A Study of Anting Behaviour in Birds.

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(Med et dansk resumé: Fugles opforsel over for myrer).

Introduction.

The ornithologists' attention to the odd behaviour in birds known as anting was aroused by Chisholm (1934). His account initiated much observation, discussion, and theorizing all over the ornithological world. In the last 20 years many reports on anting in birds have been published. It is mostly casual observations in the field, the observer being at some distance from the anting bird so that details cannot be seen. Some experimental work has been done *e. g.* by Adlersparre 1936, Ivor 1943, 1956, Brackbill 1948, Groskin 1950, Goodwin 1951, 1952, 1953, Wackernagel 1951 and Whitaker (in press); and precise observations in the field have especially been made by Brackbill (*l. c.*), while many fantastic and dubious statements have been made on this subject. There exists a vast amount of literature about anting, only the most important papers of which will be treated here. For further references the reader is referred to the reviews by McAtee (1938), Chisholm (1944), Lane (1948), Ijzendoorn (1952), Ivor (1956), Simmons (in preparation) and Whitaker (in press).

When we say a bird is anting, we mean that it is on the ground or on a twig with one or both wings half-spread and with the tail drawn under the body. In this unusual attitude it can be seen picking up ants with its bill and rubbing its head among its feathers very rapidly. The head is rubbed against the undersides of the wings and the tail, stroking downward towards the tip. Some observers have only seen the curious behaviour, but have not observed that the bird was picking up ants. Other observers believe that the anting bird is placing ants among its feathers. As to the anting movements themselves there are also many divergent opinions. This, I think, is due to the fact that it is difficult for the observer's eye to follow them accurately, and that the observer watching the bird at long range gets so surprised that he does not realize what really takes place. Many observers think

that the anting bird is bathing in ants, believing that the bird enjoys the acid the ants have squirted on it, or it is suggested that the bird is preening, and in fact anting resembles to a high degree bathing and preening.

Material and Method.

In the experiments 152 birds of 24 families and 85 species were used. A shovelful of earth containing several ants was scattered on the floor of the aviaries or in a cup. The ants used were Red Wood-Ants (*Formica rufa*) and Garden-Ants (*Lasius niger*). The anting birds could be watched from a very short distance, *viz.* 10 cms.–1 m. and hundreds of individual antings were observed. A film was made of the anting performance of *Cyanocitta cristata* and *Leiothrix lutea* through a grant from the Danish State Research Foundation. Observations were also made on wild Starlings (*Sturnus vulgaris*), which were observed anting several times on lawns while searching for food.

Anting is apparently not fairly often observed, but once attention has been drawn to it one notices it more often. As early as 20 years ago I saw anting for the first time, but at that time I did not realize what happened. Then I saw Starlings (*Sturnus vulgaris*) and Pekin Robins (*Leiothrix lutea*) anting in the wild and in my aviary respectively. In the last 3 years when I have been studying anting behaviour I have seen Starlings anting mostly on calm hot days in July and August when Garden-Ants are numerous in the grass and emerge from the ground in large numbers and are swarming.

The Occurrence of Anting among birds.

Since CHISHOLM (1934) called attention to the anting phenomenon it has been found in many species of birds. NICE (1943) states anting in 38 species belonging to 13 families. In his review of anting WACKERNAGEL (1951), enumerates 63 species belonging to 18 families and IJZENDOORN (1952) results in 67 species belonging to 19 families. In table 1 is shown a list of the species in which anting has been observed. It has been prepared mainly on the basis of the papers by WACKERNAGEL and IJZENDOORN (l. c.) and it includes 72 species

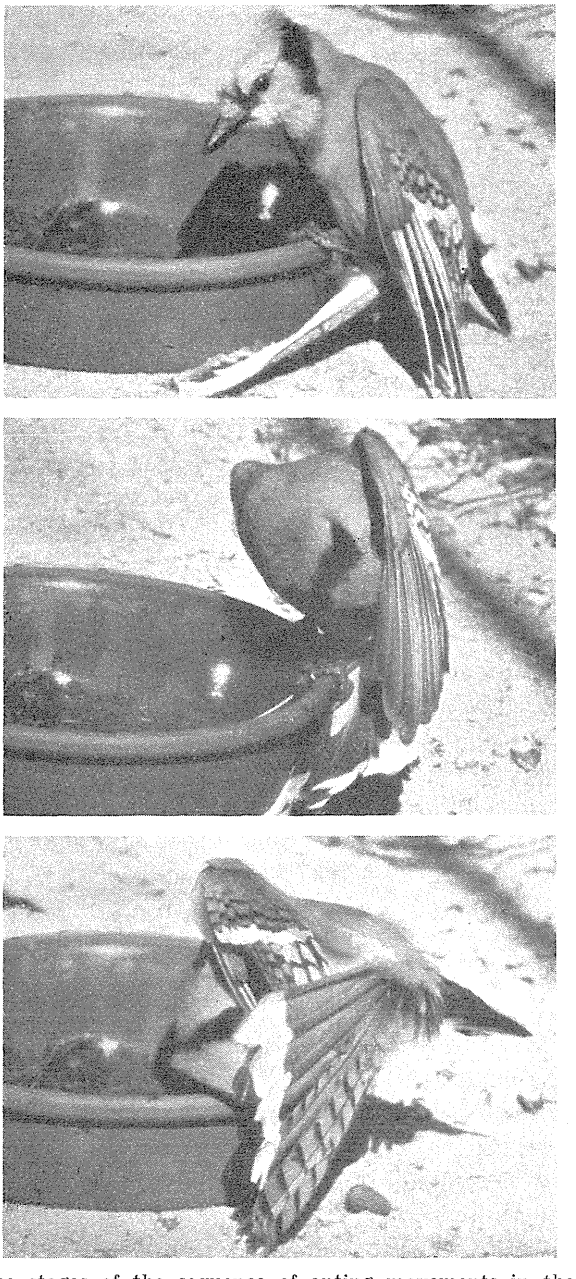

Fig. 1. Three stages of the sequence of anting movements in the Blue Jay (*Cyanocitta cristata*).
Nordamerikansk Blåskade (Cyanocitta cristata), *der »myrer« sig. Tre faser af bevægelserne ses.*

belonging to 21 families as some new records have been added viz. 4 species of corvine birds (GOODWIN 1953), the Wryneck (*Jynx torquilla*) (STONE 1954) and *Icterus spurius* (WHITAKER in press).

In the present study in which 152 birds of 85 species were used, anting has been observed in 104 individuals of 56 species belonging to 15 families, of which species 42 are new records (table 2). Thus at present over 100 species belonging to 25 families are known to ant, and the list will be steadily growing.

In many groups of birds anting has not yet been observed and is certainly not to be found, *e. g.* in *Ralli*, *Anseres Ciconii*, *Accipitres*, *Laro-Limicolae* and some other groups. In *Galli*, REYMOND (1948) states anting in *Alectoris graeca saxatilis*, *Lyrurus tetrix* and *Tetrao urogallus*. Further, anting is stated for the Wild Turkey (*Meleagris gallopavo*) by MCATEE (1947). These observations seem not to be valid as records of true anting, but they seem rather to be cases of dust-bathing carried out near or on ant nests being misinterpreted, as also pointed out by GOODWIN (1955 a). Anyhow I have never seen anting in gallinaceous birds, as it appears from table 3. They were seen eating ants on several occasions, but they never performed anting movements. In parrots I have never seen signs of interest in ants, but LANE (1948) and IVOR (1956) state that parrots ant.

