

# SABRAO JOURNAL OF BREEDING AND GENETICS

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## *Phalaenopsis* species



*P. amabilis*



*P. amboinensis*



*P. schleriana*

## Standard flowering hybrid cultivars



1702



1819



1981

## Novelty multiflora hybrid cultivars



3903



3904



3908



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**Images on the front cover:** The pre-breeding research was carried out on *Phalaenopsis* orchid related to the selection of the parental genotypes from prominent commercial cultivars. Application of *Phalaenopsis* hybrid complex in cultivars development may boost the breeding process. Ploidy evaluation is also an important factor in choosing the parental cultivars for crossing and effective breeding. The present research was carried out through Master Thesis research at the Plant Breeding and Biotechnology Study Program, Faculty of Agriculture, IPB University, Bogor, Indonesia. Information regarding performance of the species with different ploidy levels and commercial hybrids can be found in the research manuscript of Sophia *et al.* (2024). Sophia, Sukma D, Purwoko BS, Dinarti D, Sukmadjaja D, Sanjaya IPW (2024). Flow cytometry analysis reveals nuclear DNA content variation in *Phalaenopsis* young leaf and root tip cells. *SABRAO J. Breed. Genet.* 56(4): 1410-1423. <http://doi.org/10.54910/sabrao2024.56.4.8>.

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- Kipshakbayeva G, Ashirbekova I, Tleulina Z, Kadrinov M, Kipshakbayeva A, Amantayev B, Baitelenova A, Kiselev KV (2024). *Gmsep3a* gene expression in soybean (*Glycine max* L.). *SABRAO J. Breed. Genet.* 56(4): 1334-1344. <http://doi.org/10.54910/sabrao2024.56.4.1>.
- Azimov A, Shavkiev J, Ahmedjanov A, Temirova Y, Koraev A, Nurmetov Kh, Rasulova O (2024). Genetic analysis and inbreeding depression for yield-related parameters in upland cotton. *SABRAO J. Breed. Genet.* 56(4): 1345-1356. <http://doi.org/10.54910/sabrao2024.56.4.2>.
- Trikoesoemaningtyas, Fadilah AR, Burnama PW, Rahayu F, Rachman F, Hariadi, Rini EP, Marwiyah S, Sopandie D, Wirnas D (2024). Genetic variations in sorghum segregating populations based on yield and amylose content. *SABRAO J. Breed. Genet.* 56(4): 1357-1366. <http://doi.org/10.54910/sabrao2024.56.4.3>.
- Borasulov AM, Tursagatov JM, Ruzimova XK, Maxmatkulov IX, Mengliyev GA, Kuchchiyev OR, Kodirova SHN, Ruzikulova ZU, Xashimova MR, Xalilov SHX, Toshtemirov SYU, Borasulova DD, Chorshanbiyev FM, Nizomov RA (2024). Combining ability analysis of economically important traits in the diallel crosses of cucumber. *SABRAO J. Breed. Genet.* 56(4): 1367-1376. <http://doi.org/10.54910/sabrao2024.56.4>.
- Gubsuk W, Banterng P, Vorasoot N, Jogloy S, Theerakulpisut P, Vongcharoen K (2024). Genetic diversity of chlorophyll fluorescence germplasms effects on dry matter of cassava. *SABRAO J. Breed. Genet.* 56(4): 1377-1386. <http://doi.org/10.54910/sabrao2024.56.4.5>.

