**Tables**

**Table 1. Details of the cardamom accessions used in the genetic diversity analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No** | **Name of the land race/ variety** | **Type** | **Source** | **Remarks** |
| 1 | ACC 1 | Vazhukka | Selection from Appangala region | Around 3 panicles per tiller, small globose shaped light green capsules |
| 2 | ALFRED CLONE | Malabar | From farmers’ field | Presence of both terminal and basal panicle |
| 3 | BEP 1 | Vazhukka | Selection from farmers’ field | Close internodes between raceme |
| 4 | BEP 2 | Vazhukka | Four panicles per tiller, light green color capsules |
| 5 | CHETTI 1 | Malabar | Selection from farmers’ field | Short stature |
| 6 | CHETTI 2 | Malabar | Tolerant to pest and diseases |
| 7 | CHETTI 3 | Malabar |
| 8 | CLONE 37 | Malabar | From Indian Institute of Spices Research (ISSR) Regional Station, Appangala | Released as Appangala 1 |
| 9 | CLONE 57 | Malabar | From IISR Regional Station, Appangala | Globose light green capsule |
| 10 | COM.PAN | Malabar | Collection from Kodagu region. | Branched panicles |
| 11 | GREEN GOLD | Vazhukka | Famers variety of Idukki | High yield with quick fertilizer response |
| 12 | HEMA | Vazhukka |  | Seventeen seeds per capsule |
| 13 | MANJURABAD | Malabar | From Shakleshpur | Three to four panicles per tiller |
| 14 | MBP | Malabar | Collection from Kodagu | Multibranched panicles |
| 15 | MCC 11 | - | From Indian Cardamom Research Institute, Myladumapra |  |
| 16 | MCC 40 | Malabar | From Indian Cardamom Research Institute, Myladumapra | High yielder |
| 17 | MCC 61 | Vazhukka | From Indian Cardamom Research Institute, Myladumapra | Released as ICRI 2 |
| 18 | MINI PINK | Malabar | Pampadumpara region | Pink coloration at the base of the pseudostem |
| 19 | PINK BASE | Malabar | Pampadumpara region | Pink coloration in the pseudostem |
| 20 | PPK 1 | Vazhukka | Selection from farmers field | Long bold capsules |
| 21 | PPK 2 | Vazhukka | Selection form green gold, Farmers variety | Extra-long panicle but smaller capsules |
| 22 | PRO 17 | - | - | Light green colored rhizome |
| 23 | PRO 107 | - | - | Lower surface of leaf is glabrous |
| 24 | PS 10 | Malabar | Plant selection from Cardamom Research Station | Elongated green color bold capsules |
| 25 | PS 12 | Vazhukka | - do - | Three panicles per tiller |
| 26 | PS 13 | Malabar | - do - | Globose light green capsules |
| 27 | PS 14 | Malabar | - do - | Round and light green-color bold capsules |
| 28 | PS 16 | Vazhukka | - do - | Elongated light green bold capsules |
| 29 | PS 17 | Malabar | - do - | Light green color capsules |
| 30 | PS 18 | Vazhukka | - do - | Elongated light green color capsules |
| 31 | PS 19 | Vazhukka | - do - | Elongated green capsules |
| 32 | PS 2 | Malabar | - do - | Bold elongated light green color capsules |
| 33 | PS 21 | Vazhukka | - do - | Elongated light green capsules |
| 34 | PS 22 | Vazhukka | - do - | Light green color bold capsules |
| 35 | PS 23 | Malabar | - do - | Elongated green capsule |
| 36 | PS 24 | Malabar | - do - | Green elongated bold capsules |
| 37 | PS 25 | Malabar | - do - | Elongated light green capsules |
| 38 | PS 26 | Malabar | - do - | Around fourteen seeds per capsule |
| 39 | PS 27 | Malabar | - do - | High yielder with bold capsules |
| 40 | PS 28 | Malabar | - do - | Green elongated capsules |
| 41 | PS 29 | Malabar | - do - | Green elongated bold capsules |
| 42 | PS 30 | Malabar | - do - | Bold elongated light green color capsules |
| 43 | PS 31 | Vazhukka | - do - | Bold elongated green color capsules |
| 44 | PS 32 | Malabar | - do - | Bold elongated green color capsules |
| 45 | PS 4 | Malabar | - do - | Green elongated bold capsules |
| 46 | PS 5 | Malabar | - do - | Green elongated bold capsules |
| 47 | PS 7 | Malabar | - do - | Light green globose shaped capsules |
| 48 | PS 8 | Vazhukka | - do - | Light green globose shaped capsules |
| 49 | PS 9 | Vazhukka | Plant selection from Cardamom Research Station | Elongated green capsules |
| 50 | PV 10 | Mysore | - do - | Light green color rhizome |
| 51 | PV 11 | Vazhukka | - do - | Glabrous leaves |
| 52 | PV 12 | Vazhukka | - do - | Elongated bold green color capsules |
| 53 | PV 2 | Vazhukka | - do - | Bold elongated light green color capsule |
| 54 | PV 33 | Malabar | Cardamom Research Station, Pampadumpara | Light green elongated capsule |
| 55 | PV 34 | Malabar | Cardamom Research Station, Pampadumpara | Higher volatile oil content |
| 56 | PV 5 | Malabar | - do - | Light green color globose shaped capsules |
| 57 | PV 6 | Malabar | - do - | Dark green color capsules |
| 58 | PV 7 | Malabar | - do - | Poor yielder |
| 59 | PV 8 | Mysore | - do - | Narrow leaf lamina |
| 60 | PV1 | Malabar | Cardamom Research Station, Pampadumpara | Released variety with long thin capsules |
| 61 | S 1 | Malabar | Seedling selection from commercial plantation of Cardamom Research Station | Higher yielder with long bold dark green capsules |
| 62 | Sinchona sel | Mysore |  | Light green color capsules |
| 63 | Type 1 | Malabar | Seedling selection from the Malabar types | Around eighteen seeds per capsule |
| 64 | Type 103 | Malabar | Seedling selection from the Malabar types | Around ten seeds per capsule |
| 65 | Type 4 | Malabar | Seedling selection from Cardamom Research Station, Pampadumpara | Light green color rhizome |
| 66 | Type 6 | Malabar | Seedling selection from Cardamom Research Station, Pampadumpara | Globose shaped light green color capsules |
| 67 | VEERAPUTHRAN | Malabar | From Indian Cardamom Research Institute, Myladumapra | Released as ICRI 1 variety. |

