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STUDIES ON THE PHYSIOLOGY OF DIGESTION IN *PSITTACULA KRAMERI (SCOP.)*

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The physiological studies include the pH determination and qualitative estimation of enzymes in different parts of the gut of *Psittacula krameri*.

INTRODUCTION

The distinctive features of the avian digestive system have been correlated with the development of flight and a high metabolic rate by Mangold (1930 & 1934) and Dilger (1957) According to Magnan (1910 & 1913), Groebbels (1932), Stresemann (1934) and Eber (1956) various adaptive modifications found in birds can be correlated with their respective food habits. Eber (1956) and Ziswiler (1967) have found that the individual parts of the digestive tract of birds show variations in form and function. Very few attempts have been made to study the pattern of enzyme activity in the digestive tract of birds. The present paper deals with the distribution of various hydrolases including carbohydrases, proteases, esterases, oxidases and amidase in the different parts of alimentary canal of *Psittacula krameri* (Scop.).

MATERIAL AND METHODS

For pH measurements of the normal feeding birds, live animals were dissected soon after they were collected. The different parts of the gut were carefully separated and thoroughly cleared of any food contents. The pH was then measured with the help of Cambridge pH indicator using soft tissue electrode and by the indicator paper method. For each experiment, 6-8 specimens were studied and the results averaged. pH measurements were also made in the birds starved for about 72 96 hrs.

The enzymatic estimation was done *in vitro*. The different parts *viz.* oesophagus. crop, proventriculus, gizzard, intestine, rectum and associated glands were carefully separated. The tissues were chilled and ground up with a crystal of thymol into a uniform emulsion in a precooled mortar. Grinding was aided by the addition of a little sand. Centrifuged at 6000 rpm. the supernatents were preserved under toluene. All the extracts were diluted to 10% by adding

50% glycerine. Alcoholic extracts were also prepared by grinding the tissue and diluting it with 90% alcohol.

RESULTS AND DISCUSSION

A few drops of the extracts were incubated with a few drops of the different substrates at room temperature with control experiments in each case. The incubated mixtures were tested after 2, 4 and 8 hrs to determine the digestion of the substrates. For determination of amylase, invertase, glycogenase, raffinase, inulinase and salicinase. Benedict's tests were performed while for maltase and lactase Barfoed's test was performed.

For lipase ten drops of olive oil were dissolved in 4 ml absolute alcohol and 4 ml of hot water. The mixture was then allowed to cool after which 10 drops of phenol red were added. A few drops of 0.01 N NaOH were added to make the emulsion faintly pink. 2 ml of this mixture was incubated with 1 ml of different extracts. The colour of the incubation mixture was compared with standard pink colour at different intervals.

Th presence of proteases was investigated by incubating a few drops of the different extracts with 10% gelatine solution.

The average pH of the different parts of the gut under normal and starved conditions is tabulated in Table I. The medium was almost similar throughout the alimentary canal. It is throughout weakly acidic except in the liver where it is alkaline and in gizzard it is acidic.

Table I. pH of the alimentary canal of *P. krameri* under different conditions.

	Oeso.	Crop	Prov.	Giz.	Int.	Rectum	Liver	Pan.
Freshly collected	6.6	6.8	4.5	2.9	5.6	5.9	7.3	6.4
After starvation	6.5	6.7	4.5	2 9	5.5	6.0	7.3	6.5

Farner (1942), Mussehl *et al.* (1933), Mayhew (1935) and Buckner *et al.* (1944) have dealt in great details the pH of avian digestive system and have stated the avian gut weakly acidic. The present observations endorse this view in parrot. However, the pH in gizzard lies near 3.9. It has also been noticed that

Table II. Distribution of carbohydrases, proteases, esterases, oxidases and amidase in the different regions and glands associated to the digestive tract of *P. kramøri*.

Enzymes	Duration of reaction and extent of digestion (in hrs)																								Control after 8 hrs
	Oeso.			Crop.			Prov.			Gizzard			Int.			Rectum			Liver			Pancreas			
	2	4	8	2	4	8	2	4	8	2	4	8	2	4	8	2	4	8	2	4	8	2	4	8	
Amylase	+	+	+	±	±	±	+	+	+	±	+	+	±	±	±	−	−	−	−	−	−	+	+	+	−
Maltase	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Lactase	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Invertase	−	−	±	−	+	+	−	±	−	−	−	−	±	±	+	−	±	±	−	−	+	±	±	+	−
Glycogenase	−	−	−	−	+	+	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	−	−	−	−
Raffinase	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	±	−	−
Inulinase	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Salicinase	−	−	−	−	−	−	−	−	−	±	±	±	−	−	−	−	−	−	−	−	−	−	−	−	−
Melibiase	+	+	+	+	+	+	+	+	+	+	+ +	+ +	+	+	+	+	+	+	+	+	+	+	+	+	−
Trehalase	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Lipase	−	−	−	±	±	−	−	−	−	±	±	−	±	+	+	−	−	−	±	±	−	±	+	+	−
Esterase	−	−	−	−	−	−	−	−	−	−	−	−	±	±	+	−	−	−	−	±	±	±	+	+	−
Pepsin	−	±	±	−	−	−	−	±	±	−	+	+	±	±	+	±	±	−	−	−	−	±	±	±	−
Trypsin	−	−	−	−	−	−	−	−	−	−	−	−	−	±	+	−	−	−	−	−	−	±	±	+	−
Polypeptidase	±	±	−	±	−	−	−	±	−	−	−	±	±	+	+	±	±	−	−	−	−	+	+	+	−
Catecholase	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−
Peroxidase	±	±	+	±	±	+	±	±	+	−	−	+	−	±+		±	±	+	±	±	+	−	±	±	−
Urease	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Chitinase	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

+ Positive, + vigorous, ± traces, and − no reaction.
+

starvation does not effect the pH to any considerable extent. Farner (1942) observed increase in pH of gastric juice due to the diets rich in protein while Vonk *et al.* (1946) observed decreased pH under these conditions.

Qualitative estimation of enzymes showed that the proventriculus, intesttine, liver and pancreas to be the main organs of enzymes secretion (Table II). The diversity of the enzymes and their relative strength may be supposed to form a sort of spectrum correlated with the specific feeding habit. In the frugivorous bird, the sucrolytic enzymes are more active than the proteolytic enzymes since their diet is mainly composed of carbohydrates. However, the presence of a few other enzymes may be attributed to the fact that a small quantity of proteins and fats are also taken by the bird in one form or the other. In the present bird, the matase and lactase were absent. However, in chicken lactase has been reported by Hamilton & Mitchell (1924).

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