- Gins EM, Baikov AA, Khasanova SD, Goryunova SV, Gins VK, Gins MS, Motyleva SM (2024). Amaranthus species assessment for morphological and biochemical parameters. *SABRAO J. Breed. Genet.* 56(4): 1387-1399. <http://doi.org/10.54910/sabrao2024.56.4.6>.
- Saswita HM, Syamsuardi, Nurainas, Suwardi AB (2024). Phylogenetic analysis of potential wild fruits of *Baccaurea* spp. (Phyllanthaceae) indigenous to West Sumatra, Indonesia. *SABRAO J. Breed. Genet.* 56(4): 1400-1409. <http://doi.org/10.54910/sabrao2024.56.4.7>.
- Sophia, Sukma D, Purwoko BS, Dinarti D, Sukmadjaja D, Sanjaya IPW (2024). Flow cytometry analysis reveals nuclear DNA content variation in *Phalaenopsis* young leaf and root tip cells. *SABRAO J. Breed. Genet.* 56(4): 1410-1423. <http://doi.org/10.54910/sabrao2024.56.4.8>.
- Gins EM, Goryunova SV, Motyleva SM, Khasanova SD, Gins YK, Pivovarov YF, Kulikov IM, Baikov AA, Gins MS (2024). Modulation of low-molecular-weight antioxidants in *Amaranthus tricolor* leaves exposed to cold stress during the ripening stage. *SABRAO J. Breed. Genet.* 56(4): 1424-1436. <http://doi.org/10.54910/sabrao2024.56.4.9>.
- Rauf A, Barus WA, Munar A, Lestami A (2024). Physiological characteristics of the red rice with application of ascorbic acid under salinity stress conditions. *SABRAO J. Breed. Genet.* 56(4): 1437-1445. <http://doi.org/10.54910/sabrao2024.56.4.10>.
- Zega AV, Wiendi NMA, Guntoro D (2024). Morphological and productivity analysis of patchouli (*Pogostemon cablin*) mutants derived through mutation. *SABRAO J. Breed. Genet.* 56(4): 1446-1458. <http://doi.org/10.54910/sabrao2024.56.4.11>.
- Sadri H, Hajnajari H, Zeinalabedini M, Kazemi N, Asgarpour R (2024). Production of a diverse range of early ripening apple progenies through scalar screening for pheno-morpho and yield traits. *SABRAO J. Breed. Genet.* 56(4): 1459-1472. <http://doi.org/10.54910/sabrao2024.56.4.12>.
- Jawad MM, Al-Taie AT, Al-Hadeethi MAH, Khal LH (2024). Molecular analysis of wildly grown genus *veronica* species (Plantaginaceae) in Iraq. *SABRAO J. Breed. Genet.* 56(4): 1473-1483. <http://doi.org/10.54910/sabrao2024.56.4.13>.
- Merhij MY, Hanoon MB, Karbul MA, Atab HA (2024). Genotypic and phenotypic variations and genetic gain in faba bean with influence of nano-silicon. *SABRAO J. Breed. Genet.* 56(4): 1484-1491. <http://doi.org/10.54910/sabrao2024.56.4.14>.
- Hieu PV, Linh NTK, My NTT, Long NV, Dung NX (2024). Effect of culture conditions on the growth of in vitro ngoc linh ginseng (*Panax vietnamensis* Ha et Grushv.). *SABRAO J. Breed. Genet.* 56(4): 1492-1500. <http://doi.org/10.54910/sabrao2024.56.4.15>.

