DANISH REVIEW OF GAME BIOLOGY Vol. 6 no. 1

Edited by Anders Holm Joensen

Feather Pecking in Pheasants - an Ethological Approach to the Problem

by INGE HOFFMEYER

(Med et dansk resumé: Fjerpilning hos fasaner – en ethologisk undersøgelse.)

Этологическое исследование щипания перьев у фазанов

Vildtbiologisk Station, Kalø, 8410 Rønde, Denmark

1969

DANISH REVIEW OF GAME BIOLOGY Vol. 6 no. 1

Edited by Anders Holm Joensen

Feather Pecking in Pheasants - an Ethological Approach to the Problem

by Inge Hoffmeyer

(Med et dansk resumé: Fjerpilning hos fasaner – en ethologisk undersøgelse.)

Этологическое исследование щипания перьев у фазанов

Vildtbiologisk Station, Kalø, 8410 Rønde, Denmark
1969

CONTENTS

Authors address: Zoological Laboratory,
Universitetsparken 15, 2100 Copenhagen Ø.

Introduction

In spite of numerous theories and investigations, the real causes of feather pecking have not yet been revealed. Reviews of the huge literature about the problem are given e.g. in articles by SIRÉN (1963) and MADSEN (1966).

Most experiments have been based on the hypothesis that feather pecking is due to a need for some specific nutritional substance. However, as pointed out by e.g. SCHAIBLE et al. (1947) and WILLIMON & MORGAN (1953) results are very inconsistent. Many a nutrient supplement, which appears to be effective in one experiment, turns out to be of no influence, when the experiment is repeated. Lately, this was the case with arginine, (see MADSEN, 1966, contra SIRÉN, 1963). Even within the same experiment differences in results have been registered, between groups receiving exactly the same nutritional treatment.

The lack of consistency in results with a great number of alimentary treatments, the apparent influence of the way in which feed is dispensed (pellets versus mash: e.g. CALET 1965), and the finding of some differences in feather pecking between male and female pheasants, when the sexes were kept in separate groups, (MADSEN 1966), all favour the theoretical statement of WOOD-GUSH (1956) that »cannibalism and feather pecking are good subjects for the behaviourist«; these facts form the basis of the conclusion drawn by MADSEN which led to the present study.

In the literature on feather pecking, factors implying behavioral aspects (aggressiveness, »sadism«, boredom, habit formation) do occur in the long lists of hypothetic causes. However, I have not been able to find any work, which concentrates on tackling the problem from the ethological side.

Evidently, the present introductory study does not pretend to lead to the final solution of the problem, incl. to provide efficient practical means against feather pecking. As in all matters of behaviour, a whole complex of factors no doubt are involved. However, since contradictory theories about aggressiveness, nutritional needs etc. still appear, it seems reasonable to investigate the behavioral nature of feather pecking, and try to settle once for all into which category it belongs. This may point at the dominating aspects which should be the subject of future investigations.

The possibility of intraspecific aggressiveness being at the root of the problem, which might seem implied in the widespread opinion that »cannibalism« results from keeping the birds crowded, was enhanced by the finding of a correlation between extent of victimization from feather pecking and rank in the »peck order« (PULLIAINEN 1965); the experiments of MADSEN (1.c.) showing more pecking of back-feathers in male- than in female-groups of pheasants might also be interpreted in the same direction.

I wish to thank dr. HOLGER MADSEN for his encouragement to the present study and for all his kind assistance. I am also much indebted to the pheasant breeders E. CHRISTENSEN, Freerslev, J. CHR. GEJL, Svenstrup, and K. ULFKJÆR, Gyldensteen.

Material and Methods

The study was carried out during the summers of 1966 and 1967, from mid-March to October, at the pheasant breeding farm at Freerslev (Zeeland) mainly, and at the breeding farms of Svenstrup (Zeeland) and of Gyldensteen (Funen).

BEHAVIOUR

An intimate knowledge of the normal behaviour patterns of pheasants was required to understand the nature of their feather pecking behaviour. Therefore, notes were taken about all types of behaviour shown, from hatching of the chicks, throughout their development and when adults.

In the present study, I have however concentrated only on a comparison between feather pecking behaviour and the types of normal behaviour in which a *pecking act* occurs (aggressive behaviour and feeding behaviour). Such a comparative method may be used to elucidate some kind of behaviour, the origin of which is not immediately obvious to the observer; it is possible because of the uniformity and specificity of behaviour patterns in birds. Aggressive pecking and food pecking respectively are performed in the same way by all individuals of the species, and both involve characteristics of the »mood« of the bird. They are typical fixed action patterns, i.e. genetically fixed, internally coordinated and motivated motor patterns.

A general resemblance in external form between either of these types of normal behaviour and the »abnormal« pecking behaviour may be taken as an indication that they are also influenced by the same internal and external factors. This would provide good material for the elucidation of feather pecking, since the factors influencing both feeding and aggressive behaviour have already been studied in detail in various other types of gallinaceous birds, especially domestic fowl.

The behaviour of the adult pheasants was studied mainly during the first part of the breeding season (mating- and early egg-laying period); that of the chicks, from hatching to the age of abt. 12–14 weeks. A total of seven groups of chicks, each comprising abt. one hundred individuals, hatching at one week's interval, were regularly observed; this permitted a continuous repetition of the records taken in regard to each stage of the chicks' ontogenetic development.

The pheasants were watched under natural conditions – in the wood – as well as in houses or flight cages. With regard to the adult birds, it was in both cases necessary to use a hide made of pine-branches. A total of abt. 250 hours were used on observation only.

Along with each observation, records were taken of such specific conditions, which could possibly play a rôle: e.g. types of brooder/house/flight cage used, number of chicks per area unit, type of cagefloor, type of illumination, temperature and available pecking material (e.g. vegetation). With regard to small chicks the following points were particularly noted: the presence or not of a brooding hen, time of removal of heating elements, time of giving the chicks access to outdoor flight cages, time of bill-cutting – mounting of »spectacles«, etc.

Especially during the second year of observation, the aspects of plumage were noted at various ages for the body regions most often victimized (tail, upper tail coverts, back and wings).

EXPERIMENTS

Some of the conclusions drawn from the behaviour study were followed up by experiments based upon registration of extent of feather pecking victimization.

Registration of feather pecking victimization

Discerning the body regions: tail, upper tail coverts, back and wings, the extent of victimization was classified by scores from zero (no sign of feather pecking) to four (no feathers left).

The Tables 1, 2, 3, 6 and 7 are based on the scores registered for each particular body region; the figures given in the ranges (4–3, 2–1 and 0) indicate the number of individuals having received the respective scores for the body region in question.

The Tables 4 and 5 and the Figs. 2, 5 and 6 are based on »total-body scores« obtained by summing the scores of the various body regions of each bird.

Since the relative distribution of scores on single body regions is subject to some variation from group to group, (in one group there may be particularly much tail pecking, in another one almost no tail pecking but back pecking instead), a classification based on total-body scores is supposed to give a better picture of the actual amount of pecking within the particular experimental groups. An individual with high total-body scores must have suffered more pecking than one with low; contrarily, a comparison based on e.g. tail scores alone may often be misleading, since the individual with low tail scores may well have been pecked just as much as the one with high tail scores only on some of the other body regions.

The reason for giving the classifications based on scores of single body regions (Tables 1, 2, 3, 6 and 7) was to provide, as an example, a more detailed account of the feather pecking pattern in some pheasant groups. In regard to the comparison of males and females (Table 6 and 7), the purpose was to see whether in similarity to the results of MADSEN (1966) possible differences in pecking scores between separated males and females might be »concentrated« on single body regions.

At the end of each table text, the numbers obtained by summing up the total-body scores of all the individuals of each group are given. This provides a more complete picture of the differences in amount of feather pecking between the respective groups.

Experimental conditions

In all experiments, factors such as age, number of chicks per m^2, relative proportion of males and females, were as far as possible kept the same within each set of experimental groups (except of course, where one of the mentioned factors was the subject of the experiment). Thus, the chicks of experimental groups to be compared were always from the same hatch, – they were distributed in equal numbers in the groups, – same proportion of males and females in each. Furthermore, the groups compared were given exactly the same conditions apart from the experimental treatment, (same type of flight cage, same climate conditions, same food, etc.).

A certain mortality during the experimental period was of course inevitable, but in order to avoid extraneous factors as much as possible, the dead individuals were not replaced. This is why, in the tables, the numbers of individuals of the groups compared often differ.

Particular data concerning the single tables:

Table 1: Area available per group 11 m^2; initial number of chicks per group 50.

Table 2. Area available per group 24 m^2; initial number of chicks per group 150; (for registration of pecking scores 80 were caught at random from each).

Table 3. Area available per group 24 m^2; initial number of chicks per group 66. The supplies of green were not as abundant as in the two former experiments.

Table 4. Area available per group 24 m^2; initial number of chicks per group 150, (for registration of pecking scores 80 were caught at random from each). The green plastic bands were attached with small intervals to a wooden frame of 3 × 3 m^2 with cross-bars, hanging down from the ceiling, parallel to the cage-floor, and abt. 40 cm above the latter. The plastic bands almost reached the floor, and in addition to their supposed function as »pecking material«, they could act as a hide just as well as the branches with leaves provided to the other experimental group, (Group II).

Table 5. There was in this experiment no possibility of distinguishing between density and flock-size; therefore the latter is mentioned in brackets in the texts of Table 5 and Fig. 5; (for registration of pecking scores, 80 chicks were caught at random from each group).

		Group I – *Hold I*	Group II – *Hold II*	
Body region *Kropsregion*	Feather pecking scores *Fjerpilnings-points*	No supply of clover *Intet kløvertilskud*	Supply of clover *Kløvertilskud*	Probability of Chi-square test *Statistisk sandsynlighed*
		Number of individuals *Antal individer*	Number of individuals *Antal individer*	
Hale Tail	4–3	24	0	< 0,001
	2–1	9	0	
	0	4	45	
Upper tail coverts *Overgump*	4–3	3	0	0,02–0,01
	2–1	3	0	
	0	31	45	
Back *Ryg*	4–3	14	0	< 0,001
	2–1	9	0	
	0	14	45	
Wings *Vinger*	4–3	1	0	< 0,001
	2–1	12	0	
	0	24	45	

Table 1. Influence of abundant (regular) supplies of green clover. Experiment at Gyldensteen breeding farm. Feather pecking scores registered when chicks were three weeks old. Density: abt. 4 chicks per m^2. Sum of total-body scores: For Group I (37 individuals) 208; – for Group II (45 individuals) 0.

Tabel 1. Indflydelse af rigeligt (regelmæssigt) tilskud af grøn kløver. Forsøg i Gyldensteen's fasanopdræt. Fjerpilningsgraden bedømt, da kyllingerne var tre uger gamle. Tæthed: ca. 4 kyllinger pr. m^2. Summen af points opnået ved at lægge totalpoints pr. individ sammen for hvert enkelt hold: Hold I (37 dyr) 208; – Hold II (45 dyr) 0.

Results

BEHAVIOUR

Comparative study

The pecking act

The *aggressive* peck of game pheasants is a steep, quick and vigorous movement, preferably directed to the *head* of the other bird. Since fighting pheasants normally face each other, the peck in general hits the front or crown of the opponent. However, if the latter tries to escape, other body parts may of course be hit, but then always as closely as possible to the head (i.e. neck or upper back).

The peck performed by *feather pecking* pheasants is much less quick and vigorous, and is rather not directed at the head region.

Also other differences between aggressive pecking and feather pecking are obvious: At the start of pecking the *aggressive* pheasant is keeping its head high, in a characteristic way, the bill pointing steeply downwards. The posture is tense and the strong curvature of the upper neck line further emphasized by erected neck feathers. Leaping towards the opponent as if to fortify the movement often accompanies aggressive pecking.

The posture of the *feather pecking* pheasant is generally normal and relaxed. The head and neck do not present the sharply broken line seen in aggressive birds, and neck feathers are not raised. Leaping towards the victim is never observed.

Body region *Kropsregion*	Feather pecking scores *Fjerpilningspoints*	Group I – *Hold I*	Group II – *Hold II*	
		No supply of clover *Intet kløvertilskud*	Supply of clover *Kløvertilskud*	Probability of Chi-square test *Statistisk sandsynlighed*
		Number of individuals *Antal individer*	Number of individuals *Antal individer*	
Tail *Hale*	4–3	58	1	< 0,001
	2–1	17	15	
	0	5	64	
Upper tail coverts *Overgump*	4–3	13	2	< 0,001
	2–1	21	7	
	0	46	71	
Back *Ryg*	4–3	6	6	0,80–0,75
	2–1	54	50	
	0	20	24	
Wings *Vinger*	4–3	0	1	0,005–0,001
	2–1	22	6	
	0	58	73	

Table 2. Influence of abundant (regular) supplies of green clover. Experiment at Freerslev breeding farm. Feather pecking scores registered when chicks were five weeks old. Density: abt. 6 chicks per m^2. Sum of total-body scores: For Group I (80 individuals) 507; – for Group II (80 individuals) 155.

