 | 48.30 | 17.00 | 11.23 | 541.03 | 38.66 | 42.33 |
| 38 | BO-20-2 | 140.60 | 35.53 | 43.33 | 17.33 | 6.83 | 528.93 | 38.00 | 42.66 |
| 39 | BO-21-2 | 138.50 | 31.50 | 36.53 | 18.00 | 7.46 | 575.46 | 39.00 | 44.66 |
| 40 | BO-12-2 | 159.80 | 34.90 | 38.20 | 16.33 | 8.20 | 512.16 | 39.00 | 43.00 |
| 41 | BO-2-13 | 142.40 | 40.70 | 49.90 | 19.00 | 9.36 | 559.30 | 38.33 | 44.00 |
| 42 | Arka Anamika | 146.80 | 36.16 | 40.56 | 18.33 | 9.73 | 531.03 | 41.33 | 45.00 |
| 43 | BO-2-3 | 159.13 | 50.40 | 44.40 | 18.33 | 7.93 | 437.26 | 39.00 | 43.33 |
| 44 | Parbhani Kranti | 165.56 | 39.00 | 43.33 | 15.00 | 9.10 | 484.30 | 39.00 | 45.33 |
| 45 | BO-2-5 | 149.36 | 43.13 | 49.16 | 17.66 | 9.13 | 386.06 | 36.33 | 42.33 |
| 46 | BO-2-6 | 147.86 | 49.16 | 43.20 | 16.00 | 7.20 | 426.43 | 39.00 | 42.66 |
| 47 | BO-2-7 | 143.76 | 50.40 | 41.16 | 18.33 | 10.16 | 454.90 | 39.66 | 42.66 |
| 48 | BO-2-9 | 158.16 | 35.86 | 33.23 | 15.33 | 6.40 | 439.46 | 40.66 | 44.66 |
| 49 | BO-4-6 | 156.63 | 41.26 | 45.90 | 16.00 | 10.13 | 469.76 | 40.00 | 43.33 |
| 50 | BO-5-6 | 147.03 | 34.90 | 37.30 | 16.33 | 11.13 | 411.86 | 38.00 | 41.33 |
| 51 | BO-8-3 | 132.23 | 36.23 | 41.33 | 16.66 | 6.16 | 410.80 | 38.00 | 41.33 |
| 52 | BO-10-2 | 138.16 | 43.26 | 49.03 | 18.33 | 8.33 | 398.76 | 39.66 | 42.00 |

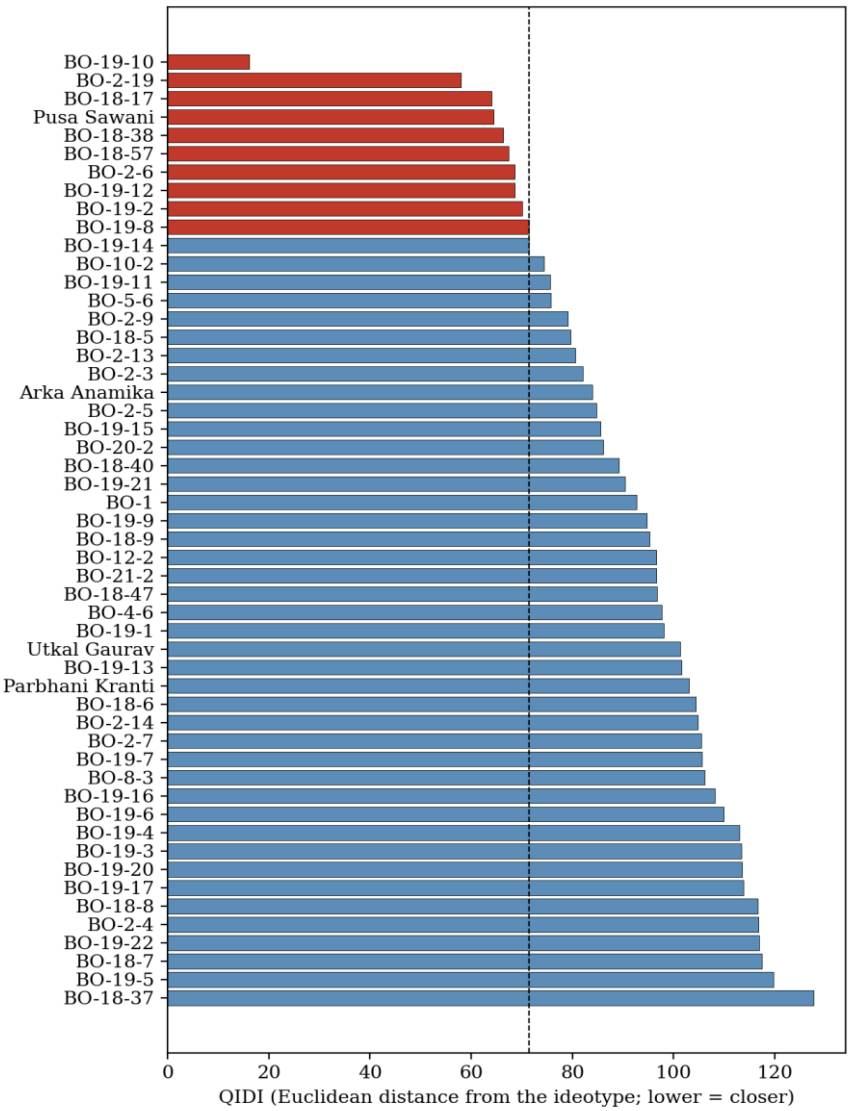
Genotype means of the 15 agronomic traits are reproduced from (18), so that the divergence, principal component and Ward-clustering analyses of the main text, which used these means together with the fruit quality means in Table 2, can be verified. The traits were recorded in the same trial (Kharif 2023–24; three replications); average fruit weight, number of fruits per plant and total yield per plant were recorded independently and are reproduced as published.