**Table 2. Pooled analysis (2016-2018) of yield and biotic stress characters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name of cultivar** | **Wet weight (g)** | **Dry weight (g)** | **100 capsules weight** | **Incidence of thrips (%)** | **Incidence of borer (%)** | **Incidence of Azhukal (%)** |
| ACC 1 | 1373.500 | 297.000 | 97.000 | 21.656 | 0.707 | 1.171 |
| ALFRED CLONE | 922.500 | 163.000 | 92.500 | 19.358 | 0.977 | 0.707 |
| BEP 1 | 2103.500 | 456.500 | 104.000 | 12.494 | 0.707 | 0.707 |
| BEP 2 | 2034.000 | 445.000 | 94.000 | 25.411 | 1.171 | 1.225 |
| CHETTI 1 | 2074.500 | 319.000 | 75.000 | 27.271 | 0.977 | 0.707 |
| CHETTI 2 | 1137.000 | 209.000 | 105.500 | 20.889 | 0.977 | 0.707 |
| CHETTI 3 | 930.500 | 172.000 | 99.000 | 25.741 | 1.171 | 1.171 |
| CLONE 37 | 421.500 | 87.500 | 89.000 | 16.430 | 0.707 | 0.707 |
| CLONE 57 | 1772.500 | 90.500 | **116.000** | 18.787 | 0.707 | 1.171 |
| COM.PAN | 1610.166 | 367.500 | 104.000 | 13.554 | 1.331 | 0.977 |
| GREENGOLD | 1865.000 | 399.000 | 103.500 | 25.463 | **1.728** | 0.707 |
| HEMA | 210.300 | 46.500 | 76.500 | 15.105 | 0.977 | 0.707 |
| MANJURABAD | 1016.500 | 187.500 | 98.000 | 26.176 | 1.559 | 1.225 |
| MBP | 2001.000 | 405.500 | 99.000 | 20.257 | 1.225 | 0.707 |
| MCC 11 | 1060.500 | 200.500 | 100.500 | 25.411 | 1.595 | 0.707 |
| MCC 40 | 910.500 | 178.500 | 94.500 | 17.171 | 0.977 | 0.707 |
| MCC 61 | 1170.000 | 185.000 | 101.500 | 21.837 | 1.171 | 1.171 |
| MINI PINK | 289.500 | 63.000 | 88.000 | 23.033 | 0.977 | **1.331** |
| PINK BASE | **160.500** | **34.625** | 95.000 | 17.948 | 1.470 | 0.707 |
| PPK 1 | 1623.000 | 334.500 | **115.000** | 21.898 | 1.693 | 0.707 |
| PPK 2 | **3051.000** | 509.000 | 81.000 | 22.396 | 0.707 | 1.171 |
| PR 17 | 456.000 | 103.000 | 83.500 | 16.833 | 1.171 | 0.707 |
| PRO 107 | 259.500 | 59.000 | 92.500 | 22.455 | 0.707 | 0.707 |
| PS 10 | 2635.500 | **558.000** | 107.000 | 18.824 | 0.707 | 0.707 |
| PS 12 | 2166.500 | 454.500 | 104.000 | 20.584 | 0.977 | 1.171 |
| PS 13 | 1891.500 | 411.000 | 102.500 | 14.535 | 1.693 | 0.707 |
| PS 14 | 1566.750 | 319.000 | 92.500 | 18.265 | 1.171 | 0.707 |
| PS 16 | 2580.500 | 194.000 | 86.000 | 14.049 | 0.707 | 0.707 |
| PS 17 | 412.150 | 79.000 | 85.000 | **7.759** | 0.977 | 0.707 |
| PS 18 | 1383.500 | 203.500 | 95.500 | 19.166 | 0.707 | 0.707 |
| PS 19 | 1022.500 | 207.500 | 94.000 | 33.825 | 1.331 | 0.707 |
| PS 2 | 1571.000 | 322.350 | 94.000 | 19.533 | 0.707 | 0.707 |
| PS 21 | 1208.500 | 233.500 | 111.000 | 12.746 | 1.581 | 0.977 |
| PS 22 | 1655.500 | 273.500 | **115.500** | 19.166 | 1.581 | **1.331** |
| PS 23 | 1337.333 | 376.000 | 104.000 | 11.477 | 1.470 | 0.707 |
| PS 24 | 887.500 | 163.000 | 99.000 | 25.161 | 1.331 | 0.707 |
| PS 25 | 995.000 | 184.000 | 104.000 | **45.407** | 0.707 | 0.707 |
| PS 26 | 1515.000 | 319.000 | 101.000 | 28.308 | 0.707 | 0.977 |
| PS 27 | 2478.500 | 459.500 | 98.500 | 15.956 | 0.707 | 0.707 |
| PS 28 | **3018.000** | **560.000** | 100.000 | 28.956 | 0.977 | 0.707 |
| PS 29 | 1016.000 | 201.500 | 102.500 | 10.611 | 1.225 | 0.977 |
| PS 30 | 493.500 | 89.500 | 87.500 | 13.481 | 0.977 | 0.707 |
| PS 31 | 630.000 | 139.000 | 82.500 | 15.240 | 1.331 | 0.977 |
| PS 32 | 1175.500 | 234.000 | 86.500 | 18.741 | 1.171 | 0.707 |
| PS 4 | 1321.000 | 263.500 | 88.500 | 10.765 | 1.559 | 0.707 |
| PS 5 | 1488.000 | 331.500 | 93.500 | 15.889 | 0.977 | 0.707 |
| PS 7 | 692.000 | 113.500 | **73.000** | 11.021 | 0.707 | 0.707 |
| PS 8 | 676.000 | 107.000 | 91.500 | 14.707 | 1.693 | 0.977 |
| PS 9 | 1011.500 | 224.500 | 91.500 | 20.495 | 1.171 | 1.171 |
| PV 10 | 1643.000 | 367.500 | 91.000 | 14.764 | 0.977 | 0.707 |
| PV 11 | 620.500 | 131.500 | 89.000 | 17.948 | 0.707 | 0.707 |
| PV 12 | 1321.500 | 266.500 | 103.500 | 15.846 | **1.728** | 0.707 |
| PV 2 | 918.500 | 204.000 | 92.000 | 25.489 | 0.707 | 0.707 |
| PV 33 | 718.000 | 139.500 | 91.000 | 26.720 | 0.707 | 0.707 |
| PV 34 | 476.000 | 90.000 | 96.500 | 19.680 | 0.707 | 0.707 |
| PV 5 | 407.250 | 92.500 | 84.000 | 16.739 | 1.559 | 0.977 |
| PV 6 | **161.500** | 35.000 | 83.500 | 22.384 | 0.707 | 0.977 |
| PV 7 | 249.500 | 42.166 | **74.000** | 18.421 | 1.225 | 0.707 |
| PV 8 | 422.500 | 139.500 | **75.000** | 17.777 | 0.707 | 0.707 |
| PV1 | 905.000 | 186.000 | 90.500 | 29.374 | 1.225 | 0.977 |
| S 1 | 1291.000 | 225.900 | 100.000 | 18.880 | 1.171 | 0.977 |
| Sinchona sel | 2516.500 | 440.500 | 106.500 | 23.292 | 0.707 | 0.977 |
| Type 1 | 855.000 | 155.500 | 106.000 | 20.889 | 1.171 | 0.707 |
| Type 103 | 1027.500 | 203.000 | 103.000 | 17.441 | 0.977 | 0.707 |
| Type 4 | 609.000 | 136.000 | 100.500 | 16.078 | 1.171 | 0.977 |
| Type 6 | 256.000 | 49.500 | 112.000 | 18.824 | 0.707 | 0.707 |
| VEERAPUTHRAN | 655.500 | 149.000 | 98.500 | 14.049 | 0.707 | 0.707 |
| **CV** | **50.203** | **68.197** | **31.431** | **32.641** | **28.704** | **24.1** |
| **CD (1%)** | **1266.21** | **350.814** | **65.540** | **13.494** | **0.647** | **0.425** |
| **CD (5 %)** | **963.42** | **266.92** | **49.864** | **10.267** | **0.492** | **0.323** |