Tabel 2. Indflydelse af rigeligt (regelmæssigt) tilskud af grøn kløver. Forsøg i Freerslev's fasanopdræt. Fjerpilningsgraden bedømt, da kyllingerne var fem uger gamle. Tæthed: ca. 6 kyllinger pr. m^2. Summen af points opnået ved at lægge totalpoints pr. individ sammen for hvert enkelt hold: Hold I (80 dyr) 507; – Hold II (80 dyr) 155.

Behaviour preceding the pecking act

Aggressive pecking is normally preceded by more or less elaborate threatening attitudes: »tall«[1]) posture with legs completely stretched, breast and neck-line almost vertical, tail low. Another threatening posture is the »deep crouch«[1]) with legs flexed, breast almost touching the ground, neck and head drawn back close to the body, tail slightly lifted, tail feathers spread, wings lowered and held out. Intermediates between the mentioned postures are seen, and fighting pheasants often shift quickly up and down, from »deep crouch« to »tall« posture etc. The threatening postures are often accompanied by a characteristic rolling sound, which may be heard from the age of 2–3 weeks.

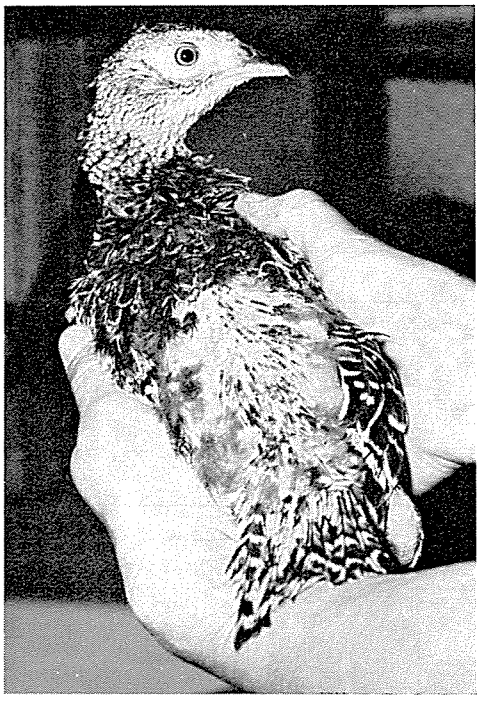

Fig. 1. Growing feathers offer the same type of optical stimuli as the drawings and objects, which in experiments were found to release the feeding pecks of pheasant chicks (see p. 12).

Fig. 1. Fjer, der endnu ikke er udvoksede, frembyder samme type optiske stimuli som tegninger og genstande, der, iflg. forsøg, udløser fasankyllingers fødehak (se s. 12).

[1]) the terms »tall« and »deep crouch« are used by FOREMAN & ALLEE (1959) for similar postures of domestic fowl.

Feather pecking is preceded by a quite different behaviour. The posture is normal, the movements relaxed. The pheasant either stands or walks about as if »searching for something to peck at«. The behaviour gives a general impression of randomness: The pheasants observed did peck at various companions, which they encountered while walking about, and in between they pecked in exactly the same manner at various objects available. However, some individuals from time to time showed a certain constancy in feather pecking, (I use the term: »feather pecking specialists«). These birds repeatedly pecked at the feathers of penmates, or even sometimes at the same body region of several birds in succession. Such constancy was observed already with regard to bill- or toe-pecking in newly hatched chicks.

Angle of approach

Feather pecking pheasants generally approach their victims from behind or from the side. This also is in contrast with the behaviour of *aggressive* birds, which try to »face« the opponent. Pecking at frontal regions in the non-aggressive way however occurred in particular cases: small chicks would peck at the bill or toes of others from the frontal side, and breast-feathers of a pheasant cock were pecked at by companions from which it was separated by a wire fence.

The latter observations indicate that feather pecking pheasants avoid frontal parts because, pecks directed from a

»facing« position generally elicit an aggressive response (see below). Among very young chicks, aggressive patterns have not maturated yet and therefore bill- and toe-pecking from the front is still possible. In the case of the cock mentioned, the presence of a wire fence apparently inhibited the normal aggressiveness-releasing effect of such frontal pecking.

Behaviour succeeding the pecking act

The *aggressive* bird may continue for some time to threat and peck at the opponent, and if the latter tries to escape, to pursue it in »tall« posture directing more pecks as closely as possible to the head. Finally, the »winner« often shows some post-fight patterns, such as ruffling the feathers and walking about in a characteristic tense manner, with short steps on stiff legs.

The *feather pecking* pheasant generally just pecks a few times at a feather of some penmate and then walks on to the next one or to any other pecking item in the cage. The very pecking at a feather of a certain size sitting on a penmate is followed by a pulling act exactly similar to the pulling at any attached pecking item: a leaf on a branch, a rootlet or an attached woollen string. Once loosened, the feather is either swallowed or dropped to the ground, pecked up again or left. This also quite resembles the usual way of treating any pecking item of a similar size and placement.

If a pheasant is pecking at a feather,

Body region *Kropsregion*	Feather pecking scores *Fjerpilningspoints*	Group I – *Hold I*	Group II – *Hold II*	Probability of Chi-square test *Statistisk sandsynlighed*
		Supply of beech branches with green leaves *Tilskud af bøgegrene med grønne blade*	Supply of green clover on floor *Tilskud af grøn kløver spredt på voliéregulvet*	
		Number of individuals *Antal individer*	Number of individuals *Antal individer*	
Tail *Hale*	4–3	42	63	< 0,001
	2–1	3	0	
	0	13	1	
Upper tail coverts *Overgump*	4–3	22	46	< 0,001
	2–1	10	9	
	0	26	9	
Back *Ryg*	4–3	12	50	< 0,001
	2–1	9	7	
	0	37	7	

Table 3. Influence of the way in which the green food supply is given. Leaves attached to branches is the way most closely imitating the conditions of pheasants' natural habitat. Experiment at Freerslev breeding farm. Feather pecking scores registered when chicks were ten weeks old. Density: abt. 3 chicks per m^2. Sum of total-body scores for Group I (58 individuals) 316; – for Group II (64 individuals)638.

Tabel 3. Indflydelse af den måde hvorpå grønttilskud gives. Fastsiddende blade på grene er det, der bedst ligner betingelserne i fasanernes naturlige miljø. Forsøg i Freerslev's fasanopdræt. Fjerpilningsgraden bedømt, da kyllingerne var ti uger gamle. Tæthed ca. 3 kyllinger pr. m^2. Summen af points opnået ved at lægge totalpoints pr. individ sammen for hvert enkelt hold: Hold I (58 dyr) 316; – Hold II (64 dyr) 638.

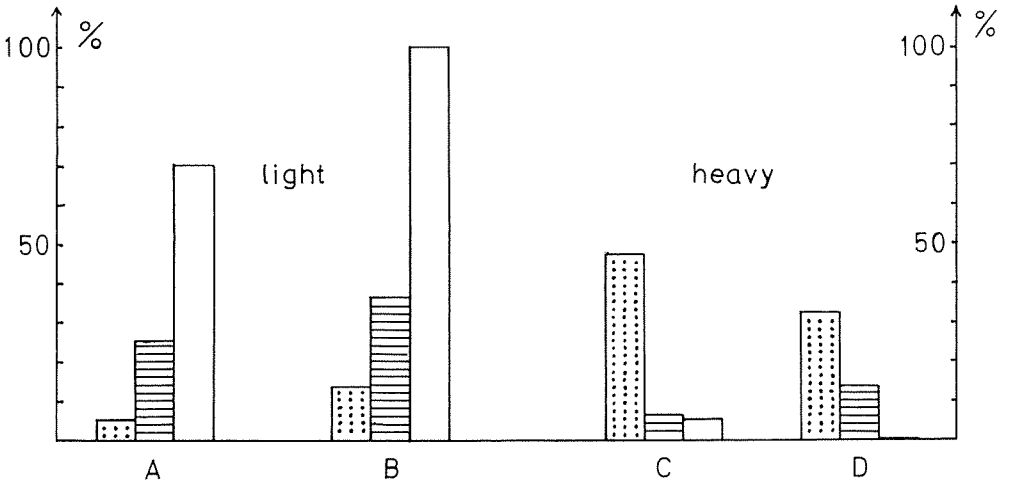

Fig. 2. Results from two parallel experiments concerning the influence on feather pecking of green supplies; the experiments were carried out at separate breeding farms. A and C represent the experimental groups of Freerslev, (age at registration of pecking scores: 5 weeks); B and D represent the experimental groups of Gyldensteen, (age at registration of pecking scores: 3 weeks). Each block shows the percentage of the respective experimental group, which had a given level of total-body scores: 1) 0–2 in the category »light«; 2) $\geqq 7$ in the category »heavy«.

Dotted blocks represent groups having received no green supply; hatched blocks represent groups having received regular supplies of branches with green leaves; unfilled blocks represent groups having received regular supplies of short green clover.

Except for the pair »branch«-group/»clover«-group of C, all the differences are significant: $p < 0{,}05$.

Fig. 2. Resultatet fra to parallel-forsøg udført i adskilte opdræt, angående indflydelsen af grønttilskud på graden af fjerpilning. A og C repræsenterer forsøgsholdene i Freerslev (fasankyllingernes alder ved bedømmelse af fjerpilninsgraden: fem uger); B og D repræsenterer forsøgsholdene på Gyldensteen (alder ved bedømmelse af fjerpilningsgraden: tre uger). Hver blok viser den procent af det pågældende forsøgshold, som fik et givet antal points for alle kropsregioner tilsammen: 1) 0–2 i kategorien »light« (let grad); 2) $\geqq 7$ i kategorien »heavy« (svær grad). Prikket, skraveret, ikke udfyldt, angiver respektivt: hold der ikke fik noget grønttilskud, hold der fik regelmæssige tilskud af grene med grønne blade, hold der fik regelmæssige tilskud af kortskåren grøn kløver.

Med undtagelse af »gren«-hold/»kløver«-hold-sammenligningen i C, er alle forskelle signifikante: $p < 0{,}05$.

the attention of one or more penmates may often be attracted and the latter starts pecking at the same, (this happens whether the feather is still sitting on the tail or back of a bird, or is lying on the ground).

»Food-running« with feathers was also observed quite frequently. This curious behaviour pattern which consists in the chick running about with some pecking item in its bill has previously been described by various authors in domestic chicks and junglefowl (see e.g. SPALDING 1873, BRÜCKNER 1933, BÄUMER 1955 and KRUIJT 1964). It is apparently released by an item of a certain size which is too big to be swallowed quickly. Pheasant chicks were observed running in this way with all sorts of objects: living prey, chips of wood, leaves (both fresh

and dead) woollen strings, feathers etc.

At first sight, the behaviour seems to have the function of saving some »attractive food« from other chicks. However, in a group, the sudden running of one member rather attracts the attention of the others: A few often start pursuing their food-running companion trying to catch the object, which thus may be passed on to several individuals in succession. In view of this, the behaviour is suggested to have a function in the spreading of feeding habits within a group of social birds, (see KRUIJT 1964). More particularly in regard to feather pecking, food-running with feathers may attract the attention of others than the »pioneers« to this type of pecking object, (see Discussion).

»Peck-releasing« stimulation

Acting on the suggestion of WOOD-GUSH (1956) according to which the »stimuli which initiate outbreaks of feather peck-

	Group I – *Hold I*	Group II – *Hold II*	
Feather pecking* scores of total body *Fjerpilningspoints* for hele kroppen*	Supply of green plastic bands attached to a frame *Nedhængende grønne plasticstrimler*	Supply of beech branches with green leaves *Bøgegrene med grønne blade*	Probability of Chi-square test *Statistisk sandsynlighed*
	Number of individuals *Antal individer*	Number of individuals *Antal individer*	
≧7	38	5	< 0,001
6–3	38	55	
2–0	4	20	

	Group I – *Hold I*	Group II – *Hold II*	
Feather pecking scores of total body *Fjerpilningspoints for hele kroppen*	Supply of green plastic bands attached to a frame *Nedhængende grønne plasticstrimler*	Supply of green clover on cage floor *Afskåren grøn kløver*	Probability of Chi-square test *Statistisk sandsynlighed*
	Number of individuals *Antal individer*	Number of individuals *Antal individer*	
≧7	38	4	< 0,001
6–3	38	20	
2–0	4	56	

Table 4. Influence of the nature of the pecking material supplied. Experiment at Freerslev breeding farm. Feather pecking scores registered when chicks were five weeks old. Density: abt. 6 chicks per m². Sum of total-body scores: for Group I (80 individuals) 507; – for Group II (80 individuals) 308; – for Group III (80 individuals) 155. * See p. 5.