**Supplementary Table 2.** Genotype means for fruiting and yield traits of 52 okra genotypes (18).

| Sl. No. | Genotype | Days to 1st fruiting | Pedicel length (cm) | Fruit length (cm) | Fruit girth (cm) | Average fruit weight (g) | No. of fruits per plant | Total yield per plant (g) |
|---|---|---|---|---|---|---|---|---|
| 1 | BO-18-40 | 47.66 | 3.06 | 12.90 | 6.66 | 82.33 | 17.00 | 155.96 |
| 2 | BO-18-57 | 47.00 | 2.66 | 12.00 | 6.36 | 75.00 | 19.00 | 187.30 |
| 3 | BO-18-37 | 46.33 | 2.93 | 15.70 | 6.33 | 86.66 | 13.00 | 85.06 |
| 4 | BO-18-38 | 46.00 | 2.66 | 12.43 | 6.06 | 83.33 | 16.66 | 76.66 |
| 5 | BO-18-7 | 45.33 | 2.66 | 12.23 | 6.20 | 70.00 | 6.00 | 33.06 |
| 6 | BO-18-47 | 44.00 | 3.06 | 13.33 | 5.66 | 76.66 | 19.33 | 128.43 |
| 7 | BO-18-8 | 43.66 | 2.70 | 16.20 | 6.56 | 91.00 | 15.33 | 51.67 |
| 8 | BO-18-5 | 43.00 | 3.20 | 13.86 | 5.86 | 75.33 | 4.00 | 125.26 |
| 9 | BO-18-9 | 45.00 | 2.60 | 13.20 | 6.20 | 87.00 | 6.66 | 137.40 |
| 10 | BO-18-6 | 45.66 | 3.30 | 12.56 | 6.30 | 76.33 | 8.33 | 197.73 |
| 11 | BO-19-7 | 46.33 | 3.13 | 14.60 | 6.53 | 77.66 | 20.00 | 157.96 |
| 12 | BO-19-1 | 45.33 | 1.96 | 13.03 | 5.76 | 64.66 | 3.33 | 105.73 |
| 13 | BO-19-3 | 46.66 | 2.86 | 12.16 | 5.66 | 70.00 | 0.66 | 16.33 |
| 14 | BO-19-4 | 47.33 | 1.93 | 12.13 | 6.23 | 72.33 | 15.00 | 233.96 |
| 15 | BO-19-5 | 45.00 | 3.10 | 13.23 | 5.80 | 78.33 | 21.33 | 33.60 |
| 16 | BO-19-2 | 47.66 | 3.13 | 12.60 | 6.26 | 86.33 | 3.33 | 159.36 |
| 17 | BO-19-6 | 46.33 | 2.86 | 14.46 | 6.16 | 83.66 | 22.66 | 272.23 |
| 18 | BO-19-22 | 45.33 | 2.80 | 12.33 | 6.56 | 88.66 | 19.00 | 160.66 |
| 19 | BO-18-17 | 46.66 | 2.43 | 13.00 | 6.30 | 73.66 | 10.66 | 230.20 |
| 20 | BO-2-14 | 44.66 | 3.06 | 13.20 | 6.10 | 80.66 | 22.66 | 248.50 |
| 21 | BO-19-8 | 44.33 | 2.70 | 11.80 | 5.90 | 72.00 | 5.66 | 211.60 |
| 22 | BO-2-4 | 46.00 | 3.06 | 13.80 | 6.16 | 86.33 | 18.33 | 270.80 |
| 23 | Pusa Sawani | 45.33 | 2.70 | 12.63 | 6.10 | 76.00 | 3.00 | 182.60 |
| 24 | Utkal Gaurav | 44.33 | 2.43 | 15.76 | 6.10 | 86.00 | 9.33 | 208.93 |
| 25 | BO-19-20 | 47.00 | 2.83 | 13.26 | 6.43 | 91.00 | 8.66 | 30.33 |
| 26 | BO-19-21 | 46.00 | 3.00 | 13.53 | 6.63 | 81.33 | 16.66 | 35.23 |
| 27 | BO-19-13 | 46.33 | 3.13 | 13.76 | 6.23 | 92.33 | 1.66 | 59.53 |
| 28 | BO-19-14 | 45.33 | 2.66 | 13.76 | 6.30 | 82.00 | 2.66 | 82.50 |
