Marker-Trait Associations for Enhancing Agronomic Performance, Disease Resistance, and Grain Quality in Synthetic and Bread Wheat Accessions in Western Siberia

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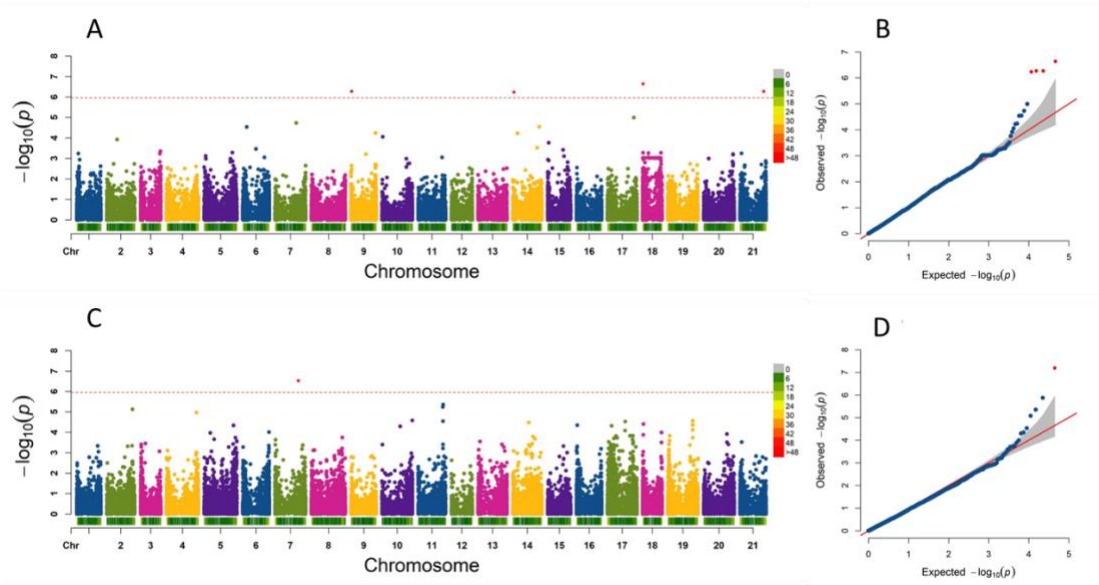
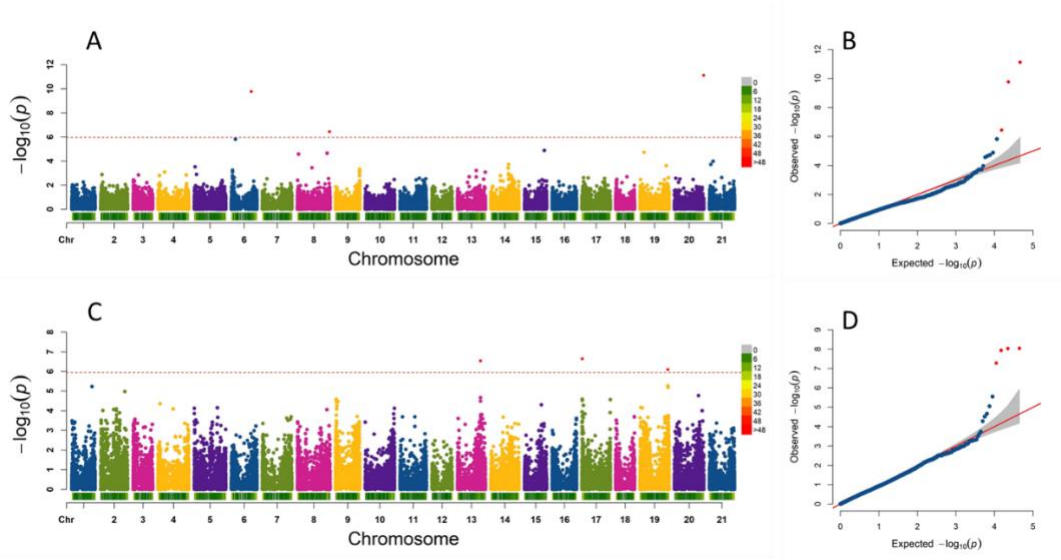
Figure S1. Manhattan and quantile-quantile (Q-Q) plots for 35 traits in 143 diverse wheat accessions obtained from a genome-wide association study.

1. Grain yield



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

2. Total root length



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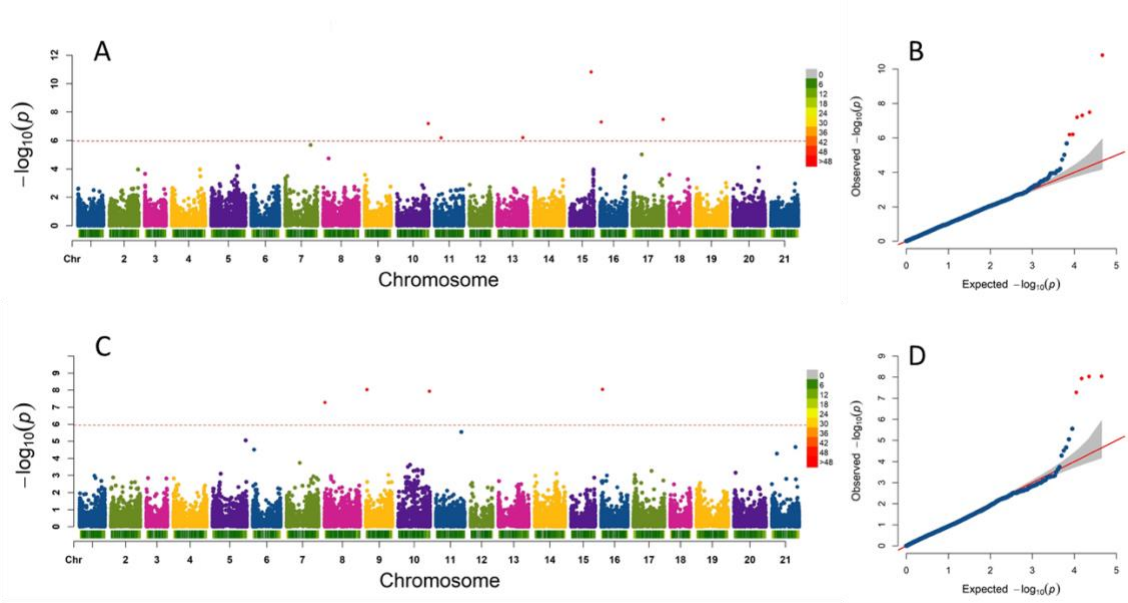
3. Thousand kernel weight



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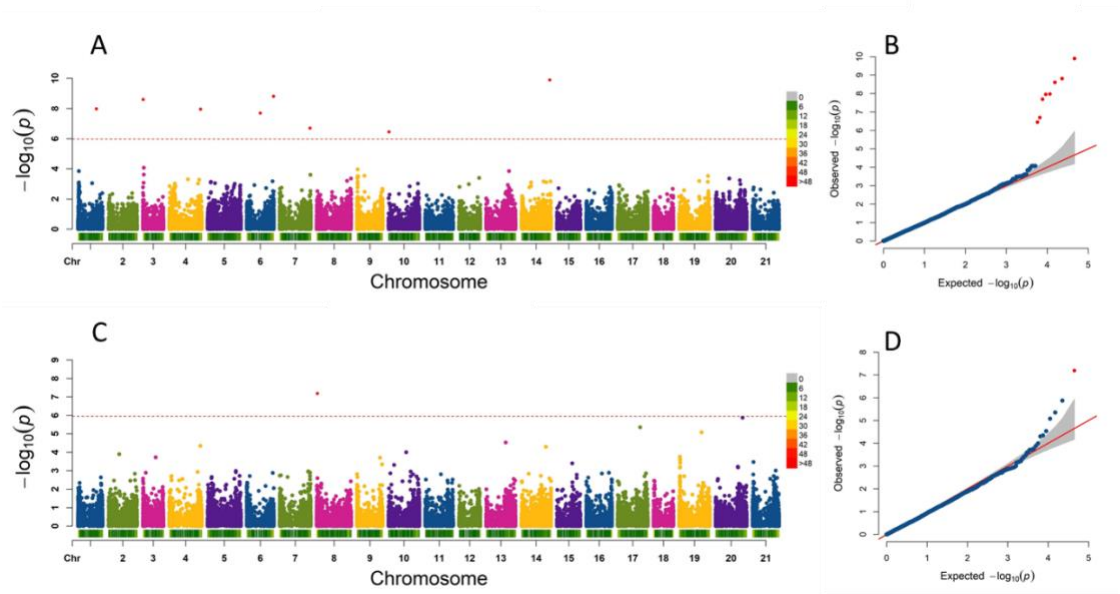
4. Grain protein content