*Tabel 4. Indflydelse af arten af det tilbudte »hakkemateriale«. Forsøg i Freerslev fasanopdræt. Fjerpilningsgraden bedømt, da kyllingerne var fem uger gamle. Tæthed: ca. 6 kyllinger pr. m². Summen af points opnået ved at lægge totalpoints pr. individ sammen for hvert enkelt hold: Hold I (80 dyr) 507; – Hold II (80 dyr) 308; – Hold III (80 dyr) 155. * See s. 5.*

ing and cannibalism« should be searched for, an attempt was made to analyse the environmental situation under which aggressive pecking and food pecking respectively occurs, in order to get some indication as to what type of stimuli may release feather pecking. Only a short description:

Aggressive pecking

At early ontogenetic stages (from the age of abt. 4–5 days, light threatening and fighting occurred, when two or more pheasant chicks happened suddenly to face each other. Such small initial fights were particularly often recorded at places illuminated by some light source (under a lamp or close to a window).

From the age of abt. 3 weeks, such quick arousals of aggressiveness were observed quite often during »flight-hopping«, when two chicks accidentally more or less bumped into each other front to front.

Thus, initial fighting is apparently elicited by such stimuli, optical and tactile, which are normally provided by an opponent during a fight. These stimuli (e.g. visual impressions provided by the sudden approach of bill and frontal parts of another chick) are the strongest releasers of aggressive pecking, since they are effective even when the birds are not aggressively motivated beforehand. The importance of optical stimulation is indicated by the high frequency of aggressive encounters in connection with a light source.

Another type of aggression-releasing situation was further observed. Even very young pheasant chicks would direct vigorous aggressive pecks at the crown or upper neck of companions in cases where several individuals were pecking eagerly at the same object. Here, the chicks were obviously motivated beforehand by the competition factor and stimuli less than optimal were required to release aggressive pecking.

From the age of abt. 4 weeks, some individuals seemed to become aggressively motivated even without the immediate presence of other chicks, but close to a food tray or some other desired item. Such pheasants would walk within a certain distance from e.g. the food tray in the characteristic lightly threatening way, with tense movements and body feathers slightly raised. In these cases aggressive pecking was released by the mere approach of some companion to the defended area.

Food pecking

Contrarily to aggressive behaviour, which clearly goes through a post-hatching maturation process, the fixed motor patterns and respective »releasing mechanisms« of feeding behaviour in pheasants are present from the moment of hatching.

By using figures drawn on a uniform background as has been done by others with e.g. domestic chicks (see p. 25), it was in the first place demonstrated that optical stimuli alone may release feeding pecks of pheasant chicks just like described for the domestic chicks.

In tests, where the chicks were given a choice between two pecking items, each representing one stimulus quality, the following innate preferences were noted: – In general, small spots and fine lines were pecked at. Furthermore, fine lines radiating from a bigger spot (diameter abt. 20 mm), and the edge of the spot were preferred to the middle of same. Small 3-dimensional items were preferred to flat (2-dimensional) ones of the same size, colour and sheen. Shiny items were preferred to dull ones. Green was preferred to all colours (see also KEAR 1964). In short, *contrast* and *green* colour

were the strongest releasers of feeding pecks in newly hatched pheasant chicks. Food pecking was further stimulated by *moving* the pecking object. Call notes from a hen clearly increased pecking motivation.

Feather pecking

Although, in aggressive encounters, feathers happen to be loosened when the opponents peck at each other, (they may even be swallowed on such occasions) – feather pecking in the normally observed form occurred quite independently of the aggression-releasing situations mentioned above, i.e. rather without frontal approach and without competitive factors. In fact, it was observed all over the available area of the breeding cages, i.e. not particularly at food trays or other competitive objects.

Initially, i.e. during a few days after hatching, a type of pecking quite similar to the type later shown in feather pecking was aimed by the chicks at feet, bill, cloaca and wings of companions. This suggested a relationship with normal food pecking behaviour, since the mentioned body parts very clearly provide the same kind of optical stimuli as such figures and objects, which, as mentioned above, the newly hatched pheasant chicks preferably pecked at.

1) Small growing *wing feathers* may – particularly at the base – give the same optical impression as a narrow contrasting line with a shiny surface. This contrast effect of new wing feathers on a downy chick is particularly evident on the white mutants; the latter also were particularly frequent victims of wing pecking.

2) The *cloaca* of a chick gives the optical effect of a contrasting spot. The stimulus effect may even be enhanced by the movement produced by the cloacal muscle.

3) Pecking at *toes* of companions was frequent as long as the feet remained pink and shiny i.e. offering sharp contrast upon the dark netting of the brooder.

At later developmental stages, pheasants were often observed pecking at those body regions of companions where new feathers were just appearing or in growth. This observation, as well as an apparent correlation in time between the development of feathers on the back and tail region, and the victimization of these parts, further indicate that feather pecking is elicited by the same types of stimuli which release the normal food pecking response. Small developing feathers are particularly rich in contrast effect, (see Fig. 1 p. 8). They are narrow-shaped, of a different colour, and the feather sheat has a shiny surface.

Behaviour of pheasants subject to feather pecking

Generally, the pheasants from which feathers were pecked did not show any particular reaction. They would continue eating, dust-bathing or the like, as if completely unaware of being pecked. On the contrary a chick, which was approached and pecked by an aggressive bird, always reacted in some way, either by threatening or by submissive postures.

Reactions such as fleeing, defense postures or even attack may be seen if the feather pecking bird pecks at frontal parts, or if the pecking causes pain. The latter is particularly the case among older and stronger individuals and in groups, where feather pecking has developed to such an extent that the victimized body regions have become wounded and sore.

The question of correspondence between dominant-subordinate relationships (»peck order«) and »feather-pecker«-victim relationships

Dominant-subordinate relationships are established in pheasants like in domestic fowl (see COLLIAS & TABER 1951, PULLIAINEN 1965). The factors which determine dominance have been

studied in domestic fowl. Frequency of aggressive pecking is one (KING 1965); furthermore, sex and age play a rôle: males dominate females – the administration of male sex hormone makes the respective birds progress in the »peck-order« – (e.g. ALLEE et al. 1939 and GUHL 1964); older individuals dominate younger companions; concerning the rôle of body weight as indicant of success in dominance encounters, there is some divergence in results. COLLIAS (1944), GUHL (1953) and WOOD-GUSH (1955) found a correlation in domestic fowl, whereas Pulliainen did find no such correlation in a group of pheasants.

In view of the possibility of a correspondence between feather pecking and dominance pecking (PULLIAINEN 1965 found a correspondence between ranking after feather pecking scores and »peck order«), special attention was paid during observation of the pheasants' behaviour, to the question whether the individuals pecking feathers from penmates were identical with the dominants of the »peck order« relationships.

The result in short was that there is no primary correlation between the two phenomena. Feather pecking pheasants did not assume the attitudes which are normally displayed by dominants in approaching subordinate individuals. Furthermore, feather pecking occurred in complete disaccord with normal »peck rights«. Small weak individuals were observed pecking feathers from bigger and stronger companions, young from older ones, females from males, subordinates of a clearly established »peck order« from their dominants – just as the reverse.

Such disaccord with hierarchical order might of course be a consequence of extreme crowding: KING (1965 a) describes »disruptions in the pecking order concomitant with crowding at a food source«.

	Group I – *Hold I*	Group II – *Hold II*	Group III – *Hold III*
Feather pecking scores of total body *Fjerpilningspoints for hele kroppen*	1,1 chick/m² *1,1 kylling/m²*	1,8 chick/m² *1,8 kylling/m²*	2,5 chick/m² *2,5 kylling/m²*
	Number of individuals *Antal individer*	Number of individuals *Antal individer*	Number of individuals *Antal individer*
≧7	2	6	38
6–3	37	47	34
2–0	41	27	8
Probability of Chi-square test: *Statistisk sandsynlighed:*	0,05–0,025	< 0,001	

Table 5. Influence of density (flock-size); (see p. 6). Experiment at Freerslev breeding farm. Feather pecking scores registered, when chicks were seven weeks old. All three groups were kept on the same size of area (84 m²), but Group I comprised 90 chicks, Group II 150 chicks and Group III 210 chicks. For registration of pecking scores, 80 individuals were caught at random from each group. Sum of total body scores: for Group I (80 individuals) 216; – for Group II (80 individuals) 273; – for Group III (80 individuals) 509.

Tabel 5. Indflydelse af tæthed (flokstørrelse); (se s. 6). Forsøg i Freerslev fasanopdræt. Fjerpilningsgraden bedømt, da kyllingerne var syv uger gamle. Alle tre hold havde samme størrelse areal til rådighed (84 m²), men Hold I bestod af 90 dyr, Hold II af 150 dyr og Hold III af 210 dyr. Til bedømmelse af fjerpilningsgrad blev der foretaget en tilfældig indfangst af 80 dyr fra hvert hold. Summen af points opnået ved at lægge totalpoints pr. indvid sammen for hvert enkelt hold: Hold I (80 dyr) 216; – Hold II (80 dyr) 273; – Hold III (80 dyr) 509.

Body region *Kropsregion*	Feather pecking scores *Fjerpilningspoints*	Group I – *Hold I*	Group II – *Hold II*	Probability of Chi-square test *Statistisk sandsynlighed*
		Males *Hanner*	Females *Hunner*	
		Number of individuals *Antal individer*	Number of individuals *Antal individer*	
Tail *Hale*	4–3	43	10	< 0,001
	2–1	7	6	
	0	9	24	
Upper tail coverts *Overgump*	4–3	3	5	0,005–0,001
	2–1	8	15	
	0	48	20	
Back *Ryg*	4–3	2	5	0,005–0,001
	2–1	7	15	
	0	50	20	

Table 6. Comparison of feather pecking in male and in female pheasant chicks, which have been kept in separate groups from the age of one week. Experiment at Freerslev breeding farm. Feather pecking scores registered when chicks were twelve weeks old. Density: 1) for the male group abt. 0,7 chick per m^2, 2) for the female group abt 0,5 chick per m^2; (the area available to each group, being of 84 m^2, the density factor is judged of minor importance in the present case). Sum of total-body scores: for Group I (59 individuals) 203; – for Group II (40 individuals) 119.

Tabel 6. Sammenligning af fejrpilning mellem et han-hold og et hun-hold af fasankyllinger, hvor kønnene har været adskilt, fra dyrene var én uge gamle. Forsøg i Freerslev fasanopdræt. Fjerpilningsgraden bedømt, da kyllingerne var tolv uger gamle, Tæthed: 1) i han-holdet ca. 0,7 kylling pr. m^2, 2) i hun-holdet ca. 0,5 kylling pr. m^2; (da hvert hold havde et areal på 84 m^2 til rådighed, kan tæthedsfaktoren i dette tilfælde næppe spille nogen større rolle). Summen af points opnået ved at lægge totalpoints pr. individ sammen for hvert enkelt hold: Hold I (59 dyr) 203; – Hold II (40 dyr) 119.

However, as mentioned, the cases of feather pecking observed occurred all over the available area of the pens, and not particularly at food trays or other places providing a cause for competition.

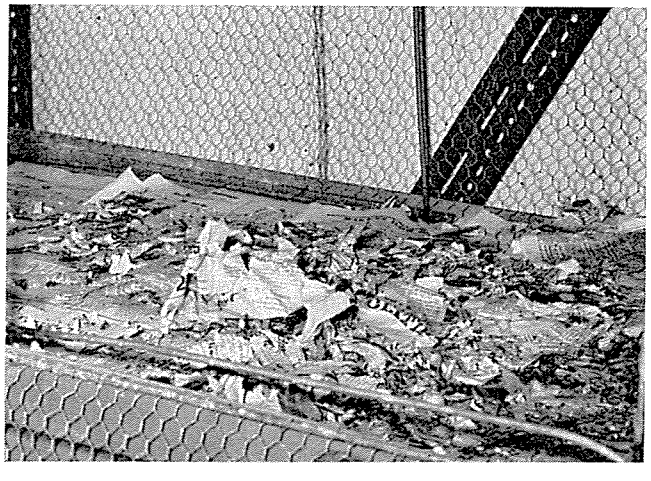

Fig. 3. A pheasant cockerel, which was kept isolated, pecked newspapers to pieces. Food pellets and water were constantly available.

Fig. 3. En ung fasankok, der holdtes isoleret, hakkede aviser i småstumper. Der var til stadighed rigelige mængder af foderpiller og vand i buret.

Conclusion

The feather pecking behaviour appears to be completely different in aspect from the aggressive behaviour of the species. Thus, feather pecking is apparently not motivated by intraspecific aggressiveness. Even if the noxious pecking were a case of »redirected pecking«, like ground pecking in aggressive junglefowl (KRUIJT 1964) and grass-pulling in fighting gulls (TINBERGEN 1953), there would be some traits (e.g. vigour of movement) revealing the actual »mood« of the birds. This however was never the case in the numerous instances of feather pecking observed.

