Ancient insects preferred warmer climates

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For millions of years, insects and plants have coevolved—leaf-eaters adapting to the modifications of their hosts and plants changing to protect themselves from herbivory. The abundance and diversity of both insects and plants have varied depending on changes in climate.

However, according to a study published in the November issue of *Ecological Monographs,* a journal of the Ecological Society of America, abnormally high global temperatures have historically lead to a greater diversity and abundance of insects, separate from plant diversity and adaptations.

Ellen Currano formerly from Pennsylvania State University and colleagues examined a total of 9071 fossilized leaves at nine sites of the Bighorn Basin in Wyoming that had fossils dating back 52.7 to 59 million years ago. This particular location contains fossils created during a period when global temperatures gradually warmed to the greatest sustained highs of the last 65 million years. In addition to this gradual rise, there was also a temporary spike in temperature and partial pressure, similar to the weight, of carbon dioxide in the atmosphere and a subsequent cooling period.

From the fossils during this six million year span, the researchers identified 107 plant species and recorded multiple types of insect feeding damage. They paid special attention to variations of insect feeding on one leaf, indicating the presence of multiple species of insects. By comparing these findings with the established temperature records, Currano and colleagues found that a rise in global

temperature—both gradual and abrupt—led to an increase in insect populations. Surprisingly, the increase in insect diversity and abundance was not necessarily correlated with changes in plant diversity or abundance, suggesting that warmer temperatures directly affected insect numbers.

This relationship, said the authors, can be attributed to insect migration: As temperatures rose, insects could move northward and to previously uninhabitable altitudes. These climate shifts, then, may have also caused insect migration over higher latitude land bridges connecting North America, Europe and Asia.

"Our findings indicate possible changes to come as a result of anthropogenic climate change," said Currano. "As temperatures rose some 60 million years ago, tropical and subtropical insects were able to migrate northward to Wyoming. It is likely that present-day anthropogenic warming will lead to similar distributions of insect populations and cause an increase in herbivore damage."

More information: "Fossil insect folivory tracks paleotemperature for six million years" from ESA's journal Ecological Monographs is available open-access at www.esajournals.org/doi/pdf/10.1890/09-2138.1

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