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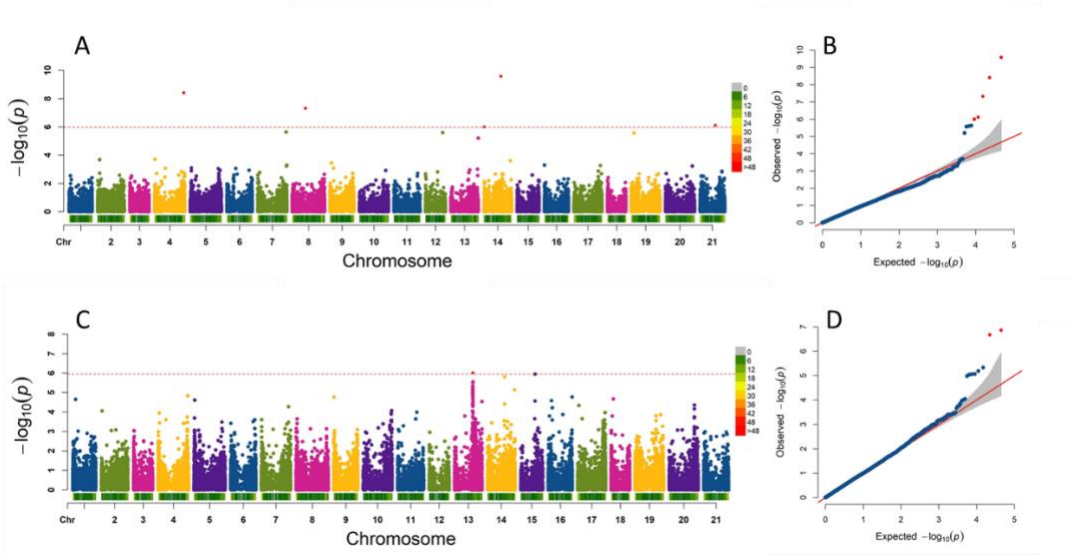
5. Gluten content



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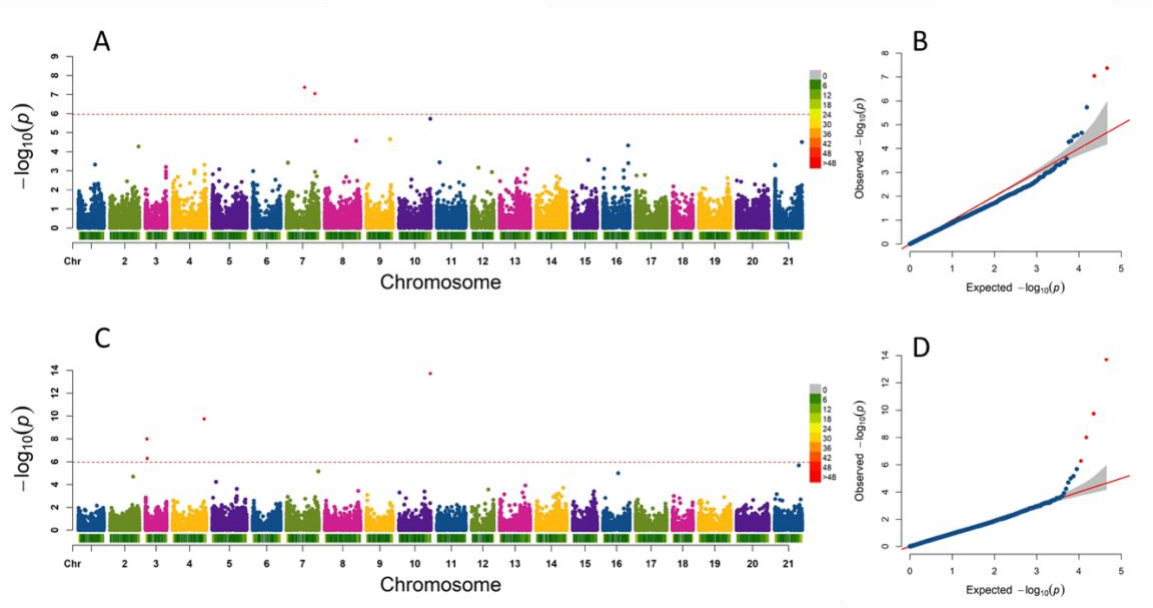
6. Grain area



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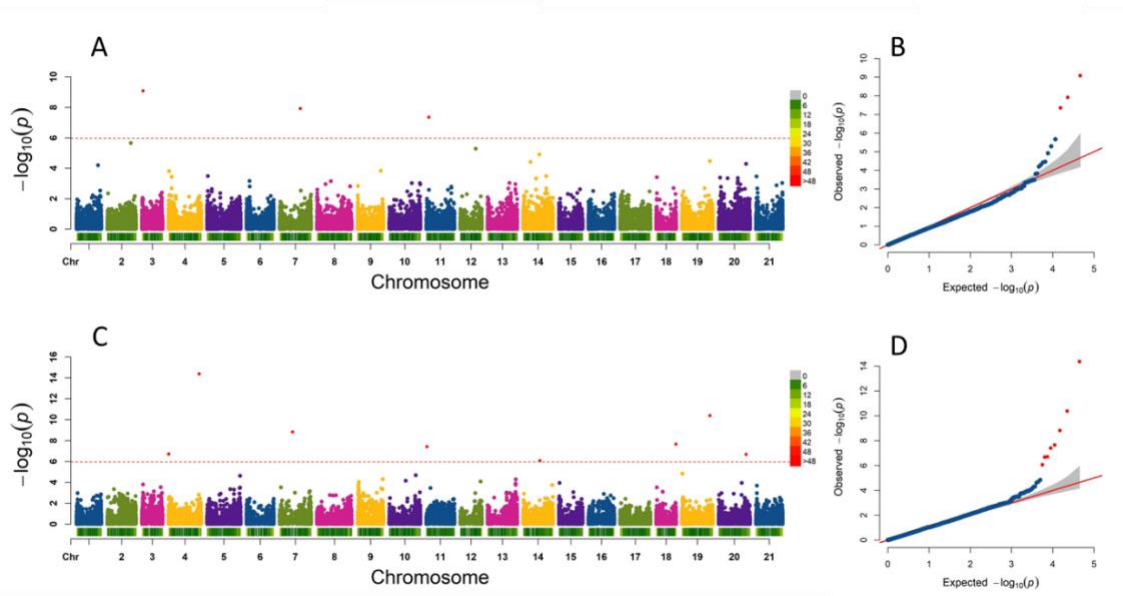
7. Grain length