The close resemblance to feeding patterns also demonstrates that feather pecking is rather due to factors concerning the feeding instinct.

As the types of behaviour shown by pheasants do not diverge in principle from those described in earlier literature on domestic fowl, generalization as to feather pecking in domestic fowl seems admissible.

EXPERIMENTS

Some experiments were made to investigate whether a supply of vegetation in the breeding cage might have an effect in limiting feather pecking. The rationale for these experiments were the following facts:

1) The feather pecking behaviour of pheasants is very similar to their normal feeding behaviour directed at leaves, rootlets and the like.

2) Items plucked from surrounding vegetation constitute an important part of the food intake of free living pheasants. Analysis of crop contents (see e.g. HAMMER, KØIE & SPÄRCK 1955) generally show a high percentage of green food. My own observations as to the feeding habits of free living pheasants confirm this. The birds in fact spend much time pecking and pulling at the surrounding vegetation.

3) During the observation period, I got the impression that pheasant groups provided with some sort of vegetation in their cage, showed much less feather pecking than those which had only food pellets and water at their disposal.

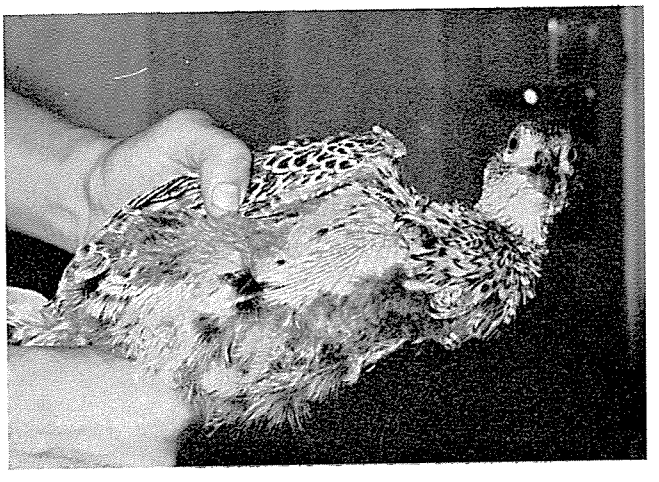

Fig. 4. A pheasant chick, which was kept isolated in a totally bare room, pecked its own breast feathers. Food pellets and water were constantly available.

Fig. 4. En fasankylling, der holdtes isoleret i et helt bart rum, pillede sine egne brystfjer. Der var til stadighed rigelige mængder af foderpiller og vand i buret.

Influence of supplies of fresh green food

To test whether a green food supply may actually have an influence on feather pecking, two similar experiments were made at separate breeding farms (Freerslev and Gyldensteen). In each, one group of pheasant chicks received from the age of one week a daily supply of clover (shortly cut), whereas the control group received no such clover supply. All other

		I	II	
Body region *Kropsregion*	Feather pecking scores *Fjerpilningspoints*	Males *Hanner*	Females *Hunner*	Probability of Chi-square test *Statistisk sandsynlighed*
		Number of individuals *Antal individer*	Number of individuals *Antal individer*	
Tail *Hale*	4–3	26	16	0,05–0,025
	2–1	1	2	
	0	3	10	
Upper tail coverts *Overgump*	4–3	12	10	0,75–0,70
	2–1	6	4	
	0	12	14	
Back *Ryg*	4–3	4	8	0,20–0,10
	2–1	3	6	
	0	23	14	

Group with both males and females = the »branch«- group of Table 3.
Hold af hanner og hunner sammen = »gren«-holdet fra Tabel 3.

		I	II	
Body region *Kropsregion*	Feather pecking scores *Fjerpilningspoints*	Males *Hanner*	Females *Hunner*	Probability of Chi-square test *Statistisk sandsynlighed*
		Number of individuals *Antal individer*	Number of individuals *Antal individer*	
Tail *Hale*	4–3	31	32	–
	2–1	0	0	
	0	1	0	
Upper tail coverts *Overgump*	4–3	21	25	0,10–0,05
	2–1	4	5	
	0	7	2	
Back *Ryg*	4–3	22	28	0,05–0,025
	2–1	3	4	
	0	7	0	

Group with both males and females = the »clover«-group of Table 3.
Hold af hanner og hunner sammen = »kløver«-holdet fra Tabel 3.

Table 7. Comparison of feather pecking in male and female pheasant chicks, which have been kept together in mixed groups from hatching. For further data see Table 3, as the chicks used here are the same as those of that table.

Tabel 7. Sammenligning af fjerpilning mellem han- og hun-fasankyllinger hvor kønnene ikke er blev holdt adskilt. Angående yderligere data, se tabel 3, da der er tale om de samme dyr.

conditions (food etc.) were equal. The results are given in: Tables 1 and 2. In both experiments the extent of feather pecking victimization was significantly lower in the »clover group«.

Influence of the way in which green food is given

The feather pecking scores of ten week old pheasant chicks were compared after they had been separated for two weeks in equal groups. One of the groups had received beech branches, the leaves of which the chicks must detach by pulling, and the other one shortly cut clover leaves on the floor. All other conditions (food etc.) were equal. The results are given in Table 3. There is a clear difference between the two groups. The chicks, which received their green food supply in a way most closely imitating natural conditions showed less feather pecking than the other ones.

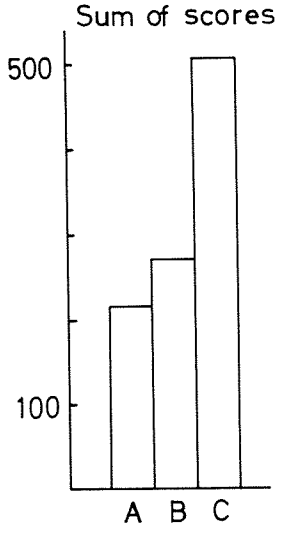

Fig. 5. Influence of density. Each block represents the sum of total-body scores of 80 individuals caught at random in one of the following groups: A – a group of 90 chicks on 84 m^2. B – a group of 150 chicks on 84 m^2. C – a group of 210 chicks on 84 m^2; (see also Table 5).

Fig. 5. Indflydelse af tæthed. Hver blok repræsenterer summen af points (angivende fjerpilningsgrad) for 80 individer indfanget ved tilfældig udvælgelse i et af følgende hold: A – et hold med 90 kyllinger på 84 m^2. B – et hold med 150 kyllinger på 84 m^2. C – et hold med 210 kyllinger på 84 m^2; (se iøvrigt Tabel 5).

Influence of the nature of the pecking material supplied

To test the possible influence of the nature of the pecking objects on feather pecking limitation, one group of pheasant chicks (group I) was given green plastic bands attached to a wooden frame hanging down from the ceiling of the cage. At the beginning, the chicks pecked at the plastic bands, but they soon »lost interest« in this type of vegetation substitute. After a period of four weeks, the victimization scores of the »plastic group« were compared to those of corresponding groups having received branches with leaves (group II) and clover (group III) respectively during the same period. The three groups were treated equally in all other respects. The results are given in Table 4 p. 11.

This shows that the nature of the pecking objects is not unimportant. Under the given conditions, loose clover (group III) gave the least feather pecking.

When comparing the results of this experiment with that of the previous one, a contradiction appears in regard to the respective effects of branches with leaves as opposed to loose clover. This however is certainly due to the difference in age of the chicks used, (ten weeks at registration of scores in the experiment of Table 3 and five weeks in the experiment of Table 4). From direct observation it was noted that the younger chicks were pecking less at the leaves on branches than at the loose clover leaves. The same was the case in a third experiment, where

pecking scores were registered already in three week old chicks.

For comparison, the results of the two experiments with 3 and 5 week old chicks are given together in Fig. 2 p. 10.

It is a problem, why pheasant chicks younger than five weeks were pecking less at leaves on branches than their older companions – which usually pulled every bit off. A generally lower interest in plant material during the first month after hatching (see results of crop analyses – Hammer, Køie & Spärck 1955 – according to which food of animal origin predominates in young pheasant chicks) is not likely to be the only reason, as chicks of the same age continually pecked at the clover leaves on the floor. The explanation may rather be found in the lesser ability of smaller chicks to pull off the leaves, which might have »discouraged« them from pecking at this type of green material, after a certain number of unsuccessful attempts; – in a similar way as it happened in the »plastic group«.

Anyhow, the registration-results and the observations, when taken together, indicate that feather pecking scores are influenced by the amount of pecking directed at material available in the breeding cage.

Relative distribution of pheasants' food pecking activity under conditions of food deprivation and of non-deprivation

To get an idea of the food pecking activity of pheasants, and of the »portions of pecking« directed at the normal food supply (grains or pellets), and at other material without feeding value respectively, the following experiment was made:

The number of feeding pecks effected by pheasant chicks during five minutes were counted. Thereby, the pecks directed at food, and those directed at other objects in the cage were recorded in separate columns. 5–6 chicks were used, but only one at a time was observed.

As could be expected, pecking activity was much greater, when the chicks had been deprived of food, than when food was continuously available; furthermore, when the chicks had been deprived, they directed most of their pecks at the food-tray. However, when food was continuously available a large portion of the total number of pecks were directed at objects different from the pheasant fodd. This portion for instance in the middle of the day: Of an average of 60 pecks/5minutes (obtained from 6 chicks) only 20% were directed at food, and 80% at other available material; see Table 9 p. 22.

Examples of the consequences of such »surplus pecking« may be given: An isolated pheasant cockerel pecked newspapers covering the bottom of its cage to pieces (see Fig. 3). A group of pheasants tore a sackcloth partition-curtain apart; another one pulled the wall paper of their cage to pieces. It does not seem unreasonable to draw a parallel between these cases and that of an isolated pheasant chick, which pulled its own breast feathers (see Fig. 4); the chick in question had no paper nor any other pecking material in its cage, except the normal supply of grains and pellets.

The question why pheasant chicks go on pecking at some material and stop pecking at other – as in the case of the chicks' reaction to fastened green plastic bands would deserve more detailed studies. Certainly, to make the chicks acquire the habit of pecking at a given type of material, it is necessary that this provides some positive reinforcement. The precise nature of this reinforcement should be the object of future investigation; »detachability«, taste, tactile impressions (e.g. »juiciness«) possibility of being swallowed, are some of the quali-

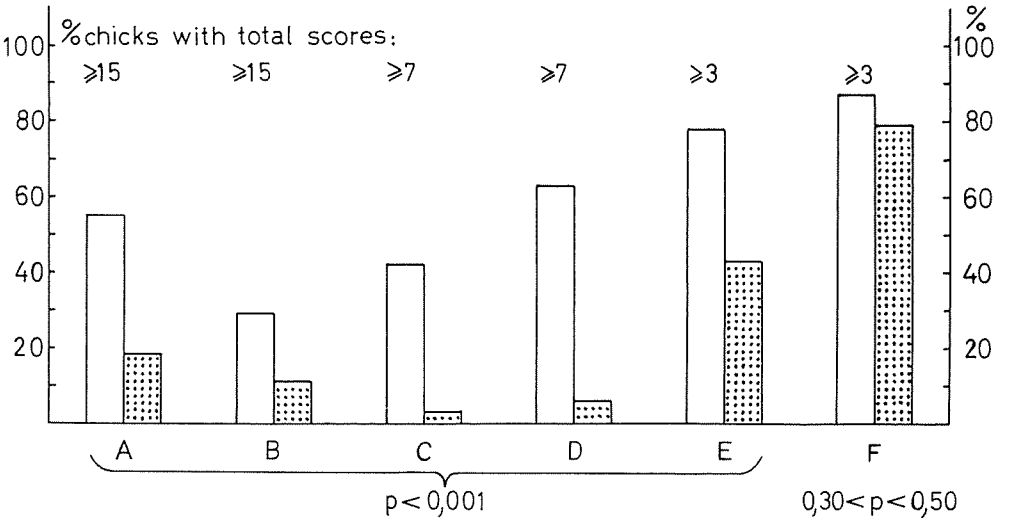

Fig. 6. Comparison of male and female pheasant chicks with regard to feather pecking. A, B, C, D and E are from experiments, where the two sexes were kept in separate groups; F is from one, where the sexes were together in the same group. The blocks represent the percentage of chicks of the respective groups with a given amount of total-body scores, (≧ 15 in the A and B groups, etc.). The unfilled blocks are the males, the dotted blocks the females. Since, the extent of feather pecking victimization varied from one experiment to the other, the level of total-body scores taken for comparison had to be chosen individually for each pair of experimental groups. The statistical probabilities (Chi-square tests) are based on the numbers given in Table 8 p. 21.