In woodpeckers anting was not observed by GROSKIN (1943), who saw Flickers (*Colaptes auratus luteus*) eating ants emerging from the ground without attempting any form of anting. Nor was anting noticed by me in a related species, viz. *Colaptes agricola* feeding on *Formica rufa* and *Lasius niger*. On the other hand anting is recorded in *Picus viridis* by ALLSOP (1949) and STANFORD (1949), but this statement needs to be confirmed.

All the species listed in table 3 were often seen eating ants, but were never seen performing anting movements. They just picked up the ants and swalloved them immediately. Other species sometimes did the same, but in many cases they also performed anting movements with the ants. *Phoenicurus*, *Luscinia*, and *Erithacus* eat ants in the following way: They pick up ants, crush them in their bills, throw them aside, pick

them up, and swallow them just as they do in the case of other insects. When the birds eat ants in this way the ants may have little chance of irritating the bird.

When a bird does not take the ant put into its cage, or it eats the ants without anting, it is difficult to decide whether it has the anting movements or not. Even when ants are put into a cage several times, anting may not be observed in a species which will perform anting another time when the experiment is repeated. The same is the case with field observations. Some observers say that a certain species does not ant and later on other observers state that they have seen this species anting. Thus IVOR (1943) states that the Brambling (*Fringilla montifringilla*) eats ants, but does not ant, whereas I have seen this species anting several times when eating Garden-Ants. GROSKIN (1943) mentions that he observed that the American Robin (*Turdus migratorius*) showed no interest whatever in ants, whereas NICHOLS (1943) and IVOR (1943) have seen this species anting. Nor did GROSKIN see the Catbird (*Dumetella carolinensis*) and the Purple Grackle (*Quiscalus quiscula*) ant, whereas the former species has been observed to do so both by IVOR (l. c.) and BRACKBILL (1948), and further the latter species has been seen anting by BRACKBILL (l. c.).

Like IVOR (l. c.) the present writer also found that a species having an opportunity to ant would not always do so, and that not all species of any one family performed, but all individuals of a species which anted also performed. But perhaps anting behaviour will be found also in the missing species in future observations.

From our present knowledge it seems that anting is confined to Passerines, but it is true that while many passerine birds ant, others apparently do not.

Different Types of Anting.

As the present study went on it soon became evident that not all birds ant in the common way as described on page 267. In the birds studied in the present investigation 5 types af anting were observed, which will be described below.

1. All the birds listed in table 2 except *Quiscalus*, *Dacnis*, *Garrulus*, *Cissa*, *Urocissa* and *Turdus* were seen anting in the

following way (see also fig. 1 and 2): The bird picks up an ant with its bill and rubs its head on the ventral side of the primaries and secondaries of the one wing, which is held more or less outspread and almost vertically, the tips of the primaries touching the ground. *Cyanocitta cristata* occasionally also rubs its head on the dorsal side of the wing. Now and then the bird changes over to the other wing also while anting with one individual ant. Sometimes the bird rubs its head among the tail-feathers from the ventral side, the tail in most cases being held outspread and brought forward. Otherwise this is also done in some cases when the bird is only rubbing its head among the wing-feathers. The tail is always brought forward on the same side as the extended wing. Now and then the anting bird winks its eyes and—or—scratches its head and rubs its head on its shoulder. Very often the bird will squat on the length of its tarsi with its tail brought forward and to one side, in which position it appears to be more or less sitting on its tail. The intensity of the rubbing actions is such that the bird not infrequently loses its balance and topples to one side or tumbles backward. The anting behaviour described above does not apply to some individual bird or birds, but to all individuals of the species in question. The intensity in which the anting movements are carried out differs with the different species. Thus *Kittacincla malabarica* and *Copsychus saularis* rub the ant between the feathers with 1–3 strokes, whereas in *Ploceidae* and *Timaliidae* the movements are performed several times very quickly (3–9 strokes) with each ant. *Cyanocitta cristata* was often observed with both wings outspread when it was on the ground picking up ants, anting and swallowing them. Anting with both wings outspread in this species is presumably high-intensity anting.

Very often the Blue Jay (*Cyanocitta cristata*) and the Starling (*Sturnus vulgaris*)—and on one occasion also *Turdus migratorius*—do not clutch only a single ant in their bills at a time as the other species do, but continue picking up ants and performing anting movements until they have up to about 20 ants in their bills, and only then do they swallow all the ants they have in the tips of their bills. Sometimes they discard the ball of ants and go on picking up other ants, and

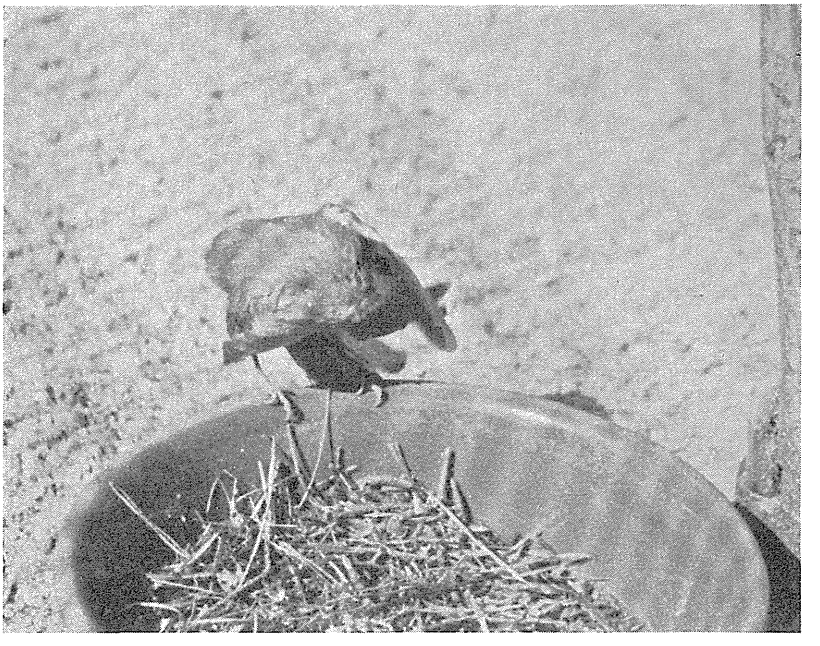

Fig. 2. A Pekin Robin (*Leiothrix lutea*) anting.
Solfugl (Leiothrix lutea) *der »myrer« sig.*

later on they pick up the lump and swallow it. All the observed species sometimes swallow the ants after having performed anting and sometimes reject them. On some occasions they begin to eat some ants, and then pick up ants and ant with them and cast them away.

2. At no time did I see a bird placing ants among its feathers as Ivor (1943) states, nor did I see any bird rubbing ants on any other part of the plumage than wings and tail until I watched a *Quiscalus quiscula* anting with Wood-Ants (*Formica rufa*). It rubbed its bill with the ant among the wing feathers, breast feathers, scapulars, rump feathers and upper-tail covers as also stated by Brackbill (1948). Then it discarded the ant with a slight toss of the head while it was moving the head forwards to pick up another ant. At first it seemed to me that the bird placed the ants among its feathers, but after some time I detected that the bird flung the ants away. On other occasions the bird was eating ants, but then without anting. It made 1–4 strokes with a single ant. Usually it only raised

the wing moderately and the tail was streched out behind the bird, only rarely was the tail bent to one side. This anting behaviour was later on observed in two other birds of the same species. The three birds were seen anting from 2–15 minutes.