- Sheikh MR, Shafiuzzaman M, Khan A, Turin MTS, Abedin MT, Sayed MA (2024). Morphophysiological characterization of buckwheat landraces toward the development of germplasm in Bangladesh. *SABRAO J. Breed. Genet.* 56(4): 1501-1512. <http://doi.org/10.54910/sabrao2024.56.4.16>.
- Kodirova S, Amanov B, Muminov KH, Abdiyev F, Buronov A, Tursunova N, Kurbanbayev I (2024). Physiological and biochemical parameters of the exotic species of grass pea (*Lathyrus sativus* L.). *SABRAO J. Breed. Genet.* 56(4): 1513-1523. <http://doi.org/10.54910/sabrao2024.56.4.17>.
- Qulmamatova DE, Adilova ShSh, Matkarimov FI, Fayzullaev AZ, Nurmetov KhS, Kholliyev OE, Ziyadullaev ZF, Akbarova GO, Turaev OS, Baboev SK (2024). Regression analysis of yield-related traits in chickpea (*Cicer arietinum* L.). *SABRAO J. Breed. Genet.* 56(4): 1524-1533. <http://doi.org/10.54910/sabrao2024.56.4.18>.
- Kenenbayev S, Yessenbayeva G, Zhanbyrbayev Y, Tabynbayeva I (2024). Green agriculture with negation of chemicals in Kazakhstan. *SABRAO J. Breed. Genet.* 56(4): 1534-1542. <http://doi.org/10.54910/sabrao2024.56.4.19>.
- Aliyeva NZ, Mamedov ZM, Azizov IV (2024). Determination of physiological parameters and DMDH enzyme activity in maize (*Zea mays* L.) Sprouts grown under combined stress conditions. *SABRAO J. Breed. Genet.* 56(4): 1543-1551. <http://doi.org/10.54910/sabrao2024.56.4.20>.
- Khedr NM, Ibrahim AA, El-Metwally M, Eldakroory S, Soliman MI (2024). Phytochemical analysis, antioxidant activity, antimicrobial evaluation, and cytotoxicity effects of wild medicinal plants. *SABRAO J. Breed. Genet.* 56(4): 1552-1562. <http://doi.org/10.54910/sabrao2024.56.4.21>.
- Astuti D, Widyajayantie D, Wiyono S, Hidayat SH, Nugroho S, Trikoesoemaningtyas (2024). Agronomic variability of sorghum (*Sorghum bicolor*) genotypes with different lignin content assessed for biomaterial purposes. *SABRAO J. Breed. Genet.* 56(4): 1563-1573. <http://doi.org/10.54910/sabrao2024.56.4.22>.
- Rahmawati RS, Khumaida N, Ardie SW, Sukma D, Fathoni A, Sudarsono S (2024). Cassava (*Manihot esculenta* Crantz) mutant genotypes evaluation for early harvest and yield. *SABRAO J. Breed. Genet.* 56(4): 1574-1587. <http://doi.org/10.54910/sabrao2024.56.4.23>.
- Asim M, Ahmad S, Rehman MA, Ghazanfar MU, Arshad M, Atiq M, Luqman M, Gul S (2024). Citrus canker disease: status and severity in different genotypes. *SABRAO J. Breed. Genet.* 56(4): 1588-1596. <http://doi.org/10.54910/sabrao2024.56.4.24>.
- Akhmad ZA, Yassi A, Bahrnun AH, Zaenab S (2024). Effect of liquid organic fertilizer and urea on the growth and productivity of rice with asymmetrical irrigation. *SABRAO J. Breed. Genet.* 56(4): 1597-1608. <http://doi.org/10.54910/sabrao2024.56.4.25>.