Fig. 6. Sammenligning af fjerpilning hos han- og hun-fasankyllinger. A, B, C, D og E er fra forsøg, hvor de to køn blev holdt adskilt, F er fra ét, hvor de gik sammen. Hver blok viser den procent af det pågældende hold, som fik et givet antal points for alle kropsregioner tilsammen (≧ 15 i A- og B-grupperne, etc.). Ikke udfyldt og prikket angiver henholdsvis hanner og hunner. Da graden af pilning varierede ret betydeligt fra forsøg til forsøg, var det nødvendigt hver gang særskilt at vælge det niveau, som skulle danne grundlag for sammenligning af de pågældende hanner og hunner, (derfor 15 for A og B, 7 for C og D osv.). Udregningerne af statistisk sandsynlighed er baseret på de tal, som er angivet i Tabel 8, s. 21.

ties which may act as positive reinforcement.

Vegetation being a normal »goal« of pheasants' food pecking in their natural habitat is likely to consume a good portion of their pecking activity in breeding cages. This must be the way in which vegetation is effective in limiting feather pecking.

Influence of number of individuals per area unit

By registration of feather pecking scores of groups of pheasant chicks, with different numbers of individuals per m^2, the results shown in Table 5 and Fig. 5 were obtained. According to these, there is a rise in feather pecking with increasing number of individuals per m^2.

On the condition of paying regard to differences in age and treatment, the same tendency may be noted when comparing other experimental groups with different densities: e.g. the groups of Table 2 (6 chicks per m^2) with those of Table 6 (0,5–0,7 chicks per m^2).

However, this influence of density on

Experiment *Forsøg*	Age in weeks *Alder i uger*	Level of total-body scores *Fjerpilningspoints for hele kroppen*	Number of individuals *Antal individer* ♂	♀	Sum of total-body scores whole group *Sum af points opnået ved at lægge sammen for alle regioner for alle individer pr. hold* ♂	♀
A) Freerslev 1964 (+ arginine)	6	≧ 15	68	24	2415 (n=124)	1430 (n=130)
		< 15	56	106		
			124	130		
B) Freerslev 1964 (÷ arginine)	6	≧ 15	36	12	1504 (n=124)	1153 (n=112)
		< 15	88	100		
			124	112		
C) Svenstrup 1964 (+ arginine)	6	≧ 7	15	1	223 (n= 36)	49 (n= 32)
		< 7	21	31		
			36	32		
D) Svenstrup 1964 (÷ arginine)	6	≧ 7	12	2	137 (n= 19)	87 (n= 36)
		< 7	7	34		
			19	36		
E) Freerslev 1966	12	≧ 3	46	17	203 (n= 59)	118 (n= 40)
		< 3	13	23		
			59	40		
F) Freerslev 1964	10	≧ 3	26	22	173 (n= 30)	143 (n= 28)
		< 3	4	6		
			30	28		

Table 8. The sets of experimental groups A, B, C and D are groups used primarily in experiments on the effect of arginine (see Madsen 1966).
Tabel 8. Forsøgsgrupperne A, B, C og D anvendtes primært til arginin-forsøg (se Madsen 1966).

the extent of victimization does not imply that crowding is the *cause* of feather pecking (see Discussion p. 28).

Influence of separation of sexes

The scores of *separated* males and females are given in Table 6, and those of males and females from *mixed* groups in Table 7 p. 17.

The results are in accordance with those of MADSEN (1966) in one respect: a clear difference between males and females when kept in separate groups which is lacking in the mixed groups. However, the results of MADSEN diverge from mine in regard to the body region, where the difference in feather pecking victimization appears. MADSEN found that the females pecked the back significantly less than the males, while there was no significant difference in tail pecking. In my experiment, on the contrary, it was the tail region which was pecked significantly less in the female than in the male group; the same female group, however showed relatively more back pecking: 70% of the female group showed back-pecking victimization as opposed to only 20% of the male group; (in regard to the tail region, 40% of the female group showed victimization as opposed to 85% of the male group).

This gave rise to the question, whether the differences found between separated males and females are at all due to sex dependent factors, i.e. whether they represent anything else than the sort of variations, which may always arise between separated groups.

In fact for a full understanding of the

A. Number of pecks/5 minutes directed by 5 pheasant chicks respectively at food and at other material in the cage, when food trays have been removed for a time. (5 chicks were observed separately).
A. Antal hak/5 min. rettet mod henholdsvis foder og andre tilfældige objekter i buret når foderet har været fjernet et stykke tid; (5 dyr blev observeret særskilt).

Number of pecks/5 minutes directed at .. *Antal hak/5min. rettet mod*	Food *Foder*	Other material in the pen *Andre objekter*	Total
Morning (food-trays removed »over-night«) *Morgen (foder havde været fjernet hele natten)*	154	30	184
	312	24	336
	237	27	264
	392	13	405
	501	0	501
n = 5	1596	94	1690
(Average = *Gennemsnit* =	319	19	338)

Number of pecks/5 minutes directed at .. *Antal hak/5min. rettet mod*	Food *Foder*	Other material in the pen *Andre objekter*	Total
Evening (food-trays had been removed for 5 hours) *Aften (foder havde været fjernet i 5 timer)*	753	0	753
	260	6	266
	336	0	336
	448	0	448
	521	2	523
n = 5	2318	8	2326
(Average = *Gennemsnit* =	464	2	465)

B. Number of pecks/5 minutes directed by 6 pheasant chicks respectively at food and at other material in the cage when food was continuously available in the trays. (6 chicks were observed separately).
B. Antal hak/5 min. rettet mod henholdsvis foder og andre tilfældige objekter i buret når der til stadighed havde været adgang til foderet; (6 dyr blev observeret særskilt).

Number of pecks/5minutes directed at .. *Antal hak/5 min. rettet mod*	Food *Foder*	Other material in the pen *Andre objekter*	Total
Morning *Morgen*	3	60	63
	48	68	116
	10	31	41
	9	50	59
	1	17	18
	46	30	76
n = 6	117	256	373
(Average = *Gennemsnit* =	20	43	63)

Number of pecks/5 minutes directed at .. *Antal hak/5min. rettet mod*	Food *Foder*	Other material in the pen *Andre objekter*	Total
Middle of the day *Midt på dagen*	0	65	65
	27	72	99
	13	45	58
	9	27	36
	0	33	33
	20	46	66
n = 6	69	288	357
(Average = *Gennemsnit* =	12	48	60)

Number of pecks/5 minutes directed at .. *Antal hak/5min. rettet mod*	Food *Foder*	Other material in the pen *Andre objekter*	Total
Evening *Aften*	76	87	163
	3	39	42
	85	47	132
	21	28	49
	45	18	63
n = 5	230	219	449
(Average = *Gennemsnit* =	46	44	90)

Table 9.

Tabel 9.

nature of feather pecking, it is of interest to know 1) whether there is a general sex difference in feather pecking activity; 2) whether the differences in choice of body region can be correlated with sex differences in the aspect of plumage at various ages.

In regard to the first question, male and female groups were compared, this time on the basis of the total scores per individual; this, as mentioned gives a better representation of the actual amount of pecking within the particular groups. Both the scores registered by Madsen in his experiments, and those obtained in mine have served for the presentation given in Fig. 6 p. 20.

In regard to the second question, it may be mentioned that some other female groups of the same age as those of Table 6 showed a similar preponderance on back pecking as opposed to tail pecking: Of a total of 163 twelve week old females, 52% showed back victimization as opposed to 26% only with tail victimization.

Observations made during the registration of feather pecking scores:

Some independency between the victimization of various body regions was generally noted:

An individual with almost no feathers on the back may have completely intact tail feathers; contrarily, another one which e.g. is missing all its tail feathers may show no signs of back pecking.

Within a group, a comparison of back and tail scores, confirms the above mentioned independency between victimization of the two body regions in question. This is in accordance with the finding of Madsen: »in most cases the habit of pecking the tail feathers goes on independently of the pecking of the back«.

A comparison of scores from *separated groups* reveals differences in regard to the body region most heavily severed, which are independent of the experimental treatment.

A possible explanation of these variations is given in »Discussion«.

Discussion

CAUSAL FACTORS

Motivating factors

The tendency to correlate »cannibalistic« behaviour with *aggressive* behaviour no doubt ensues from the fact that in both, injurious pecking is directed at species companions. Furthermore, a relationship might be suggested by three data on agonistic behaviour in domestic fowl, which all correspond well with similar data on feather pecking: 1) there is a rise in aggressiveness with crowding (GUHL 1953, FLICKINGER 1961); 2) there is a correlation between peck frequency and position in the »peck order« (KING 1965b); 3) males are more aggressive than females (e.g. KING 1965b).

However, as mentioned, a closer investigation based on observation of the actual behaviour displayed by pheasants in feather pecking and in agonistic encounters respectively, led to the conclusion that the two types of behaviour are fundamentally different. GUHL (1953) also briefly mentions such a difference with reference to domestic fowl.

Intraspecific competition may thus be excluded as a direct cause of feather pecking. Also, increase in feather pecking victimization with crowding (Table 5), correlation between degrees of feather pecking and »peck order« (PULLIAINEN 1965), and higher scores in male than in female groups (MADSEN 1966, Table 6 and Fig. 6) are explainable without having recourse to aggressiveness as motivating factor in feather pecking, (see p. 26–29).

No doubt, the fact that so many traits

similar to normal *feeding* behaviour are involved in feather pecking, is the reason why a number of research workers have believed the lack of some specific nutrient substance to be the cause of the problem.

It is a common opinion that feeding behaviour is motivated by hunger (i.e. by the nutritive need of the organism). However, parts of the feeding behaviour may also be shown by animals which are not hungry; (LORENZ 1937, RÄBER 1950, HINDE 1953 and LEYHAUSEN 1960). Predators in captivity (owls, cats) may perform hunting patterns even when entirely satiated. Similarly, tits having just eaten on a feeding board may start tearing at wall paper in the same way as when tearing off bark to reach their natural prey. In both cases, behaviour patterns which under natural circumstances have the function of attaining food, do occur when food is superabundant, i.e under conditions where hunger is not the motivating factor.

The feather pecking of gallinaceous birds, apparently constitutes a parallel to the hunting behaviour of wild predators in captivity and to the paper tearing of satiated tits; e.g. like paper tearing by tits, feather pecking of pheasants is in all aspects similar to normal feeding behaviour only concerned with »wrong« items; the pheasant food given in the breeding farms is of high nutrient value and satiation can easily be reached.

It is a common observation that gallinaceous birds have a strong inherent tendency for pecking in the feeding manner at all sorts of objects available. KRUIJT (1964) writes about Burmese junglefowl: »the tendency to peck at inedible objects remains high throughout life«. This trial-and-error pecking, through which the birds may become acquainted with a great variety of possible food sources, being biologically important, has been laid down as an instinctive pattern. As such the behaviour cannot be altered by a sudden change in environment and feeding conditions such as in industrial breeding. In the uniform environment of many industrial breeding pens, the birds do not have the variety of pecking items which are available in their natural habitat. Yet their pecking tendency is the same. This may have consequences such as shown on the Figs. 3 p. 15 and 4 p. 16, when a pheasant is kept isolated, and may lead to heavy feather pecking of penmates in the case of birds in groups.

In support of this suggestion may be mentioned, that in experiments with domestic fowl there seems to be greater incidence and severity of feather pecking if the food ration is given in a way reducing the average time of each meal. If the ration is pelleted the average time per meal is much less than if it is given in the mash form (JENSEN et al. 1962), and the tendency for feather pecking is greater (e.g. ZIEGENHAGEN et al. 1947, BEARSE et al. 1949 and CALET 1965).

The results of my vegetation-experiments can be interpreted along the same lines. The reason why the groups receiving clover or beech-branches had the lowest feather pecking scores, certainly was that the chicks had been spending more time pecking and pulling at such items which in their natural habitat constitute a main food source and to which their instinctive feeding behaviour is adapted – (see e.g. the innate preference of green colour). The control groups had nothing but their penmates' feathers to compensate for the lack of adequate pecking items; consequently their feather pecking scores were much higher.

Differences recorded between groups receiving clover or branches with leaves, may be explained by differences as to the

value of these two types of vegetation as »pecking occupation«, as pointed out above.

Releasing factors

The pecking act

Food pecking of pheasant chicks was found to be released by the same types of stimuli as those which elicit the feeding pecks of domestic chicks (see SPALDING 1873, POULSEN 1951 and FANTZ 1957) and junglefowl (KRUIJT 1964).

Initially, figures drawn on paper may as well be pecked at as real food items. The chicks, however, show clear preferences when given the choice between different drawn items.

The effect of different optical stimuli (shape, colour etc.) may supplement each other, and optimal releasers of the food pecking response are constituted by objects or figures presenting all the preferred qualities. These are required to elicit food pecking in the case of low motivation. If on the contrary pecking motivation is strong, objects sharing fewer characters with the optimal one may release the response (see e.g. HINDE 1966). If *green* spots were not offered, the pheasant chicks readily pecked at spots of another less preferred colour. Similarly, if optimal pecking items such as fresh green leaves are not available in the breeding pens, items offering just a few of the mentioned stimuli may elicit the food pecking response.