**Table 2.1 Pooled analysis (2016) of yield and biotic stress characters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name of cultivar** | **Wet weight (g)** | **Dry weight (g)** | **100 capsules weight** | **Incidence of thrips (%)** | **Incidence of borer (%)** | **Incidence of Azhukal (%)** |
| ACC 1 | 1373.5 | 297 | 97 | 14 | 0 | 1 |
| ALFRED CLONE | 922.5 | 163 | 92.5 | 11 | 0.5 | 0 |
| BEP 1 | 2103.5 | 456.5 | 104 | 5 | 0 | 0 |
| BEP 2 | 2034 | 445 | 94 | 18.5 | 1 | 1 |
| CHETT 1 | 2074.5 | 319 | 75 | 21 | 0.5 | 0 |
| CHETTI 2 | 1137 | 209 | 105.5 | 13 | 0.5 | 0 |
| CHETTI 3 | 930.5 | 172 | 99 | 19.5 | 1 | 1 |
| CLONE 37 | 421.5 | 87.5 | 89 | 8 | 0 | 0 |
| CLONE 57 | 421.5 | 90.5 | 116 | 11.5 | 0 | 1 |
| COM.PAN | 1772.5 | 367.5 | 104 | 5.5 | 1.5 | 0.5 |
| GREENGOLD | 1865 | 399 | 103.5 | 18.5 | 2.5 | 0 |
| HEMA | 210.3 | 46.5 | 76.5 | 7 | 0.5 | 0 |
| MANJURABAD | 1016.5 | 187.5 | 98 | 19.5 | 2 | 1 |
| MBP | 2001 | 405.5 | 99 | 12 | 1 | 0 |
| MCC 11 | 1060.5 | 200.5 | 100.5 | 18.5 | 2.5 | 0 |
| MCC 40 | 910.5 | 178.5 | 94.5 | 9 | 0.5 | 0 |
| MCC 61 | 1170 | 185 | 101.5 | 14 | 1 | 1 |
| MINI PINK | 289.5 | 63 | 88 | 17 | 0.5 | 1.5 |
| PINK BASE | 160.5 | 34.625 | 95 | 9.5 | 2 | 0 |
| PPK 1 | 1623 | 334.5 | 115 | 14 | 2.5 | 0 |
| PPK 2 | 3051 | 509 | 81 | 15 | 0 | 1 |
| PR 17 | 456 | 103 | 83.5 | 8.5 | 1 | 0 |
| PRO 107 | 259.5 | 59 | 92.5 | 15.5 | 0 | 0 |
| PS 10 | 2635.5 | 558 | 107 | 10.5 | 0 | 0 |
| PS 12 | 2166.5 | 454.5 | 104 | 13.5 | 0.5 | 1 |
| PS 13 | 1891.5 | 411 | 352.5 | 7.5 | 2.5 | 0 |
| PS 14 | 1566.75 | 319 | 92.5 | 10.5 | 1 | 0 |
| PS 16 | 2580.5 | 194 | 86 | 6 | 0 | 0 |
| PS 17 | 412.15 | 79 | 85 | 4 | 0.5 | 0 |
| PS 18 | 1383.5 | 203.5 | 95.5 | 11 | 0 | 0 |
| PS 19 | 1022.5 | 207.5 | 94 | 33.5 | 1.5 | 0 |
| PS 2 | 1571 | 322.35 | 94 | 13 | 0 | 0 |
| PS 21 | 1208.5 | 233.5 | 111 | 5 | 2 | 0.5 |
| PS 22 | 1655.5 | 273.5 | 115.5 | 11 | 2 | 1.5 |
| PS 23 | 1910.5 | 376 | 104 | 4 | 2 | 0 |
| PS 24 | 887.5 | 163 | 99 | 19 | 1.5 | 0 |
| PS 25 | 995 | 184 | 104 | 50.5 | 0 | 0 |
| PS 26 | 1515 | 1319 | 101 | 22.5 | 0 | 0.5 |
| PS 27 | 2478.5 | 459.5 | 98.5 | 8.5 | 0 | 0 |
| PS 28 | 3018 | 560 | 100 | 23.5 | 0.5 | 0 |
| PS 29 | 1016 | 201.5 | 102.5 | 3.5 | 1 | 0.5 |
| PS 30 | 493.5 | 89.5 | 87.5 | 5.5 | 0.5 | 0 |
| PS 31 | 630 | 139 | 82.5 | 7 | 1.5 | 0.5 |
| PS 32 | 1175.5 | 234 | 86.5 | 10.5 | 1 | 0 |
| PS 4 | 1321 | 263.5 | 88.5 | 3.5 | 2 | 0 |
| PS 5 | 1488 | 331.5 | 93.5 | 7.5 | 0.5 | 0 |
| PS 7 | 692 | 113.5 | 73 | 8 | 0 | 0 |
| PS 8 | 676 | 107 | 91.5 | 6.5 | 2.5 | 0.5 |
| PS 9 | 1011.5 | 224.5 | 91.5 | 12.5 | 1 | 1 |
| PV 10 | 1643 | 367.5 | 91 | 6.5 | 0.5 | 0 |
| PV 11 | 620.5 | 131.5 | 89 | 9.5 | 0 | 0 |
| PV 12 | 1321.5 | 266.5 | 103.5 | 8 | 2.5 | 0 |
| PV 2 | 918.5 | 204 | 92 | 19.5 | 0 | 0 |
| PV 33 | 718 | 139.5 | 91 | 21 | 0 | 0 |
| PV 34 | 476 | 90 | 96.5 | 11.5 | 0 | 0 |
| PV 5 | 407.25 | 92.5 | 84 | 9 | 2 | 0.5 |
| PV 6 | 161.5 | 35 | 83.5 | 16.5 | 0 | 0.5 |
| PV 7 | 249.5 | 42.5 | 74 | 10 | 1 | 0 |
| PV 8 | 422.5 | 139.5 | 75 | 20 | 0 | 0 |
| PV1 | 905 | 186 | 90.5 | 24.5 | 1 | 0.5 |
| S 1 | 1291 | 225.9 | 100 | 11 | 1 | 0.5 |
| Sinchona sel | 2516.5 | 440.5 | 106.5 | 18.5 | 0 | 0.5 |
| Type 1 | 855 | 155.5 | 106 | 13 | 1 | 0 |
| Type 103 | 1027.5 | 203 | 103 | 9 | 0.5 | 0 |
| Type 4 | 609 | 136 | 100.5 | 8 | 1 | 0.5 |
| Type 6 | 256 | 49.5 | 112 | 10.5 | 0 | 0 |
| VEERAPUTHRAN | 655.5 | 149 | 98.5 | 6 | 0 | 0 |