- Fendiyanto MH, Satrio RD, Junaedi A, Supena EDJ, Hairmansis A, Nugroho S, Miftahudin M (2024). Correlation and path analyses for shoot architecture, photosynthesis, and yield-related traits in recombinant inbred lines of rice. *SABRAO J. Breed. Genet.* 56(4): 1609-1620. <http://doi.org/10.54910/sabrao2024.56.4.26>.
- Yapias RJM, Soto JP, Victorio JPE, Huamaní RG, Astete JAQ, Areche FO, Araujo VJS (2024). Phytoremediation and nutritional potential of the ice plants (*Mesembryanthemum crystallinum* L.). *SABRAO J. Breed. Genet.* 56(4): 1621-1631. <http://doi.org/10.54910/sabrao2024.56.4.27>.
- Ishaq MZ, Qayyum A, Noor E (2024). The role of potassium in improving drought tolerance in upland cotton (*Gossypium hirsutum* L.). *SABRAO J. Breed. Genet.* 56(4): 1632-1642. <http://doi.org/10.54910/sabrao2024.56.4.28>.
- Naeem M, Mamoon-Ur-Rashid M (2024). Insecticidal potential of hexane plant extract against pulse beetle (*Callosobruchus analis*) on stored mung bean (*Vigna radiata* L.). *SABRAO J. Breed. Genet.* 56(4): 1643-1653. <http://doi.org/10.54910/sabrao2024.56.4.29>.
- Nur M, Syam'un E, Sjam S (2024). Effect of horse manure vermicompost on the growth and yield traits of shallot (*Allium ascalonicum* L.). *SABRAO J. Breed. Genet.* 56(4): 1654-1660. <http://doi.org/10.54910/sabrao2024.56.4.30>.
- Kuse KG, Riadi M, Sjahril R (2024). Response of low nickel fertilization on the quantitative parameters of shallot under hydroponic conditions. *SABRAO J. Breed. Genet.* 56(4): 1661-1668. <http://doi.org/10.54910/sabrao2024.56.4.31>.
- El-Sayed GM, Soliman GM, Elkelany US, Ameen HH, Nour SA, Hussein W (2024). Overproduction of neutral protease in *Bacillus subtilis* 168 through site-directed mutation for biocontrol of *Meloidogyne incognita*. *SABRAO J. Breed. Genet.* 56(4): 1669-1681. <http://doi.org/10.54910/sabrao2024.56.4.32>.
- Bakry AB, Sabra DM, Ahmed AYM (2024). Morphological, biochemical, and molecular analyses to assess the flax (*Linum usitatissimum* L.) Genotypes under sandy soil conditions. *SABRAO J. Breed. Genet.* 56(4): 1682-1693. <http://doi.org/10.54910/sabrao2024.56.4.33>.
- Sajjad M, Razzaq H, Kashif M, Wahid MA (2024). Relationship of various parameters to *Bradyrhizobium japonicum* in soybeans. *SABRAO J. Breed. Genet.* 56(4): 1694-1704. <http://doi.org/10.54910/sabrao2024.56.4.34>.
- Al-Zubaidi AHA (2024). Biofertilizer impact on the productivity of broad bean (*Vicia faba* L.). *SABRAO J. Breed. Genet.* 56(4): 1705-1711. <http://doi.org/10.54910/sabrao2024.56.4.35>.
- Musa FS, Al-Alahiny NSH, Ali JK (2024). Seed activation effect on the wheat growth and yield components. *SABRAO J. Breed. Genet.* 56(4): 1712-1719. <http://doi.org/10.54910/sabrao2024.56.4.36>.



- Alsawaf MSI, Mahmood BS, Ahmed MA, Ayoub SF (2024). Effect of electrocution with magnetized water on seed germination and growth traits of *Acacia cyanophylla* L.. *SABRAO J. Breed. Genet.* 56(4): 1720-1727. <http://doi.org/10.54910/sabrao2024.56.4.37>.
- Ali TJM, Mahmood OH, Gouda FK (2024). Organic manure and nano-zinc effects on the peach seedlings growth. *SABRAO J. Breed. Genet.* 56(4): 1728-1737. <http://doi.org/10.54910/sabrao2024.56.4.38>.
- Fatima MM, Al-Yasari MNH (2024). Maize response to mineral fertilizers and seaweed extract for growth and yield-related traits. *SABRAO J. Breed. Genet.* 56(4): 1738-1748. <http://doi.org/10.54910/sabrao2024.56.4.39>.
- Blebish FKJ, Al-Anbari MAI (2024). Effect of mineral and organic fertilizer combinations on the yield-related traits of maize through path coefficient analysis. *SABRAO J. Breed. Genet.* 56(4): 1749-1757. <http://doi.org/10.54910/sabrao2024.56.4.40>.

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Priority is given to articles that are of direct relevance to plant breeders with an emphasis on the Asian region. Research articles, short communications, methods, reviews, commentaries, and opinion articles will be accepted or invited for publication. Scientific contributions will be refereed and edited to international standards.

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