Tomato plant's male reproduction organs shrivel under high temperatures

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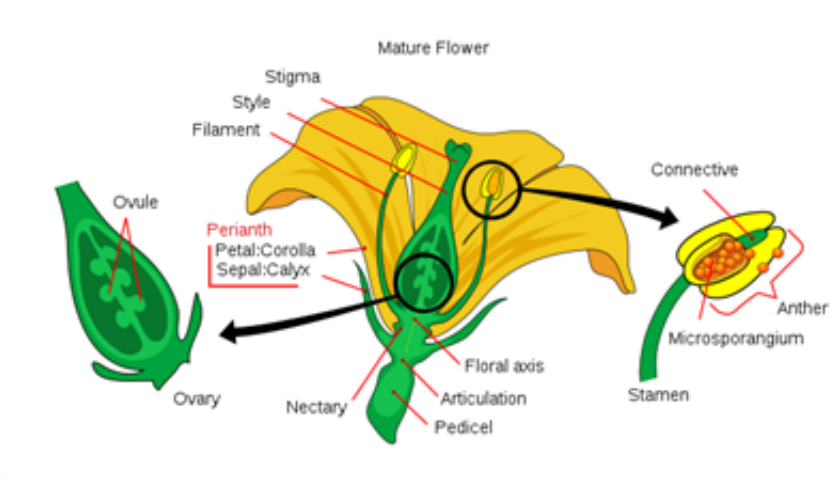

The anatomy of a flower. Credit: Wikipedia

The male reproductive organs of tomato plants can't stand the heat. When temperatures rise above 32 degrees Celsius for several consecutive days, their appearance changes and they produce less and less fertile pollen, leading to lower agricultural yields. Biologists at Radboud University published these results in *PLOS ONE* on December 9.

Rising temperatures on earth - and the increasing frequency of heat waves in particular - cause lower agricultural yields. To avoid possible problems in food supply, Ivo Rieu and his colleague biologists at Radboud University study the mechanisms behind these processes. They

wonder why flowers become sterile under high temperatures and how this disables their ability to produce seeds and fruits.

Radboud University's molecular plant physiologists focus on the tomato plant (Solanum lycopersicum). In 2014, the world production of this crop was approximately 165 million tons; The Netherlands produce 1 million tons. Furthermore, The Netherlands are a world leader in breeding, producing and selling tomato seeds.

In the *PLOS ONE* article, the researchers show that the male reproduction organs of tomato plants – the stamen, made up of a filament with an anther – become less virile under continuous high temperatures of 32 or 34 degrees Celsius (see Figure 1 and 2). The anthers deform, and the temperature reduces the pollen's quality and quantity. Through genetic analysis, the biologists discovered that these effects are caused by a lowered expression of the genes that define the floral organ identity. Ivo Rieu's research group also studies genes that provide plants with an increased heat resistance. More knowledge about these processes is useful for the cultivation of heat resistant tomatoes and other crops.

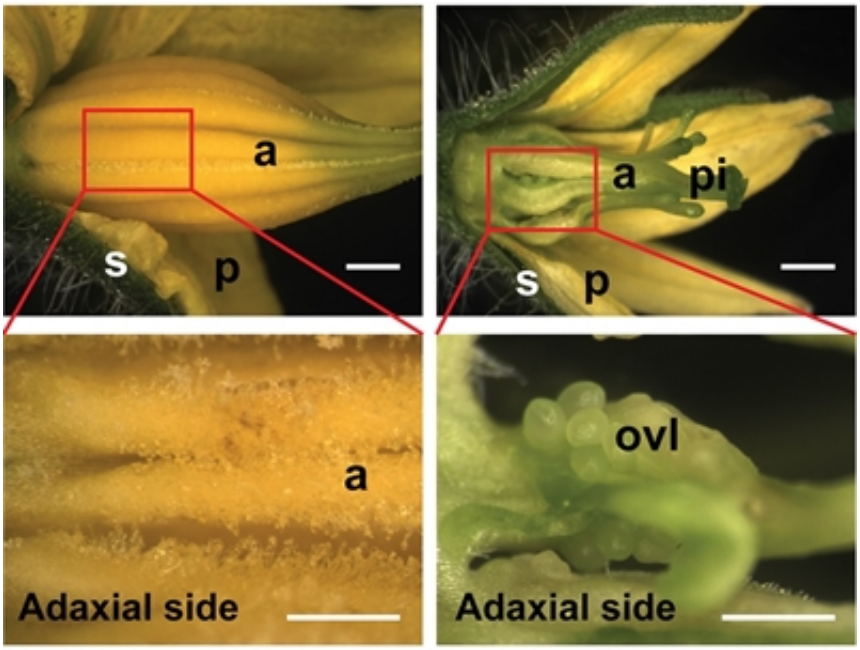

Figure 1. Left: mature flowers of a tomato plant under control conditions (25 degrees Celsius during the day, 19 at night). Right: mature flowers of a tomato plant under hot conditions (32 degrees Celsius during the day, 26 at night). Scale bar: 1 mm. Legend: a = anther, p = petal, s = sepal, pi = pistil, ovl = ovule-like structures. Credit: PLOS ONE

