BioS Reports

glimpse into the activities of the Master's course „Biology in Society"

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ANIMALS AND MONEY

This part of BioSReports unravels interesting relations between animals and the economy.

Common Pine Sawfly – Mass Outbreak Potentially Causing € 3.6 Mio of Economic Damage in a Study Area of Brandenburg

by Natalia Wulff

Mass outbreaks of forest insect pests are an increasing problem[1], particularly for the forestry industry. Germany´s federal state of Brandenburg (BBG), one of the most densely forested states, comprises over 1.1 million ha of forest. This corresponds to 37% of the total area of the state, where the forestry and wood industry are the largest economic sector and entail 10% of all enterprises of the state[2]. Here, the most important and most abundant tree species is the pine tree, comprising 735,000 ha, or 67%, of the forested area[2]. In 2012, the forestry and wood sector generated 3.2 billion euros in revenue[2]. However, the economy and forest protection are frequently challenged by a multitude of plant-eating insects, among them the common pine sawfly (CPS), *Diprion pini L.*[3]. Monitoring and control of CPS are particularly challenging to forest protection due to the variable, highly adaptable and mostly unpredictable lifestyle of the CPS, and population dynamics with comparably strong dependency on climatic factors[3,4]. The annual climate determines whether CPS follow a univoltine or bivoltine life cycle. Importantly, these life cycle patterns are a key aspect in the occurring forest damage[3,5]. Throughout the common univoltine cycle, only one generation of larvae occurs and preferably feeds on pine needles from the previous year[1]. Extended warm and dry periods from April to May induce the bivoltine cycle, bearing potential for mass outbreaks. Here, first-generation larvae finish their development faster, and second-generation larvae appear within the same year, primarily feeding on needles from the current year[3]. This can pose a severe threat to plant stands[3]. This bivoltine cycle with the second larvae outbreak often comes as a surprise to forest monitoring[3]. Brandenburg pine forests have been affected several times in the past by CPS mass propagations. Recent infestations in 2005, 2009, and 2016 inflicted heavy damages[3]. Throughout the latest mass outbreak in 2016, researchers have monitored a study area of 23,000 ha within the south of Brandenburg. Identified were 1,300 ha with over 90% defoliation, which knowingly increases tree mortality significantly[3]. Assuming that such an infestation definitely leads to the death of trees and thus to direct loss of income, the economic damage for this area alone can be estimated at 3.6 million €. Costs for the entirety of Brandenburg will not be estimated here due to unknown variables and thus even more error-prone calculations. Nonetheless, costs to the state's economy which greatly exceed the estimate above must be considered. Furthermore, it must be assumed that the economic costs caused by CPS will increase in the future, as there is a continuous trend of more area being affected and increased defoliation[5].5 While the cost assessment also hinges on regional parameters such as soil properties, anthropogenic forces have a crucial impact in this context as well[3,6]. Climatic conditions promoting mass propagations include periods of heat and drought, which are expected to get worse due to human-made climate change[5,6]. Seeing as this is a growing problem, the impact of CPS on pine stands and the Brandenburg economy should be considered to be continuously monitored.

FACT CHECK

In this section students evaluate the scientific evidence behind a certain urban myth.

Hospitals as the origin of multi-resistant bacteria?

by Sabine Zantop Linares, Nina Bürger, Judy Menz, Charlice Hill, Helen Rothfuß, Nele Kheim

As the German news channel NTV and BR Wissen stated, multidrug-resistant bacteria are often called superbugs or hospital germs[1,2]. Those are bacteria, that can withstand the treatment with antibiotics, often even multiple antibiotics, and are therefore hard to get rid of. Annually, infections with multidrug-resistant bacteria cause more deaths than HIV or malaria[3].

Despite the indication of the name "hospital germ", several environments and reasons exist that enable the evolution of multidrug-resistant bacteria. The evolution of multidrug-resistant bacteria is linked to the presence and easy spread of bacteria in general, as well as the heavy application of antibiotics. In the following we examined why not only hospitals, but also agriculture and the food sector play a detrimental role in the formation and spreading.

Antibiotics can promote the emergence of multidrug-resistant bacterial strains, since the selective pressure favours the survival of randomly resistant individual bacteria[4,5]. Because bacteria pass on the resistance to their offspring, it is very likely that new resistant bacteria strains will evolve.

Bacteria spread easily in hospitals. They have many opportunities to enter the bodies of people, so called potential infection routes, due to the increasing variety of medical procedures and invasive techniques. Bacteria can also reach susceptible hosts via contact with staff or visitors. Bacteria that enter the bodies of patients can often not be combated by the body, since the patients´ immune system is often strained with previous diseases and treatments. Patients often receive antibiotics for therapy or prophylaxis. Along with the presence of bacteria and susceptible hosts, the high amounts of antibiotics are the last puzzle piece for the evolution of multidrug-resistant bacteria[4,5]. Now that multidrug-resistant bacteria had an opportunity to evolve, they have the chance to disseminate easily via human contact and medical procedures. Especially shared hospital units with multiple beds and lacking hygiene standards provide ideal conditions for the spread of multidrug-resistant bacteria in hospitals[6]. Despite the progress in health and hospital care, infections with multi-resistant bacteria continue to develop in hospitalized patients[7].

As examined, many multi-resistant bacteria can come from hospitals. However, antibiotics are also used excessively in the livestock sector. Here, antibiotics are used to control infections and improve animal growth and productivity. Because of the amount of closely kept susceptible hosts, intensive mass animal farming is an ideal ground for formation and spread of resistant bacteria[8,9,10,11]. Those bacteria are transmitted to humans by eating contaminated foods[12,13,14]. Multidrug-resistant bacteria were found in both meat and fresh produce[14].

Even though multidrug-resistant bacteria can evolve in just one infected organism, travelers can unknowingly carry such resistant strains, making this a global problem in a globalized world[17]. To summarize, multidrug-resistant bacteria do not exclusively originate in hospitals. In hospitals as well as in the livestock sector the key factor causing the formation of those hard-to-treat bacteria is the heavy use of antibiotics.

EXCURSIONS AND OTHER NEWS

Small insights in student's or professor's points of view, field trips, and other stuff.

Second generation BioS Students started their studies with a week away in Bad Schandau to get to know each other. Welcome to the Master's programme!

EXCURSIONS AND OTHER NEWS

Cell manipulation with acoustofluidics – Student job insights

by Emma Markwardt

To diagnose diseases from biofluids such as blood or urine, the sample has to be collected, prepared and analysed. Traditionally, this procedure can take multiple days and so may delay diagnosis for patients. A faster, but also cheaper and more efficient solution may be to use microfluidic devices, which only require small amounts of the sample and reagents.

In the Leibniz Institute for Solid State and Materials Research Dresden (IFW) the group around Dr Winkler researches on such a microfluidic device. The sample can be used as a whole and with the help of surface acoustic waves (SAW), blood cells and other particles can be manipulated and separated by size in a microchannel rapidly and with high precision. The separated plasma can then be used for diagnostics, e.g. cancer diagnostics.

I started working in their group as student assistant for 9h per week, and now I am also doing my Lab Rotation Advanced there. In their group I got a nice insight into a more applied field of research with an interesting combination of life and material sciences. I have the opportunity to do my own projects with supervision of experienced researchers and I can learn new techniques.

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