**Table 2.2 Pooled analysis (2017) of yield and biotic stress characters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name of cultivar** | **Wet weight (g)** | **Dry weight (g)** | **100 capsules weight** | **Incidence of thrips (%)** | **Incidence of borer (%)** | **Incidence of Azhukal (%)** |
| ACC 1 | 1432 | 329 | 99 | 20 | 0 | 0 |
| ALFRED CLONE | 605 | 78 | 95 | 12 | 1 | 0 |
| BEP 1 | 2202 | 461 | 105 | 8 | 0 | 0 |
| BEP 2 | 2053 | 440 | 93 | 22 | 0 | 1 |
| CHETT 1 | 1199 | 231 | 75 | 20 | 0 | 0 |
| CHETTI 2 | 1108 | 222 | 103 | 8 | 0 | 0 |
| CHETTI 3 | 321 | 69 | 98 | 29 | 0 | 0 |
| CLONE 37 | 250 | 52 | 88 | 8 | 0 | 0 |
| CLONE 57 | 250 | 52 | 122 | 3 | 0 | 0 |
| COM.PAN | 1078 | 239 | 103 | 6 | 3 | 0 |
| GREENGOLD | 1750 | 363 | 102 | 20 | 2 | 0 |
| HEMA | 120.6 | 25 | 75 | 10 | 1 | 0 |
| MANJURABAD | 1407 | 282 | 98 | 17 | 3 | 1 |
| MBP | 815 | 175 | 105 | 11 | 1 | 0 |
| MCC 11 | 996 | 191 | 103 | 22 | 0 | 0 |
| MCC 40 | 739 | 162 | 101 | 5 | 0 | 0 |
| MCC 61 | 540 | 100 | 103 | 18 | 2 | 2 |
| MINI PINK | 163 | 39 | 78 | 4 | 1 | 0 |
| PINK BASE | 35 | 9.25 |  | 9 | 0 | 0 |
| PPK 1 | 1666 | 368 | 120 | 11 | 4 | 0 |
| PPK 2 | 3217 | 520 | 78 | 22 | 0 | 0 |
| PR 17 | 299 | 71 | 92 | 6 | 0 | 0 |
| PRO 107 | 226 | 48 | 87 | 6 | 0 | 0 |
| PS 10 | 871 | 181 | 109 | 13 | 0 | 0 |
| PS 12 | 733 | 159 | 108 | 23 | 1 | 2 |
| PS 13 | 983 | 202 | 105 | 14 | 1 | 0 |
| PS 14 | 1283.5 | 278 | 100 | 17 | 0 | 0 |
| PS 16 | 1261 | 243 | 102 | 8 | 0 | 0 |
| PS 17 | 14.3 | 3 |  |  | 0 | 0 |
| PS 18 | 417 | 77 | 96 | 15 | 0 | 0 |
| PS 19 | 645 | 140 | 103 | 60 | 0 | 0 |
| PS 2 | 842 | 164.7 | 103 | 24 | 0 | 0 |
| PS 21 | 217 | 47 | 112 | 7 | 2 | 0 |
| PS 22 | 1856 | 287 | 121 | 15 | 2 | 0 |
| PS 23 | 321 | 62 | 98 | 5 | 0 | 0 |
| PS 24 | 305 | 61 | 113 | 30 | 0 | 0 |
| PS 25 | 80 | 18 | 98 | 90 | 0 | 0 |
| PS 26 | 1100 | 2248 | 107 | 21 | 0 | 1 |
| PS 27 | 1357 | 289 | 97 | 15 | 0 | 0 |
| PS 28 | 436 | 90 | 100 | 20 | 0 | 0 |
| PS 29 | 232 | 43 | 110 | 2 | 1 | 0 |
| PS 30 | 217 | 39 | 80 | 4 | 1 | 0 |
| PS 31 | 380 | 78 | 85 | 9 | 0 | 0 |
| PS 32 | 351 | 73 | 98 | 7 | 0 | 0 |
| PS 4 | 1292 | 292 | 92 | 4 | 1 | 0 |
| PS 5 | 676 | 198 | 102 | 8 | 0 | 0 |
| PS 7 | 54 | 12 | 81 | 8 | 0 | 0 |
| PS 8 | 52 | 9 | 83 | 8 | 1 | 1 |
| PS 9 | 1458 | 329 | 113 | 17 | 0 | 2 |
| PV 10 | 186 | 45 | 92 | 7 | 0 | 0 |
| PV 11 | 673 | 161 | 80 | 9 | 0 | 0 |
| PV 12 | 1805 | 380 | 114 | 13 | 3 | 0 |
| PV 2 | 727 | 158 | 74 | 31 | 0 | 0 |
| PV 33 | 766 | 164 | 102 | 32 | 0 | 0 |
| PV 34 | 392 | 80 | 93 | 8 | 0 | 0 |
| PV 5 | 81.5 | 17 | 73 | 3 | 1 | 0 |
| PV 6 | 222 | 49 | 82 | 30 | 0 | 0 |
| PV 7 | 276 | 43 | 68 | 9 | 1 | 0 |
| PV 8 | 7 | 2 |  |  | 0 | 0 |
| PV1 | 1320 | 271 | 96 | 34 | 1 | 0 |
| S 1 | 1272 | 201.8 | 102 | 17 | 0 | 1 |
| Sinchona sel | 1116 | 241 | 108 | 35 | 0 | 0 |
| Type 1 | 295 | 61 | 110 | 8 | 2 | 0 |
| Type 103 | 1365 | 253 | 95 | 8 | 1 | 0 |
| Type 4 | 198 | 47 | 103 | 12 | 2 | 0 |
| Type 6 | 132 | 24 | 116 | 13 | 0 | 0 |
| VEERAPUTHRAN | 800 | 200 | 102 | 8 | 0 | 0 |