| 29 | BO-19-15 | 48.33 | 2.53 | 15.73 | 6.30 | 85.66 | 14.00 | 244.53 |
| 30 | BO-19-16 | 50.00 | 2.70 | 18.30 | 6.60 | 87.33 | 5.33 | 102.36 |
| 31 | BO-19-17 | 45.33 | 2.33 | 12.53 | 6.53 | 88.33 | 23.00 | 278.13 |
| 32 | BO-19-9 | 44.33 | 3.06 | 14.16 | 6.13 | 90.66 | 22.66 | 83.46 |
| 33 | BO-19-10 | 47.66 | 2.50 | 14.10 | 5.80 | 70.33 | 3.20 | 125.93 |
| 34 | BO-19-11 | 45.00 | 2.83 | 12.63 | 6.43 | 77.33 | 13.00 | 44.53 |
| 35 | BO-19-12 | 45.33 | 2.93 | 12.16 | 6.13 | 69.00 | 8.66 | 107.53 |
| 36 | BO-2-19 | 45.00 | 2.70 | 10.16 | 6.60 | 62.33 | 8.40 | 47.90 |
| 37 | BO-1 | 46.33 | 3.30 | 13.93 | 6.13 | 80.66 | 16.66 | 22.80 |
| 38 | BO-20-2 | 44.33 | 2.63 | 13.43 | 6.40 | 78.00 | 3.33 | 46.80 |
| 39 | BO-21-2 | 46.33 | 2.43 | 14.30 | 5.86 | 82.00 | 10.00 | 54.60 |
| 40 | BO-12-2 | 48.33 | 2.93 | 11.46 | 5.83 | 75.66 | 11.66 | 141.36 |
| 41 | BO-2-13 | 46.33 | 2.40 | 15.60 | 6.20 | 81.33 | 14.66 | 108.73 |
| 42 | Arka Anamika | 48.33 | 2.93 | 15.30 | 7.13 | 114.66 | 9.33 | 213.13 |
| 43 | BO-2-3 | 44.66 | 2.90 | 13.36 | 6.40 | 122.33 | 3.00 | 77.00 |
| 44 | Parbhani Kranti | 45.33 | 3.26 | 13.50 | 6.26 | 101.33 | 3.66 | 149.26 |
| 45 | BO-2-5 | 43.33 | 2.80 | 13.26 | 6.10 | 79.00 | 15.66 | 43.13 |
| 46 | BO-2-6 | 46.00 | 2.43 | 13.63 | 6.20 | 67.66 | 7.00 | 25.23 |
| 47 | BO-2-7 | 44.33 | 2.36 | 13.03 | 6.53 | 70.66 | 3.33 | 77.06 |
| 48 | BO-2-9 | 48.33 | 2.76 | 16.46 | 6.10 | 81.66 | 11.00 | 25.13 |
| 49 | BO-4-6 | 45.00 | 3.20 | 13.66 | 6.53 | 78.33 | 19.33 | 79.23 |
| 50 | BO-5-6 | 45.00 | 2.80 | 18.50 | 6.86 | 116.00 | 15.66 | 142.50 |
| 51 | BO-8-3 | 43.33 | 2.53 | 15.43 | 6.36 | 88.66 | 22.66 | 26.03 |
| 52 | BO-10-2 | 43.66 | 2.80 | 13.66 | 6.40 | 69.00 | 5.33 | 70.63 |




**Supplementary Fig. 1.** Scree plot of the principal component analysis of 18 standardised quantitative traits: variance explained by each component (bars) and cumulative variance (line). Seven components have eigenvalues ≥ 1 and together explain 70.69 % of the variance (Table 9).




**Supplementary Fig. 2.** Quality ideotype-distance index (QIDI) of 52 okra genotypes (Euclidean distance from the ideotype of Eq. 3; lower values indicate closer similarity). Red bars mark the ten genotypes with the lowest QIDI; the dashed line marks this descriptive cut-off. Values are given in Table 2.