3. A third mode of anting was noticed in the Blue Sugarbird (*Dacnis cayana*), of which 3 specimens were observed. This species picks up an ant in its bill, and very rapidly it rises in an almost vertical position with spread tail and moves both wings forward so that they touch each other while quivering, and the head is moved downwards among the tips of the wings. After this the bird swallowed the ant or sometimes discarded it. These movements have nothing to do with preening in this species. This type of anting resembles type 4, but the tail is not brought forward.

4. A fourth type of anting behaviour was observed in *Garrulus glandarius*, *Cissa chinensis* and *Urocissa erythrorhyncha*. These species bring both wings forward simultaneously (with a peculiar shuddering movement) and spread them widely, whereas most other species bring only one wing forward at a time. Both wings are also used in the Sugarbird and the Blue Jay as described above, and in some *Turdus*-species described below but these birds do it in quite another manner. GOODWIN (1953) states the same behaviour for the species in question, and further mentions that these birds as distinct from other species of corvine birds make the anting movements without previously having picked up an ant, although they make head movements that from a distance look as if they are doing so. This statement agrees with the observations of the present writer, who has seen these birds behaving in the way described above, while several ants were crawling on them while they were searching for food in the earth and picking up ants pupae and sometimes a few ants. All other species pick ants up when anting. Anticipatory anting movements as soon as the bird saw the ants at a distance were observed in a Jay (*Garrulus glandarius*) just as mentioned by GOODWIN (l. c.).

It is a peculiar fact that within the corvine birds there exists so different types of anting behaviour as described for *Garrulus* and *Cyanocitta* (see further GOODWIN 1953).

5. A fifth type of anting behaviour was observed in some

Turdus-species *viz. Turdus migratorius*, *Turdus musicus* and *Turdus philomelos*. These birds were on some occasions seen going to the ants and eating them without performing anting movements, and on other occasions they deliberately went to the ants without eating them, but picked them up in their bills and performed anting movements and then flung them away without eating them. Or they began to eat the ants without applying them to their feathers, and then suddenly fluffed their feathers and spread both tail-feathers and wing-feathers, making 1–3 strokes with a single ant, which was then discarded. All the while they were sitting on the ground and allowing the ants to crawl on them without removing them (see fig. 3), and chasing away other birds coming to the ants. The anting performances lasted 1–15 minutes. Very often the birds shook ants off their legs, obviously because the ants bit their tarsi. A little later the birds suddenly shifted behaviour and picked up ants and swallowed them. When eating ants they did not allow the ants to crawl on them, but took them in their bills and thrust them away or swallowed them. When the anting bird has applied the ant to the feathers it throws it away with a slight sideways movement of the head while it again is moving its head forwards to pick up another ant. Only from a distance of some cms. is one able to ascertain that the bird throws the ants away and that it does not place them among its feathers. Further one can see the ants, which the bird has used, lying dead or dying on the ground as the bird has crushed them with its bill.

The last described anting behaviour was not observed in any other species than the above mentioned *Turdus*-species and it was not observed every time these birds got ants. A similar manner of anting in which the birds expose their plumage to the ants is stated for *Corvus brachyrhynchus* (Ivor, cited in Lane 1948), *Corvus corone* (Wackernagel 1951, Goodwin 1953) and *Corvus frugilegus* (Goodwin l. c.).

I have studied anting behaviour for several years, but I did not see this type of anting until the summer of 1955. Therefore these observations are not included in my previous paper on the same subject (Poulsen 1956). It was with astonishment that I for the first time observed this behaviour in which the

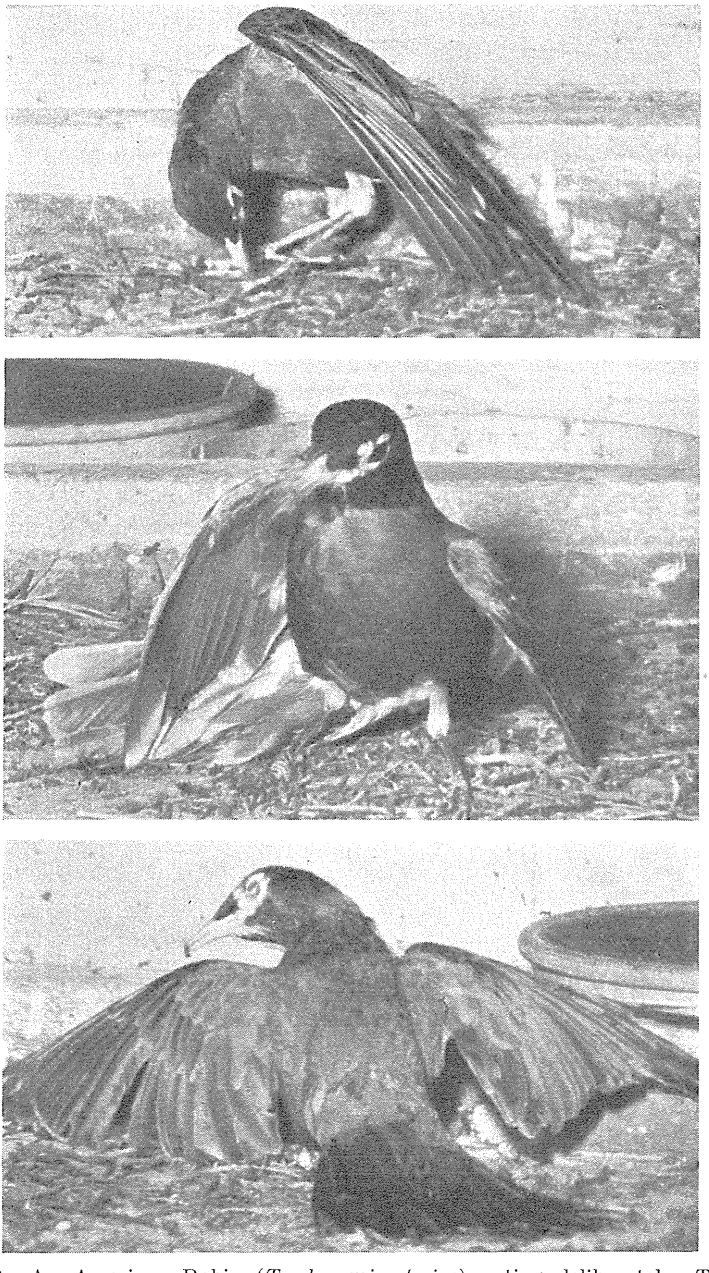

Fig. 3. An American Robin (*Turdus migratorius*) anting deliberately. Three stages of the attitudes adopted while anting. On the lower photo the bird has closed its nictitating membrane.
Vandredrossel (Turdus migratorius) *der tager »myrebad«. Tre forskellige stillinger ses. På det nederste billede har fuglen lukket blinkhinden for øjet.*

birds take a "bath" in ants. Other *Turdidae*, e. g. *Kittacincla malabarica* and *Copsychus saularis*, pick up ants and swallow them, sometimes after anting. Some other species eat ants, but are never seen anting, e. g. *Erithacus rubecula* and *Luscinia luscinia*.

Once I had noticed these birds discarding ants after having anted with them I also saw this in some other species (see table 4), which on other occasions were eating ants after anting or were eating them without anting. These birds were anting in their characteristic way as described under type 1, 2 and 3 and were not lying down among the ants.