Feathers on penmates do, especially during growth, present such optical stimuli which generally release the food pecking of pheasants. In future, the apparent correlation between the pecking of particular body regions and the onset of molt on these regions should be the object of detailed study. In this connection it may be remembered that pecking of the cloaca has often been recorded among laying poults; (the cloacal region is generally more conspicuous during egg-laying).

The swallowing act

Sensory stimuli provided by the object pecked are decisive for the object to be swallowed or not. ENGELMANN, (1941, 1942 and 1951) clearly demonstrated the importance of tactile and taste impressions in the food preferences of domestic hens. The latter showed marked selectivity in regard to factors such as consistency, texture and surface of the pecking items, quite independently of the actual nutritional contents. Grains of an »unliked« consistency were soon avoided and then other grains, when only having the same colour, were avoided too, even though of a »better liked« consistency. (Taste selectivity was found to be most pronounced in young chicks).

Feathers may in regard to various tactile stimuli (consistency, surface quality, resistance to pulling and for the growing ones: »juiciness«) present similarities to leaves, rootlets etc. Furthermore, the taste impressions provided by e.g. blood and/or secrete from the uropygidial gland may have a positive influence on chicks' choice of feathers as possible food, thereby contributing to the probability of habit formation.

The problem as to what extent the mentioned tactile and taste stimuli are effective in feather pecking should be the object of future study.

Conclusion

Simple sensory stimuli inherently specific to the feeding response mechanisms of gallinaceous birds may in combination with a general pecking tendency (trial-and-error type) account for the start of feather pecking and for repetition of the experience, which finally leads to habit formation.

EXPLANATION OF VARIOUS FEATHER PECKING PHENOMENA IN ACCORDANCE WITH THE CONCLUSION DRAWN IN THE PRESENT STUDY

The various facts noted in the study of feather pecking may be explained by principles which are generally valid of the *feeding* behaviour of gallinaceous birds.

The possibility that feathers are accepted as »edible material« on the basis of general feeding releasers, implies that learning processes, normally responsible for the acquirement of feeding habits in gallinaceous birds, may be responsible for the further development of feather pecking too.

»Feather pecking specialists« (see p. 8)

Domestic fowl as well as pheasants show a certain constancy in preferring pecking items of a type once accepted. This presents a parallel to the finding of de RUITER (1952) that once a bird found a caterpillar it would go on pecking at similar-looking sticks for some time afterwards. The so called »specialization« observed in particular pheasant chicks with regard to feather pecking, may be explained as being another case of this phenomenon.

Pecking restricted to particular body regions

ENGELMANN (1951) describes a phenomenon »Ortsstereotypie« observed in food preference tests with domestic hens; it consists in a constant preference of the *place* where a certain type of food has once been found. This problem of «preferred positions« is also mentioned by others (e.g. KEAR 1964). A given position may become more important for hens' (or other birds') choice in food preference tests than the very items offered. The constancy observed in certain pheasant chicks as to pecking at the same body region of several companions in succession may well be an expression of the same phenomenon.

Variability

The often registered differences between groups, which have received the same experimental treatment (see MADSEN 1966) are explainable on the basis of the plasticity characteristic of learning processes (e.g. difference between separated groups with regard to starting time, and body regions initially pecked at). Furthermore, individual differences in general activity certainly play an important rôle.

Correspondence between ranking after feather pecking scores and existing »peck order« (PULLIAINEN 1965).

A hierarchy of precedence in competition for food etc. has been described both in domestic fowl (SCHJELDERUP-EBBE 1922, GUHL 1953, 1958, 1964, and WOOD-GUSH 1955) and in pheasants (COLLIAS & TABER 1951). That pecking plays an important part in the establishment of such dominance orders was proved by KING (1965b), who found that high peck frequency (of the aggressive type) is correlated with high position in the hierarchy. Consideration of this, in connection with the results of PULLIAINEN that pheasant hens lowest in rank were the ones which were the most victimized by feather pecking, might suggest some correlation between level of aggressiveness and feather pecking tendency. (The number of birds available to PULLIAINEN was however very small).

Nevertheless, observation of the actual cases of feather pecking provided no

support for the above interpretation. Certainly, (see p. 14) there is in feather pecking no primary correspondence with normal »peck rights«.

Correlation between order of dominance and order of feather pecking scores such as found by PULLIAINEN must be of a secondary nature. The fact that subordinate birds show greater reluctancy to approach their dominants (MURCHISON 1935, KING 1965b and 1966) may explain, why the latter are less victimized by feather pecking, – and vice versa.

Differences in feather pecking between male and female groups

Comparison of sums of total-body scores (Text of Fig. 6) shows that feather pecking occurs at a higher frequency in groups of male pheasants than in groups of females. Since aggressive encounters are more frequent and more violent in male than in female groups, the above results too could be taken as indication of some relationship between feather pecking and intraspecific competition. However, as mentioned, direct observation of the pheasants' behaviour provided no support for this assumption. The higher degrees of feather pecking in male groups must simply be a consequence of a higher level of activity in males than in females. This is in fact the case of many animal species.

For experimental proof in the present case, the food pecking activity (incl. trial-and-error pecking) of pheasant males should be compared to that of females under identical conditions.

The divergence in results as to the body region where a difference in victimization appeared between separated male and female groups (see p. 21), is taken as a good proof, both of the influence of molting plumage as pecking releaser and, of the habit formation within a group, (»Ortsstereotypie« p. 26). The difference in age of the experimental chicks at registration of pecking scores (those of MADSEN were 6–7 weeks old, while mine were 12 weeks old), may explain why MADSEN found the »sex difference« in back scores, while I found it in tail scores. In fact, the molt of back feathers in pheasant chicks starts before molt of tail feathers, which means that »the critical period« of the back region is in advance of that of the tail.

Rôle of crowding

Feather pecking is often reported from breeding groups, where many birds are kept on a relatively small space. The result presented in Table 5 and Fig. 5 indicates that there may be a rise in feather pecking with increasing number of chicks on a given area.

There was accordingly some reason in posing the question whether crowding could be the cause of the feather pecking problem. This was one of the facts, which draw the attention to aggressiveness as possible »motivating factor«, since increased aggressiveness is a common effect of crowding (see DAVIS, in ETKIN 1964). In gallinaceous birds, the establishment of hierarchy, through which real fighting is replaced by threatening and submissive manoeuvres, is a way to limit and control intraspecific aggressiveness. However, this sort of control is rendered difficult in bigger groups (see e.g. HEDIGER 1942, GUHL 1953, and FLICKINGER 1961) and may as already mentioned be totally disrupted by intense crowding (KING 1965a). Aggressiveness also seems to be in some way responsible for the physiological effects normally attributed to crowding and revealed by histological changes and weight changes of various endocrine glands, (e.g. adrenals). Thus, FLICKINGER (1961)

found that such changes correlated well with the amount of avoidance, actual pecking and fighting within the groups of domestic chicks studied.

The question whether crowding is a direct cause of feather pecking might thus be considered in two ways: 1) by asking whether feather pecking represents a direct expression of the increased intraspecific competition due to crowding; 2) by asking whether feather pecking arises as a reaction to physiological effects of crowding.

As to the first, the answer has already been given above. There is no similarity between feather pecking and intraspecific competition. As to the second question, the following should be taken into account: Feather pecking may occur in small groups (2 individuals, or even with one isolated bird – see Fig. 4), and in groups where the individuals are not crowded. These rather few observations are not sufficient, however, to denounce the possibility that physiological effects of crowding (stress) are having some influence.

The result in Table 5 may be explained without having to consider crowding as the direct cause of feather pecking, – by seing it rather, as a condition which promotes pecking within a group. Such an explanation is in better accordance with the »causation theory« deduced from the present behaviour study and vegetation experiments.

That pecking frequency must increase with density is the conclusion of a number of facts and mostly based on experimental results of other people. In short, with reduction of interindividual distance, conditions are bettered 1) for amount of feather pecking by the individual bird to rise, and 2) for more birds of the group to acquire the habit.

1. Increase of pecking by the individual bird: This is a consequence of a change in releasing conditions. Pecks released *directly*, i.e. by optical stimuli from the very body parts of companions, must become more frequent the denser the group, since such stimuli will be more easily and frequently encountered. The increased probability of encountering the mentioned stimuli, gives the individual bird a bigger chance of acquiring the habit; (increased probability of making its first experience – as well as of repeating the experience of feather pecking). Pecking released *indirectly* i.e. by way of social facilitation, must also become more frequent with reduction of interindividual distance. The type of social facilitation in question consists in that pecking of one chick releases the pecking of another one, (see TOLMAN & WILSON 1965 and TOLMAN 1967). Thus, the pecking frequency of one chick has been found to influence the pecking frequency of another chick.

2. Spreading of the feather pecking habit to other members of the group: The possibility that the feather pecking habit is transmitted from one chick to others is based on results of e.g. KLOPFER (1959, 1961) and TURNER (1964) according to which the choice of pecking items by a social bird is influenced by the choice made by its companions. This type of social facilitation called »local enhancement« consists in one bird drawing the attention of others to a particular part of the environment. If one chick starts pecking at a given object, a grain or a feather, one or a few others will often join and start pecking at the same object.

As THORPE (1956) says about the acquirement of feeding habits in social birds: »trial-and-error is adequate to account for the achievement of the pioneers and local enhancement accounts for the spread of this and other similar habits«.

Summary

1) The present investigation was started because various facts from experiments on feather pecking pointed to a dependency on behavioural factors (MADSEN 1966).

2) The total behaviour of game pheasants was studied. Chicks: from hatching to the age of 12–14 weeks. Adults: mainly in the period of mating and egg-laying. Pheasants in flight-cages and free-living ones were observed.

Here, the behaviour of feather pecking is compared point by point to the two types of normal behaviour, which also involve a pecking act (aggressive behaviour, feeding behaviour). The behaviour of feather pecking is found to be clearly different from aggressive behaviour, although in both pecking is directed at species companions. Moreover, disaccord with »peck order« was found. On the other hand, great similarity exists between the behaviour shown in feather pecking and the normal feeding behaviour. Feathers were treated in the same way as leaves and other items pulled from surrounding vegetation, which in the natural habitat of pheasants constitute a main food source. Feathers and other body parts may provide the same type of visual stimuli, which were preferred in tests concerning release of the food-pecking response of newly hatched pheasant chicks. Already at an early age, pheasant chicks showed a tendency to specialize; (certain individuals would direct pecking of the feeding type at several other chicks in succession, sometimes even preferring the same body region on all). Newly hatched pheasant chicks preferred green to other colours.

3) The subsequent experiments were based on registration of feather pecking scores. Groups having received regular supplies of cut green clover in addition to the normal pheasant food showed significantly less feather pecking than the controls. (Tables 1 and 2). Groups having received branches with green leaves also showed less feather pecking than those with only normal pheasant food at their disposal (Fig. 2 p. 10).

Comparison of two groups which for two weeks had received respectively branches with green leaves, and cut clover spread on the cage floor, showed significantly less feather pecking in the former group. (Table 3). Among younger chicks, however, »clover-groups« showed less feather pecking than the corresponding »branch-groups«. These younger chicks had also been pecking more at the loose clover leaves than at the leaves sitting on branches. The latter results together with the results of an experiment in which a group had been offered artificial vegetation (Table 4) indicate that the amount of feather pecking within a group is inversely correlated to the amount of pecking directed at some supplement to the ordinary ration of pheasant food. In fact, the group, which received green plastic bands only pecked at this artificial vegetation at the beginning of the experiment.

Relatively many feeding pecks were directed at other objects in the cage, when normal pheasant food was constantly available, (Table 9B p. 22).

Pecking scores increased with group density (Table 5, Fig. 5). Pecking scores were higher in male than in female groups (Table 6 p. 15 and Fig. 6 p. 20).

4) Together with explanations in the literature of behaviour patterns shown by wild animals satiated under artificial feeding conditions (RÄBER 1950, HINDE

»Food-running« with some pecking item may, as mentioned above, also have a function in drawing the attention of companions to the type of objects in question, (KRUIJT 1964).

Since reduction of distance between individuals favours the various forms of social facilitation, the conditions of local enhancement must also be bettered, and thereby no doubt the probability of more individuals acquiring the feather pecking habit.

Finally should be mentioned that when pecking frequency increases in a group, as a consequence of the above mentioned facts, the body parts affected much sooner become naked and/or stained with blood, which makes them more conspicuous and thereby more effective as pecking releasers. This also is liable to increase pecking activity within the group.

Summing up: The total number of pecks directed at feathers within a group must increase with density even without reference to any physiological consequences of crowding.

