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Silver and nickel pins in entomology: historical attempts at combating corrosion problems in insect collections

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Abstract

We describe some examples of silver and nickel entomological pins and provide the context for their promotion and use. Insects pinned with these silver pins have been identified and an example of subsequent corrosion illustrated. The aim is to highlight the possible existence of silver in this context, which generally has not been considered in historical collections. This is compared in appearance with other kinds of metal corrosion that can occur in museum insect collections. Pins made from other materials are referred to.

Keywords: collections, historical, entomology; metallic corrosion, sulphides, verdigris, rust

Introduction

On a few occasions silver pins were promoted for entomological use with some enthusiasm but they do not seem to have been generally adopted. Until the invention of stainless steel and its subsequent recognition of value for making insect pins, silver did offer some advantages over plated or lacquered brass or mild steel. There is an obvious disadvantage of softness and difficulty in producing a sharp point needed particularly for piercing harder integuments. This might have been sufficient disinclination to use silver pins. There seems to have been little or no reaction or feedback following this suggestion as an answer to pin corrosion problems and so it would seem silver pins were not widely perceived as valuable in this context. The existence of samples of unused silver pins still in their packets and finding some in collections that had been deployed provides an opportunity to analyse the situation. Pure nickel pins have also been investigated in a similar manner and their use described.

Historic accounts of promoting the use of silver pins

David Sharp (1840-1922), was employed as Curator of Insects at Cambridge University Museum of Zoology from 1890 to 1909 (Clark, 2004). While there he wrote how silver wire was "the best material to use" for pinning small insects (Sharp, 1892). He had been using it for twenty years and originally made his own pins by hand. In this published note he announced they were being sold by Watkins & Doncaster, the natural history dealers then based in The Strand, London. They were available in a number of sizes that Sharp had recommended to them. He compared silver pins favourably with those made of brass and steel, which were prone to degradation by corrosion. Such problems often manifest themselves today when dealing with old insect collections (e.g. Garner, *et al*., 2011).

Sharp pointed out silver that was used in the arts was annealed and un-annealed metal should be used for pins as it was harder. Nevertheless, to counter the relative softness of silver he described how for some insects he used another pin to make a small hole prior to insertion of the silver one. This would have been necessary with beetles, Sharp's speciality, although he did not say if he actually used silver pins for Coleoptera. In fact, it is unlikely as he said that small insects were staged on small cork blocks covered in paper. Except for very large species which are direct-pinned, beetles were traditionally glued on card, a technique still widely used even though it renders the ventral surface impossible to see. Some examples of Sharp's specimens are illustrated by Foster and Close (2014).

William Farren (1836-1887) also claimed he had been using silver pins for several years and he stuck them into elder pith rather than cork to avoid any possibility of bending (Farren, 1892). He expressed surprise that complaints about rusting of steel "minutien nadeln" (i.e., micro pins) were not consistently avoided by the use of silver pins for smaller microlepidopterans such as the Nepticulidae. Farren was known for his work as a Cambridgeshire dealer/naturalist (C[arrington], 1888).

It seems that the value of silver pins was promoted and they became commercially available so might have been used by other collectors but with what frequency is not known. After these two articles appeared no further mention of silver pins appears for a number of years although the merits and demerits of other kinds of pins were regularly the subject of discussion in the various popular British entomological journals.

Forty years elapsed before another recommendation for silver was made. Austen and Hegh (1922) stated "pins made of silver wire have the great advantage of never becoming corroded, but, owing to their softness, need to be used with special care; for tsetse flies the most suitable sizes are "0" and "3" costing in each case about 8s. 6d. per 1,000." They do not refer to a supplier but in the same paragraph allude to D.F. Tayler with reference to "pins of the ordinary type". D.F. Tayler of Newhall Works, Birmingham, England, manufactured a range of entomological pins and in 1939 did include pure silver pins in their advertising. What date they were first offered for sale has not been established (pers. comm., Brian Jowett, October 2010). In addition to silver they made pins of pure nickel, black (tempered) carbon steel, stainless steel and brass. In 1960, silver pins were only available in one size, No.16 with a length of $1\frac{3}{8}$ inch and a gauge, or diameter, of 0.024 inch. This is larger than sizes suggested by Austen and Hegh (1922) and would seem inherently unsuitable for use with smaller insects.

