Open Access

Genetic Consequence of Polyploidy in Plant Breeding

Temesgen Begna*
Ethiopian Institute of Agricultural Research, Chiro National Sorghum Research and Training Center, Ethiopia

Abstract

[illegible]

Citation: Temesgen B (2024) Genetic Consequence of Polyploidy in Plant Breeding. Adv Crop Sci Tech 12: 682.

Classification of polyploids

Euploidy

Aneuploidy

Table 1: List of major crop and their ploidy.

Common Name	Ploidy	Name	Propagation
Maize	2x=20	Diploid	Out Crossing
Sorghum	2x=20	Diploid	Self́ng
Wheat	6x=46	Hexapod	Out Crossing
Rice	2x=24	Diploid	Self́ng
Potatoes	4x=48	Tetraploid	Outcrossing, Vegetative
Soybean	2x=40	Diploid	Self́ng
Barley	2x=14	Diploid	Self́ng
Tomato	2x=24	Diploid	Self́ng
Banana	3x=33	Triploid	Vegetative
Watermelon	2x=22	Diploid	Out Crossing
Sugarcane	8x=80	Octoploid	Outcrossing,Vegetative
Sugar Beat	2x=18	Diploid	Out Crossing
Cassava	2x=36	Diploid	Outcrossing,Vegetative

Autopolyploidy

Allopolyploids

[illegible]

Common applications of polyploidy in plant breeding

[illegible]

Mutation breeding: [illegible]

Conclusion

References

1. Acquaah G (2009) Principles of plant genetics and breeding. John Wiley & Sons.
2. Birchler JA (2012) Genetic consequences of polyploidy in plants. In Polyploidy and genome evolution 21-32.
3. Bourke PM, Voorrips RE, Visser RG, Maliepaard C (2018) Tools for genetic studies in experimental populations of polyploids. Frontiers in plant science 9: 513.
4. Bowers JE, Chapman BA, Rong J, Paterson AH (2003) Unravelling angiosperm genome evolution by phylogenetic analysis of chromosomal duplication events. Nature 422: 433-438.
5. Bradshaw JE (2017) Plant breeding: past, present and future. Euphytica 213: 1-12.
6. Bretagnolle FA, THOMPSON JD (1995) Gametes with the somatic chromosome number: mechanisms of their formation and role in the evolution of autopolyploid plants. New Phytologist 129: 1-22.
7. Brochmann C, Brysting AK, Alsos IG, Borgen L, Grundt HH, et al. (2004) Polyploidy in arctic plants. Biological journal of the Linnean society 82: 521-536.
8. Chen K, Rajewsky N (2007) The evolution of gene regulation by transcription factors and microRNAs. Nature Reviews Genetics 8: 93-103.
9. Chen ZJ (2010) Molecular mechanisms of polyploidy and hybrid vigor. Trends in plant science 15: 57-71.
10. Comai L (2005) The advantages and disadvantages of being polyploid. Nature reviews genetics 6: 836-846.
11. Compton ME, Gray DJ, Elmstrom GW (1996) Identiýcation of tetraploid regenerants from cotyledons of diploid watermelon cultured in vitro. Euphytica 87: 165-172.
12. Corneillie S, De Storme N, Van Acker R, Fangel JU, De Bruyne M, et al. (2019) Polyploidy a ects plant growth and alters cell wall composition. Plant Physiology 179: 74-87.
13. Dhawan OP, Lavania UC (1996) Enhancing the productivity of secondary metabolites via induced polyploidy: a review. Euphytica 87: 81-89.
14. Edger PP, Smith R, McKain MR, Cooley AM, Vallejo-Marin M, et al. (2017) Subgenome dominance in an interspeciýc hybrid, synthetic allopolyploid, and a 140-year-old naturally established neo-allopolyploid monkey þower. The Plant Cell 29: 2150-2167.
15. Feldman M, Levy AA (2012) Genome evolution due to allopolyploidization in wheat. Genetics 192: 763-774.
16. Galindo-Gonz§lez L, Mhiri C, Deyholos MK, Grandbastien MA (2017) LTR-retrotransposons in plants: Engines of evolution. Gene 626: 14-25.
17. Guo M, Davis D, Birchler JA (1996) Dosage e ects on gene expression in a maize ploidy series. Genetics, 142: 1349-1355.
18. Hegarty M, Coate J, Sherman-Broyles S, Abbott R, Hiscock S, et al. (2013) Lessons from natural and artiýcial polyploids in higher plants. Cytogenetic and genome research 140: 204-225.
19. Hollister JD, Arnold BJ, Svedin E, Xue KS, Dilkes BP, et al. (2012) Genetic adaptation associated with genome-doubling in autotetraploid Arabidopsis arenosa. PLoS genetics 8: e1003093.
20. Korres NE, Norsworthy JK, Tehranchian P, Gitsopoulos TK, Loka DA, et al. (2016) Cultivars to face climate change e ects on crops and weeds: a review. Agronomy for Sustainable Development 36: 1-22.
21. Leitch AR, Leitch IJ (2008) Genomic plasticity and the diversity of polyploid plants. Science 320: pp.481-483.
22. Levin DA (1983) Polyploidy and novelty in þowering plants. The American Naturalist 122: 1-25.
23. Google scholar
24. Madani H, Escrich A, Hosseini B, Sanchez-Mu¶oz R, Khojasteh A, et al (2021) E ect of polyploidy induction on natural metabolite production in medicinal plants. Biomolecules 11: 899.
25. Mamas T, Gordon A, Brown A, Harper J, SenGupta S, et al. (2012) Detection

mimic a mosaic trophectoderm biopsy. Fertility and sterility 97: 943-947.

26. Masterson J (1994) Stomatal size in fossil plants: evidence for polyploidy in majority of angiosperms. Science 264: 421-424.
27. Nadeem MA, Nawaz MA, Shahid MQ, Doĵan Y, Comertpay G, et al. (2018) DNA molecular markers in plant breeding: current status and recent advancements in genomic selection and genome editing. Biotechnology & Biotechnological Equipment 32: 261-285.
28. Ohbayashi R, Nakamachi A, Hatakeyama TS, Watanabe S, Kanesaki Y, et al. (2019) Coordination of polyploid chromosome replication with cell size and growth in a cyanobacterium. MBio 10: 10-1128.
29. Otto SP, Whitton J (2000) Polyploid incidence and evolution. Annual review of genetics 34: 401-437.
30. Parisod C, Holderegger R, Brochmann C (2010) Evolutionary consequences of autopolyploidy. New phytologist 186: 5-17.
31. Paterson AH (2005) Polyploidy, evolutionary opportunity, and crop adaptation. Genetics of adaptation 191-196.