gebrütet haben dürften) war während des Massenvorkommens der Kleinnager in der Jahren 1941—43 besonders auffallend. — *Buteo buteo zimmermannae* gehört zu den häufigsten brütenden Tagraubvögeln des Gebietes. — *Charadrius hiaticula* (*tundrae*?) brütet vorzugsweise auf den Seesenkungen zufolge entstandenen mehr oder weniger vegetationslosen Verlandungen. — *Numenius arquata* brütet nunmehr regelmässig, wenn auch sehr spärlich)ausschliesslich auf Kulturgelände).

On the microbial decomposition of cellulose by wild gallinaceous birds (family *Tetraonidae*).

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The characteristic anatomic feature of the gallinaceous birds, the strongly developed caeca, is commonly associated with the microbial digestion of cellulose. This conclusion is easily understood considering the fact that their food at times contains cellulose to a considerable degree. However, a decomposition of cellulose in the intestinal tract of gallinaceous birds has not been proved so far (cf. MANGOLD 1943).

We have made some experiments on this subject in connection with other work on the decomposition of cellulose. These experiments being discontinued for the present, it seems advisable to publish some of our more important results.

Material. Specimens of the following Finnish species have been available: capercaillie (*Tetrao urogallus* L.), black grouse (*Lyrurus tetrix* (L.)), hazel grouse (*Tetrastes bonasia* (L.)), and willow grouse (*Lagopus lagopus* (L.)) the age of the birds varied from downy youngs to adults.

Methods. The experimental work was carried out by our earlier methods (cf. VARTIOVAARA a. ROINE 1942; VARTIOVAARA, SUOMALAINEN a. ARHIMO 1944). The microbes were cultivated in ordinary cotton-plugged test tubes, containing 300 mg. of shredded wood cellulose in 15 ml. of the following nutrient solution.

Peptone „Witte"	3.0 g.
$NH_4H_2PO_4$	2.0 g.
KH_2PO_4	1.0 g.
$MgSO_4 + 7\ H_2O$	0.2 g.
NaCl	0.1 g.
$FeSO_4$	traces

Yeast extract, prepared from 200 g. of commercial baker's yeast suspended in 800 ml. tap water, autoclaved for 10 minutes at + 120° C	20 ml.
Tap water	1000 ml.

$CaCO_3$ was used as buffering material in amounts corresponding to a 0.2 Mol. solution, and autoclaved together with the nutrient solution. — 1 ml. of 1 % ascorbic acid solution was added into the test tubes just before inoculation.

Largish samples of the contents of different parts of the alimentary canal were used for the inoculation. — The cultures were incubated at + 40—41° C.

Results. Bacterial cultures from the intestinal tract of gallinaceous birds evidently decompose cellulose less effectively than do corresponding cultures from the alimentary tract of mammals. This might be understood on the assumption that in the bird's food cellulose is present in a more palatable form than *e. g.* the pure wood cellulose used in the feeding of farm animals. Especially, the ability of the young birds to digest cellulose seems to be very low, which result may depend partly on the spoiled condition of the sample specimens. Cultures which distinctly decomposed cellulose — though at a relatively low rate — were obtained in the following cases.

Capercaillie, juv. ♀ (sample No. 173, weight 944 g.), from Kuru parish: Karjula, 7. VIII. 1944 *leg.* T. Waaramäki. — Sample from the caecum.

Capercaillie, juv. ♀ (sample No. 186, weight 1780 g.), from Pieksämäki parish: Lamminmäki, 26. VIII. 1944 *leg.* Jouko Jalkanen. — Sample from the gizzard.

Hazel grouse, juv. (sample No. 169, weight 104 g.), from Somero parish: Pyöli, Lillgård, 26. VII. 1944 *leg.* Lauri Siivonen. — Sample from the gizzard.

Willow grouse, juv. (sample No. 171, weight 302 g.), from Kuru parish: Karjula, 7. VIII. 1944 *leg.* T. Waaramäki. — Sample from the caecum.

It is thus to be noticed that the decomposition of cellulose is not limited only to the parts of the intestinal tract adjoining the caeca, but cellulose was decomposed also by samples from the gizzard. Samples from the caeca, however, were clearly the most effective.

In this connection, we wish to stress a possibly important point in the digestion of cellulose by the gallinaceous birds. It is known that they in summer feed largely on berries, while in winter *e. g.* the capercaillie uses almost exclusively pine needles. Both of these food materials — especially the coniferous needles (cf. Lojander 1941, Paavo Suomalainen 1942) — are known to contain exceptionally large amounts of ascorbic acid (vitamin C). Ascorbic acid, at least in experiments *in vitro,* is known to promote markedly the activity of the intestinal bacteria which decompose cellulose. This effect is ascribable to its power to regulate the oxidation-reduction potential in the environment of the microbes. The interrelation of these two phenomena is marked.

A transfer of effective cellulose-decomposing bacteria into the intestines of the gallinaceous birds has been considered as one of the primary conditions for their successful farming (cf. Siivonen 1944). It might thus be possible to feed the downy youngs with enrichments of these bacteria cultivated in laboratory, according to Vartiovaara, Roine and Poijärvi (1944).

Summary. Experiments *in vitro* showed that bacterial cultures from the intestinal tract of wild gallinaceous birds definitely decompose cellulose. Although samples from the caeca were the most effective, the digestion of cellulose by the gallinaceous birds is probably not limited to these and the adjoining parts of alimentary canal, a decomposition of cellulose being also caused to some extent by samples from the gizzard.

We want to express our thanks to the manager in chief of the Suomen Riistanhoito-Säätiö (Finnish Game Preservation Foundation), Dr. Lauri Siivonen for his help during this work.

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