# Authentication of Chinese plants helps deliver safe medicine

case study 3

**In 1999 two cases of kidney failure resulted from the use of a Chinese herb called *Aristolochia manshuriensis* (Chinese name: *Guan Mu Tong*) prescribed by practitioners of Chinese herbal medicine.**

**Methods**
Botanists identified the contents of two herbal prescriptions (comprising a variety of loose dried plants) using gross morphological characters (i.e. characters visible to the naked eye). Key to the successful scientific naming of these plants was comparison with reference plant material, which included herbarium specimens whose identity had been confirmed by plant taxonomists. Once one of the ingredients, *Aristolochia manshuriensis* had been identified in both prescriptions, the *Aristolochia* material underwent chemical chromatographic analysis to check for the presence of renal toxins called aristolochic acids. These were found in both prescriptions. The patients involved underwent thorough toxicological investigation to eliminate all other possible causes of renal failure.

**Outcomes and impacts**
Recognising the potential severity of adverse reactions to this plant species, the then Medicines Control Agency (MCA) of the UK Department of Health passed new legislation in 2001 banning the manufacture, import, sale or supply of any unlicensed medicine in the UK which contained herbs in the *Aristolochia* and *Mu Tong* group. The RBG Kew undertook further research to improve detection methods for aristolochic acids, especially in unlicensed multi-ingredient patent herbal remedies.

**Lessons**
The design and implementation of scientifically rigorous herbal authentication systems are vital if herbal medicine is to be safely practised in the UK. Without such systems, herbal medicine has the potential to cause life-threatening adverse reactions. Furthermore, plant taxonomic expertise is an essential prerequisite for the construction of such herbal authentication systems.

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**References:** 1: http://www.rbgkew.org.uk/scihort/ecbot-cmpac.html; 2: Lord, et. al. 1999. Nephropathy caused by Chinese herbs in the UK. The Lancet, vol. 354, August 7: 1999, pp. 481-482; 3: Kite, G.C. et al. (2002) Detecting aristolochic acids in herbal remedies by liquid chromatograpghy/serial mass spectrometry. Rapid Communications in Mass Spectrometry, 16(6):585-590; 4. The Medicines (Aristolochia and Mu Tong etc.) (Prohibition) Order 2001 SI 1841.

**Relevant sector:** Medicinal plants; Toxicology; Trade.

**Geographic location:** United Kingdom.

# Significant cost savings in road maintenance result from comprehensive taxonomic surveys

case study 19

**Namibia has an extensive all weather gravel and surfaced road structure network. In the northern parts of Namibia, where less arid conditions and higher biological diversity prevail, extensive shallow termite burrowing adversely affects the structural integrity of roads. Deterioration of road surfaces due to subsurface collapse leads to road-safety problems, higher maintenance costs and the need to regularly rehabilitate roads.**

**Methods**
A comprehensive survey and taxonomic treatise on Namibian termites was used to provide advice on the species that are likely to be of concern and how to prevent these negative impacts.

**Outcomes and Impacts**
Following comprehensive taxonomic surveys, contract requirements for road construction in certain areas of Namibia now include provision for extensive treatment of successive layers with persistent pesticides and repellents to reduce burrowing activity by termites, primarily those species that construct extensive, shallow underground galleries. No figures are available to determine cost implications, but the reduced road maintenance costs and greater safety resulting from higher standards of roads have been significant.

**Lessons**
Comprehensive taxonomic surveys bring unexpected benefits. Accurate knowledge of species diversity and distribution allowed for an evaluation of the occurrence of species capable of damaging the structural integrity of roads. Problem species should be accurately identified and surveyed to allow the implementation, where necessary, of precautionary steps to counter particular problem species.

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**Reference:** Coaton, W.G.H. & Sheasby, J.L. 1972. Preliminary report on a survey of the termites (Isoptera) of South West Africa. Cimbebasia Memoir 2.

**Relevant Sector:** Civil engineering; Road maintenance; Road Safety.

**Geographic Location:** Namibia; southern Africa.

# Taxonomy applied to control an invasive species without the environmentally damaging and costly use of pesticides

case study 21

**Around 1980 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 thought to be *Bemisia* tabaci, B. argentifolia or an alien whitefly species, *A. destructor*, already present in the region for quite some time, and its potential economic importance was ignored.**

**Methods**
Following good networking and communication, a Thai entomologist visited Hawaii to learn about similar infestations. Application of this new knowledge and use of the relevant taxonomic keys led to the definite identification of this invasive alien pest as *A dispersus*. Further, a potential biological control agent existed in Hawaii that could help lessen the infestation and provide an eventual long-term control. Researchers favoured the use of biological control as they wanted to avoid the high biodiversity and wider environmental costs that would result from widespread use of non-specific pesticides. A coccinellid, *Nephaspis oculatus* (formerly *N. amnicola*) was introduced from Hawaii in 1984 to control the infestation.

**Outcomes and Impacts**
The economic damage and loss 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 introduction of the coccinellid to control this whitefly 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 and keys, the use of 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 solution. Avoiding the destructive use of non-specific pesticides allowed application of the more sustainable biological control approach.

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**Reference:** 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

**Relevant Sector:** Biodiversity conservation; Agriculture.

**Geographic Location:** Thailand; Asia; Pacific.

# Identification of marine hotspot allows for protection of biodiversity and spawning ground from fishing industry

case study 25

**Many of the world's marine biodiversity hotspots have been over fished. These hotspots are seldom recognised as such due to a lack of taxonomic information.**

**Methods**
Surveys and more detailed programmes of sampling and identification were undertaken.

**Outcomes and Impacts**
Sampling revealed that an area of seafloor approximating 20 x 10 square km is the most diverse so far known for the New Zealand region, with high levels of local endemism. New hydroid, gorgonian, and barnacle taxa also occurred in the samples. The hitherto unsuspected species diversity of macrobenthos in this small area of seafloor off northern New Zealand resulted in the Ministry of Fisheries closing the area with the greatest number of species (in the 50-70 m depth zone) to trawling, Danish seining, and commercial scallop dredging, effective from 11 November 1999, to allow areas of affected habitat to regenerate.

**Lessons**
Only detailed, authoritative taxonomy allowed for the recognition of this area as New Zealand's marine-biodiversity hotspot, and thus for the protection of the area from fishing activities. Now, testable hypotheses based on geography, tectonics, hydrography, and the biology of the organisms themselves can be developed to explain this diversity and the area will be able to provide a spawning ground for the surrounding fishing industries.

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**Reference:** 1. Ocean Biogeographic Information System (OBIS) International Committee: <http://www.obis.org>. 2. Species 2000 Taxonomy Group: <http://sp2000.org>.3. Species 2000 Asia-Oceania Working Group: <http://www.sp2000ao.nies.go.jp/index.html>.

**Relevant Sector:** Biodiversity Conservation; Fishing Industry.

**Geographic Location:** Spirits Bay, New Zealand.

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