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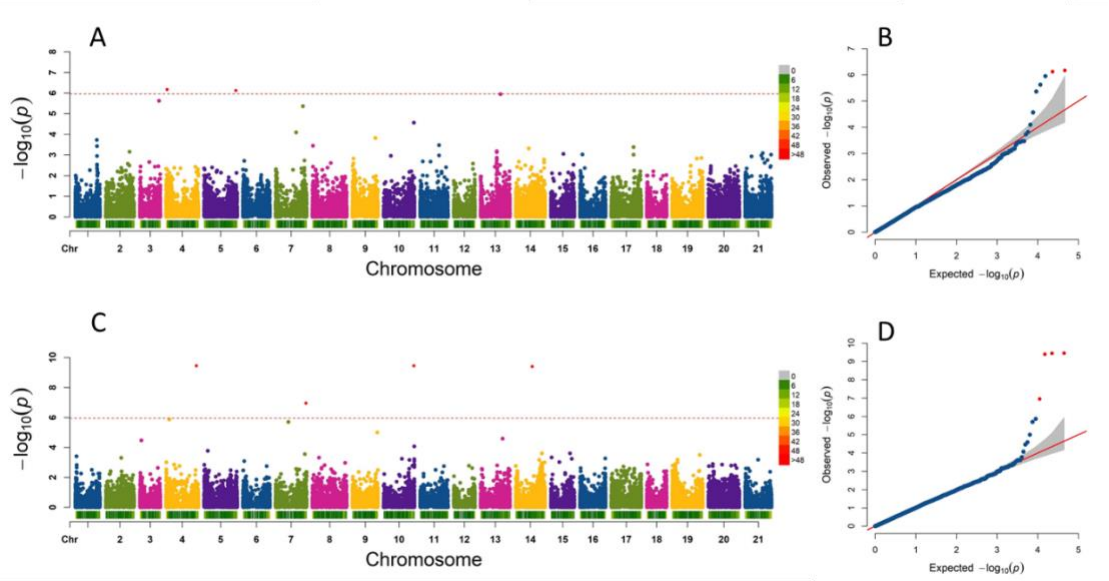
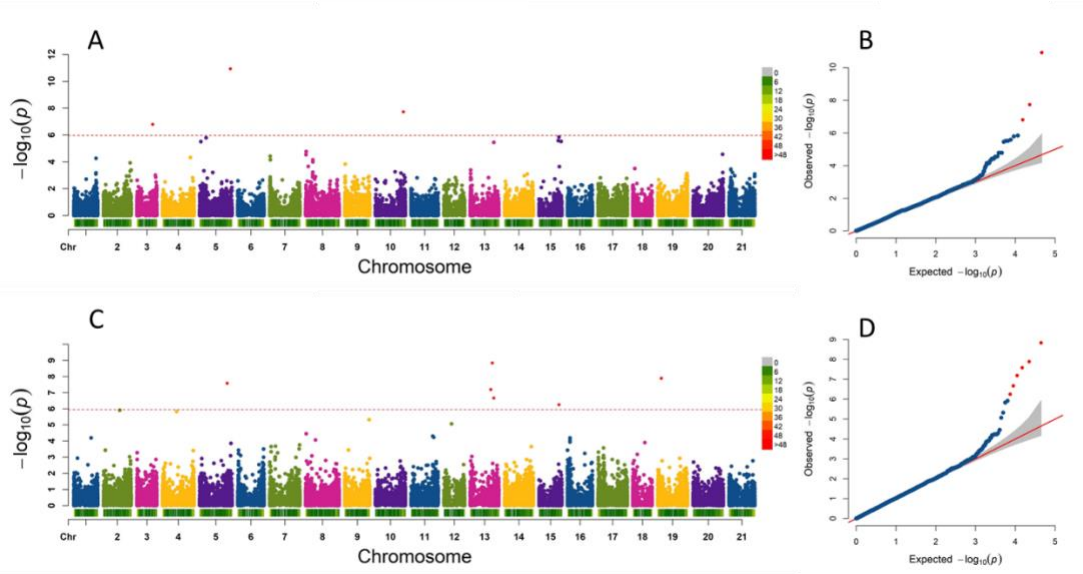
8. Grain perimeter



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

9. Days to heading



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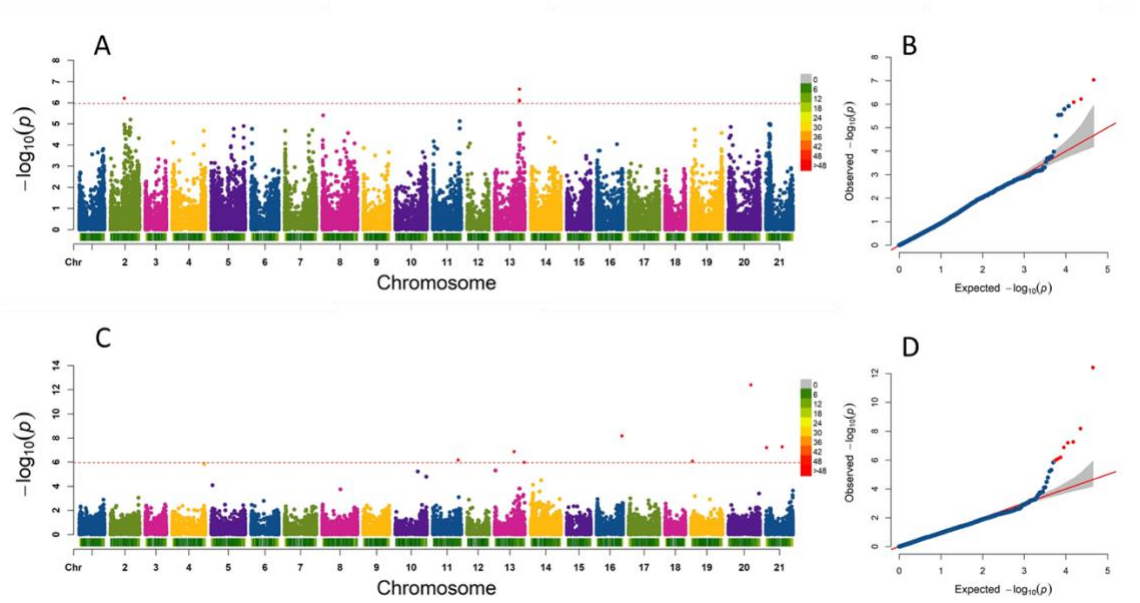
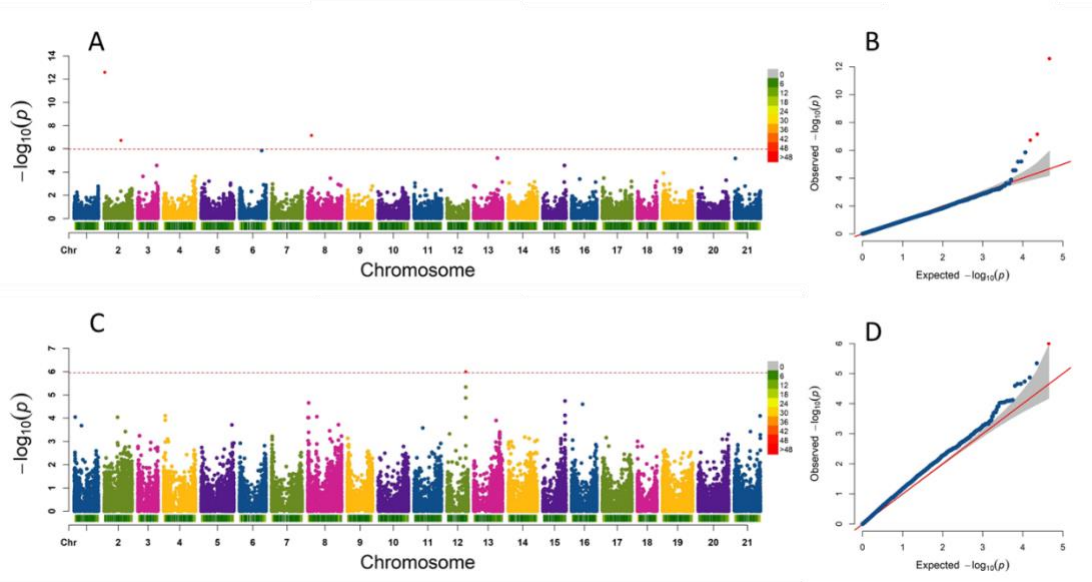
10. Harvest index



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

11. Leaf number



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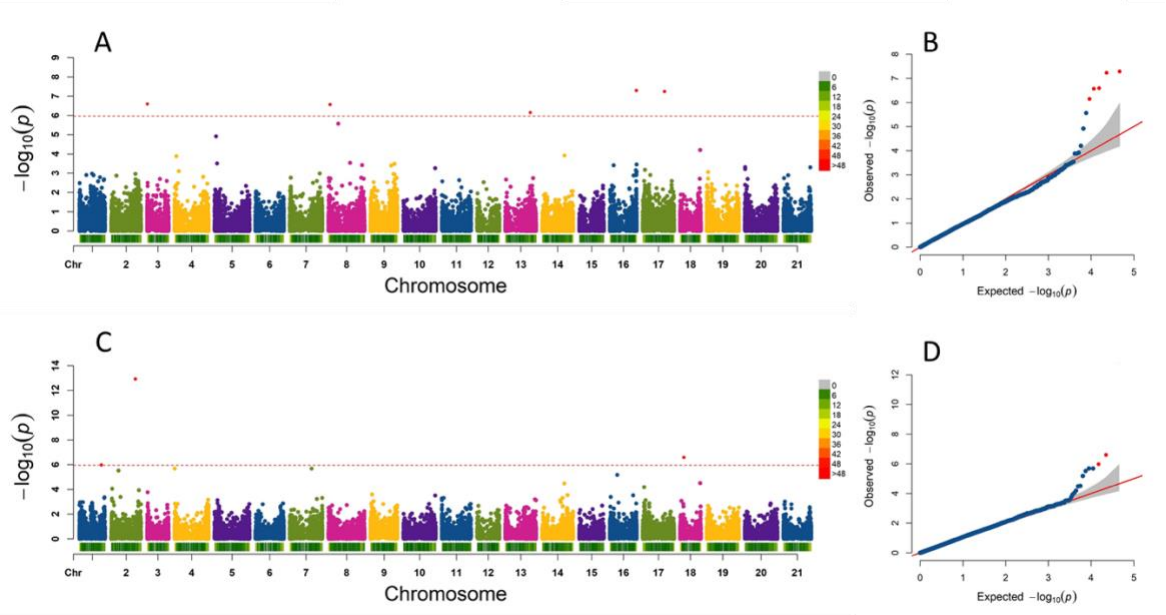
12. Leaf rust area under disease progress curve



