



## Rate of Digestion of Blowfly Maggots by Ducks

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*mophori* from one *Epomophorus labiatus* Temminck. The present results confirm the presence of *H. epomophori* in the chiropteran fauna of Zambia which probably has a wider distribution in African Pteropodidae than current records suggest (Garnham, 1966, op. cit.).

Blood films from one *Pteropus rodricensis* Dobson from Cascade Pigeon, Rodrigues (Mascarene Islands) and one *Pteropus* sp. from Praslin (Seychelles) obtained under similar conditions to those in Zambia, were negative. Slides of *Hepaticocystis epomophori* from *E. gambianus parvus* have been deposited in the

Wellcome Museum Collection, London, England (Accession Numbers: M3381-4). The nycteribiid has been deposited in the British Museum (Natural History), London, England (Accession Number BM. 1984-7).

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Although blowfly maggots are considered important as carriers of toxin in avian botulism (Duncan and Jensen, 1976, J. Wildl. Dis. 12: 116-126), it is unusual in our experience to find maggots in the digestive tract of intoxicated birds. The senior author has found remains of maggots in only one duck during more than 10 yr of investigating waterfowl botulism in Saskatchewan. This might have been because the ducks had not consumed maggots or, alternatively, maggots may have been consumed and digested before the birds developed clinical disease and were found.

The simultaneous availability of a group of ducks destined for euthanasia and necropsy for reasons other than botulism, and

of maggots collected from natural cases of botulism in ducks, provided an opportunity to test the rate of digestion of maggots. Twelve adult female mallards (*Anas platyrhynchos* L.) that had been held in cages in the field with access to both commercial and natural foods were each given 30 live 1-1.5-cm maggots. The maggots were removed from duck carcasses immediately prior to use and were not identified as to species. Maggots were placed in a soft transparent plastic tube that was passed into the bird's lower esophagus and then flushed from the tube with approximately 20 ml of water. The birds were released into a pen and observed to ensure that regurgitation did not occur. Individual birds were killed by cervical dislocation at intervals from 15 min to 12 hr after receiving maggots. At necropsy the esophagus, proventriculus, giz-

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TABLE 1. Number of blowfly maggots found in the upper alimentary tract of mallards killed at selected times after receiving 30 live maggots.

	Time (hr) after dosing											
	0.25	0.50	0.75	1.0	1.5	2	3	4	5	6	9	12
Number of maggots recovered	19	2	2	4	1	1	0	1	0	0	0	0

zard and duodenum were removed intact, opened and the contents were washed into a shallow tray for examination.

Maggot remains were found for up to 4 hr after administration (Table 1); however, even at 15 min only three of the 19 maggots found contained any internal structure. The remainder consisted of empty transparent "skins," as did all of the maggots that were found in ducks killed later. It is unlikely that maggots would have been detected during a field necropsy in any bird other than the one examined 15 min after having ingested maggots.

The maggots used in this trial contained very little toxin ( $10^2$  mouse lethal doses (MLD)/g) and none of the birds developed clinical signs of botulism; however, when maggots containing  $10^4$ – $10^5$  MLD/g of toxin have been given to ducks in other trials, there was a delay of several hours before the birds became paralyzed

and maggots have never been recovered from such birds at necropsy (Wobeser, unpubl. data). Maggots have been found in the digestive tract of birds in some outbreaks (Kalmbach and Gunderson, 1934, Western Duck Sickness, A Form of Botulism, U.S. Dept. Agric. Tech. Bull. No. 411, 81 pp.; Forrester et al., 1980, J. Wildl. Dis. 16: 323–327), but it would seem that discovery of a bird with its gizzard filled with intact maggots, as illustrated by Hunter et al. (1970, Applied Botulism Research Including Management Recommendations: A Progress Report, Calif. Dept. Fish and Game, Sacramento, California, 87 pp.) would be unlikely in a natural outbreak, even though the birds may have developed botulism through consumption of toxin-bearing maggots.

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