**Table 2.3 Pooled analysis (2018) of yield and biotic stress characters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name of cultivar** | **Wet weight (g)** | **Dry weight (g)** | **100 capsules weight** | **Incidence of thrips (%)** | **Incidence of borer (%)** | **Incidence of Azhukal (%)** |
| ACC 1 | 1315 | 265 | 95 | 8 | 0 | 2 |
| ALFRED CLONE | 1240 | 248 | 90 | 10 | 0 | 0 |
| BEP 1 | 2005 | 452 | 103 | 2 | 0 | 0 |
| BEP 2 | 2015 | 450 | 95 | 15 | 2 | 1 |
| CHETT 1 | 2950 | 407 | 75 | 22 | 1 | 0 |
| CHETTI 2 | 1166 | 196 | 108 | 18 | 1 | 0 |
| CHETTI 3 | 1540 | 275 | 100 | 10 | 2 | 2 |
| CLONE 37 | 593 | 123 | 90 | 8 | 0 | 0 |
| CLONE 57 | 593 | 129 | 110 | 20 | 0 | 2 |
| COM.PAN | 2467 | 496 | 105 | 5 | 0 | 1 |
| GREENGOLD | 1980 | 435 | 105 | 17 | 3 | 0 |
| HEMA | 300 | 68 | 78 | 4 | 0 | 0 |
| MANJURABAD | 626 | 93 | 98 | 22 | 1 | 1 |
| MBP | 3187 | 636 | 93 | 13 | 1 | 0 |
| MCC 11 | 1125 | 210 | 98 | 15 | 5 | 0 |
| MCC 40 | 1082 | 195 | 88 | 13 | 1 | 0 |
| MCC 61 | 1800 | 270 | 100 | 10 | 0 | 0 |
| MINI PINK | 416 | 87 | 98 | 30 | 0 | 3 |
| PINK BASE | 286 | 60 | 95 | 10 | 4 | 0 |
| PPK 1 | 1580 | 301 | 110 | 17 | 1 | 0 |
| PPK 2 | 2885 | 498 | 84 | 8 | 0 | 2 |
| PR 17 | 613 | 135 | 75 | 11 | 2 | 0 |
| PRO 107 | 293 | 70 | 98 | 25 | 0 | 0 |
| PS 10 | 4400 | 935 | 105 | 8 | 0 | 0 |
| PS 12 | 3600 | 750 | 100 | 4 | 0 | 0 |
| PS 13 | 2800 | 620 | 600 | 1 | 4 | 0 |
| PS 14 | 1850 | 360 | 85 | 4 | 2 | 0 |
| PS 16 | 3900 | 145 | 70 | 4 | 0 | 0 |
| PS 17 | 810 | 155 | 85 | 4 | 1 | 0 |
| PS 18 | 2350 | 330 | 95 | 7 | 0 | 0 |
| PS 19 | 1400 | 275 | 85 | 7 | 3 | 0 |
| PS 2 | 2300 | 480 | 85 | 2 | 0 | 0 |
| PS 21 | 2200 | 420 | 110 | 3 | 2 | 1 |
| PS 22 | 1455 | 260 | 110 | 7 | 2 | 3 |
| PS 23 | 3500 | 690 | 110 | 3 | 4 | 0 |
| PS 24 | 1470 | 265 | 85 | 8 | 3 | 0 |
| PS 25 | 1910 | 350 | 110 | 11 | 0 | 0 |
| PS 26 | 1930 | 390 | 95 | 24 | 0 | 0 |
| PS 27 | 3600 | 630 | 100 | 2 | 0 | 0 |
| PS 28 | 5600 | 1030 | 100 | 27 | 1 | 0 |
| PS 29 | 1800 | 360 | 95 | 5 | 1 | 1 |
| PS 30 | 770 | 140 | 95 | 7 | 0 | 0 |
| PS 31 | 880 | 200 | 80 | 5 | 3 | 1 |
| PS 32 | 2000 | 395 | 75 | 14 | 2 | 0 |
| PS 4 | 1350 | 235 | 85 | 3 | 3 | 0 |
| PS 5 | 2300 | 465 | 85 | 7 | 1 | 0 |
| PS 7 | 1330 | 215 | 65 |  | 0 | 0 |
| PS 8 | 1300 | 205 | 100 | 5 | 4 | 0 |
| PS 9 | 565 | 120 | 70 | 8 | 2 | 0 |
| PV 10 | 3100 | 690 | 90 | 6 | 1 | 0 |
| PV 11 | 568 | 102 | 98 | 10 | 0 | 0 |
| PV 12 | 838 | 153 | 93 | 3 | 2 | 0 |
| PV 2 | 1110 | 250 | 110 | 8 | 0 | 0 |
| PV 33 | 670 | 115 | 80 | 10 | 0 | 0 |
| PV 34 | 560 | 100 | 100 | 15 | 0 | 0 |
| PV 5 | 733 | 168 | 95 | 15 | 3 | 1 |
| PV 6 | 101 | 21 | 85 | 3 | 0 | 1 |
| PV 7 | 223 | 42 | 80 | 11 | 1 | 0 |
| PV 8 | 838 | 277 | 75 | 20 | 0 | 0 |
| PV1 | 490 | 101 | 85 | 15 | 1 | 1 |
| S 1 | 1310 | 250 | 98 | 5 | 2 | 0 |
| Sinchona sel | 3917 | 640 | 105 | 2 | 0 | 1 |
| Type 1 | 1415 | 250 | 102 | 18 | 0 | 0 |
| Type 103 | 690 | 153 | 111 | 10 | 0 | 0 |
| Type 4 | 1020 | 225 | 98 | 4 | 0 | 1 |
| Type 6 | 380 | 75 | 108 | 8 | 0 | 0 |
| VEERAPUTHRAN | 511 | 98 | 95 | 4 | 0 | 0 |