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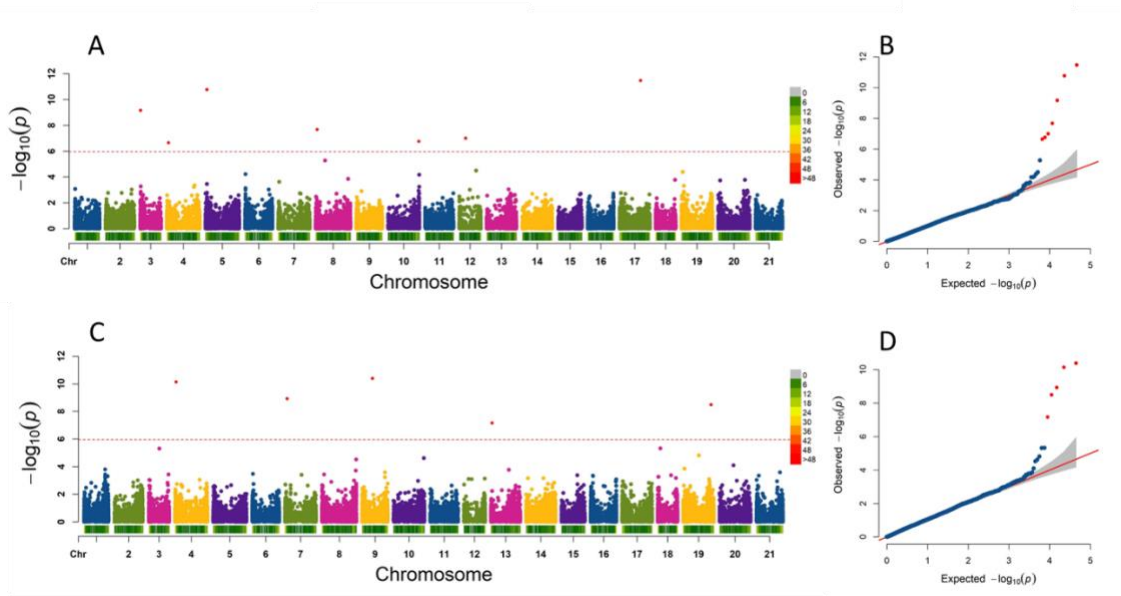
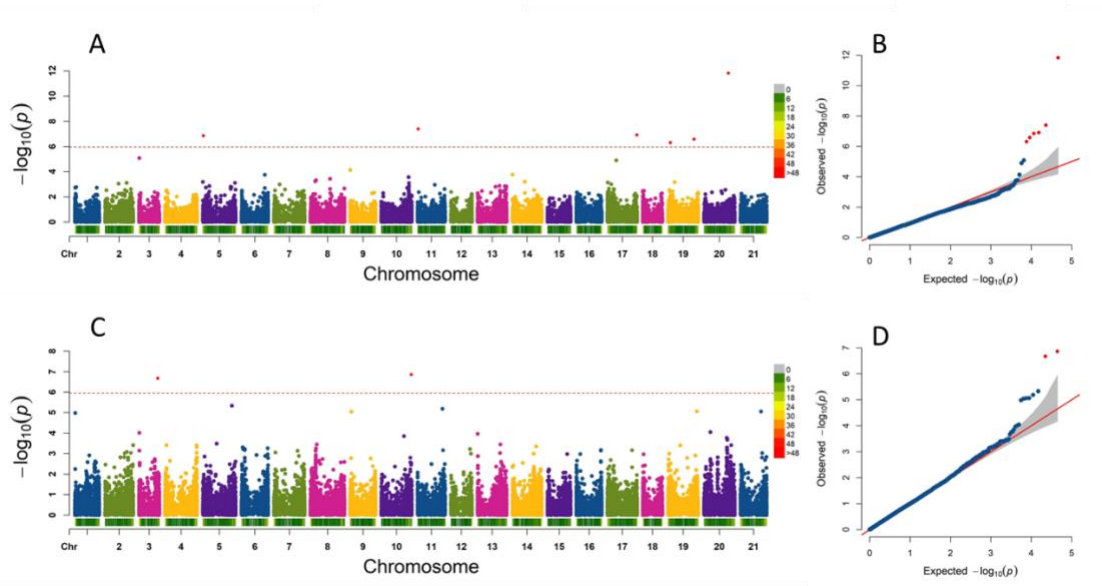
13. Leaf rust severity score



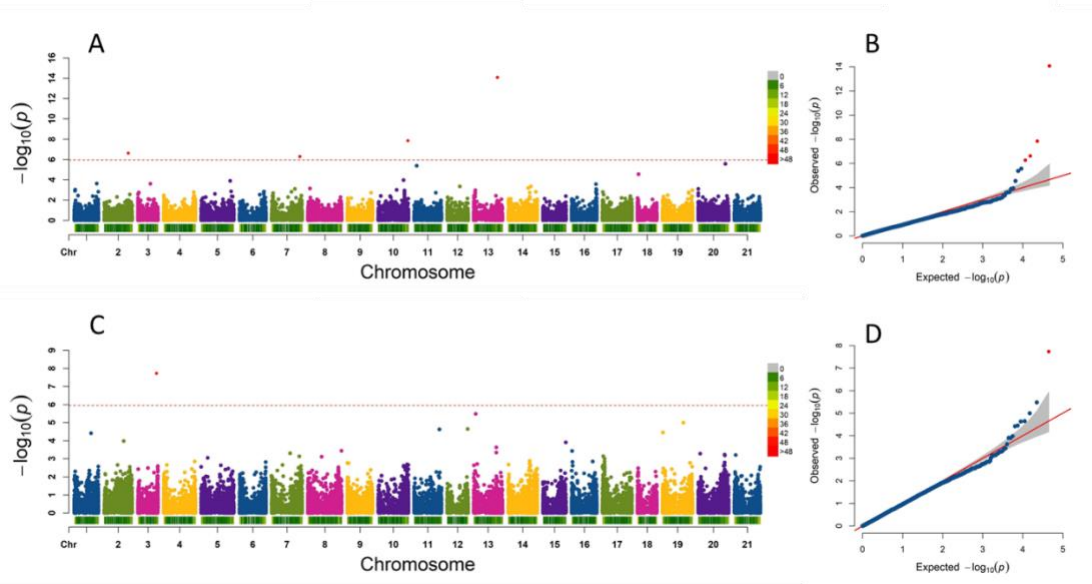
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