The above experiments show that the different types of anting behaviour are fixed behaviour patterns. These behaviour patterns have not to be learnt in the course of the life of the individual. The present writer found it to be non-learned in two one-year old hand-reared birds viz. a Starling (*Sturnus vulgaris*) and a Chaffinch (*Fringilla coelebs*) which had never seen other birds anting. The innateness of anting behaviour has also been stated by other authors, in Dipper (*Cinclus cinclus*) (HEINROTH 1911), Starling (*Sturnus vulgaris*) (HAMPE 1935), Song Sparrow (*Melospiza melodia*) (NICE & PELKWIJK 1940), Jay (*Garrulus glandarius*) (GOODWIN 1952, LÖHRL 1952), Carrion Crow (*Corvus corone*) (WACKERNAGEL 1951) and Magpie (*Pica pica*) (SCHIERER 1952). The earliest age at which anting has been seen is 36–37 days in the Song Sparrow (NICE 1943) and 37–38 days in some other American passerines (IVOR 1943).

The following features of anting behaviour are common to the different types of anting.

The movements are performed very briskly, especially *Leiothrix* and its allies have a lightning-like anting. The birds rub the bill among the wing-feathers downwards towards the tip with quivering movements of the head. It often looks as if the bird is also applying ants to the inside of the tail-feathers as the tail is brought forward at the same time as the bird is using one wing. In some cases I have observed in starlings (*Sturnidae*), weavers (*Ploceidae*) and babblers (*Timaliidae*) that the rubbing movements of the bill do proceed to the tail, which is held close to the wing. While the bird applies ants

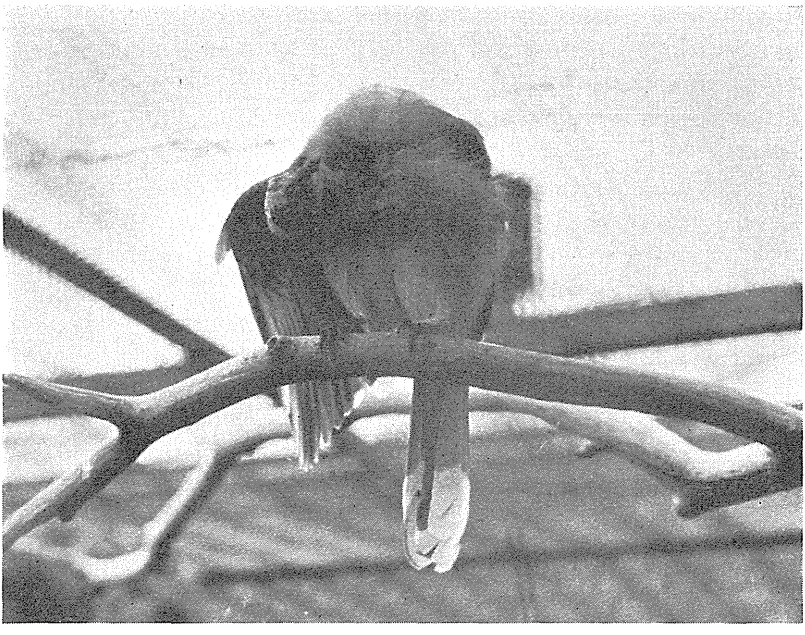

Fig. 4. A Blue Jay (*Cyanocitta cristata*) preening its wing.
Nordamerikansk Blåskade (Cyanocitta cristata) *der pudser sine vingefjer.*

to the tail, it still holds out the wing. No matter whether the tail is rubbed or not it is usually contorted, sometimes in rhythm with the rubbing movements on the wing. Often it is only the tip of the bill which touches the feathers, but I have seen several times in *Timaliidae* and in *Cyanocitta cristata* that not only the bill and the ant but also part of the head are moved between the wing-feathers. Apparently the birds are usually not afraid of the ants even if the ants are aggressive and squirt, only rarely are they cautious and hesitate a bit before they pick them up. If they are bit by the ants they shake their legs, make jumps and pick them off and fling them away. Very often the birds topple to one side or tumble backward. Apparently it is the position of the tail that account for the tumbling and not the position of the wings.

In the numerous reports of anting there are so many divergencies as to the description of the anting behaviour that one gets the impression that there is a considerable individual variation in anting behaviour. All the observations by the

present writer showed, however, that there exist different types of anting behaviour, and that each type is a fixed behaviour pattern of which types 1, 2, 4 and 5 more or less resemble parts of preening behaviour. In fact it resembles preening so much that observers quite often take it for preening, e. g. v. TYNE (1943), until the observer becomes aware that the bird is behaving in an unusual manner different from preening and is picking up something from the ground and applying it to the feathers. Because of the similarity between anting and preening I studied the preening movements in the same species as I had observed anting.

The anting behaviour resembles the parts of preening behaviour in which the bird is preening its wings and tail (see fig. 4). When preening the wings, the tail is never thrust forward as in anting, and the preening bird takes the wing-feathers in the tip of its bill and rubs along them and does not put its bill between the wing-feathers as when anting. Further when a bird is preening its tail it takes a tail-feather in the tip of its bill and rubs it down to the end from the upperside and not from the underside as in anting. Moreover the anting movements are performed more violently than preening, and in preening behaviour the birds very often flap their wings just after preening them, the wings being held up to the body.

Experiments with different Species of Ants.

The species of ants used in the experiments were *Formica rufa* and *Lasius niger*. These ants both bite and squirt formic acid on their enemies. They have a tendency when disturbed to seize the nearest available object with the jaws in a persistent grip. When seized by a bird they were seen biting at the bird's bill and moving their legs in order to escape. Just before being seized by a bird, specimens of *Formica rufa* were often seen showing aggressive behaviour with the body raised upward with opened jaws and with the abdomen thrust forward under the thorax and sometimes also a thin jet of excretion upwards against the bird was observed.

From the literature it is known that the ants used in anting belong to many different species. Only a few observers have identified the ants. GROSKIN (1950) has concerned himself

especially on this matter and gives a list of 13 species of ants used in anting, and later WACKERNAGEL (1951) has a list of 13 species of ants belonging to the genera: *Camponotus*, *Formica*, *Lasius*, *Oecophylla* and *Tapinoma*. Up to the present time little attention has been given to the identification of the ants used in anting, and many ornithologists have assumed that the birds ant to get the benefits of formic acid and have taken it for granted that all ants excrete formic acid. GROSKIN (1943) states that according to entomological authorities acid is produced by the species of certain Formicine genera such as *Lasius*, *Formica*, and *Camponotus*, whereas other ants spray other venoms with strong odours or excrete other acids as citric acid, to which WHITAKER (*in litt.*) adds butyric acid; *Acanthomyops interjectus* excretes a liquid with an odour somewhat like citronella (IVOR 1956). According to GROSKIN (1950) several birds are recorded anting with ants not known to excrete formic acid. Further it must be remembered that the poison apparatus is only present in the workers and the queens (Dr. G. LARSSON, personal communication), but nevertheless birds also ant with the male ants. When earth with ants is put in the cages, the birds pick at the earth in search of food. They eat the pupae eagerly without anting, and also take both workers and the winged females and males and sometimes ant with them.

