Invasive plants adapt to environments through trade-offs between secondary chemical responses

September 22 2020, by Zhang Nannan

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In response to shifting environments, plants may change their traits through evolutionary or ecological strategies, which enables plants to

adapt to varying abiotic and biotic environments at a biogeographic scale and a range of latitudes by producing distinct types and amounts of secondary chemicals. However, it remains unclear whether and how invasive plant chemical responses to herbivory are associated with their chemical responses to abiotic environments.

Under the guidance of Prof. Ding Jianqing, Xiao Li, who graduated from the Wuhan Botanical Garden, conducted large scale field surveys of herbivory on the invasive tallow tree (Triadica sebifera) along latitudes in both its native (China) and introduced ranges (United States), and collected leaf samples for analyses of tannins and flavonoids.

Data on climate and solar radiation were used to examine these chemical responses to abiotic environments and their variations along these latitudes and between ranges. They also re-analyzed previously published common garden data of US and China populations to investigate contributions of genetic differences to chemical concentration variation.

Results revealed higher herbivory and higher tannins for Triadica plants in the native range (China) than the introduced range (US), and that two classes of chemicals (tannins and flavonoids) differed along latitudinal gradients in both US and China.

Analyses of previously published common garden experiments indicated genetic divergence contributions to differences in these chemicals between ranges.

According to field data, the latitudinal patterns were primarily phenotypic responses to herbivory in China, while in US they were primarily phenotypic responses to abiotic environments. The variation of tannins may be linked to flavonoids, given tannins and flavonoids shared a biosynthesis pathway.

Together, the results suggest that invasive plants adjust their secondary metabolism to decrease chemicals that primarily defend against herbivory and increase those that help them to respond to their abiotic environment.

These findings deepen the understanding of how invasive plants adapt to biogeographically heterogeneous environments through trade-offs between secondary chemical responses.

This work, titled "Chemical responses of an invasive plant to herbivory and abiotic environments reveal a novel invasion mechanism,." was published in *Science of the Total Environment*.

More information: Li Xiao et al. Chemical responses of an invasive plant to herbivory and abiotic environments reveal a novel invasion mechanism, *Science of The Total Environment* (2020). DOI: 10.1016/j.scitotenv.2020.140452

Provided by Chinese Academy of Sciences