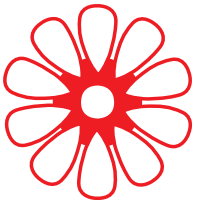

why

taxonomy matters

An age-old problem solved by taxonomy

www.bionet-intl.org/why taxonomy for health
Number 1 in a series of case studies
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Amoebic colitis and amoebic liver abscess (amoebiasis) are among the most important diseases of man. They are caused by the intestinal amoeba *Entamoeba histolytica.* In 1986, estimates suggested that about 480 million people are infected annually with *E. histolytica* of whom about 36 million develop clinical symptoms, and 40,000 die. Until 1993, the question that had vexed scientists for generations was 'Why did such a small proportion of those infected with the parasite develop serious symptoms?'

Methods

In order to address this problem, Diamond and Clark tested the decades-old hypothesis that *E. histolytica* comprises two morphologically identical species, one pathogenic, the other non-pathogenic.

Three types of evidence were used to test the hypothesis:

- biochemical evidence, using electrophoretic isoenzyme analysis;
- immunological evidence, using monoclonal antibodies;
- genetic evidence, using DNA probes to analyse genomic organization of genes, comparisons of small subunit ribosomal RNA genes, etc.

Outcomes and impacts

Following an exhaustive analysis of the data, it was concluded that the overwhelming body of evidence supported the concept that *E. histolytica* was a complex of two species: *E. histolytica* Schaudinn, 1903 (emend. Walker, 1911), which is a pathogenic species displaying varying degrees of virulence and capable of invading a variety of tissues, and *E. dispar* Brumpt, 1925 which is not capable of tissue invasion.

Lessons

The existence of two species within what was previously called *E. histolytica* has profound consequences for the interpretation of epidemiological data, for clinical evaluation of carriers and for estimating the proportion of symptomatic infections.

References: Diamond, L.S. and Clark, C.G. 1993. A redescription of *Entamoeba histolytica* Schaudinn, 1903 (Emended Walker, 1911) separating it from *Entamoeba dispar* Brumpt, 1925. Journal of Eukaryotic Microbiology 40: 340-344.

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Knowledge sharing protects crops and biodiversity across Asia-Pacific

www.bionet-intl.org/why
taxonomy for crops
21
Number 21 in a series of case studies

In the early 1980s, the spiralling whitefly, *Aleurodicus dispersus,* native to Central America, was found spreading and causing heavy damage to many agricultural crops in Asia and the Pacific Region, Australia included. It seemed to attack any "green" broad-leaved crops and fruit trees such as guava and mango. However, in Thailand and some other countries it was initially misidentified as *Bemisia tabaci, B. argentifolia* or an alien whitefly species, *A. destructor,* already present in the region for quite some time, and its potential for causing economic loss was ignored.

Methods

Following good networking and communication, a Thai entomologist visited Hawaii to learn about similar infestations. With this knowledge and the relevant taxonomic identification keys the damaging presence of the invasive alien pest as *A. dispersus* was confirmed in the Kingdom. Further, a potential biological control agent, *Nephaspis oculatus,* existed that could be introduced from Hawaii to help lessen the infestation and provide an eventual long-term control. Researchers favoured the use of biological control as the best way to avoid an eradication programme involving the widespread use of non-specific pesticides and the resulting high biodiversity and environmental costs.

Outcomes and impacts

Economic damage and crop losses have been felt in almost all the infested Asian and Pacific countries. In Thailand alone, the damage caused by this whitefly is estimated at several million US dollars over a decade spanning from the 1980s to 1990s. However, it is not known how much more economic damage the whitefly could have caused if a pesticide-based eradication campaign had been carried out. The use of biocontrol cost less than a few thousand US dollars and provided an effective long-term control. Today, *A. dispersus* is only found sporadically, causing negligible damage.

Lessons

Access to taxonomic expertise, the use of lessons learned from earlier case studies and co-operation among entomologists from other areas with infestations and facing the same economic problems led to the discovery of a highly efficacious and cost effective solution. Avoiding the destructive use of non-specific pesticides allowed application of the more sustainable biological control approach.

References: Waterhouse, D.F. and D.P.A. Sands. 2001. Classical biological control of arthropods in Australia. CSIRO Entomology, Australian Centre for Agricultural Research, Canberra. p. 559

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Vital clues

Correct taxonomic identification of many insects and other Arthropoda (spiders, scorpions, centipedes etc.) can provide vital clues to the time and location of a death. Such organisms use decaying organic matter, including the bodies of humans and animals, as a source of food. They are the first to arrive at a corpse, often within minutes of death, and the subsequent stages of decomposition are associated with different guilds (groups that share habitats or characteristics) of insects. Taxonomic information is required to identify the different guilds.