The experiments were carried out with birds belonging to type 1 of anting behaviour. The birds picked up the ants of both the applied species of ants and swallowed them after anting. Each ant was eaten, but the birds did not always make the anting movements before eating the ant. Some species as *Kittacincla malabarica* and *Copsychus saularis* very rarely anted with the little Garden Ant (*Lasius niger*), whereas they were sometimes seen anting with Red Wood Ants (*Formica rufa*). *Zosterops palpebrosa* eats *Lasius niger* ants with great eagerness after having anted with them, but when earth with *Formica rufa* ants is brought into the cage the birds approach with cautiousness, picking at the earth in search of food and seizing the ants and throwing them away. Five birds behaved in the same way, only two of the birds swallowed two ants after first having anted with them. *Dacnis cayana* behaved just

like *Zosterops palpebrosa*. *Sturnus vulgaris* and *Leiothrix lutea* were anting quicker and with more anting movements when eating *Formica rufa* ants than when eating *Lasius niger* ants, and when eating *Formica rufa* ants *Sturnus vulgaris* and *Cyanocitta cristata* often discarded the ball of ants they had in their bills and picked them up later and swallowed them. *Perdicula asiatica* and *Excalfactoria chinensis*, which very eagerly picked up and ate *Lasius niger* ants, very often hesitated before picking up *Formica rufa* ants, and sometimes they winked their eyes and scratched their heads, probably when the ants had squirted them.

The cause of the different behaviour of the birds towards the two species of ants is probably that *Formica rufa* is a much bigger and stronger ant than *Lasius niger*, and it bites more strongly and squirts more than the latter. The different species of birds showed a different sensitivity to the biting and squirting of the ants they were eating, as appears from the above.

When ants were put on the floor of the aviaries, the birds eyed them with obvious eagerness. Then they approached quickly, picking up an ant and taking wing to a perch, or they anted on the ground near the ants or among the ants while apparently trying to avoid attacks from them. The behaviour of the birds towards the ants depended on the condition of the ants. When eating ants the birds anted intensively with ants just taken from an ants'nest and therefore very active when tipped out on the floor of the aviary, whereas the birds anted much less with ants which had been kept in a sack for some days and therefore were less active. As mentioned above *Garrulus glandarius* performs anting without picking up ants. Further a *Passerina cyanea* which was eating ant pupae was observed picking up ants, anting with them, and flinging them away, and intermittently it made incipient movements of picking up ants and then incipient anting movements.

In all these experiments it could be observed that it is not every time a bird has an ant in its bill that it performs anting movements with it. Moreover the anting behaviour may be performed more or less intensively. When an ant chances to squirt for example into the bird's eye, the bird at once closes

its eye, hops away, and stands as if dazed with pain for a second or two, but soon returns to the ants. Sometimes a bird merely swallows the ant, and sometimes it shakes its head more or less vigorously, or it performs anting movements a couple of times, or it makes the anting movements several times in succession, and sometimes also rubs its eye on its shoulder, scratches its head with one of its legs, and winks the nictitating membrane.

When Garden Ants (*Lasius niger*) are hatching and swarning simultaneously throughout great areas on sunny, calm days in midsummer I have seen such birds as Starlings (*Sturnus vulgaris*), Swallows (*Hirundo rustica*), House Martins (*Delichon urbica*), Swifts (*Apus apus*) and Black-headed Gulls (*Larus ridibundus*) take the winged ants in the air. Similar observations are mentioned by MAYR (1948) and IJZENDOORN (1952). On these occasions I have also seen Starlings feeding on the numerous winged ants and the worker ants which are active in the grass.

Experiments with other Objects.

From the numerous reports of anting in the literature it is known that anting is not only elicited by ants, but also by other objects as meal-worms, cigar-butts, burning cigarettes, smoke, moth-balls, leaves, lemon-juice, vinegar, sumach berries, and even beer (see MCATEE 1938 and IJZENDOORN 1952). To this varied list NICE recently (1955) adds hot chocolate and soapy warm water.

The stimuli releasing anting could probably be tactile, irritating, olfactoric, or visual. Thus it might be the creeping movements of the ants while the bird has them in its bill, their crawling on its body or their biting, or their squirting acid, or the sight of ants, which releases anting.

Experiments were therefore carried out to decide which stimuli release anting. In order to find out whether the movements of the animal seized could release anting, the birds were given other small animals than ants, viz. woodlice (*Porcellio*), centipedes (*Lithobius*), ear-wigs (*Forficula*), beetles (*Tenebrio*) and bees (*Apis*). The birds were never seen anting with these animals except with the ear-wigs. Perhaps this is due to the

fact that this very animal has a stink gland on its abdomen. As distinct from these results the statements of the following anting objects must be mentioned: amphipodes (BRAUN 1924), meal-worm (STRESEMANN 1935) and beetles (STEINIGER 1937 and WACKERNAGEL 1951).

The above-mentioned experiments tend to show that the creeping movements of the animal seized by the bird do not release anting. Further it may be mentioned that it was often observed that when a bird (*Cyanocitta cristata*) was eating ants, some ants were crawling on its feathers on breast or back or on its legs, but the bird ignored them. It was only when the bird happened to see the ant that it took it into its bill, made anting movements, and swallowed it or sometimes threw it away. On the other hand biting by the ants when they are crawling on the birds' legs or skin or when a seized ant happens to bite at the birds' bill, apparently releases anting.

Then it was tested whether formic acid could release the anting behaviour. Some Meal-worms in a cup with formic acid were placed in the cages. The birds used in these experiments were: *Dryonastes ruficollis*, *Mesia argentauris*, *Leiothrix lutea*, *Kittacincla malabarica*, *Cyanocitta cristata*, *Sturnus vulgaris* and *Pastor roseus*. The birds at once picked up a worm and swallowed it as they used to do, but almost immediately they regurgitated it, violently shaking their heads. Nevertheless the birds tried again and ate the meal-worm at last. Sometimes when a bird had a meal-worm with formic acid in its bill and struck it against the twig on which it was sitting, a small drop of formic acid from the meal-worm might hit the bird on the head. The bird winked with the nictitating membrane and vigorously made anting movements before swallowing the meal worm just as a bird sometimes does when eating an ant.

Similar experiments with the same species were carried out with citric acid and formalin and with the same results as with formic acid. These three fluids irritate the membrane and the skin in humans, and obviously the same is the case in birds. Evidently the birds do not smell these fluids as they pick up the meal-worms and only react to the fluid on the meal-worms when they have got the meal-worms inside their bills.

They continue to take these meal worms, sometimes hesitating a moment before picking them up.

Experiments were also carried out with a substance with a pungent smell, viz. moth-balls (naphthalene). Five moth-balls were put into the cage of the Blue Jays (*Cyanocitta cristata*). These birds examine everything in their cage that is new to them, and two of the Jays picked up the moth-balls in their bills, let them fall, and flew down and pecked at them. Nine times they were seen making anting movements with pieces of the moth-balls in their bills; they also shook their heads and winked with the nictitating membrane. After some time they ignored the moth-balls. A Jay (*Garrulus glandarius*) and an *Icterus jamacaii* picked up a moth-ball and let it fall without making anting movements.

In other experiments formic acid, vinegar, lemon juice, and formalin were squirted on the birds, viz *Garrulus glandarius*, *Cyanocitta cristata*, *Leiothrix lutea*, *Dryonastes ruficollis*, with a little sprayer. When any of these fluids was squirted on their brests or backs, the birds only shook their plumage and flew away. But when they got it on their heads they made anting movements very intensively. When they got it in their eyes they winked their eyes, scratched their heads, and rubbed their heads against the branch on which they were sitting. This is also seen when a bird is anting with ants. Similar experiments were made with *Carduelis cannabina*, *Serinus canaria* and *Poliospiza leucopygia* which were never seen performing anting movements. These birds shook their heads, stroked heads on the branch on which they were sitting, and winked their eyes. This reaction is obviously shown when an irritating stimulus gets on the bird's eye. It can be seen both in anters whilst anting, in gallinaceous birds eating ants and in pigeons and many passerines as also stated by GOODWIN (1955 a).

