Plant seeds survive machine washing - Dispersal of invasive plants with clothes

After a walk in the fields you will often find plant seeds, or burrs, on your trousers and socks. These clingy seeds belong to plants that specialize in using animals to transport seeds in their fur to faraway places (epizoochory). Some of these plants, however, are invasive, i.e. they are from a different region and disperse very fast while turning native plant and sometimes animal communities upside down. Therefore, it is all the more important to know the pathways of dispersal of invasive species to take specific action.

Orsolya Valkó and her team from University of Debrecen, Hungary, studied an aspect of plant dispersal which has been so far overlooked: what is the fate of seeds attached to clothes when the clothes are cleaned in a washing machine?

The researchers tested nine grass and nine forb species at 30°C and 60°C on fleece, jeans and cotton socks. All species were able to germinate without any problems after a washing cycle at 30°C. After a washing cycle at 60°C, still ten of the 18 tested species were able to germinate, although the high temperature desynchronized germination of the washed seeds. At the same time, the team tested the influence of soap on seed germination at both temperatures, but there was no difference between seeds washed with detergent, eco-friendly wash-nut or clear water.

To estimate how many seeds actually enter the washing machine after attaching to clothes outdoors, the researchers conducted a realistic experiment: five test persons were fit with fleece sweatshirts, jeans and cotton socks, and seeds were attached to the clothes. The number of seeds remaining on the clothes was counted every hour for 8 h of their normal daily activities. Highest average retention rate was found on fleece (48 %) and cotton socks (43 %), and the lowest on blue jeans (32 %). Then they washed the clothes, and counted the number of seeds in the washing machine and on the washing line. The researchers found that after the washing cycle a total of 37 % of seeds remained attached to fleece, 26 % to jeans, and 36 % to cotton. The rest of the seeds remained in the washing machine or left it with the dirty water. Seed retention rates during the day and during washing depended on plant species, with seeds with more complex appendages remaining attached to the clothes in higher numbers.

Some of the tested plants were invasive species which are in the process of range expansion in Hungary and other parts of Europe, e.g. Tragus racemosus or Cenchrus incertus. People can bring organisms to a wide range of places – even without intending to do so. Seed dispersal on clothes is the most important dispersal type that allows the establishment of exotic and potentially invasive species in otherwise isolated nature reserves with a unique and vulnerable flora. Regarding an increasing mobility of people and rising visitor numbers in national parks and nature reserves, these pathways of dispersal will become even more important in the future.

Worldwide, a total of ca. 450 clothes-dispersed plant species have been identified so far. The majority of these plants are globally widespread weeds. Despite the importance of the topic, there have been only a few studies that investigated dispersal via clothes. The number of candidate species among the total of ca. 250 000 vascular plant species will likely increase with more research. Although there are some biosafety measures on intercontinental flights to prevent seed dispersal on the clothes and shoes of passengers, there are no similar protocols on flights within Europe. Furthermore, there is hardly any possibility to check the clothes in the luggage of passengers for seeds.
Another aspect: with washing detergents becoming more and more effective, and with the aim to decrease energy demand of washing machines, lower washing temperatures have become possible and recommendable. Today 40°C is the new 60°C, which is highly desirable from the viewpoint of energy demand. At the same time, this could mean that in the future more seeds will be able to survive the washing cycle and establish in places where they are not meant to be.

Also, the discovery of a rare plant in an unusual place was the inspiration for this study: "The whole story started with a common observation:" Orsolya Valkó says, "There are always a huge number of seeds that I find on my clothes after fieldwork or outdoor activities. I noticed that the clothes were full with seeds even after washing and I wondered whether these seeds were still able to germinate. I was more than surprised when a yellow star-thistle (Centaurea solstitialis), a protected species in Hungary, suddenly germinated and bloomed under our drying line - from the concrete surface on a balcony at the third floor of a building! After this observation, I became very curious about the fate of the clothes-dispersed seeds after washing."

Orsolya Valkó will present her work on Tuesday, 11 September 2018 16:30 at the 48th Annual Meeting of the Ecological Society of Germany, Austria and Switzerland in Vienna, Austria.

The 48th Annual Meeting of the Ecological Society of Germany, Austria and Switzerland takes place from 10 to 13 September 2018 in Vienna, Austria. The motto is "Ecology - meeting the scientific challenges of a complex world". An international scientific audience will discuss recent results of ecological research from a variety of different disciplines. Highlights are the talk of Dr. Martin Sorg on insect decline (Hallmann et al. 2017 PLOSone) and the public evening lecture of Prof. Dr. Klement Tockner on the domestication of our water bodies (the talk will be in German).

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Links to resources:
48th Annual Meeting of the Ecological Society of Germany, Austria and Switzerland: https://www.gfoe-conference.de/

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High-resolution images are available on request.

For more information on the meeting, high-resolution images or to request press access, please contact: Juliane Röder, Press Officer, Ecological Society of Germany, Austria and Switzerland, Email: presse@gfoe.org, Tel: +49 (0)6421 28 23381, Mobile: +49 (0)179 64 68 958

The 48th Annual Meeting of the Ecological Society of Germany, Austria and Switzerland is taking place at the “Alte Wirtschaftsuniversität (Alte WU)“, Augasse 2-6, in Wien, Österreich, from 10 to 14 September 2018. The full programme is available here: https://www.gfoe-conference.de/index.php?cat=program

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Seeds of wild carrot (Daucus carota) on cotton socks.
Réka Kiss
Seeds of different plant species at the start of the germination experiment.
Orsolya Valkó