**Table 3. Pooled analysis (2016-2018) of yield attributing characters**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accession** | **Plant height(cm)** | **No. of tillers/clump** | **No. of panicles/clump** | **No. of capsules/clump** | **Panicle length (cm)** | **No.of panicles /tiller)** | **Number of internodes/panicle** | **No. of seeds /capsule** |
| ACC 1 | 266.66 | 28.66 | 12 | 466.3 | 42 | 3 | 22 | 16.1 |
| Alfred clone | **152.66** | 44.66 | **3.33** | 501.3 | 39 | 3 | 22 | 16.7 |
| BEP 1 | 295.33 | 27.66 | 18.33 | 1355.5 | 24 | 4 | 19 | 16.5 |
| BEP 2 | 225 | 40.33 | 13 | 815.6 | 45 | 3 | 21 | 14.7 |
| CHETTI 1 | 282 | 34.33 | 28.33 | 1041.3 | 25 | 2 | 19 | 12.3 |
| CHETTI 2 | 265.66 | 19.66 | 15 | 1114.7 | 32 | 2 | 22 | 13.3 |
| CHETTI 3 | 268.33 | 32.33 | 13 | 954.6 | 24 | 3 | 24 | 15.8 |
| CLONE 37 | 256 | 35 | 18 | 1186.6 | 50 | 4 | 25 | 14.9 |
| CLONE 57 | 228 | 41.66 | 18.33 | 1067.2 | 43 | 2 | 22 | 13.1 |
| COM. PAN | 329.33 | 45.33 | 23 | 1502.2 | **85** | 3 | 34 | 14.7 |
| GREEN GOLD | 255.33 | 26.33 | 8.33 | 1451.6 | 19 | 2 | 16 | 15.3 |
| HEMA | 269.66 | 34 | 16.6 | 889 | 71 | 3 | 29 | 16.8 |
| MANJURABAD | 220.33 | 48.66 | 8.6 | 924.3 | 25 | 3 | 17 | 17.1 |
| MBP | 328.66 | 32.33 | 31 | **3139.2** | 69 | 2 | 34 | 11.8 |
| MCC 11 | 266.2 | 26 | 21.66 | 2010.6 | 34 | 2 | 25 | 14.4 |
| MCC 40 | 292 | 29 | 10 | 1041.2 | 19 | 1 | 16 | 11.7 |
| MCC 61 | 241.33 | 28.33 | **5** | **156.3** | **12** | 1 | **7** | 13.1 |
| MINI PINK | 306.66 | 21 | 14.66 | 178.4 | 43 | 3 | 21 | 11.7 |
| PINK BASE | 245 | 24 | 9.33 | 203.3 | 55 | 3 | **1** | 14 |
| PPK 1 | 213.66 | 51 | 24 | 739 | 30 | 3 | 14 | 12.7 |
| PPK 2 | 261 | 32.33 | 31 | 1050.6 | 32 | 3 | 18 | 14.4 |
| PRO107 | 291 | 32.66 | 23.66 | 1111.6 | 29 | 2 | 19 | 16.2 |
| PRO17 | 260 | 23 | 23 | 450.6 | 14 | 2 | 11 | 16.6 |
| PS 10 | 301 | 36 | 16.33 | 1637.6 | 39 | 3 | 20 | 11.5 |
| PS 12 | 325 | 22.66 | 31.33 | 1895.9 | 49 | 3 | 20 | **20.3** |
| PS 13 | 214 | 26.66 | 8.66 | 991.6 | 28 | 2 | 17 | 14.3 |
| PS 14 | 210.66 | 38.33 | 7.33 | 790.9 | 42 | 4 | 22 | 12.8 |
| PS 16 | 218.33 | 24 | 12 | 1158.6 | 39 | 3 | 20 | 15.4 |
| PS 17 | 215 | 40.33 | 14.33 | 298 | 38 | 2 | 21 | 14.9 |
| PS 18 | 330 | 24.66 | **40.66** | 783.2 | 47 | 2 | 12 | 12.9 |
| PS 19 | 251.66 | **5.33** | 27.33 | 536.8 | 39 | 4 | 28 | 14.1 |
| PS 2 | 270.66 | 23.33 | **3.66** | 1141.6 | 43 | 1 | 17 | 13.3 |
| PS 21 | 274.66 | 18 | 5.66 | 673.3 | 21 | 2 | 20 | **19.9** |
| PS 22 | 278.66 | 18.66 | 23.66 | 1207.8 | 63 | 1 | 17 | 15.4 |
| PS 23 | 239.66 | 35 | 21.66 | 920 | 42 | 2 | 19 | 13.5 |
| PS 24 | 295.33 | 30 | 33 | 1817.9 | 30 | 3 | 20 | 14.4 |
| PS 25 | 264.33 | 35.66 | 20.66 | 409.3 | 63 | 2 | 33 | 13.7 |
| PS 26 | 229 | 32 | 23 | 1356.9 | 18 | 2 | 30 | 14.3 |
| PS 27 | 284.33 | 27.33 | 17 | 1433.5 | 23 | 3 | 19 | 11.3 |
| PS 28 | 224 | 37.33 | 15.33 | 576.6 | 17 | 2 | 16 | 13.7 |
| PS 29 | 265 | 32 | 28 | 1687.6 | 34 | 3 | 21 | 12.4 |
| PS 30 | 252.33 | 31 | 20.33 | 779.9 | 34 | 2 | 25 | 10.4 |
| PS 31 | 312.66 | 26 | 30.33 | 2050.5 | 60 | 2 | 24 | 17.3 |
| PS 32 | 244 | 24 | 11 | **110** | 30 | 2 | 18 | 12.5 |
| PS 4 | 290 | 24 | 23.33 | 1852.6 | **85** | 4 | 19 | 14.8 |
| PS 5 | 318.33 | 24.6 | 15 | 1188.3 | 43 | 3 | **37** | 16.4 |
| PS 7 | 288.3 | 31.66 | 36 | 1621.9 | 26 | 2 | 16 | 14.1 |
| PS 8 | 296.66 | 31.33 | 16.66 | 430.5 | 30 | 2 | 13 | 10.6 |
| PS 9 | **358** | 29 | 33.66 | **2674.4** | 45 | 2 | 21 | 15.6 |
| PV 33 | 332.33 | **15.33** | 17.66 | 813.6 | 42 | 3 | 24 | 15.1 |
| PV 34 | 269 | 23.33 | 11 | 529 | 20 | 2 | 16 | 12.8 |
| PV1 | **156.33** | 31.33 | **4** | 474.5 | 15 | 2 | **8** | **9.6** |
| PV10 | 234 | 46.33 | 14.66 | 132.9 | 26 | 2 | 16 | **9.4** |
| PV11 | 207.66 | 37.66 | 27 | 273 | 19 | 1 | 11 | 12.5 |
| PV12 | 216.66 | **62** | 8.6 | 261.9 | 33 | 2 | 19 | 13.5 |
| PV2 | 220 | 35 | 20.3 | 558.2 | 40 | 4 | 11 | 12.1 |
| PV5 | 277.33 | 43 | 17 | 589.2 | 68 | 2 | 23 | 14.1 |
| PV6 | 242.33 | 37 | 24.33 | 719.9 | 50 | 2 | 21 | 15.3 |
| PV7 | 194 | 31.33 | 8 | 326 | 14 | 2 | 10 | **10** |
| PV8 | 215 | 44 | 12.66 | 281 | **10** | 2 | **9** | **8.1** |
| S -1 | 340.66 | 33.66 | 37.33 | **2464** | 60 | 4 | 28 | 17.3 |
| Sinchona sel. | 254.33 | 20 | 20 | 861.6 | 29 | 1 | 14 | 18.5 |
| TYPE 1 | 294 | **53.66** | 29 | 602.3 | 30 | 2 | 16 | **18.5** |
| Type 103 | 271.66 | 25 | 19.66 | 700.2 | **90** | 4 | **38** | 10.6 |
| TYPE 4 | 282 | 33.66 | 16.3 | 267 | 24 | 2 | 15 | 11.9 |
| TYPE 6 | 211 | 27 | **5** | 256.3 | 44 | 3 | 24 | 10.9 |
| Veeraputhran | **356** | 38.33 | **46.66** | 1936.3 | 48 | 3 | 22 | 14.8 |
| Mean | 263.3679 | 31.71269 | 18.86 | 1005 | 38.26 | 2.476 | 19.63 | 14.01 |
| SD | 43.77519 | 9.566578 | 9.5737 | 647.9 | 18.21 | 0.831 | 6.913 | 2.4662 |
| CV | 16.62 | 30.16 | 50.73 | 64.40 | 47.6 | 33.5 | 35.21 | 17.6 |
| CD 0.01 | 8.778 | 4.298 | 4.189 | 4.325 | 3.943 | NA | 3.824 | 4.223 |
| CD 0.05 | 6.679 | 3.271 | 3.187 | 3.291 | 3 | NA | 2.91 | 3.213 |

