NSCG Newsletter

Title: Control of Stegobium paniceum in the economic botany collections at RBG Kew

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waiter' lift shaft, which present ideal routes of entry, as well as dead areas in which detritus can accumulate and where pests can breed. Also, but less likely, specimens could have been infested when drawers were opened for study elsewhere. Other factors have also contributed to the pest infestation problem. Because the dry collection is not often used, infestations are likely to go unnoticed for long periods of time. A change in housekeeping policy meant that the storeroom was no longer cleaned. The effect of the preventative chemicals added to the collection in the past (probably BM mixture - a cocktail of saturated solution of naphthalene in benzene, often with a proportion of beechwood creosote and even phenol), has also worn off. This has all occurred against the background of reduced staffing levels.

But, with greater emphasis now placed on Collections Management within the BMNH, it was recognised that priority should be given to the problem. It has been tackled in various ways. Removal of extraneous items has provided a less cluttered environment. All collection drawers have been frozen and cleared of frass. Any remaining type specimens have been removed and placed into methyl alcohol. Cabinet interiors and bases have been treated with 'Constrain', a permethrin-based insecticide approved for museum use. The collection is also being monitored by sticky traps and three-monthly visual checks. Drione dessicant dust may be used in the future in dead spaces as an additional measure. Hopefully, such a strategy should spell the end of *A. sarnicus* in the dry Arachnida and Myriapoda collection.

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Control of *Stegobium paniceum* in the Economic Botany Collections at RBG Kew.

The Economic Botany Collections (EBC) at the Royal Botanic Gardens include more than 30,000 timber samples, and 44,000 specimens of economic plants, spanning the whole spectrum of uses, such as food, forage, fuel, fibres, medicines, poisons, dyes, gums and resins. Specimens range from dried plant parts - medicinal roots and herbs, to artefacts manufactured from plants. All specimens are now stored in taxonomic order, in an open shelf, wheel-to-compactor system, in an air conditioned and purpose built storage space in the Sir Joseph Banks Building at Kew. All items were repackaged in acid free boxes, plastic topped glass jars, or punctured plastic bags. The move of specimens to the store was completed in 1993.

The first *Stegobium paniceum* (Herbarium or drug store beetle) appeared in the store in August 1993, and collected by the windows, and the following July numbers reached epidemic proportions. Spot checks revealed some heavily infested families, with a poison and starch bias. Consultation suggested several methods of management of the problem within the store: regular cleaning, greater insulation of fire exit and connecting doors, placement of traps and regular monitoring. The main method was to be through temperature control, with the presumption that sustained low temperatures would prevent the *Stegobium* completing their life cycle. The air conditioning system was capable of lowering to 15°-16°C (with the RH around 60°C acceptable for organic collections). Traps were placed at intervals throughout the compactors - a mixture of pheromone lured and non-lured Fuji traps, and museum traps. Very severe infestations were found on the shelves containing certain families, genera and species - notably *Ricinus communis, Castanea sativa, Manihot esculenta, Papaver somniferum*, and *Myristica fragrans*. Major infestations were in concentrated areas around the main collections. All infected specimens were removed and frozen for a minimum of 3 days at -30°C.

With the lowering of the storeroom temperature, there was an immediate drop in *Stegobium* activity. Some trap catches were made, with higher numbers on the pheromone lured than non-lured traps, but this was not an accurate indication of activity. In most cases, insects preferred the specimens to lured traps placed among them - perhaps due to reduced attractiveness of the pheromone lure at lower temperatures.

In July 1995 activity was much reduced, but it was decided that a temperature below 13°C would be more effective in preventing the *Stegobium* completing their life-

cycle. In October 1995, the floor space was sprayed with encapsulated Empire 20, as a further precaution to stop the spread of beetles.

Although activity is negligible, a spot check in May 1997 revealed some heavily infested jars of *Plantago* and *Chenopodium* seeds (with close fitting plastic lids). There was no apparent activity, but on removal from the store to a warm office for a few days, two live beetles emerged. This suggests that the pupae can survive for long periods of time in a dormant state.

The method has proved a successful management technique, involving minimum interference with specimens, for a severe pest problem in a difficult storage space.

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Pesticide Residues on Herbarium Sheets Housed Within The National Museum and Galleries of Wales

The National Museum and Galleries of Wales (NMGW) Biodiversity and Systematic Biology department houses 250,000 vascular herbarium specimens, many dating back to the 18th century. Vascular material is prone to attack from pests. If the conditions are suitable the pest will spread very quickly, stripping the dried material. This can be devastating to a collection, as important characteristics and data can be lost. Institutions and collectors have overcome this problem through applications of pesticides. However, the types of chemicals applied since the beginning of the 20th century are now known to be harmful and could present a possible risk to staff and visitors handling the collections.

The aim of this project is to attempt to identify organic and inorganic pesticide residues found on herbarium sheets. These will relate to what the specimen itself has been treated with. The preferred analytical techniques to be used include spot tests, Atomic absorption spectroscopy (AAS), Mass Spectrometry (MS) and Energy Dispersive X-rays (EDX). The results should correlate certain pesticides with dates, collectors, institutions or even species. The results will be accumulated and a comprehensive data list made available, informing other institutions of what may be on their own herbarium sheets.

Prior to analysis, various herbarium specimens, including type specimens, were remounted using conservation grade materials and the original sheet was taken for testing. Numerous heavy metal spot tests were conducted to determine presence of arsenic and mercury and initially, these results appeared ambiguous. It was decided that a more precise method of analysis should be used on a few samples to determine the exact concentrations of residues present. Dr Trevor Brown of the Department of Chemistry, Derby University, carried out Inductively Coupled Plasma-MS and EDX analysis on five small samples of herbarium paper to verify presence of inorganic material. EDX is a surface technique which has been used in the past to verify the presence of arsenic and mercury residues found on taxidermal specimens. This method was found to be far too insensitive for analysing herbarium specimens as the pesticide was often applied as a liquid or spray which would then soak into the specimen and the sheet below becoming an intrinsic part of the fabric and not simply remaining on the paper surface. ICP-MS requires complete digestion of the paper and identifies all inorganic material throughout the paper, allowing an accurate measure of concentration to be made. The ICP-MS results were conclusive. The five herbarium samples were dated from 1848-1964 and each gave a positive result for both mercury and arsenic. Mercury was present in high concentration but the arsenic was generally much lower. Further spot tests were carried out and this time it was possible to measure, by eye, the very slight difference in colour intensity of the reagent and the samples. The spot tests did correlate with the ICP-MS results, but the sensitivity of these spot tests is far less than those carried out on taxidermal specimens. The sensitivity for the taxidermal tests should be 0.05 ug of mercury, but the value for these experiments was closer to 6 mg of mercury.

Future plans will involve providing standards of well-known pesticides