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Fog, plant leaves and deposition of droplets

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For various plants and animals, the accumulation of fog or dew droplets constitutes an essential part of their water supply. Understanding how water droplets deposited by fog or dew events interact with plant or animal surfaces is essential for gaining insight into the functionality of these surfaces. Besides being interesting within the realm of biology, this knowledge is indispensable for technical applications.

Frequently, it is advantageous to know (i) the growth rate of a droplet attached by surface tension to a surface which grows due to a given influx of fog particles, (ii) the maximum volume and (iii) the "lifespan" of a droplet before it detaches from the surface or starts to slide down along the plant surface, driven by gravity. Starting from principles of physics, we calculate quantitative expressions addressing questions (i) to (iii) for droplets which are attached to surfaces characterised by a high degree of symmetry, such as horizontally oriented or inclined planes, sections of spheres, cones and rotationally symmetric crevices. Furthermore, we treat the behaviour of droplets attached to a surface of non-constant contact angle. Although real surfaces never meet their geometric idealisations, results based on these often represent suitable and useful approximations to reality.

Finally, we apply our results to *Stipagrostis sabulicola*, a dune grass of the Namib desert which satisfies its water demand solely by capturing fog and dew droplets. Pictures taken with a scanning electron microscope show that the stem of *S. sabulicola* is longitudinally built up by alternating elevated and countersunk strips. Filling gaps in the experimental observation with theoretical speculation, the following picture emerges: Assuming that the elevated strips exhibit a higher contact angle than the countersunk strips, water droplets being deposited on the elevated strips are drawn towards the latter. The lower contact angle which prevails there increases the droplets' contact area with the plant surface at the expense of their thickness, thus expediting coalescence with neighbouring droplets. Once the droplets have grown to the critical size at which surface tension is overcome by gravitational attraction, the countersunk strips act as drainlike channels guiding the sliding droplets towards the basis of the stem and the roots.