As the discussion by Austen and Hegh (1922) was embedded in a monograph of medically important insects it is unlikely to have reached the community of British amateur naturalists with an interest in preserving their specimens. It seems to have had little detectable impact on preferred practices.

In the Hunterian Museum collection of historical entomological collecting and preserving equipment and materials are two batches of unused silver pins (Figure 1 and 2). They were originally obtained by one of the authors (EGH) from John Heath (1922-1987). They are both labelled by parts of gummed labels with "Quick Lab., Cambridge" printed on them and some handwritten notation. In a glass tube are some marked "0" and in a small metal glass-topped box are paper packets marked "0" and "3". As quoted above, these clearly conform to those recommended by Austen and Hegh (1922). Heath lived in the area and worked for the

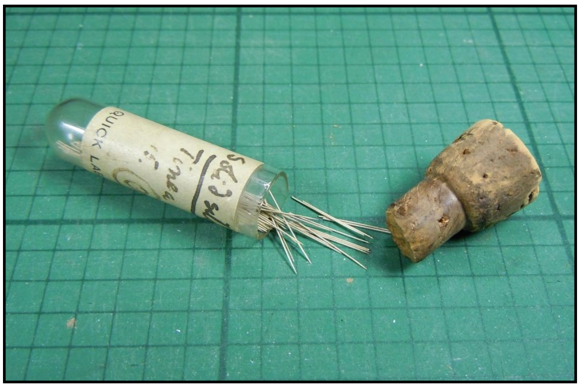

Figure 1. Tube of silver pins, size "0" and 15 mm long, labelled as suitable for Tinea moths (The Hunterian, University of Glasgow).

Figure 2. Pill box with packets of silver pins, sizes "0" and "3" (The Hunterian, University of Glasgow).

Figure 3. One of two boxes of silver pins (Hope Department, OUMNH).

Biological Records Centre at Monkswood Research Station, Huntingdonshire. This involved data processing at Cambridge University prior to distribution map printing and so he may have obtained the silver pins at that time. But earlier, from 1947 to 1952, he had been employed by the Biological Research Department of Pest Control, near Cambridge and so could have got them during that period (Anon., 1988). One of Heath's specialities was the study of the tiny moths in the family Micropterigidae so he may have considered trying silver for pinning his specimens. The Hope Department, Oxford University Museum of Natural History, also has some unused silver pins in their historical collection (Figure 3).

Corrosion of silver pins

Analysis of an unusual kind of corrosion on a pin in the Natural History Museum, London (Figure 4), proved to be crystals of silver sulphide and the specimen was illustrated by Selwyn (2004; fig. 11.7, p. 138). There are a few other examples of silver pin corrosion in the same part of the collection, drawers that include type specimens of Hymenoptera from the collection of Peter Cameron (1847-1912). His collection was acquired in 1914 and the specimen figured here was collected in 1906. The corrosion presents a dramatic appearance from which, in technical literature, the word whiskers has been adopted. The silver sulphide crystals sprout radially from the pin and are very different in form from other kinds of metal corrosion products seen in entomology collections. Selwyn (2004) groups corrosion products according to their situation, in this case as "Corrosion Indoors", separate from either outdoor or burial conditions. This sulphide is typical of indoor corrosion found in a variety of stored museum artefacts.

An attempt to find more examples in other principal British entomology collections produced no results. Some searching was made through specific areas of collections such as tsetse flies in several museums also with negative results. Their use appears to have been transient. Sharp (1882) described how the pins turned black but said that this was merely an initial effect of no further detriment; he clearly regarded it as cosmetic.

