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Carpet beetle and other insect pest infestation relating to bird re-feathering and repair

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Abstract

A technique is suggested whereby taxidermy specimens of birds that have been severely damaged by pest infestation, can be stabilised and repaired. Feathers, that have been damaged, can also be repaired plus some suggestions for down feather treatment are also proposed. A brief mention of double-freezing and anoxic treatments is also included.

Introduction

The effects of the damp Summers of '07 and '08 have been felt in many ways. Not least is a bumper crop of clothes moths and *Anthrenus* (carpet beetles or CB) infestation outbreaks! Despite good housekeeping, the heritage sector is reporting infestations and re-infestations like no other previous year!

Birds seem to have been particularly on the pest 'hit-list' and much work has already been done to try and repair the damage. Clothes moth outbreaks seemed to be down earlier in the year but more recently they have been observed flying around almost everywhere! Their larval damage is considerably more rapid and more severe than carpet beetle (Fig.1). Clothes moth larvae will eat almost every part of a taxidermy bird, often leaving the conservator insufficient material to repair! Carpet beetle larvae are not quite so voracious and will normally loosen the plumage, feeding primarily on the bird skin before ingesting the harder keratinaceous proteins of the feathers.

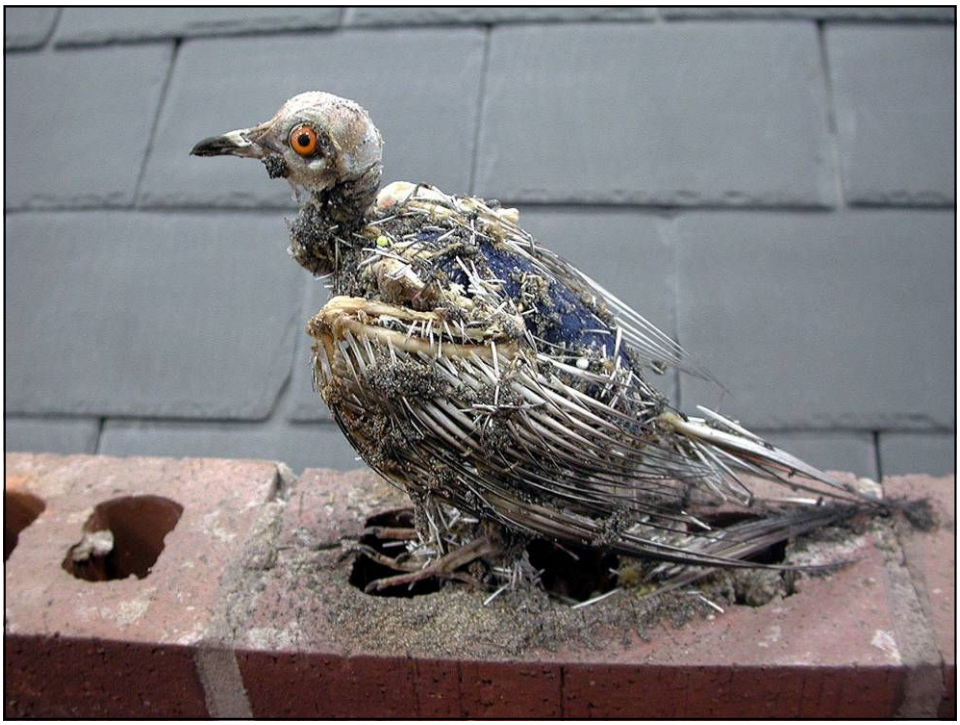

Fig. 1. Taxidermy pigeon having suffered depredations of clothes moth larvae *(Tineola bisselliella)* , not enough left to conserve!

Anthrenus beetles have rather short lives as adults, they feed on nectar from cow parsley (I have observed), mate, then find a suitable natural fibre carpet, taxidermy case, or other source, in which to lay their egg cluster and on which their larvae can feed *ad nauseam*! The beetles' tough exterior and tiny size enables entrance through the tiniest cracks (less than 0.5 mm!) and if they had a lean time as a larva and are subsequently a bit smaller, then the ingress point can be even tighter, although their egg clutch will be smaller (Fig.2). Even a normal egg clutch is so small in size as to require a practised eye to notice it and it can withstand prolonged freezing at -20° C (-30° C will kill it).

