Comparison of techniques for the analysis of wildfowl viscera

D. F. W. POLLARD

Summary

Gullet and gizzard contents were analysed after water extraction and conventional extraction techniques had been applied. The results suggested that the four species of seed eaten had been digested differentially within the gizzard, due mainly to differences in their resistance to mechanical digestion. A similar order of relative resistance was observed following artificial grinding of an undigested sample from the gullet. Since the more resistant seed species accumulate within the gizzard, conventional analysis may show an undue bias towards these forms; extraction methods which sample only the gullet should overcome this problem, at the expense of some qualitative precision.

Differential digestion rates have been observed by Koersveld (1950) to exert a considerable effect on the results of viscera analysis of dead jackdaws. Olney (1961) has suggested that the results of analysis of wildfowl might be similarly modified. Since analyses of wildfowl viscera are usually confined to the oesophagus, proventriculus and gizzard, the main source of error would appear to lie in differences in the rates of mechanical digestion within the latter organ, whilst the bird was alive.

While investigating various methods of viscera analysis, an opportunity arose for comparative analyses of a single bird by conventional and water extraction (see Pollard 1967) techniques. A duck Mallard was shot in January, 1966, shortly after feeding among flood debris from the River Severn. The intact bird was first treated by washing out the oesophagus and proventriculus, after which the viscera were removed. It was found that the oesophagus and proventriculus had been completely emptied by washing; the gizzard contents were set aside for analysis. Five sub-samples were taken from each sample of ingested food, and separated into food types. These comprised seeds of four species of flowering plants. The mean frequency of each species in each sample is given in Table I, as a percentage of the total number of seeds in each sample.

Statistical analysis of the sub-sample counts showed that significant differences ($P = 0.05$) in the percentage frequencies occurred in all four species. The results suggest that the order of digestion rates was as follows: *Rumex* sp. (very rapid), *Glyceria maxima, Ranunculus* sp. and *Polygonum persicaria* (slow). Clearly, if the gizzard only had contained food, analysis would have indicated that *Polygonum* and *Ranunculus* together formed a considerable proportion (32.6 per cent) of the food ingested, whilst *Rumex* would be regarded as almost a trace item. In fact, analysis of the gullet revealed that the former species totalled only 8.2 per cent, whereas *Rumex* formed 15.6 per cent of the number of items taken.

In comparing the results of these two analyses, it has been assumed that the food items were distributed at random in the feeding area, and that the bird did not alter its preference for any particular species whilst feeding. The nature of the feeding area suggests that the former assumption was reasonable, but there could be no check on preference changes.

As a further check on the hypothesis that the seed species under consideration varied in their resistance to mechanical digestion, an attempt was made to simulate gizzard action on an undigested sample. The classified contents of the oesophagus and proventriculus were mixed with grit from the gizzard for the same bird, moistened, and lightly ground with a pestle and mortar for about a minute. After resorting, the numbers of remaining intact seeds were calculated as

Table I. Results of viscera analyses.

Food species	*Mean frequency (%) in oesophagus and proventriculus*	*Mean frequency (%) in gizzard*
Glyceria maxima	75.2	65.8
Polygonum persicaria	3.8	16.4
Ranunculus sp.	4.4	16.2
Rumex sp.	15.6	1.6

percentages of their original frequency. The losses incurred by each species during this treatment were as follows: *Rumex* 87%, *Glyceria* 86%, *Polygonum* 26% and *Ranunculus* 4%. Whilst there is obviously considerable difference between grinding by the gizzard in a live bird and the simulated treatment applied, the orders of resistance observed are rather similar. The comparatively high percentage loss shown for *Glyceria*, after artificial grinding, was due to the fact that most seeds were simply broken into two pieces; as such they were still identifiable. This also applied to some fragments of other species. However, under natural conditions, there would be a certain amount of chemical digestion, rendering identification more difficult, whilst fragments would be quickly passed into the intestine.

Whilst the results presented above cannot be regarded as entirely conclusive, they do indicate that conventional analysis of viscera may bias the apparent food preferences or availabilities towards items more resistant to mechanical digestion. This resistance would be controlled by a variety of factors, including, in the case of seeds, size, shape and wall thickness; the nature of other items ingested is probably important also. In an analysis of contents of crop, gizzard and droppings of force-fed quail, Jensen and Korschgen (1947) observed similar effects of differential digestion on the apparent diet composition. For example, the original diet included 11.8 per cent, by weight, *Pinus* seeds and 24.3 per cent *Robinia* seeds. Slight reductions were observed in the crop composition (10.5 and 19.2 per cent respectively); the gizzard was found to contain 71.2 per cent *Pinus* and 6.5 per cent *Robinia* seeds. Analytical methods involving the gullet only, such as the rapid extraction techniques described by Pollard (1967), would appear to overcome this problem, although they are less sensitive, qualitatively, than full analysis of all three viscera components.

References

JENSEN, G. H. and L. J. KORSCHGEN. 1947. Contents of crops, gizzards and droppings of bobwhite quail, force-fed known kinds and quantities of seeds. *Journ. Wildl. Mgt.* 11 : 37-43.

KOERSVELD, E. V. 1950. Difficulties in stomach analysis. *Proc. 10th Int. Orn. Congress* : 592-4.

OLNEY, P. J. S. 1961. Food habits of wildfowl. In: *The New Wildfowler* : 85-96.

POLLARD, D. F. W. 1967. Techniques for rapid extraction of ingested food from wildfowl viscera. *Wildfowl Trust 18th Ann. Rep.* : 156-7.