General Conclusion

Industrial breeding pens offer a too uniform environment in regard to pecking items. Therefore, the strong inherent tendency of gallinaceous birds for trial-and-error pecking – and more particularly for pulling at attached vegetational items – is directed at inadequate objects such as e.g. feathers on penmates. The behaviour brings satisfaction because the »pecking drive« finds expression even though no immediate biological advantage is gained.

Learning processes normally involved in the acquirement of food habits are responsible for the further development of feather pecking: Individual conditioning, (reinforcement being provided by taste and tactile impressions received from the feathers and by the reward involved in reduction of the pecking need), and social learning, i.e. spreading of the habit to others of the group.

Nobody believes that morphological structures such as the shape of a wing or a bill can be changed by simply putting birds into cages. But a change in *instinctive behaviour* is just as impossible under such conditions. Instincts are genetically fixed and adapted to the conditions of the natural environment.

Therefore, to limit feather pecking the best way must be to provide an *environment* which, especially in regard to pecking items, imitates the original habitat of gallinaceous birds as closely as possible.

1953, LEYHAUSEN 1960) the results of the present investigation led to the following conclusion: feather pecking is a substitute for normal feeding behaviour. Feathers may provide some of the sensory stimuli (optical, tactile) to which the (innate) feeding response mechanisms of pheasants are specifically attuned. Green leaves (some kinds more than others) which are a normal goal of pheasants' food pecking activity in the natural habitat must provide optimal sign stimuli for this behaviour. If such pecking items are lacking in the breeding cages, objects giving just some of the same sensory impression will be chosen. The satisfaction obtained by this behaviour – although the releasing stimuli are suboptimal – provides a basis for the same types of learning processes which occur in the acquirement of *normal* feeding habits. The tendency towards exploratory pecking (trial-and-error), which evidently furthers the risk of responding to feathers, is particularly obvious in young chicks, where learning about possible food items is important. This tendency also seems to be particularly shown, when the same type of food is constantly available (Table 9B).

5) The results of Table 5, Fig. 5, and Table 6, Fig. 6 as well as various other phenomena registered in the study of feather pecking are explained (p. 26–29) (with reference to ethological literature) in accordance with the above conclusion.

Dansk resumé

Fjerpilning hos fasaner – en ethologisk undersøgelse.

1) Undersøgelsen blev startet, fordi der på trods af talrige forsøg ikke forelå nogen løsning på spørgsmålet om, hvad der forårsager fjerpilning i opdræt. MADSEN (1966) kunne vise, at problemet er adfærdsmæssigt bestemt. I litteraturen findes følgende baggrund: Tilskud af snart det ene, snart det andet ernæringsstof har gang på gang givet modstridende resultater, (sidst m.h.t. arginin: MADSEN 1966 contra SIRÉN 1963). Endvidere er der ofte indenfor de enkelte forsøg fundet stor variation mellem hold, som blev fodret med nøjagtigt det samme. Dette viser, at den rent ernæringsmæssige side af sagen er mindre væsentlig. Måden, hvorpå foderet gives, kan have betydning. Nogle forfattere nævner, at fjerpilningsgraden kan afhænge af, om foderet gives i pille-form eller som pulver (»mash«). At aggressivitet skulle spille en rolle er også blevet nævnt.

2) For i første omgang at blive klar over, hvilken slags adfærd fjerpilning må henregnes til, og derigennem hvilke faktorer, der har primær betydning, foretoges et grundigt studium af fasaners adfærd i sin helhed. Syv hold kyllinger à ca. 100 stk., klækket med én uges mellemrum blev observeret regelmæssigt fra klækning til en alder af 12–14 uger. Endvidere fulgtes nogle hold voksne fasaner (høner og kokke) i parrings- og æglægningsperioden. Ialt ca. 250 timer blev anvendt udelukkende på observation. Både fritlevende og volière-fasaner iagttoges fra skjul. Her beskrives kun fjerpilningsadfærden samt de to typer af normal adfærd, der også omfatter hakkebevægelser: den aggressive adfærd og den fødesøgende adfærd. Fjerpilningsadfærden sammenlignes punkt for punkt med den ene og den anden af disse to adfærdstyper. Fjerpilningsadfærden er klart forskellig fra den aggressive adfærd, selv om der i begge rettes hak mod artsfæller. Ydermere var der overhovedet in-

gen overensstemmelse mellem observerede »fjerpilningsrelationer« og dominansforhold (»hakkeorden«) i flokkene. På alle punkter stemmer fjerpilningsadfærden derimod overens med den fødesøgende adfærd (måden dyrene bevæger sig på før, under og efter hakket; fjerene behandles som ethvert andet objekt af nogenlunde samme størrelse og beskaffenhed: blade, papirstumper osv.). Nyklækkede fasankyllinger retter deres fødehakken mod pletter, streger, kanter. De foretrækker genstande, der danner fremspring fra underlaget, har en glinsende overflade og bevæger sig. Fjer og andre legemsdele kan (Fig. 1) give de *synsindtryk*, som alene er i stand til at fremkalde denne fødehakken. Af farver foretrækkes klart den grønne. Allerede på et tidligt alderstrin viser visse fasankyllinger tendens til ligesom at specialisere sig. Disse dyr vil i perioder fortrinsvis hakke efter flere af de andre kyllinger efter tur på den beskrevne fødesøgende måde. Der er sågar eksempler på en holden sig til bestemte legemsregioner på disse (nogle hakker fortrinsvis efter næb, andre efter fødder og andre efter vingefjer).

3) Som basis for de derefter følgende forsøg anvendtes den af MADSEN angivne metode til registrering af fjerpilningsgrad. Der gives points for hver legemsregion (hale, overgump, ryg) efter en skala fra 0 til 4. 0 betyder, at legemsregionen ikke er pillet; 4 angiver den stærkeste grad af pilning. En sammenligning af forsøgshold på basis af de enkelte legemsregioner er foretaget i tabellerne 1, 2, 3, 6 og 7. Da det viste sig, at der meget ofte optræder variation mellem hold m.h.t. den kropsregion, som fortrinsvis er pillet, blev nogle forsøg baseret på en sammenligning af samlede point-tal (tabellerne 4 og 5, samt figurerne 2, 5 og 6).

4) Baggrunden for forsøgene med tilskud af grønt var: a) Den store lighed mellem fasanernes adfærd under fjerpilning og deres fødesøgende adfærd i det naturlige miljø, hvor en stor del af tiden går med at pille grønt fra den omgivende vegetation. b) Nyklækkede fasankyllingers præferens for grønne objekter. c) En beskrivelse i litteraturen af, at tamhøns blev mindre og mindre kræsne m.h.t. de planter, de ville æde, jo længere man undlod at give dem grønt. d) At jeg under adfærdsobservationerne havde bemærket, at fjerpilning syntes at forekomme mindre hyppigt i volièrer, hvor fasanerne havde adgang til grønt.

Tabellerne 1 og 2 viser, at hold, der fik regelmæssige og rigelige tilskud af grøn kløver, viste mindre fjerpilning end hold, der ikke fik tilskud af grønt. Tabel 3 viser, at et hold der regelmæssigt fik bøgegrene med grønne blade, som fasanerne selv skulle pille af på samme måde som i naturen, viste mindre fjerpilning end et hold, der fik afskåren grøn kløver. Dette var dog ikke tilfældet i forsøg med yngre kyllinger, der viste størst interesse for den afskårne kløver. Også hos disse dyr var der dog betydeligt mindre fjerpilning i de hold, som fik grene, end i de hold, som slet intet grønt-tilskud fik (Fig. 2). Tabel 4 viser forskellen mellem et hold, der kun fik nedhængende grønne plastikstrimler (I) og hold, der henholdsvis fik grene med grønne blade (II) og afskåren grøn kløver (III). Selv om fasankyllingerne hakkede efter plastikstrimlerne i begyndelsen, mistede de hurtigt interessen herfor.

5) Tabel 5 og Fig. 5 viser stigende fjerpilning med stigende tæthed af dyr.

6) Tabel 6 viser forskel i fjerpilning mellem hanner og hunner, der var blevet holdt adskilt. Der er stærkere pilning af hale-regionen i han- end i hun-holdet. MADSEN (1966) fandt i flere forsøg med yngre dyr stærkere pilning af ryg-regionen i han- end i hun-hold. En sammenligning af adskilte han- og hun-hold på basis af samlede point-tal (Fig. 6: A, B, C, D og E) viser dog generelt mere fjerpilning i han- end i hun-hold. Tabel 7 og Fig. 6: F viser mangel på klar forskel mellem hanner og hunner, når disse ikke har været holdt adskilt.

Literature

ALLEE, W. C., N. E. COLLIAS & CATHARINE Z. LUTHERMAN, 1939: Modification of the social order in flocks of hens by the injection of testosterone propionate. Physiol. Zool. 12: 412–440.

BÄUMER, E., 1955: Lebensart des Haushuhnes. Z. Tierpsychol. 12: 387–401.

BEARSE, G. E., L. R. BERG, C. F. MCCLARY & V. L. MILLER, 1949: Poult. Sci. 28: 756.

BRÜCKNER, G. H., 1933: Untersuchungen zur Tiersoziologie, ins besondere zur Auflösung der Familie. Z. Psychol. 128: 1–110.

CALET, C., 1965: The relative value of pellets versus mash and grain in poultry nutrition. World's Poultry Sci. J. 21: 23–49.

COLLIAS, N. E., 1944: Aggressive behaviour among vertebrate animals. Physiol. Zool. 17: 83–123.

COLLIAS, N. E. & R. D. TABER, 1951: A field study of some grouping and dominance relations in pheasants. Condor. 53 (No. 6): 265–275.

DAVIS see ETKIN.

ENGELMANN, C., 1941, 1942: Versuche über den Geschmackssinn des Huhns. Der Einfluss von Korngrösse und Körnerform auf die Beliebtheit einiger Getreidearten. Z. Tierpsychol. 4: 204–218, 5: 42–59.

ENGELMANN, C., 1951a: Beiträge zum Gedächtnis des Huhns. Z. Tierpsychol. 8: 110–121.

ENGELMANN, C., 1951b: Beliebtheit einiger Grünfutterpflanzen beim Huhn. Z. Tierpsychol. 8, 121–131.

ETKIN, W. (edit.), 1964: Social behaviour and organization among vertebrates. The University of Chicago Press. Chicago and London.

FANTZ, R. L., 1957: Form-preference in newly hatched chicks. J. comp. physiol. Psychol. 50: 422–430.

FLICKINGER, G. L., 1961: Effect of grouping on adrenals and gonads of chickens. Gen. Comp. Endocr. 1 (4): 332–340.

FOREMAN, D. & W. C. ALLEE, 1959: A correlation between posture stance and outcome in paired contests of domestic hens. Anim. Behav. 7: 180–188.

GUHL, A. M., 1953: Social behaviour of the domestic fowl. Techn. Bull. 73, Agric. Exp. Station, Manhattan, Kansas, 73: 1–48.

GUHL, A. M., 1958: The development of social organization in the domestic chick. Anim. Behav. 6: 82–111.

GUHL, A. M., 1964: Psychophysiological interrelations in the social behaviour of chickens. Psychol. Bull. 61: 277–285.

HAMMER, M., M. KØIE & R. SPÄRCK, 1955: Undersøgelser over ernæringen hos agerhøns, fasaner og urfugle i Danmark. Danske Vildtundersøgelser 4.

HEDIGER, H., 1942: Wild animals in captivity. Basel.

HINDE, R. A., 1953: A possible explanation of paper tearing in birds. Brit. Birds 46: 21–23.

HINDE, R. A., 1966: Animal Behaviour. McGraw-Hill.

JENSEN, L. S., L H. MERRILL, C. V. REDDY & J. MCGINNIS, 1962: Observations on eating patterns and rate of food passage of birds fed pelleted and unpelleted diets. Poultry Sci. 41: 1414–1419.

KEAR ,J., 1964: Colour preference in young Anatidae. Ibis. 106: 361–369.
Appendix: List of species tested, (Phasianidae).

KING, M. G., 1965a: Disruptions in the pecking order of cockerels concomitant with degrees of accessibility to feed. Anim. Behav. 13: 504–506.

KING, M. G., 1965b: Peck frequency and minimal approach distance in domestic fowl. J. genet. Psychol. 106: 35–38.

KING, M. G., 1966a: Social Reflexes Nos. 1 and 2 in relation to approach and avoidance tendencies. J. genet. Psychol. 109: 101–107.

KLOPFER, P. H., 1959: Social interactions in discrimination learning with special reference to feeding behaviour. Behaviour. 14: 282–299.

KLOPFER, P. H., 1961: Observational learning in birds. Behaviour. 17: 71–80.

KRUIJT, J. P., 1964: Ontogeny of social behaviour in Burmese red junglefowl, (Gallus gallus spadiceus). Behaviour Suppl. 12: 1–201.