**Table 4. Cluster details of landraces/cultivars**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Cluster Number** | **Accessions included** | **Number of accessions** | **Central accession** | **Vazhukka** | **Mysore** | **Malabar** |
| 1 | ACC 1, PRO 17 | 2 | ACC 1 | 1 |  |  |
| 2 | Alfred clone, BEP 2, Chetti 1, Chetti 3, Hema, MCC 40, PPK 1, PRO 107, PS 14, PS 19, PS 23, PS 30, PS 5, PV 1, PV 6, Sinchona Sel. | 16 | Sinchona selection | 4 | 1 | 10 |
| 3 | BEP 1, Chetti 2, Clone 37, Clone 57, Compound panicle, Green gold, Manjurabad, MBP, MCC 11, Mini pink, PPK 2, PS 10, PS 12, PS 13, PS 16, PS 2, PS 22, PS 24, PS 26, PS 27, PS 29, PS 31, PS 4, PS 7,PS 9, S1, Veeraputhran | 27 | PS 7 | 8 |  | 18 |
| 4 | MCC 61 | 1 | MCC 61 | 1 |  |  |
| 5 | Pink base | 1 | Pink base |  |  | 1 |
| 6 | PS 17, PS 25, PS 8 | 3 | PS 25 | 1 |  | 2 |
| 7 | PS 18, PS 21, PS 28, PV 33, PV 34, PV 2, PV 5, PV 7, Type 1 | 9 | Type 1 | 3 |  | 6 |
| 8 | PS 32 | 1 | PS 32 |  |  | 1 |
| 9 | PV 10 | 1 | PV 10 |  | 1 |  |
| 10 | PV 11, PV 8 | 2 | PV 11 | 1 | 1 |  |
| 11 | PV 12 | 1 | PV 12 | 1 |  |  |
| 12 | Type 103 | 1 | Type 103 |  |  | 1 |
| 13 | Type 4 | 1 | Type 4 |  |  | 1 |
| 14 | Type 6 | 1 | Type 6 |  |  | 1 |