It has been maintained that birds enjoy having their plumage sprayed with acid from ants. It is also said (HAMPE 1935) that birds enjoy bathing in acid water, and GOODWIN (1955 a) states that bathing usually follows anting. These statements do not agree with the observations of the present writer. When I gave different birds, viz. *Leiothrix lutea*, *Sturnus*

vulgaris, and *Cyanocitta cristata*, two cups with water, one with pure water and one with water and vinegar or formic acid. The birds took baths in both cups, but if the birds by making incipient bathing movements in the acid water happened to get a little in their bills or in their eyes, they shook their heads and flew away, and on two occasions I saw a *Cyanocitta cristata* making anting movements.

Visual stimuli may also play a part in releasing anting. Incipient anting was sometimes observed when a Jay (*Garrulus glandarius*) and four Blue Jays (*Cyanocitta cristata*) saw ants from a distance. Visual stimuli also released anting in the following observations. Four Blue Jays which had been anting and eating Garden Ants (*Lasius niger*) were seen anting and eating the tiny non-squirting Pharaoh-Ants (*Monomorium pharaonis*) which were crawling on the wall at the end of the aviary.

In the following observation anting was a conditioned response to a visual stimulus. A Jay which anted when I squirted formic acid on it made incipient anting movements and sometimes complete anting movements—without ants—when I was standing in front of the aviary with the sprayer in my hand some hours later. The next day the bird reacted only slightly to the sight of the sprayer.

"Anting" in Mammals.

Anting in its widest sense is also to be found in mammals; there is at least one account of a mammal anting, *viz.* the Grey Squirrel (*Sciurus carolinensis*) (Bagg 1952). This animal was seen behaving in a remarkable manner in a locality where there were many ants. It crawled on its belly, rolled on its sides, and performed somersaults. During this varied performance the animal was seen to scratch itself several times. In fact it behaved as if possessed. This continued for about 5 minutes in the same place. Eventually the animal walked slowly away. The author claims that the actions of the animal appeared intentional and deliberate and it is suggested that the behaviour is a means of reducing the ectoparasites in the animal's fur and that the animal likes the formic acid.

As I wanted to see this behaviour in a mammal I made

some experiments with two Common Squirrels (*Sciurus vulgaris*) and a Stone Marten (*Martes foina*). I squirted formic on the animals with a little sprayer, and they did not react to it, but when the acid happened to penetrate the hairs and struck the skin on the belly, on the head, or on the snout, the animals suddenly behaved in the above-mentioned way, rubbing their heads and bellies against the ground or the walls of their cages, winking their eyes, and scratching their heads and bellies. Obviously they tried to rub off the irritating stimulus just as we would do in the same situation and were not behaving intentionally to have their fur sprayed with formic acid, enjoying the acid. I think that this is the explanation of the behaviour of the Grey Squirrel too, when this animal happens to be attacked by ants.

Further I put some *Formica rufa* ants into the cage of two Common Squirrels. While they were eating their nuts and apples, several ants attacked them, squirting on them, crawling on them, and biting them. Then the squirrels were seen shaking their legs and rubbing their heads and bellies and running away from the place where the ants were crawling about.

Discussion.

Anting as a part of feeding behaviour is a reaction to a stimulus, and there seems not to be any waxing and waning of an internal drive. Many birds eating and anting with ants did so every day—sometimes several times daily—for more than a month. But there is evidence that anting performed as "bathing" in ants is internally activated, so that birds perform this anting when in anting mood. Anting is apparently never exploding *in vacuo*. In all the apparent cases of vacuum anting (anticipatory anting) the birds see an object from which they have learned that an irritating stimulus emanates. Goodwin (1951) states that the Jay (*Garrulus glandarius*) will not ant for two or three days running in contrast to water bathing, which is indulged from one to several times daily. Further Ivor (1943) states that the tendency to perform anting varies with the season. It was much greater during late April to the end of July than it was in early spring and in autumn. I have not studied the varying of the tendency to perform

anting thoroughly, but in some of the few species in which I have observed "bathing" in ants, *viz. Turdus philomelos* and *Turdus musicus*, I found that sometimes they did so twice with an interval of 4 hours but not on the next day. Not until 3 days later did they perform anting. A *Turdus migratorius* did not perform anting on 3 days running, but did so on the fourth day.

From the many field observations of anting in the literature there seem to be many individual variations of anting behaviour, but this is not the case. There exist different types of anting behaviour, but in every species observed every individual performed it identically also when other objects than ants were used. The different types of anting are behaviour patterns specific to the species.

In the experiments it was never seen that ants were placed among the feathers as is often stated. The birds always rubbed their heads between their feathers with the ant in the tip of their bills, and then swallowed it or discarded it with a slight sideways movement of the head.

As stated in the beginning of this paper, three of the types of anting are similar to part of preening (see p. 279). Therefore the writer would suggest that anting has developed from preening, at least in many passerine birds. SIMMONS (1955) seems to be of the same opinion, saying that he considers anting to be modified preening. CHISHOLM (1944) on the other hand believes that anting may have arisen from dust bathing in the loose earth found on ants' nests. ROTHSCHILD & CLAY (1952) suggest that anting has developed from birds sunning themselves in the vicinity of the ants' nests and IVOR (1956) thinks that anting is a primal form of behaviour lost by some birds, but retained by others.

The anting performance is released by irritating and perhaps by tactile stimuli. From observations of the above-mentioned hand-raised birds it would seem that anting behaviour is first released through the acid of the ants or any other irritating stimulus, and that the birds learn to recognize the ants and other anting objects visually. NICE (1943) and GOODWIN (1952) come to the same conclusion. In any case anting is also released by the sight of ants.

The anting movements are performed when an irritating stimulus strikes the skin or the membranes. When the irritating stimulus hits the eye, the birds wink or rub the closed eye on their shoulder or on the branch.

The different species of birds have a different sensivity to the irritating stimuli caused by the ants. The birds which eat ants without anting pick up an ant very quickly and swallow it immediately, whereas other birds keep the ant in the tip of their bills, crush it, and often make anting movements before swallowing it. The birds eating ants seem more inclined to ant with the bigger *Formica rufa* than with *Lasius niger* ants.

The dead or dying ants seen on the ground when the anting birds have departed result from the birds' searching for the pupae. When they are attacked by worker ants they seize them, crush them, and fling them away. Sometimes birds were also seen to take up ants, ant with them, throw them away and later pick up the dying ants again and ant with them and swallow them. But dead or dying ants may also originate from birds having anted deliberately and having rejected them after use.

Unintentional anting is not only connected with the eating of ants as is to be seen from the following observation. A Superb Starling (*Spreo superbus*) which was picking up nest materials took some straws on which Garden-Ants were seen to be crawling. The bird was seen on several occasions anting with the nest material containing ants in its bill.

In a few species anting is performed without the bird having any ant in its bill (see p. 274), and some birds which were squirted with different fluids performed without any ants. Therefore perhaps what is called anting in smoke, of which there are several records in the literature, may be interpreted to the effect that the smoke provides the irritating stimulus eliciting anting behaviour. I have not seen anting in smoke myself, and perhaps it is not the same as what we call anting.