14. Peduncle length



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

15. Plant height



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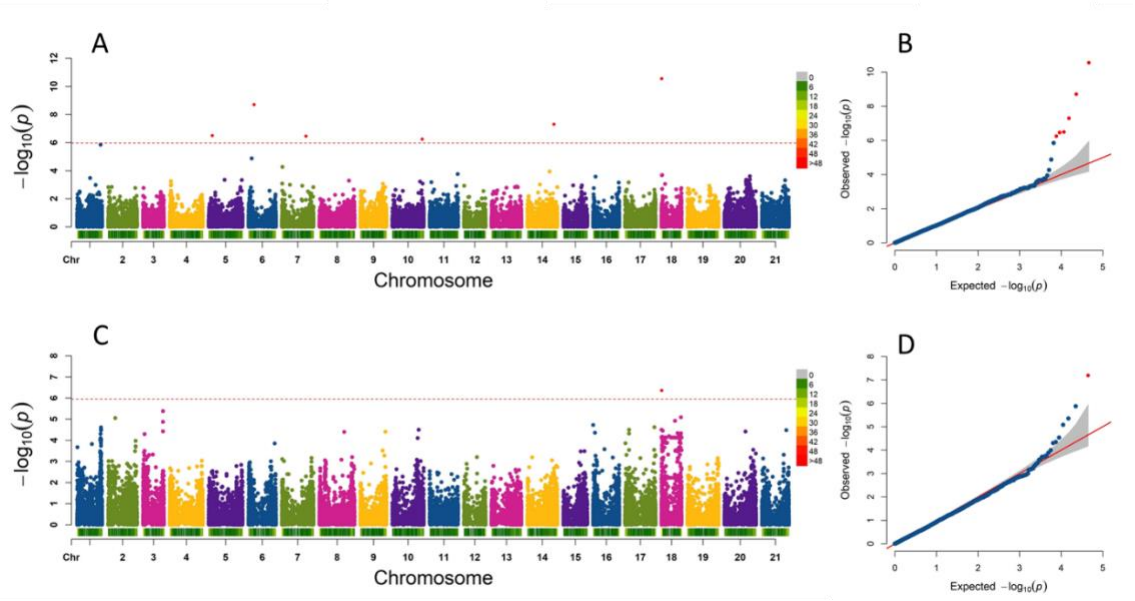
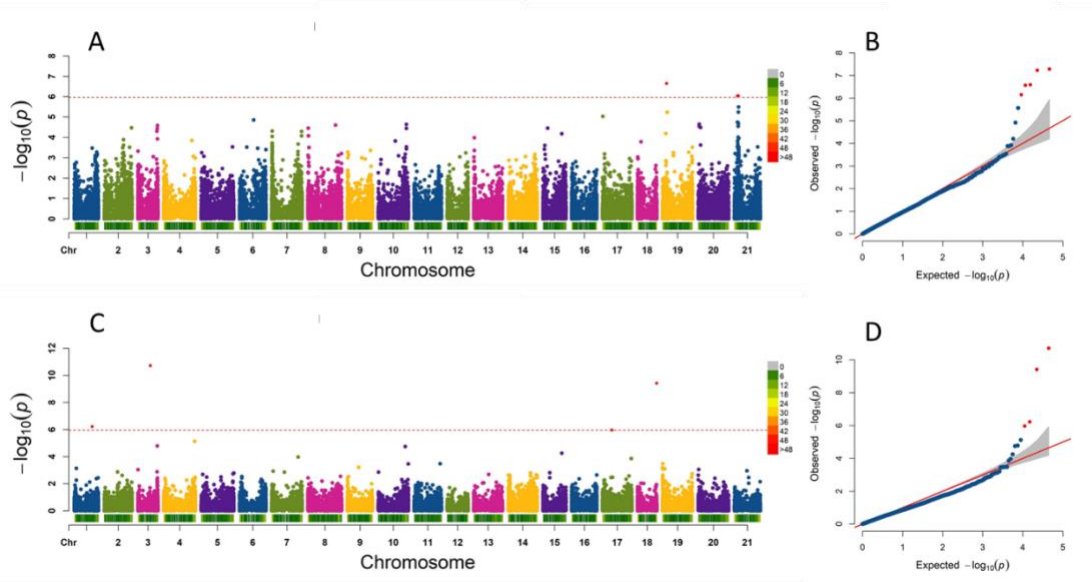
16. Powdery mildew severity score



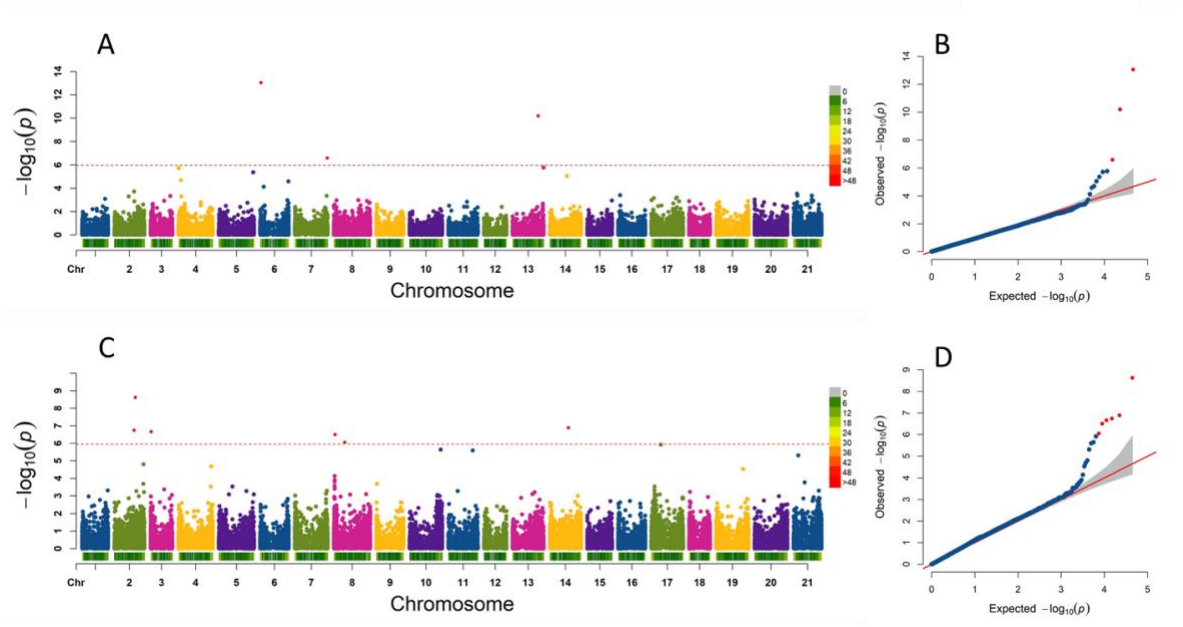
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

17. Number of plants



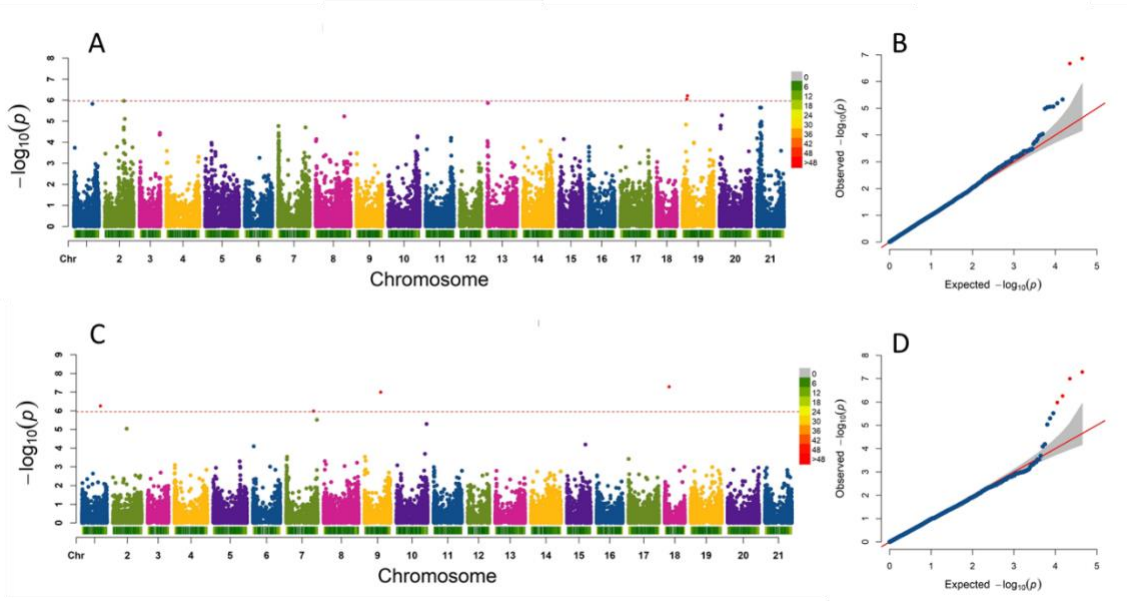
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