Fig.3: Mini Pink: Accession with highest incidence of *Azhukal* disease on cardamom capsules



Fig 4: PPK2 – Accession with least incidence of *Azhukal* disease on cardamom capsules



Fig 5: Green Gold - accession with the highest incidence of capsule borer.



Fig 6: PS 27 - accession with the highest incidence of capsule borer.



Fig 7: PS 25 - accession with the highest incidence of Thrips.

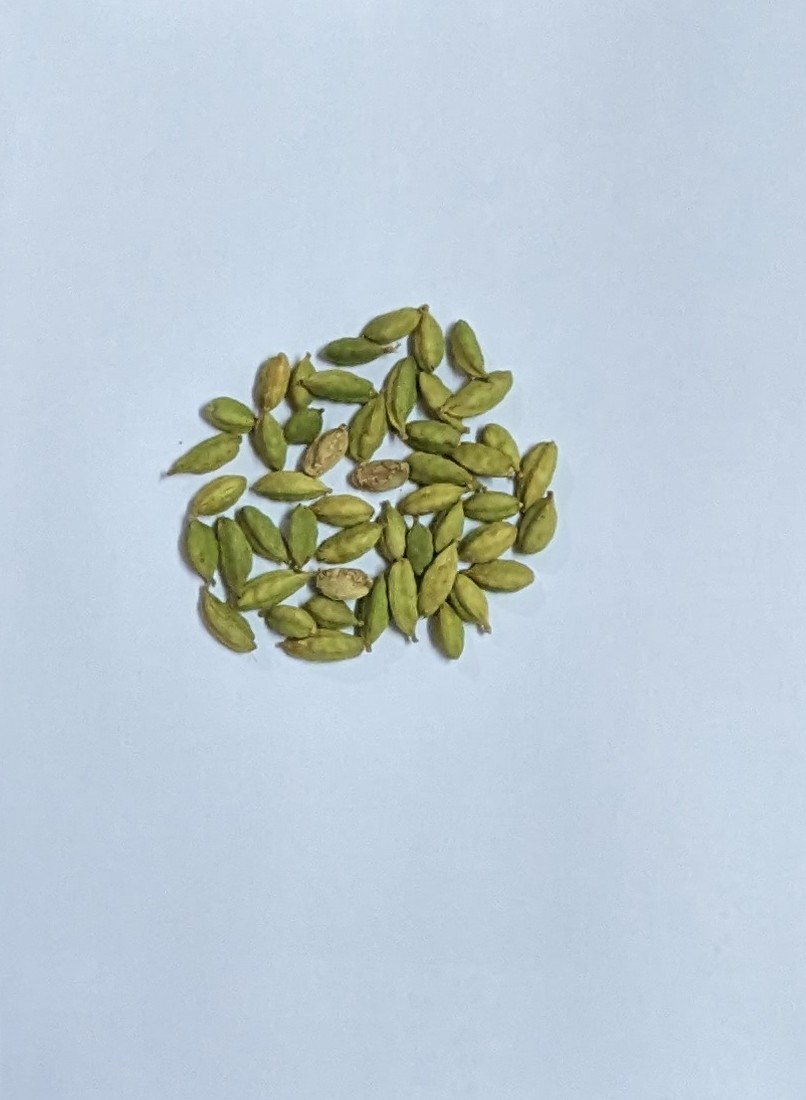


Fig 8: PS 23 - accession with the least incidence of Thrips.



Fig 9: *Malabar* variety of Cardamom



Fig 10: *Vazhukka* variety of Cardamom



Fig 11: *Mysore* variety of Cardamom