Fig. 2. Beetles and larval skins of *Anthrenus verbasci*, the varied carpet beetle, with some half-eaten feathers.

Smaller outbreaks inside cases tend to die out. Either the humidity level is uncomfortably low for the beetles and/or larvae (below 40% RH) for them to live long enough to cause any serious damage or there may be some old preventive product present in the bird's skin.

Early signs of infestation are disruptions to the plumage and the tell-tale little bristly skins that the larvae leave behind as they grow in size (Fig. 3).

The problems of CB-infested birds is that as weakened or shredded feathers drop out, the underlying down layer often becomes mixed into the upper plumage layer causing difficult-to-repair lumps. Most smaller museums can resort to bagging and freezing infested cases but larger cases, that will not fit inside a standard domestic freezer, may be either bagged and left or, I have noted, some presently-banned pesticide has been found and used. Although this may cause some raised eyebrows, providing that the case is suitably hazard-labelled (and dated) and the whole sealed into a poly-bag away from public areas, then the problem is at least, reduced.

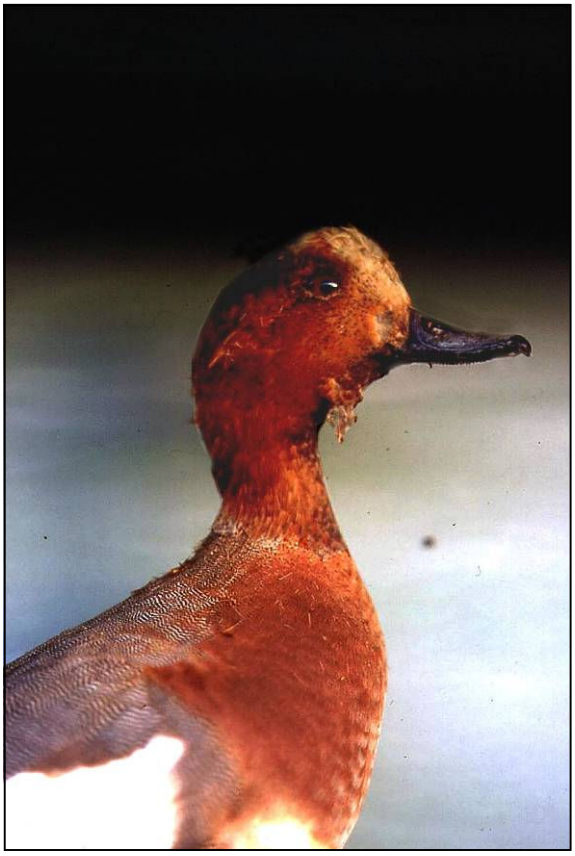

Fig. 3. Duck with 'beard' of feathers loosened and damaged by larval *Anthrenus*.

Techniques

Repairing bird skins (and feathers) can be carried out using fine grade Japanese tissue (8gsm grade *Gampi* tissue is ideal). This is fine enough yet with a breaking strain of c. 2Kg, and can be coated with neutral pH PVA as both a liner and adhesive to form a pseudo-skin and to conjoin remaining areas of skin together into a stronger framework. When applying adhesive to finer *Gampi* or other Japanese tissues, always ensure that the glue is thinned out by the action of dragging the tissue through the glue and out the other side until it no longer leaves a trail or by brushing surplus glue off the tissue. If not, then the tissue will curl and can roll itself into a tight scroll. A palette of glass is useful for the dragging technique (Fig. 4).

Fig. 4. Dragging the tissue strip through the glue and way out the other side will prevent it from rolling up (right) – note the glue trails (left & right).