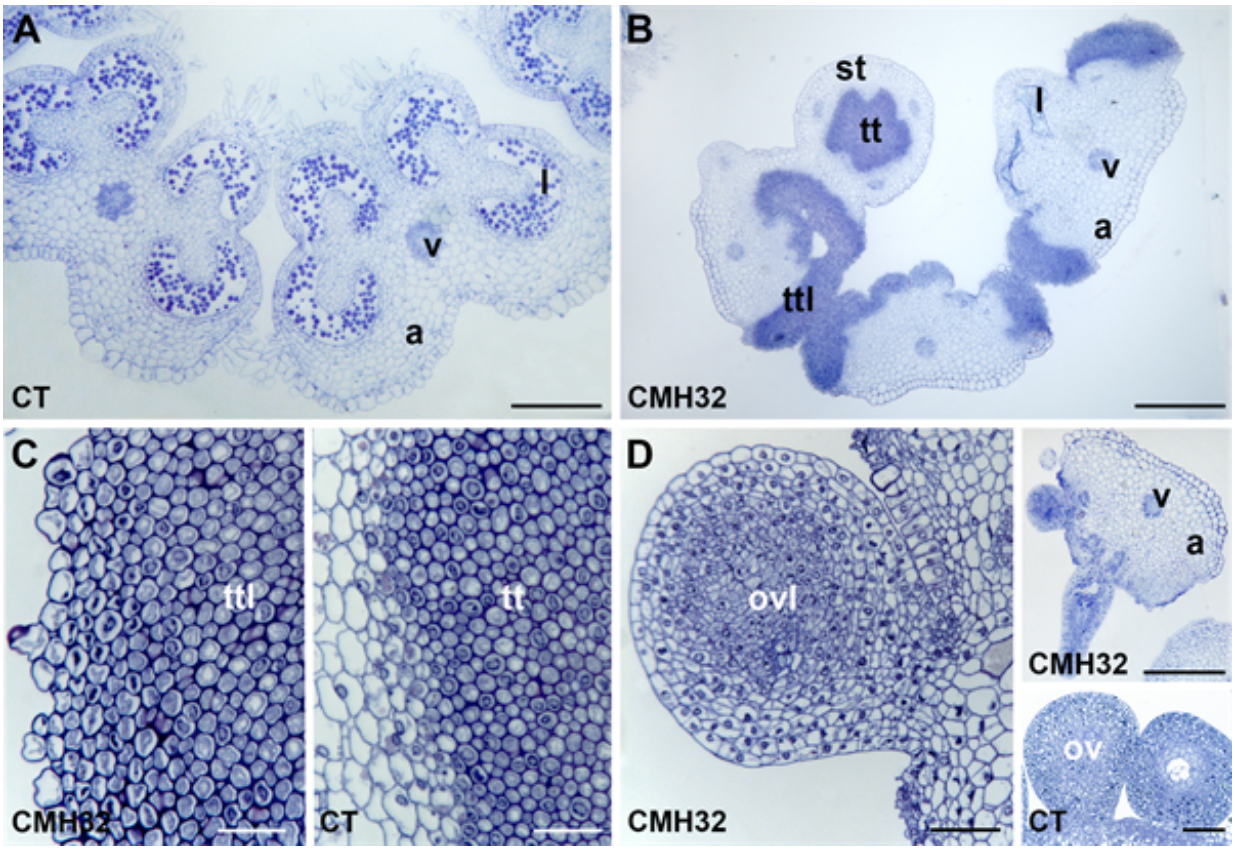

Figure 2. Microscopic images of cross sections of anthers from mature flowers of tomato plants under various conditions. A: anthers of a plant under control conditions (CT, 25 degrees Celsius during the day, 19 at night). B: anthers of a plant under hot conditions (CMH32, 32 degrees Celsius during the day, 26 at night). Scale bar: 300 µm. Legend: a= anther, l = locule, v = vascular bundle, st = style, tt = transmitting tissue, ttl = transmitting tissue-like cells. Credit: PLOS ONE

More information: Florian Müller et al. High-Temperature-Induced Defects in Tomato (Solanum lycopersicum) Anther and Pollen Development Are Associated with Reduced Expression of B-Class Floral Patterning Genes, *PLOS ONE* (2016). DOI: 10.1371/journal.pone.0167614

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