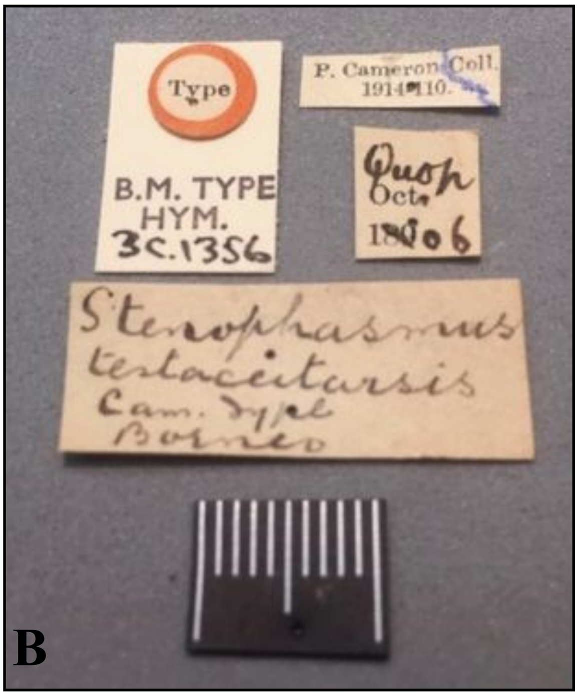

Figure 4a & b. Corrosion of a silver pin on a parasitic hymenopteran showing silver sulphide whiskers; with data labels (Cameron collection, NHM, London).

This characteristic of silver means that that such pins would be difficult to find when scanning by eye down rows of small insects as they would appear similar to black-varnished steel pins. It may be that conditions under which the pins developed a fine growth of silver sulphide whiskers, were in some way abnormal, but any relevant history has not been established.

Nickel pins

Pure nickel pins were made and advertised by D.F. Tayler. Theoretically, nickel would have been a good material for pins before stainless-steel became the choice material (Figure 5). The earliest mention of nickel pins having been tested and then marketed was made by Emile Deyrolle, Paris (Anon., 1895). Pure nickel was said to be too brittle to be drawn into wire so a "secret alloy" had been made in order to do so. It claimed that a successful search had been made "to produce a pin which should be as nearly perfect as possible". Two boxes labelled "Pure Nickel" are in Oxford alongside the silver ones, also dating from the mid twentieth century (Figure 6). Any lack of purity in the nickel may compromise them, as with any metal product. To test this both nickel and silver unused pins have been analysed (see below). No pins that could be identified as nickel could be found when looking through collections and no published statement on their use by any British entomologist has been traced. However, a corroded pin that looked slightly different from the "normal" verdigris as often seen in museum insect collections was tested and its metallic spectrum is that of nickel. The corrosion products of nickel are also green and may be hydrated carbonate with an organic addition (Faithfull, 2019 *pers comm.*). This serendipitous discovery may make it possible to visually identify nickel pins from the different appearance of the green coating.

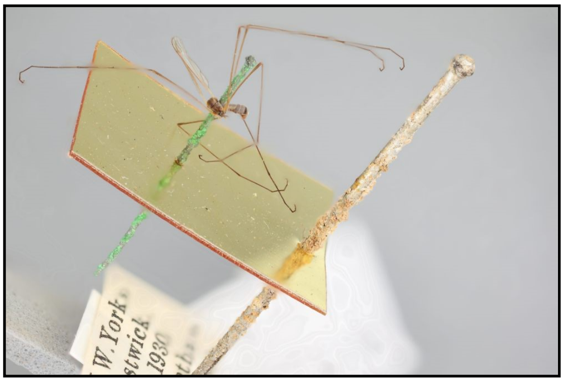

Figure 5. A cranefly specimen, one of the first examples of Dicranomyia aperta *Wahlgren, 1904 to be collected in Britain in 1926, on a pin with green corrosion. Analysis proved it to be nickel.*

Purity of the silver and nickel pins

The historic unused silver and nickel pins in Glasgow and Oxford were tested by EDS (Energy Dispersion X-ray Spectroscopy) with a Stereoscan Electron Microscope. The results show the level of purity. The silver ones are between 82-89% silver with some metallic copper and carbon present. Nickel pins were 92-95% pure with some carbon present. One sample from Oxford although labelled as such but did not look like silver was tested and confirmed as tin-plated brass.

