

Eye of the beholder

Joanne Finlay, Science Communication Specialist for the NSW Department of Primary Industries and co-curator of *Natura Morta*, interviews her colleague Murray Fletcher, Principal Research Scientist, about the ways in which agriculture and the identification of pests has changed since the scientific illustrations produced by EH (Emil) Zeck (1920s to late 1950s) and Margaret Senior (1960s)



↑ Illustration by EH Zeck of the life cycle of the codling moth

→ Illustrations by Margaret Senior of mushroom virus complex, leaf spots, wheat loose smut and diseases of potatoes

What is the purpose of the NSW Agricultural Scientific Collections?

The Plant Pathology Herbarium and the Entomological Collections were originally established as reference collections in 1890 when the NSW Department of Agriculture was founded. They are a source of information about the identities, distributions, host plants and pest status of agriculturally important insects, mites and plant pathogens in NSW.

These collections have been built up from specimens submitted by growers, members of the public and departmental advisory and research officers. Unlike the biodiversity collections held by state museums and the CSIRO in Canberra, our collections contain information not only about the specimens themselves but also host organisms and the impact on the local environment.

How important is the work of EH Zeck and Margaret Senior?

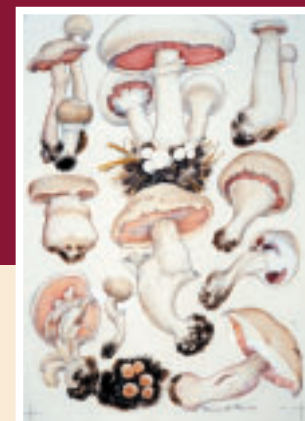
The attention to detail and taxonomic correctness of the illustrations is very important. The illustrations were created in order that people looking at the pests and diseases in real life would be able to recognise

them from the illustrations. Very often identification of the organism needs to be undertaken by a grower, consultant or agronomist standing in a crop with a hand lens.

Diagnostic features differ for different pests, which is why the illustrator needed to work in constant communication with the specialist entomologists and plant pathologists. In Zeck's insect paintings, he not only illustrated the adult insect but also the immature stages (egg, larva and pupa or egg and nymph, depending on the type of life cycle).

For diseases, the damage to the leaves might be characteristic or it might be the colour spots on the fruit, stems or even roots that need to be illustrated. Margaret Senior's illustrations are mainly of symptoms associated with disease-causing organisms (bacteria, viruses, fungi or protozoans), usually too small to be seen with the naked eye.

Today, there are new techniques for illustrating pests. High quality microphotography and digital imaging, using cameras and scanners, has meant that even line drawings are produced using computers now.





↑ Illustration by EH Zeck of the life cycle of the furniture beetle

How hard is it to identify an agricultural pest?

There are several possible pathways. Some species, such as the black orchard butterfly or the crusader bug, are recognisable to most gardeners, whilst others are immediately recognisable to most entomologists. There are a range of species, such as the vegetable weevil, pinhole borer and common brown leafhopper, that are only recognisable to specialist entomologists. However, the vast bulk of species require some special technique. Almost all mites, for example, need to be slide mounted and examined, usually by a specialist mite taxonomist. Most leafhoppers can only be identified by dissection and examination of the internal structures of the male genitalia.

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Specialist taxonomists exist for most groups of organisms, but not necessarily somewhere convenient. For example, many scale insect identifications need to go off-shore. I provide a service nationally (and internationally) for my area of expertise, which is leafhoppers and planthoppers. My colleague Danuta Knihinicki does the same with eriophyid mites. This becomes most important for quarantine incursions. A possible outbreak of fireblight in the Melbourne Botanic Gardens was examined by genetics laboratories in Sydney and Germany. The incursion of the Southern red mite in Sydney needed to be confirmed by Carlos Flechtmann in Brazil.

Have agricultural pests changed since the days of Zeck and Senior?

The main agricultural pests do change over time for a number of reasons. Firstly, agriculture itself changes.

New crops are introduced, new varieties are developed, new areas are opened up for agriculture. Each of these will attract a different range of pests and diseases. In addition, new agricultural practices will change the suite of pests associated with a particular crop.

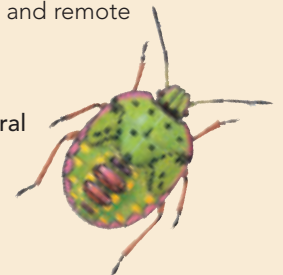
Management of chemical sprays becomes quite complex, with rotation of different chemicals used to avoid development of resistance. Increasing environmental awareness and a need to reduce non-target effects and environmental contamination has also meant an increase in research on novel means of pest control. At the same time, all the minor pest species that were controlled when the major pests were sprayed are now making a comeback.

How recent an innovation is DNA identification? How long will it be before it is more important than visual/taxonomic identification?

DNA identification is still relatively new. DNA will become an important backup but will not replace visual identification, especially for those species that are relatively distinctive. Why bother spending time extracting DNA and running tests against a library of gene sequences when you can tell at a glance what the species is?

Digital imaging helps enormously. I have taken digital photos of insects and emailed them to specialists overseas and got authoritative identifications. The new Cooperative Research Centre for Plant Biosecurity will be investigating the possibility of using robotics to allow a taxonomist to examine a specimen remotely. The specimen may be under a microscope in Perth, but is being examined by a taxonomist in London who is using computer visuals and remote robotic control of the microscope.

All Zeck and Senior illustrations are reproduced courtesy of the Agricultural Scientific Collections Trust



entomology

The branch of zoology that deals with insects

pathology

The science of the origin, nature and course of diseases

taxonomy

The department of science which deals with the classification and scientific names of organisms