Further ARMSTRONG (1949) writes that he has seen a Starling repeatedly putting its bill under its wing without picking up ants, *i. e.* performing anting only by seeing ants. This observation cannot be regarded as a case of displacement

anting as IJZENDOORN (1952) does but is a case of anticipatory anting as described by GOODWIN (1952).

The experimental birds did not like acid or any other substance which is able to irritate the skin or has a pungent smell that irritates the membranes in the nostrils, and maybe also something in the taste releases anting. When I gave 4 Blue Jays (*Cyanocitta cristata*) meal-worms from my hand they came and took them eagerly, but when I squirted formic acid or lemon juice on the birds from a little sprayer hidden in my other hand, the birds after a few attempts would not come any more, until after some hours later, and then they were more cautious. They did not come near to intercept the squirting of acid and going through the motions of bathing as stated by HAMPE (1935) for *Sturnus vulgaris* and *Garrulus glandarius*. Similar experiments were not carried out with the species which were observed deliberately exposing their plumage to the ants. As mentioned earlier the experimental birds apparently did not like to have acid on their skin, on the contrary. On the other hand, some species were observed going to the ants, exposing their plumage to the ants.

STEINIGER (1937) and PALMGREN *et al.* (1937) after a number of feeding experiments in which birds were given ants arrived at the conclusion that ants are protected by their distasteful qualities. STEINIGER made experiments with: *Erithacus rubecula*, *Luscinia suecica*, *Sylvia borin*, *S. atricapilla*, *Muscicapa striata*, *Parus caeruleus*, *Turdus philomelos*, *Pica pica*, *Corvus corone* and *Leiothrix lutea*. PALMGREN *et al.* used the following species: *Erithacus rubecula*, *Phoenicurus phoenicurus*, *Sylvia borin*, *S. communis*, and *Muscicapa hypoleuca*. These species did not eat ants, or only exceptionally. STEINIGER states that *Erithacus* shows interest in the ants, it approaches the ants, but it does not pick them up. *Muscicapa striata* and *Leiothrix*, however, eat the ants, and the latter species also perform anting movements with the ants in their bills.

I made experiments with the Robin (*Erithacus rubecula*), a species used both by STEINIGER and PALMGREN *et al.* Two birds were used. They were fed with a special mixture food for insectivorous birds and with live meal-worms. When earth with ants was thrown into the cage, the birds hopped down

attracted by the crawling ants and picked them up, swallowing them immediately after, without keeping them a moment in the tip of their bills as anting species do. In two experiments the birds each ate 50 Garden Ants (*Lasius niger*), workers and queens, and in two other experiments the birds each ate 25 and 35 Wood-Ants (*Formica rufa*) workers.

HEIKERTINGER (1919 & 1954) referring to the investigations of CZIKI and others, who found worker-ants of different species in the stomachs of more than 50 species of European birds, maintains that ants form an important part of the food of these birds, and that the ant mimicry thus is shown not to exist, although he says that birds mostly do not take ants so long as they can get other and better food animals.

The apparent disagreement between the results of STEINIGER and PALMGREN *et al.* and the present investigation, in which birds ate the ants, is due to the fact that the birds' avoidance of the ants proved by the above authors is a relative one and not an absolute one, as HEIKERTINGER erroneously claims. As pointed out by PALMGREN the birds' avoidance of ants is dependant on the experimental birds' possibility of getting live insects to eat. When the experimental birds are almost entirely fed by artificial food they eagerly eat ants. The same was the case with the birds used in the present investigation.

When birds in the wild are hungry they will take the ants they otherwise abandon. Therefore it is of survival value at least for some insectivorous birds that they have a means, *viz.* anting, by which they are able to overcome the defence from their prey.

Many theories have been suggested to explain anting behaviour. The theories about the biological significance of anting mentioned in the literature are as follows:

1. The theory of food-transport
2. The theory of food-cleansing
3. The theory of ectoparasite-extirpation
4. The theory of skin stimulation
5. The theory of perfuming
6. The theory of vitamin production
7. The theory of intoxication

Reference will not be made to all the views of the supporters of the different theories, I shall confine myself to some of the critical reviews of the theories of anting. WACKERNAGEL (1951) supports the acceptance of the theory of tonic effect on the skin, and IJZENDOORN (1952) assumes that the theory of intoxication is the most likely explanation and that the birds like to ant. CHISHOLM (1944) thinks that anting is practised "mainly for the satisfaction and pleasure it provides" originating from the effect of the acid on the skin, and that anting before eating "serve a double purpose, that of external stimulus followed by the benefit of food." GOODWIN (1955 a) is of opinion that most likely it is of some use in the destruction of ectoparasites and this is the most widely advanced explanation. Some of the other theories are obviously incorrect. All these theories, however, do not render any quite convincing explanation as to the function of anting, and still there is no positive evidence either for or against them.

The above-mentioned observations and experiments show that what is called anting behaviour is a complicated phenomenon in which at least two different phenomena are involved. This view also seems to be implied in IVOR's work (1956). In some passerine birds it can be a part of feeding behaviour by which the birds remove and/or try to avoid the irritating stimuli from the defence weapons of the ants (types 1, 3) by rubbing their heads among the rather stiff wing and tail feathers or by moving the ants among these feathers thus preventing the ants' squirtings from hitting the head. IVOR (*l. c.*) objects that it is only the tip of the bill and the ant that touch the feathers, but according to my observations the birds in many cases rub part of the head against the feathers. The birds also resist ants crawling on them and try to get rid of them. Moreover this anting behaviour is shown in other contexts with irritating stimuli from ants or other objects. This conclusion has been advanced by the present writer in a previous paper (POULSEN 1956) but it does not cover the whole problem. At that time he had only experimental evidence for this view, but now he has realized that the term anting also covers the behaviour in which birds go to ants not to eat them but only to have their plumage squirted by the ants and

permitting the ants to crawl on them (types 2, 4, 5). In this connection it may be mentioned that the plumage of the experimental birds was very fine and not infested with ectoparasites. Only a Black-headed Oriole (*Oriolus melanocephala*) had a rumpled plumage. It was seen on two occasions eating Wood-Ants (*Formica rufa*) without anting with them. Two weeks later it died and proved to have many mites among its feathers. On the other hand this is not the whole truth of anting as SIMMONS (1955) and GOODWIN (1955 b) seem to think in their criticism of my previously expressed views. The anting behaviour performed when birds are eating ants is very rapid, and the ants are only applied to the wing and tail feathers; the body where parasites are usually found is ignored, and the birds do not sit down among the ants. This anting behaviour cannot possibly function as destruction of ectoparasites. Further it must be remembered that only one species, *Quiscalus quiscula*, was seen applying the ants to other parts of the plumage, and only some *Turdus*-species were seen sitting down among the ants. But it is not understandable that even nearly related species differ; some perform anting, and others do not, as also pointed out by IVOR (1956).

In any case this amazing antic wide-spread among birds must have a function, but as yet no satisfactory definite solution can be given. The present investigation only suggests a very tentative explanation of the curious behaviour, which has stimulated and puzzled ornithologists so much and continues to do so.

Summary.

The present paper is an experimental investigation of anting behaviour. Anting was only found in passerine birds. But even closely related species differ, some ant and some do not.

Five types of anting were recorded.

Anting involves at least two phenomena. In most cases anting was observed in connection with feeding as unintentional anting. Some *Turdus*-species were observed anting deliberately, exposing their plumage to the ants. This type of anting seems to be internally activated.