18. Dry plant weight with roots



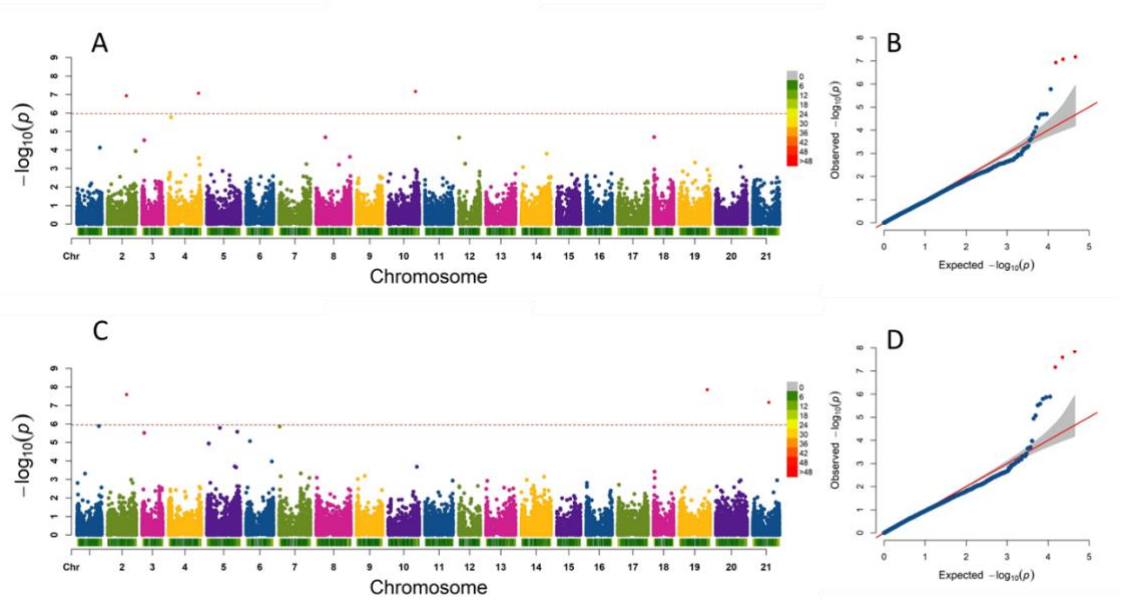
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

19. Number of spikes SNOM



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

20. Grain weight per spike



S

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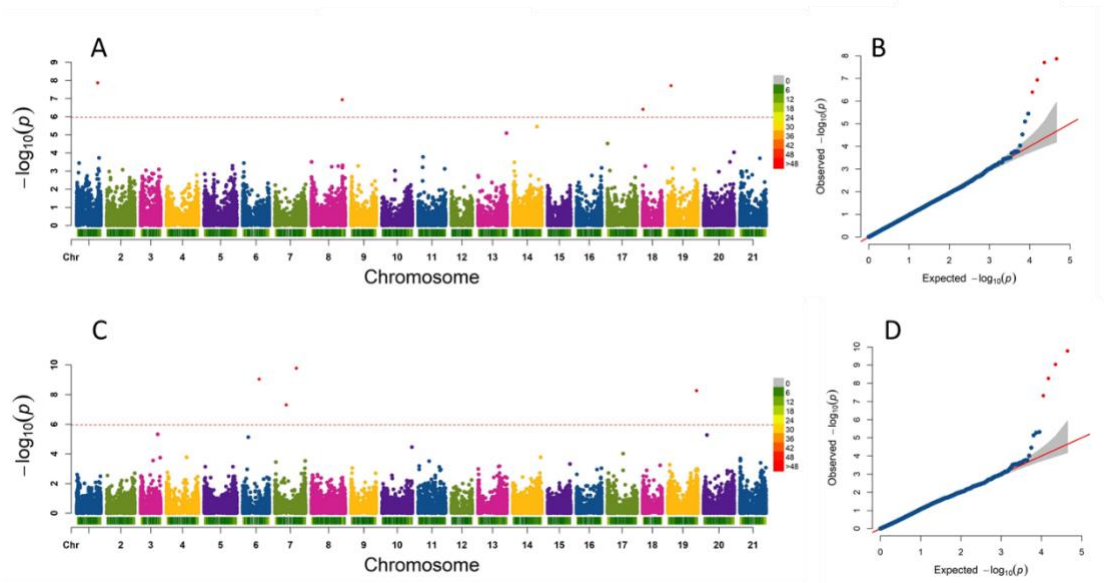
21. Spike harvest index



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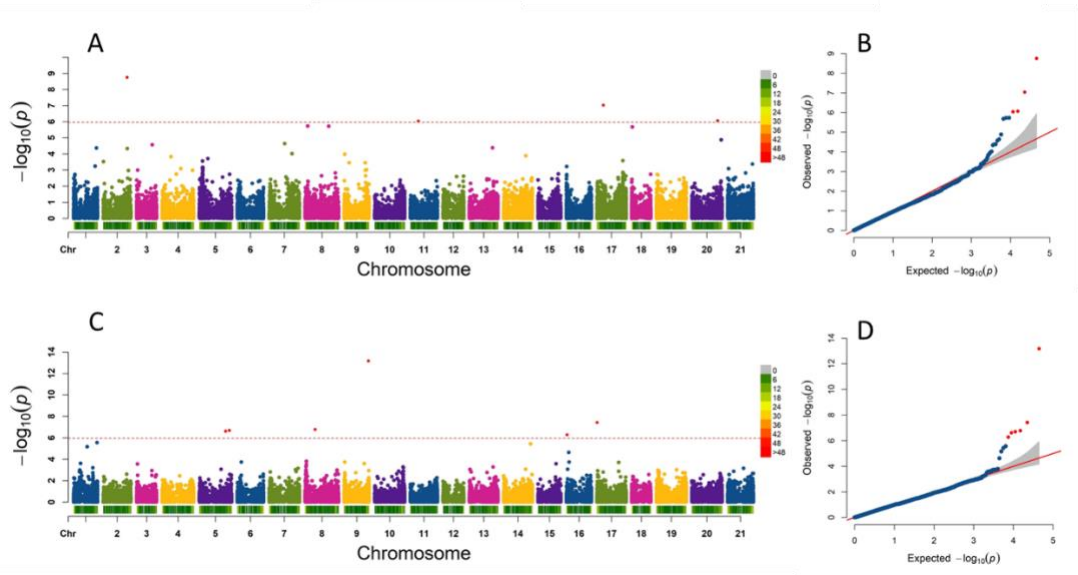
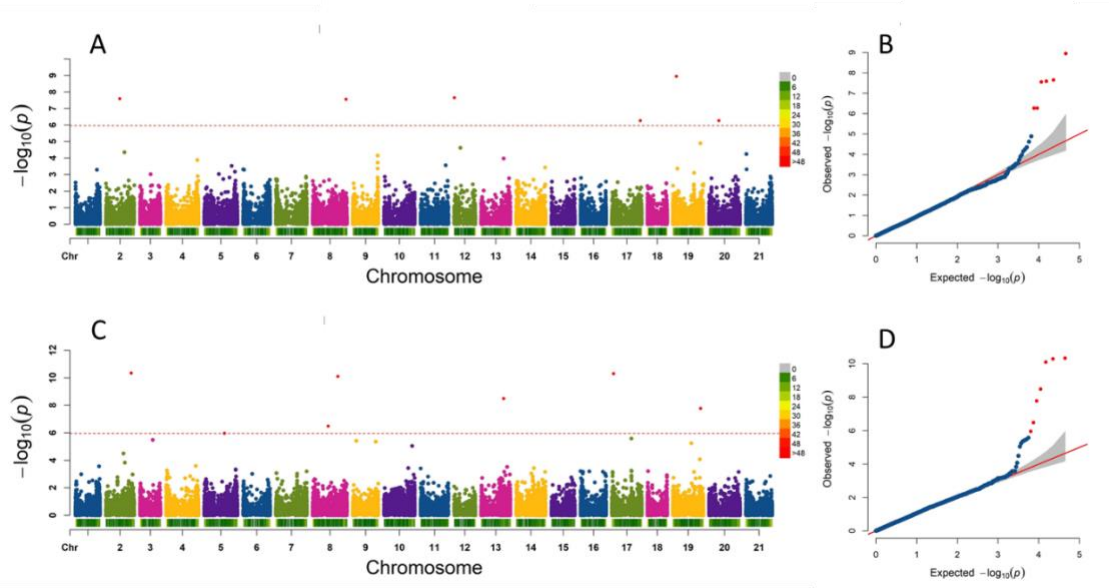
22. Spike length