Methods

Any forensic investigation that involves entomology is based on the initial taxonomic identification of the insects that are present. By identifying the insects and applying knowledge of their biology, especially the rate at which they develop from egg to adult and the specific conditions under which certain species occur, it is possible to determine their respective guilds and stage of development. With this information the time of death can be estimated along with the probability that the body has been moved.

Outcomes and impacts

Forensic Entomology is being utilised in many parts of the world, especially in South Africa where the Police Service is making increasing use of entomologists to assist them in crime scene analysis. By establishing the time of death, investigators of a crime can identify persons who disappeared at a particular time and trace the movements of potential suspects. In South Africa, over 200 cases of murder and unnatural causes of death have been investigated using forensic entomology since 1993. These analyses have assisted in the interrogation of suspects and have been presented as evidence in court on several occasions.

Lessons

Through the use of taxonomy, detailed information regarding the classification of the insects and their life stages can be found and thus the time and sometimes the cause of death may be determined. Blowflies provide the most exact and important evidence of all the insect guilds. Forensic Entomology is a clear example of the application of taxonomy being fundamental to important social issues, namely crime investigation and prevention through successful prosecutions.

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Order out of seahorse chaos

Seahorse populations are declining globally as a result of overexploitation, habitat destruction and bycatch. Conservation assessments, planning and controls were constrained by a lack of clarity on seahorse taxonomy: one name could apply to many different species, one species could be known by more than one name, or the species might be unnamed.

Methods
A review of the entire seahorse genus *(Hippocampus)* was undertaken. This involved locating/translating original species descriptions, then visiting 23 museums in 9 different countries to check type specimens, examine large numbers of other specimens from as wide a geographic range as possible, take morphological measurements and, where feasible, take material for genetic analysis. The data were used to identify species boundaries, distinctive features for the different species, and appropriate names for each.

Outcomes and impacts
The publication of a revised taxonomy of seahorses and identification guide enabled communication among researchers and conservationists and led directly to conservation assessments (e.g. IUCN Redlist assessments) and species-specific international trade controls (e.g. through listing on Appendix II of CITES, the Convention on International Trade in Endangered Species of Wild Flora and Fauna). The CITES listing was a landmark for marine species of commercial importance that has led to similar constraints on trade in other species.

The study has also stimulated additional research on seahorses around the world, including the description of new species, the compilation of information on each species (such as distribution and population status) and genetic studies of connectivity among populations thereby furthering conservation efforts at local and regional levels.

Lessons
Updating and clarifying seahorse taxonomy was critical to the implementation of effective conservation measures including new controls on trade. The new identification guide has allowed the status of seahorse populations to be reliably assessed.

References: 1. Lourie, S.A., A.C.J. Vincent and H.J. Hall (1999) Seahorses: an identification guide to the world's species and their conservation. Project Seahorse, London. 214pp. 2. Lourie, S.A., J.C. Pritchard, S.P. Casey, S.K. Truong, H.J. Hall, and A.C.J. Vincent (1999) The taxonomy of Vietnam's exploited seahorses. Biological Journal of the Linnean Society. 66(2): 231-56. 3. Lourie, S. A. (2000) Seahorse chaos: the importance of taxonomy to conservation. Biodiversity. 1(2): 24-27. 4. An updated (2004) version of the Seahorse Identification Guide can be downloaded from the WWF website: http://www.worldwildlife.org/trade/seahorses.cfm. 5. IUCN Redlist seahorse population assessments: www.iucnredlist.org.

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Why
Taxonomy Matters

The origins of taxonomy - the science of discovering and naming life on earth - lie in the 18th century when Linnaeus developed his famous naming system. His students and their successors have devoted lifetimes to collecting specimens and poring through literature up to 250 years old in their quest to name and describe species. At first glance, the outcomes of their work may not look relevant to society. In fact, taxonomists are often perceived as specialists pursuing eccentric interests relevant only to natural history museums and universities. **Some ask: is this a science that is needed in the 21st century?** **We say it is. Taxonomy does matter.** It is very relevant to today's challenges. Whether you live in the centre of London, the outskirts of Timbuktu, or in a high mountain valley in Nepal, taxonomic knowledge can improve and, at times, even save your life. Taxonomy and the work of taxonomists should not be underestimated. Its impacts on society are often beneficial, sometimes in unpredictable ways. Did you know that the work of taxonomists has improved Namibian roads and ensures the safety of Chinese medicine? In this series of case studies we see **Why Taxonomy Matters.** We see how taxonomic knowledge is applied around to the world to save LIVES, save CROPS, save HABITATS, save SPECIES, save MONEY and more… For the full set of case studies, see the Why Taxonomy Matters pages of BioNET's website. For a sample, read on.

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