Other pin types and corrosion problems in insect collections

The main purpose of this paper is to report the existence and use of silver and nickel pins. Any conservation issues that might arise have not been addressed. If the strength of the silver metal is not materially compromised by the growth of whiskers and that simple black tarnishing is a superficial surface affect it may be best not to attempt remedial conservation. Examination of specimens in most museums will usually reveal more familiar examples of corrosion. The most obvious is brass pin corrosion in which verdigris is formed, usually in the form of irregular green growths from the point of contact between pin and insect (Figure 7). These can often burst apart the specimen (Garner, et al., 2011; page 52, figures 5 and 6). According to Selwyn (2004) verdigris can be an organic compound arising from the interaction of fatty acids with copper hence its irregular growth form. It is noticeably waxy when rubbed between the fingers. This seems to be in contrast to the harder green coating on the nickel pin which is evenly distributed along the shaft and has not formed any outgrowth from the surface.

The use of mild steel pins or even sewing needles was common in the eighteenth and early nineteenth century before mass production techniques meant tin-plated brass pins could be produced specifically

Figure 6. Boxes of nickel pins (Hope Department, OUMNH).

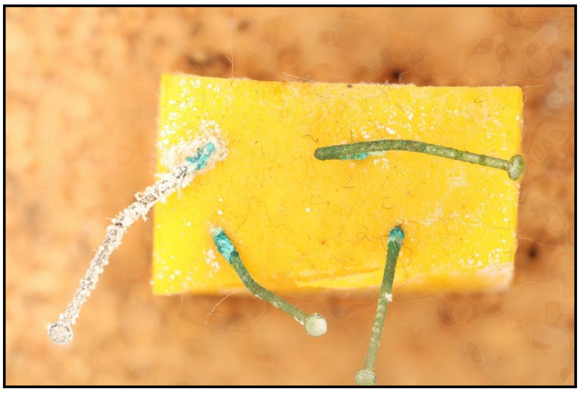

Figure 7. Verdigris on brass pins that had been used to hold down an organic insecticide product within a collection. The analysis in addition to copper and zinc showed phosphorus, a component of the pesticide.

for insects (Hancock, *et al.* 2011; Hancock (2015). They were prone to rusting and the formation of ferrous oxide, just as does verdigris in brass, compromises pin strength. Breaks can occur both inside the insect or at the level of the papered cork. Many old collections have insects on soft iron wire that had been cut into suitable lengths and a rough point made by filing or grinding. Sometimes an angled cut was sufficient to use without bothering to make a point. These wire pins easily bend in use and require careful handling. Rust on pins is figured also by Garner, et al., (2011). There are varying qualities of stainless steel - not all stainless-steel pins currently offered on the market are satisfactory (see Walker, *et al.*, 1999) plus variation in sharpness during manufacture that proves annoying when trying to pin certain groups of Coleoptera and Hymenoptera with hard integuments. Despite the adoption of so-called "Continental" pins as a museum standard there is a variety of manufacturers and suppliers and different numbering systems. In reality there is no specific standard as shown by those made in central Europe being 38 mm long but some sold under the trade name 'Asta' (which might be of English manufacture and remnants of old stock) are 1.5 inches which is 38.1 mm. Imports from China are 40 mm and Japanese ones are 42 mm long.

In severe instances of verdigris or rust corrosion remedial conservation such as pin replacement becomes necessary. Our conclusion in the case of silver and nickel pins is that their different properties and restricted adoption means they appear to present little problem for the well-being of entomological collections.

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Curatorial staff at Oxford University Museum of Natural History facilitated a loan of some unused pins. Brian Jowett, formerly of D.F. Tayler & Co., Birmingham, from his own research into the history of pin-making as part of a degree research project, has supplied many interesting facts concerning pin manufacture and the kinds of stock items that were made and sold. Dr Peter Chung, Earth Sciences, Glasgow University, kindly found time to analyse the unused silver and nickel pins and Innes Clatworthy, of the Imaging and Analysis, Core Research Laboratories of NHM provided those for pinned specimens in London. Dr John Faithfull, Curator of Mineralogy at The Hunterian, provided valuable insight into interpreting the spectroscopy results from the SEMs.

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