LEYHAUSEN, P., 1960: Verhaltenstudien an Katzen. Z. Tierpsychol., Beiheft 2 (p. 20–23, and p. 56–59).

LORENZ, K., 1937: Über die Bildung des Instinktbegriffes. Naturwiss. 25: 289–300 and 307–331.

MADSEN, H., 1966: On feather pecking and cannibalism in pheasant and partridge chicks, particularly in relation to the amino acid arginine. Acta vet. scand. 7: 272–287.

MURCHISON, C., 1935: The experimental measurement of a social hierarchy in Gallus domesticus. J. gen. Psychol. 12: 3–39.

POULSEN, H., 1951: Maturation and learning in the improvement of some instinctive activities. Vidensk. Medd. fra Dansk naturh. Foren. 113: 155–1169.

PULLIAINEN, E., 1965: Cannibalism in the pheasant (Phasianus colchicus L.) during the egg-laying period. Ann. Zool. Fenn. 2: 208–214.

7) Tabel 9 viser et forsøg på at undersøge fordelingen af fasankyllingers »fødehakken« henholdsvis på det almindelige foder (venstre kolonne) og på andre tilfældige objekter i buret (højre kolonne). Af særlig interesse er det forholdsvis store antal hak rettet mod andre objekter, når foderet ikke havde været fjernet fra dyrene, (Tabel 9B); dette svarer jo til foderbetingelserne i opdrættet.

8) De ovennævnte resultater sammenholdtes med beskrivelser i den ethologiske litteratur af vilde dyrs adfærd i fangenskab eller blot under forhold, hvor føden opnås på anden måde end under de for de pågældende dyr naturlige betingelser (RÄBER, HINDE, LEYHAUSEN). På dette grundlag kunne følgende slutninger drages: Fjerpilning må sidestilles med f.eks. den jagtadfærd, som vises af mætte rovdyr i fangenskab. En sådan adfærd er ligesom dyrenes bygning del af tilpasningen til det naturlige miljø. De »mekanismer«, som kontrollerer den, ændres ikke uden videre, når forholdene ændres.

Adfærden fremkaldes, uanset om dyrene er mætte, af sanseindtryk, der er karakteristiske for den naturlige situation (for rovdyrs jagtadfærd: »noget der bevæger sig«). Fasaner har, som andre hønsefugle, en medfødt tendens til at prøve sig frem ved at hakke mod alt, der giver dem bestemte synsindtryk. Derefter spiller faktorer som hakkeobjekternes konsistens og overfladebeskaffenhed uden tvivl en afgørende rolle for dyrenes valg (ENGELMANN's forsøg med tamhøns viste, at disse faktorer kunne være vigtigere end den indeholdte fødesubstans). I naturen er både blade, knopper o.l. et yndet mål for fasanernes hakkeaktivitet. Mangler disse i opdrætsvolièrerne, bliver dyrene mindre kræsne. De kan finde på at pille fjer, da dette, hvad sanseindtryk angår, kan give dem en vis tilfredsstillelse. Mulighederne for fjerpilning i opdræt fremmes, hvis dyrene mangler passende udløsende stimuli netop på det tidspunkt, hvor fødevanerne dannes, d.v.s. i de første leveuger, hvor kyllingerne i særlig grad viser tendens til at prøve sig frem. Tendensen til at reagere på synsindtryk fra andre objekter end det velkendte foder synes især at være til stede hos dyr, der har »god tid«.

9) Stigende fjerpilning med stigende floktæthed må betragtes som en følge af, at den individuelle fødehak-hyppighed stiger på grund af: Større tæthed af de hakudløsende indtryk som fjer giver; større mulighed for at andre individers hakkeaktivitet kan virke stimulerende (TOLMAN 1967); større mulighed for en psykisk belastning (»stress«), der kan medføre øgning af dyrenes indre aktiveringsniveau. Endvidere må chancen for, at vanen spredes stige, hvis afstanden mellem individerne mindskes.

– Kraftigere fjerpilning i han- end i hun-hold er i overensstemmelse med det forhold, at hanner generelt viser større aktivitet end hunner (påvist hos andre dyr). Dersom »stress« indvirker på hakkeaktiviteten, som nævnt ovenfor, kunne denne faktor gøre sig stærkere gældende i han- eller hun-hold p.g.a. stærkere kamptilbøjelighed hos hannerne.

– Andre fænomener såsom »fjerpilnings-specialister« samt det forhold, at én kropsregion fortrinsvis er pillet i ét hold og en anden i et andet, må betragtes som et udslag af vanedannelse af samme type, som kendes fra den almindelige fødesøgende adfærd, nemlig en holden sig til bestemte objekter henholdsvis steder.

Räber, H., 1950: Verhalten gefangener Eulen. Behaviour. 2: 1–94.
Ruiter, L. de, 1952: Some experiments on the camouflage of stick caterpillars. Behaviour. 4: 222–232.
Schaible, P. J., J. A. Davidson & S. L. Bandemer, 1947: Cannibalism and feather picking in chicks as influenced by certain changes in a specific ration. Poultry Sci. 26: 651–656.
Schjelderup-Ebbe, T., 1922: Beiträge zur Sozialpsychologie des Haushuhns. Zeitschr. Psychol. 88: 225–252.
Sirën, M. J., 1963: Cannibalism in cockerels and pheasants. Acta vet. scand. 4 (Suppl. 1): 1–48.
Spalding, D., 1954: Instinct, with original observations on young animals (1873) – Reprinted Brit. J. Anim. Behav. 2: 2–11.
Tinbergen, N., 1953: The Herring Gull's World, London.
Thorpe, W. H., 1963: Learning and instinct in animals. Methuen, London. (1st Edn., 1956).
Tolman, C. W. & G. F. Wilson, 1965: Social feeding in domestic chicks. Anim. Behav. 13: 134–142.
Tolman, C. W., 1967: The feeding behaviour of domestic chicks as a function of rate of pecking by a surrogate companion. Behaviour. 29 (1): 57–62.
Turner, E. R. A., 1964: Social feeding in birds. Behaviour. 24 (1–2): 1–46.
Willimon, Ch. P. & C. L. Morgan: The effect of minor nutrient mineral elements in the diet of chickens on feather pulling and cannibalism. Poultry Sci. 32: 309–313.
Wood-Gush, D. G. M., 1955: The behaviour of the domestic chicken: A review of the literature. Brit. J. Anim. Behav. 3: 81–110.
Wood-Gush, D. G. M., 1956: Poultry behaviour. World's Poultry Sci. J. 12: 126–130.
Ziegenhagen, E. H., L. B. Corman & J. W. Hayward, 1947: Feed particle size as a factor affecting performance of turkey poults. Poultry Sci. 26: 212–214.

Резюме на русском языке:
Этологическое исследование щипания перьев у фазанов.

1) Многочисленные попытки доказать, что причиной щипания перьев является недостаток в питании, до сих пор не дали результата. Сирен (1963) составил превосходное обозрение этой литературы. Мадсен (1966) показал, что щипание перьев обусловлено этологически.

2) Поведение фазанов изучалось от вылупления до 12–14 недельного возраста, а также и поведение взрослых особей в периоды спаривания и кладки яиц. За птицами наблюдали как на воле, так и в птицеводческих вольерах. Два типа нормального поведения включающие движение клевания, а именно агрессивное поведение и поведение при еде (feeding behaviour), подробно сравниваются с поведением щипания перьев. Поведение щипания перьев четко отличается от агрессивного поведения, хотя птица в обоих случаях клюет особей своего рода; однако, оно во многом похоже на нормальное поведение птиц при еде. С перьями они обращаются так же, как с листьями и т. п., которых они отщипывают с окружающей растительности. Недавно вылупившиеся фазаньи птенцы направляют клевки на пятна, черты и края. Они явно предпочитают предметы, выступающие из подстилки, имеющие глянцевитую поверхность, и движущиеся. Перья и другие части тела (фиг. 1) могут дать те зрительные впечатления, которые одни в состоянии вызывать кормовое клевание фазаньих птенцов. Из цветов, явно предпочитается зеленый. Уже в раннем возрасте некоторые фазаньи птенцы показывают склонность к специализации, и клюют не просто других птенцов, а определенные участки их тела.

3) Основанием нижеописанных опытов служил способ, указанный Мадсеном

(1966) для регистрации степени щипания перьев. Таблицы 1 и 2 показывают, что выводки, к пище которых регулярно и обильно добавлялся зеленый клевер (коротко срезанный), выявляли меньше склонности к щипанию перьев, чем выводки, не получавшие добавок зелени. Таблица 3 показывает, что выводок, регулярно получавший буковые ветки с зелеными листьями, которых фазанам нужно было самим отщипывать так же, как в природных условиях, щипал перьев меньше, чем выводок, к пище которого добавлялся срезанный клевер. Однако, этого не было обнаружено при двух опытах с молодыми птенцами, показывавшими наибольший интерес к срезанному клеверу (фиг. 2). Таблица 4 показывает разницу между выводком, которому давали только висячие полоски зеленой пластмассы (I), и двумя выводками, одному из которых давали ветки с зелеными листьями (II), а другому – срезанный клевер (III). Хотя фазаньи птенцы в начале опыта клевали полоски из пластмассы, они довольно скоро перестали ими интересоваться. Таблица 5 и фиг. 5 показывают сравнение трех выводков с разным числом особей на единицу площади. Таблица 6 относится к опыту, при котором птенцов разного пола держали отдельно друг от друга, а таблица 7 к опыту, при котором не было проведено разделения по полу. Фиг. 6 также показывает влияние разделения полов. Таблица 8 показывает распределение кормовых клевков фазаньих птенцов по обычному корму (левый столб) и другим случайным предметам в клетке (правый столб), А) когда птицы были голодны, и В) когда они были сыты. Особый интерес предоставляет сравнительно большое число клевков, направленных на другие предметы, когда корм был беспрерывно доступен (В).

4) На основании этих исследований, сличенных с литературой по этологии, получается следующий вывод: Щипание перьев, наблюдаемое у фазанов в птицеводческих вольерах, соответствует поведению охоты у сытых хищных животных в неволе (Рэбер 1950, Лейхаузен 1960, см. также Хинде 1953). Фазаны обладают прирожденной склонностью к опознанию возможных съедобных предметов клеванием всего, что вызывает определенные зрительные стимулы. Концентрированный корм, предлагаемый им в условиях птицеводства, без сомнения удовлетворяет их потребность питания, но не предоставляет возможности выказывать нормы поведения, требуемые для удовлетворения потребности питания в природных условиях. В природе, одним из важнейших предметов клюющей деятельности фазанов являются мягкие зеленые листья. Поскольку среда в птицеводческих вольерах в этом отношении отличается от природной среды, постольку вероятно, что фазаны начнут щипать перья, так как эти, в отношении сенсорных стимулов, могут доставлять им некоторое удовлетворение. Повышение щипания перьев при возрастающей плотности (числе птиц на $м^2$) и разницы поведения отделенных друг от друга самцов и самок могут объясняться в соответствии с вышеуказанным.

DANISH REVIEW OF GAME BIOLOGY

The journal is published and distributed by the

Game Biology Station, Kalø, Rønde, Denmark

Each paper is issued separately and when a number of papers have appeared (comprising 200–300 pages) these will be collected in a volume together with a table of contents. The price will be set separately for each volume. For volume 5 it will be 50 Danish Kroner. A limited number af back volumes (vols. 1–4) are available at a price of 50 Danish Kroner per volume.

Vol. 5.

No 1. Mette Fog: An Investigation on the Brent Goose (Branta bernicla) in Denmark. 40 pp. 1967.

No 2. Jørgen Fog: List of Recoveries in Denmark of Birds Banded Abroad and Handled through the Game Biology Station 1955–1964. 44 pp. 1968.

No 3. Poul Valentin Jensen: Food Selection of the Danish Red Deer (Cervus elaphus L.) as Determined by Examination of the Rumen Content 44 pp. 1968.

No 4. Birger Jensen: Preliminary Results from the Marking of Foxes (Vulpes vulpes L.) in Denmark. 8 pp. 1968.

No 5. Anders Holm Joensen: Wildfowl Counts in Denmark in November 1967 and January 1968 – Methods and Results. 72 pp. 1968.

No 6. Birger Jensen and Lise Brunberg Nielsen: Age Determination in the Red Fox *(Vulpes vulpes* L.) from Canine Tooth Sections. 16 pp. 1968.

No 7. Holger Madsen: Sexing Day-old Game Pheasant Chicks. 8 pp. 1969.

Vol. 6.

No 1. Inge Hoffmeyer: Feather Pecking in Pheasants – an Ethological Approach to the Problem. 1969.

No 2. Mette Fog: Studies on the Weasel (*Mustela nivalis*) and the Stoat (*Mustela erminea*) in Denmark. 1969.

CLEMENSTRYKKERIET - AARHUS