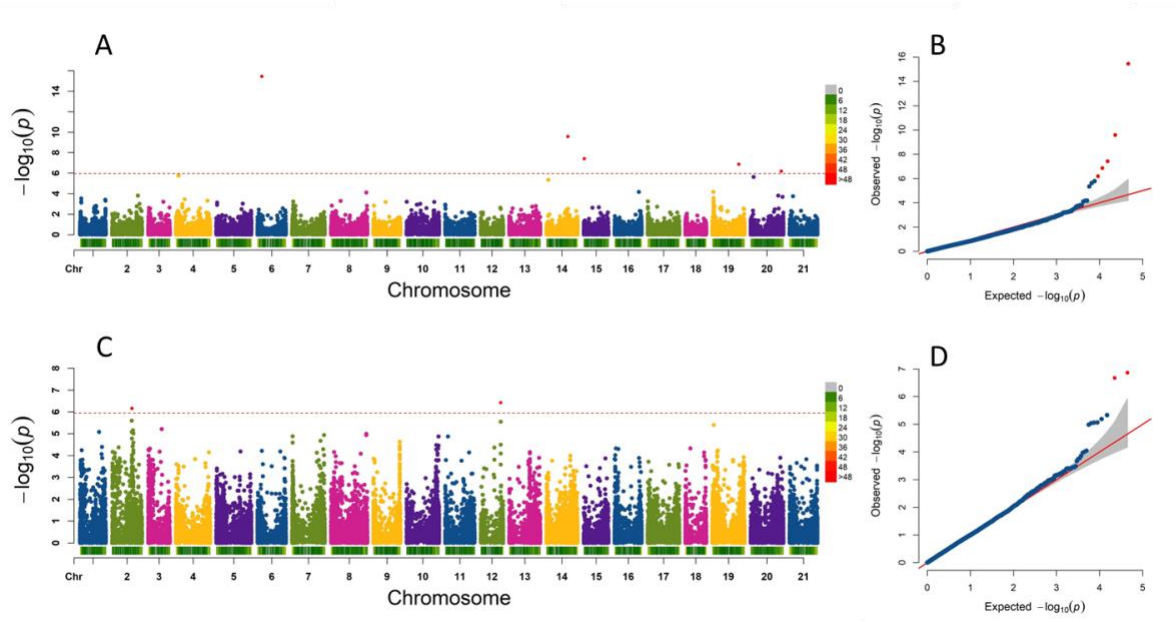
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

23. Spikelet number



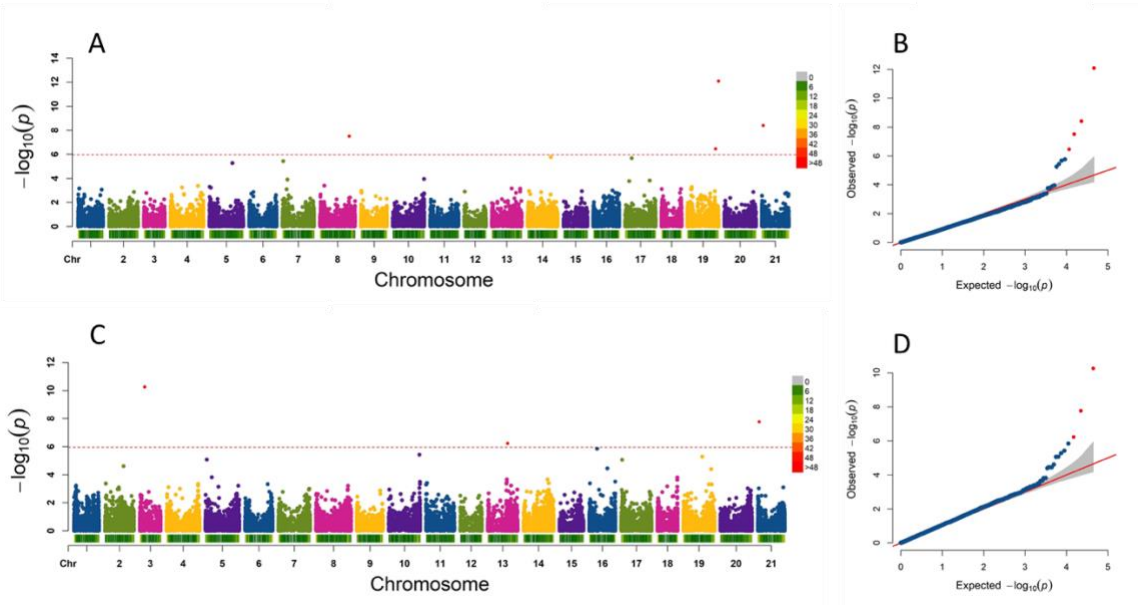
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

24. Spike weight



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

25. Stem rust area under disease progress curve



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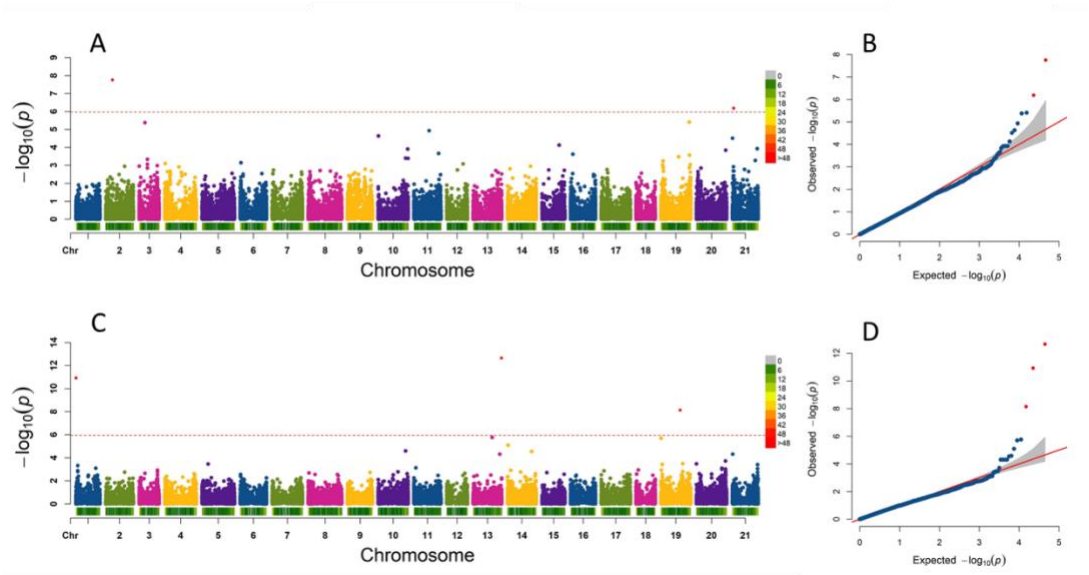
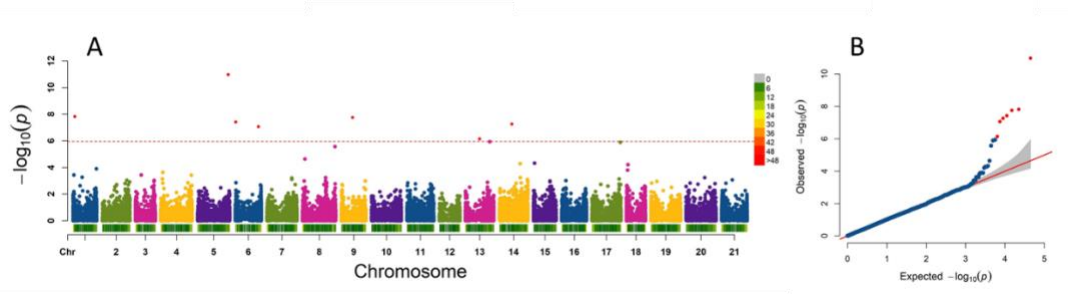
26. Stem rust disease severity score



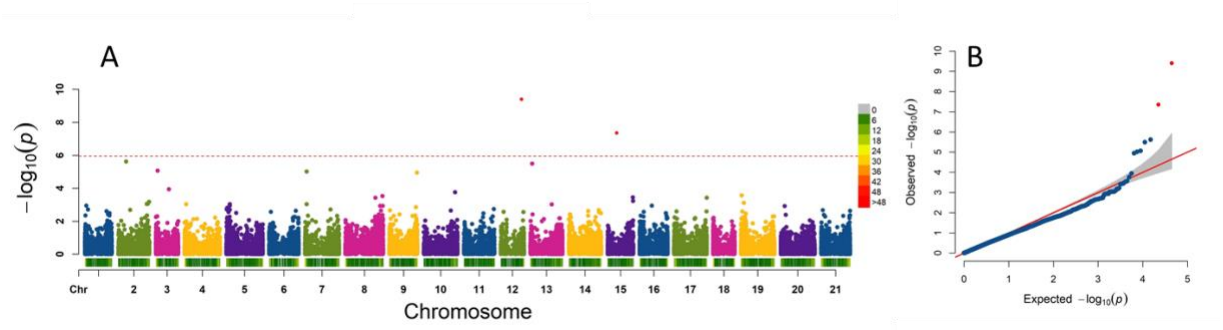
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. (C) Manhattan plot in 2018. (D) Q-Q plot in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

