American fall webworm in China: A new case of global biological invasions

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The costs of invasive alien species and their management are high, with the total reported costs reaching minimum US $1.288 trillion over the past decades (1970–2017), up to US $26.8 billion per year.4,5 Therefore, interdisciplinary subjects, such as bioclimate and biometeorology, have become new research hotspots that will hopefully aid our understanding of the role of climate change in species invasion.

In China, climate change will likely increase habitat suitability for fall webworm in middle and high latitude regions. Human mobility and logistics also increase the risk of spread of the pest to new areas. The eastern farmland and managed vegetation regions are high risk areas mainly in Liaoning, Beijing, Tianjin, Shanghai, Hebei, Shandong, Henan, Anhui, Hubei, Jiangsu, and Shanxi. Fall webworm is also threatening to spread to Jilin, Inner Mongolia, Hunan, Jiangxi, Xinjiang, Ningxia, and other provinces.

REFERENCES
1. Wu, N.N., Zhang, S.F., Li, X.W., et al. (2019). Fall webworm genomes yield insights into rapid adaptation of invasive species. Nat. Ecol. Evol. 3, 105–115.
2. Tang, R., Zhang, J.P., and Zhang, Z.N. (2012). Electrophysiological and behavioral responses of male fall webworm moths (Hyphantria cunea) to herbivory-induced mulberry (Morus alba) leaf volatiles. PLoS ONE 7, e49256.
3. Takehiko, Y., Sadahiro, T., and Masakazu, S. (2008). Adaptation to the new land or effect of global warming? An age-structured model for rapid voltinism change in an alpine lepidopteran pest. J. Anim. Ecol. 77, 585–596.
4. Diagne, C., Leroy, B., Vaissière, A.C., et al. (2020). High and rising economic costs of biological invasions worldwide. Nature 592, 571–585.
5. Wang, D., and Liu, X. (2021). Behavioral innovation promotes alien bird invasions. The Innovation 2, 100167.
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DECLARATION OF INTERESTS

The authors declare no competing interests.

Figure 1. Global distribution, climatic factors involved in outbreaks, and an example of typical fall webworm infestation (A) Known global distribution of fall webworm. (B) Precipitation anomaly percentage in the invaded areas in September 2021 in China. (C) Life cycle of fall webworm. (D) Daily mean temperature in Beijing from April to September. (E) Precipitation in Beijing in September 2020 and 2021.