The detached feathers will need to be sorted into body areas and then sub-graded into sizes before re-feathering can commence which involves adhering them one at a time until a complete layer is formed and leaving 30 minutes to one hour to dry between layers. A repetitive and somewhat tedious task but very rewarding. Errors are quickly noted as wrong feathers just will not fit into the plumage sequence. Layering of down feathers can be more difficult and requires some experience to achieve an even surface. The curvature of down plumage is very important to lift the feathers above them and for the correct shape for the bird. If these have been shredded to tiny 'floaty' components it can be advisable to omit some of these unless the bird is rare or important enough and to compensate for omitted down feathers with tissue layers to maintain an even plumage surface. Damaged down feathers need to be brushed with 50:50 acetone:water mixture mixed first and then repaired with Japanese tissue along the shaft. Barbs and barbules may be painstakingly attached with minute amounts of adhesive onto a tissue base to the feather shaft, in order to rebuild the feather, if required. Using a textile steamer can help to straighten out bent, distorted/twisted feathers and can be useful to 'calm' down-feather layers but beware of wetting the (actual) skin surface as this could re-hydrate it, giving rise to distortion and even mould growth!

Single or multiple feather insertion is simply carried out by lifting the feather layer above using a spatula and inserting the glue-bearing feather shaft tip inside and then aligning the feather by finger preening.
Where the shaft has been partly or totally eaten away but the feather barbs are still interlocked, mount the feather onto a pseudo-shaft of about 25gsm *Kozo* or *Gampi* strip folded over or a flat splinter of wood cut from a cocktail stick. For smaller/more delicate feathers use an unfolded and narrow strip of tissue.

Preventatives
Pest prevention is always complex these days with so many effective products on the 'forbidden list'! Bob Child's *Constrain* product (obtainable via www.historyonics.com) contains permethrin and this will give some lasting preventive effect against re-infestation (up to c. 1 year, sometimes longer in my experience). I used to use a Bayer product called Eulan W or Edolan to great and longer-lasting effect and it could be applied as a 5% solution in propan 2-ol (isopropyl alcohol) and which will not rehydrate the skin. However, the use of Eulan is now regulated and will need checking out before it can be used and the specimen will need to be labelled as having been treated this way, if regulations permit. If a specimen (or case) is not too large then it can either be double-frozen or treated with anoxia.

Double freezing
As mentioned, a single freezing at -30° C over a week will kill all stages of pests but this lower temperature can stress glass. To reduce the problems of glass stress, especially to older taxidermy cases, they must be bagged in polythene before freezing to form a small atmospheric barrier between the glass and the cold atmosphere of the freezer.

They are then left for a week, usually, allowed to warm up to room temperature over 24-48 hours (to allow eggs to hatch once 'winter' is over) then replaced into the freezer once again for a further week to kill the freshly-hatched larvae. Although taxidermy can withstand freezing quite well, older paint layers can be affected by prolonged freezing (over 4 weeks), glass eyes may crack sometimes and keratin may even start to delaminate slightly. For these reasons, many prefer anoxia.

Anoxia
This can either be done by nitrogen displacement (Moore in Waterhouse, 2008) in which lowering oxygen levels will cause infesting insect spiracles to open so that the insects rapidly lose body moisture and die from desiccation. For those who do not have resources to set up an anoxia unit, barrier films such as Marvelseal or Escal can be used (and there are others but these two are presently the most favoured in museum circles).

Specimens are placed in a heat-sealed envelope of this material together with an oxygen scavenger such as Ageless (Mitsubishi Corporation) together with an indicating 'eye' comprising a blue pill that will gradually turn pink as the oxygen levels are depleted down to 0.1% oxygen (it reverts to a blue/purple above 0.5% oxygen). Plastic clips are also available as barrier film sealers and although effective, are not quite as good or long-lasting as heat sealing. There are many websites illustrating this including: http://www.cwaller.de/english.htm?oxygenmeters.htm~information

Reference
Moore, S J in Waterhouse, D 2008. Hampshire Museum Service's anoxic treatment regime on a tight budget. *NatSCA News,* **14**: 8.