27. Number of productive tillers



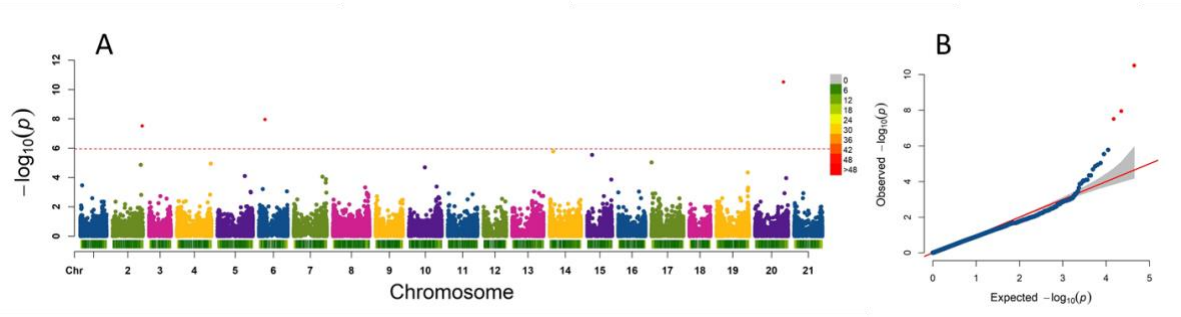
(A) Manhattan plot in 2018. (B) quantile-quantile (Q-Q) plots in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

28. Grains per spike



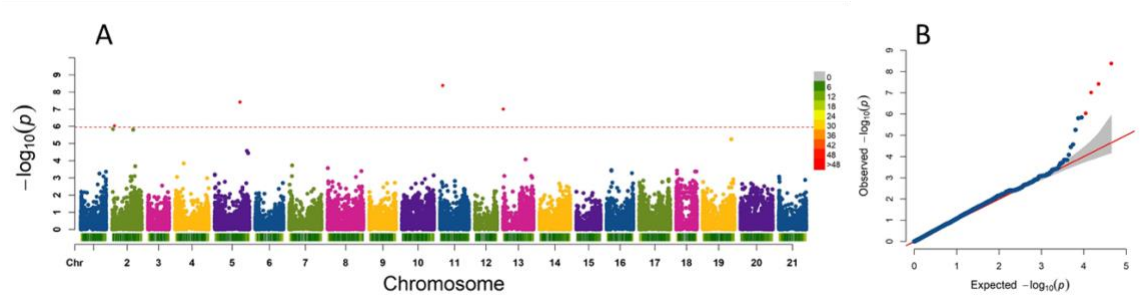
(A) Manhattan plot in 2018. (B) quantile-quantile (Q-Q) plots in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

29. Septoria disease severity score



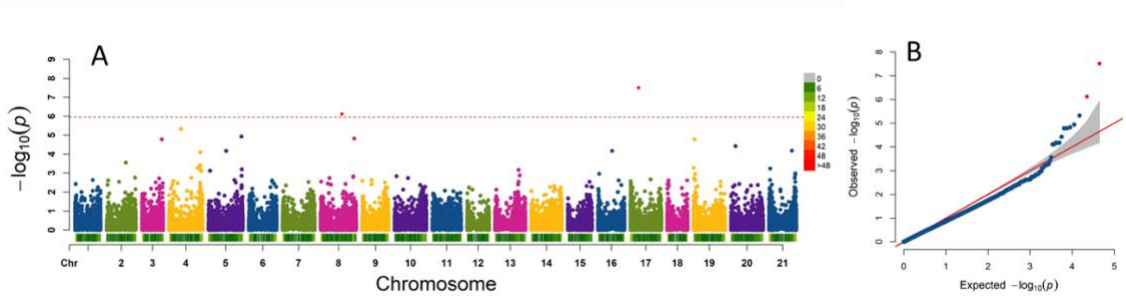
(A) Manhattan plot in 2018. (B) quantile-quantile (Q-Q) plots in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

30. Grain circularity



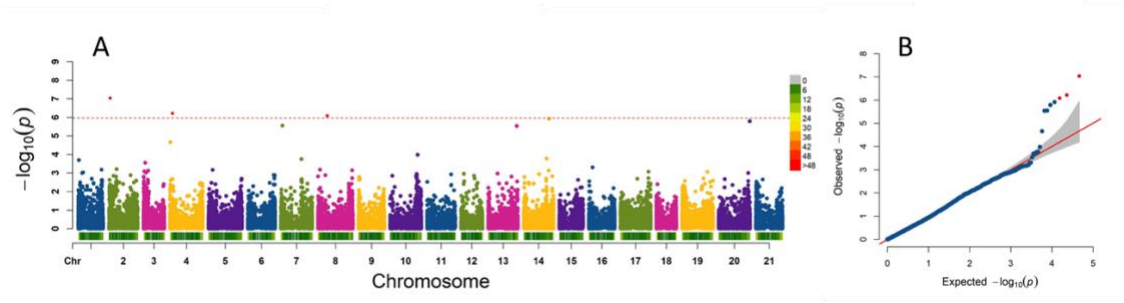
(A) Manhattan plot in 2018. (B) quantile-quantile (Q-Q) plots in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

31. Seed emergence



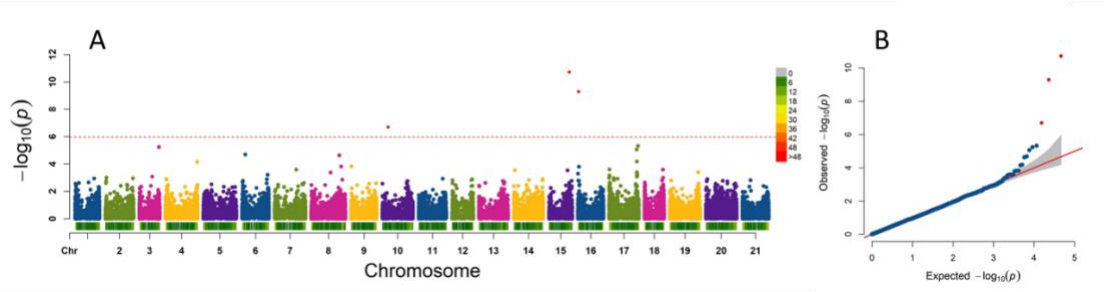
(A) Manhattan plot in 2018. (B) quantile-quantile (Q-Q) plots in 2018. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

32. Grain weight per plant 2017



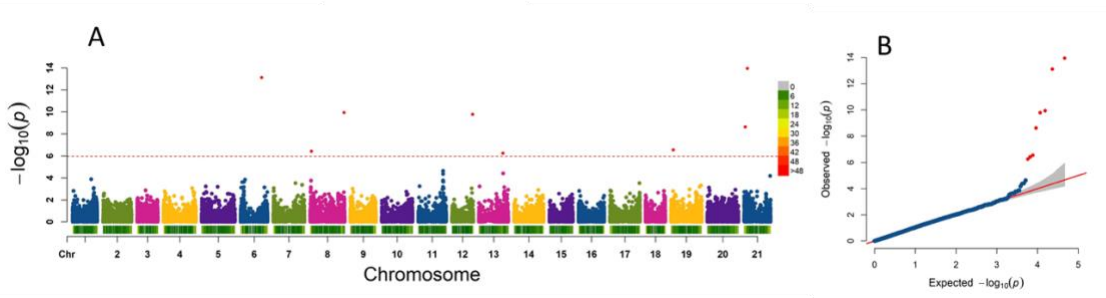
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

33. Root diameter



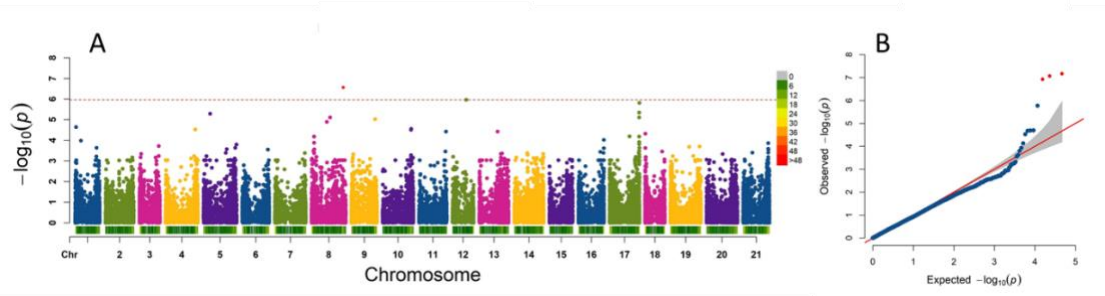
(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

34. Root volume



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].

35. Spike density



(A) Manhattan plot in 2017. (B) quantile-quantile (Q-Q) plots in 2017. The dotted red line showed the expected value at Bonferroni correction at 5% level of significance [-log10(P) = 5.97].