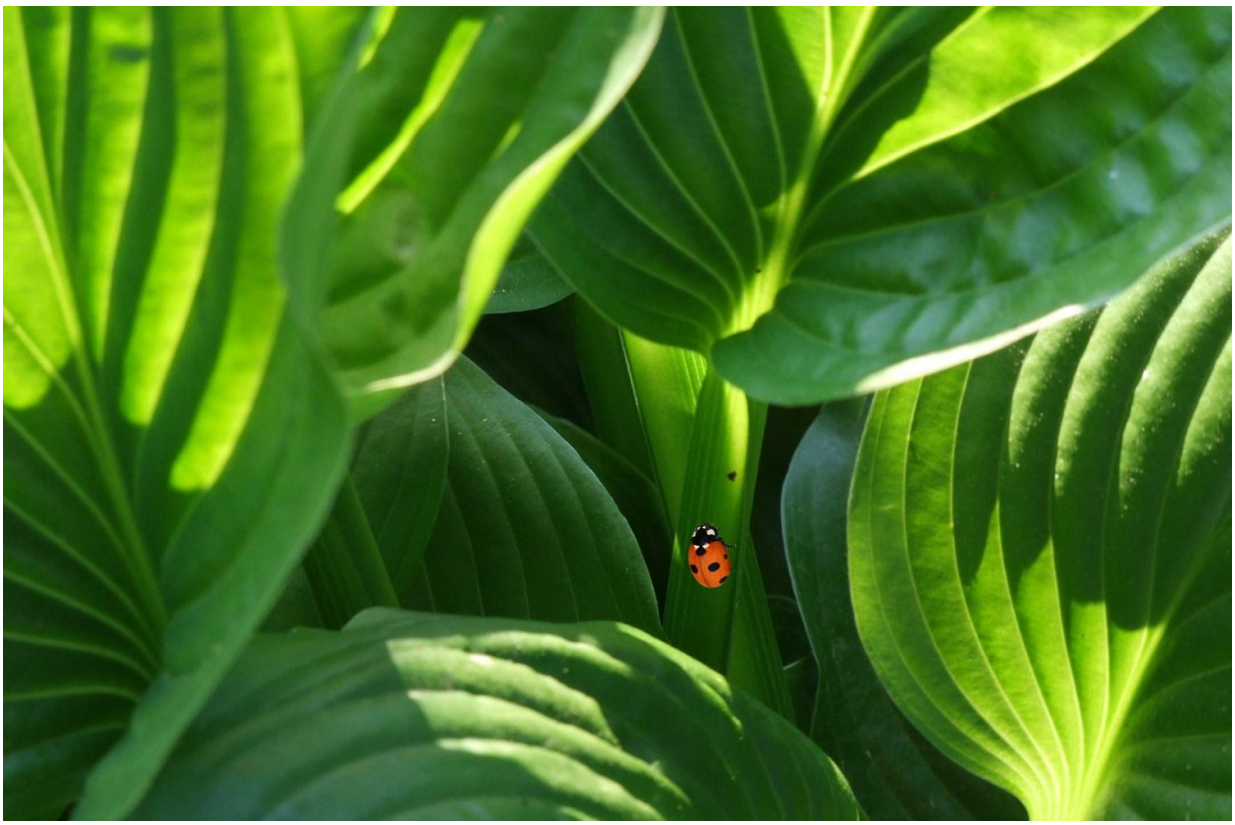
How plants use carbon affects their response to climate change

July 20 2018, by Hayley Dunning



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Under warmer conditions, plants can take up more carbon dioxide by using carbon more efficiently for growth, shows a new study.

Plants take in – or 'fix' – carbon dioxide from the atmosphere during photosynthesis. Some of the carbon is used for plant growth, and some of it is used in respiration, where the plant breaks down sugars to get energy.

The balance between the release of carbon dioxide (CO2) during respiration and fixation of carbon during photosynthesis affects the growth of the plant. Over the globe, this balance also affects the global carbon balance – how much is stored in living things compared to free in the atmosphere. The faster the rate of photosynthesis relative to respiration, the greater the rate at which atmospheric carbon is 'sucked in' by ecosystems.

As CO2 rises in the atmosphere from human input, which leads to the planet warming, the balance between photosynthesis and respiration can shift in individual plants. In a new study published this week in *Proceedings of the National Academy of Sciences*, researchers have found that in warmer conditions plants change how they use carbon—using more for growth.

By using more CO2 for growth, plants are 'fixing' more CO2 from the atmosphere as they lock it up in their leaves and stems.

Allocating carbon

Previously, scientists had measured the simple ratio between photosynthesis and respiration rate at a given temperature to estimate plant responses. However, the team have discovered a third fundamental factor that determines the ratio, called the 'carbon allocation efficiency'.

The new study, led by researchers from Imperial College London and the University of Exeter, should allow scientists to more accurately predict the response of plants to climate change using carbon allocation

efficiency.

This factor determines what happens after the CO2 is taken in during photosynthesis – whether it is used for growth or respiration. The team found that as temperatures rise, plants can allocate more carbon for growth, effectively improving their net carbon gain.

Predicting ecosystem responses

To find this out, they used a combination of mathematical modelling and data from laboratory experiments with algae. They also looked across diverse plant species, both on land and in water, and concluded that a warming-induced increase in carbon allocation efficiency is a general phenomenon.

Study co-author Dr. Samraat Pawar, from the Department of Life Sciences at Imperial, said: "Plants may be more capable of compensating the negative effects of warming on carbon fixation than previously thought, across both aquatic and terrestrial ecosystems. Our study provides a new way to better predict the effect of warming on carbon fixation by individual plants, and ultimately whole ecosystems."

More information: Bernardo García-Carreras et al. Role of carbon allocation efficiency in the temperature dependence of autotroph growth rates, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1800222115

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https://phys.org/news/2018-07-carbon-affects-response-climate.html