The different types of anting are non-learned behaviour patterns. There are no individual variations except in the intensity of the performance.

Anting is released by irritating and tactile stimuli on the skin or membranes but it may also be a conditioned response to visual stimuli viz. the sight of the producer of the irritation: ants or other objects.

The irritating stimuli may be formic acid or any other substance with a pungent smell or maybe taste (ant-substitutes). When the irritation hits the eye, the birds wink and/or rub it and that is the case both in anters and in not-anting species.

Some of the many theories as to the function of anting are obviously incorrect and none of them seem to be convincing. There is no direct evidence for any of these theories and still this problem awaits its solution.

TABLE 1.

List of birds seen anting; compiled from the literature.
It includes 74 species of 21 families.

Galli.

Phasianidae: Alectoris graeca, Lyrurus tetrix, Meleagris gallopavo, Tetrao urogallus.

Pici.

Picidae: Picus viridis, Jynx torquilla.

Passeres.

Clamatores

Dendrocolaptidae: Dendrocolaptes certhia.
Tyrannidae: Pipromorpha oleaginea.

Oscines

Mimidae: Dumetella carolinensis.
Timaliidae: Garrulax sp., Leiothrix lutea, Lioptila capistrata.
Cinclidae: Cinclus cinclus.
Turdidae: Hylocichla fuscescens, H. guttata, H. mustelina, Turdus merula, T. migratorius, T. musicus, T. philomelos, T. torquatus, T. viscivorus.
Pycnonotidae: Chloropsis jerdoni.
Bombycillidae: Bombycilla cedrorum.
Pachycephalidae: Pachycephala rufiventris.
Prionopidae: Coluricincla parvula, Grallina cyanoleuca.
Meliphagidae: Meliphaga lewini.
Mniotiltidae: Vermivora pinus.
Tanagridae: Piranga erythromelas, P. rubra.
Fringillidae: Fringilla coelebs, Hesperiphona vespertina, Junco hyemalis, Melospiza melodia, Passerella iliaca, Passerina cyanea, Pheucticus ludovicianus, P. melanocephalus, Pipilo erythrophthalmus, Richmondena cardinalis, Saltator maximus, Sporophila aurita, Zonothrichia albicollis, Z. leucophrys, Z. querula.

Ploceidae: Aegintha temporalis, Passer domesticus, Euplectes franscisciana, E. taha.
Icteridae: Dolichonyx oryzivorus, Icterus galbula, I. spurius, Molothrus ater, Quiscalus quiscula, Q. crassirostris, Q. versicolor.
Sturnidae: Acridotheres tristis, Sturnus vulgaris.
Ptilinorhynchidae: Ptilinorhynchus violaceus.
Corvidae: Corvus corax, C. frugilegus, C. corone cornix, C. c. corone, C. brachyrhynchus, Cyanocitta cristata, Garrulus glandarius, G. lanceolatus, Cissalopha beecheyi, Urocissa erythrorhyncha, Cissa chinensis, Cyanopica cyaneus, Pica pica, Struthidea cinerea.

TABLE 2.

List of birds seen anting in the present study. New records are indicated by an asterisk. The figures are numbers of individuals observed. 104 individuals of 56 species are included.

Passeres.

*Paradoxornithidae: *Suthora gularis* (1).
Timaliidae: Leiothrix lutea (4), **Mesia argentauris* (2), **Siva cyanouroptera* (2), *Lioptila capistrata* (2), **Yuhina sp.* (3), **Garrulax leucolophus* (2), **Dryonastes ruficollis* (1), **D. chinensis* (2), **Pomatorhinus olivaceus* (1), **P. erythrogenys* (1).
Turdidae: Turdus musicus (2), *T. philomelos* (2), *T. migratorius* (1), **Kittacincla malabarica* (3), **Copsychus saularis* (1).
*Muscicapidae: *Niltava sundara* (2), **Cyornis tickelliae* (2).
*Pycnonotidae: *Chloropsis aurifrons* (1).
*Zosteropidae: *Zosterops palpebrosa* (4).
*Motacillidae: *Anthus trivialis* (1).
*Coerebidae: *Dacnis cayana* (2).
*Tanagridae: *Calospiza fastuosa* (1).
Fringillidae: Fringilla coelebs (2), **F. montifringilla* (2), **Coccothraustes coccothraustes* (2), **Passerina amoena* (2), **P. leclancheri* (1), *P. cyanea* (1), **Paroaria capitata* (2).
*Ploceidae: *Bubalornis niger* (1), **Diatropura procne* (1), **D. jacksoni* (1), **Coliuspasser macrocercus* (2), **C. laticauda* (2), **Euplectes hordeacea* (2), *E. franscicana* (2), **Melanopteryx rubiginosus* (1).
*Icteridae: *Icterus jamacaii* (2), **Agelaius phoeniceus* (3), *Quiscalus quiscula* (3).
Sturnidae: Sturnus vulgaris (2), **Pastor roseus* (2), **Spreo superbus* (2), **Lamprocolius chalybaeus* (2), **Lamprotornis caudatus* (2), **Acridotheres fuscus* (2), **A. ginginianus* (2), **A. cristatellus* (1), **Sturnopastor contra* (2), **Gracula intermedia* (1).
*Ptilinorhynchidae: *Aeluraedus crassirostris* (1).
Corvidae: Cyanocitta cristata (4), *Garrulus glandarius* (1), *Cissa chinensis* (3), *Urocissa erythrorhyncha* (2).

TABLE 3.

List of birds seen eating ants, but never seen anting. 48 individuals of 29 species are included.

Galli.

Phasianidae: Chrysolophus pictus (2), *Perdix perdix* (2), *Coturnix coturnix* (2), *Alectoris chukar* (2), *Perdicula asiatica* (4), *Excalfactoria chinensis* (3).

Pici.

Picidae: Colaptes agricola (1).
Capitonidae: Trachyphonus margaritatus (1).

Coracii.

Coraciidae: Coracias garrulus (2).
Bucerotidae: Lophoceros erythrorhynchus (1), *L. melanoleucus* (1).

Cuculi.

Cuculidae: Guira guira (1).

Passeres.

Turdidae: Phoenicurus phoenicurus (2), *Luscinia luscinia* (1), *Erithacus rubecula* (2), *Saxicola caprata* (1), *Saxicoloides fulicata* (1).
Pycnonotidae: Microtarsus melanocephalus (2), *Otocompsa leucotis* (2), *O. emeria* (2).
Sittidae: Sitta castanea (1).
Coerebidae: Cyanerpes cyaneus (3).
Fringillidae: Chloris chloris (2), *Paroaria coronata* (2).
Ploceidae: Passer griseus (1).
Oriolidae: Oriolus indicus (1), *O. melanocephalus* (1).
Dicruridae: Buchanga afer (1).
Corvidae: Cyanocorax chrysops (1).

TABLE 4.

List of birds seen anting and sometimes discarding the ants.

Leiothrix lutea
Mesia argentauris
Garrulax leucolophus
Turdus musicus
Turdus philomelos
Turdus migratorius
Kittacincla malabarica
Copsychus saularis
Anthus trivialis
Dacnis cayana
Coccothraustes coccothraustes
Fringilla coelebs

Dialropura procne
Drepanoplectes jacksoni
Melanopteryx rubiginosus
Euplectes hordeacea
Agelaius phoeniceus
Quiscalus quiscula
Cyanocitta cristata

DANSK RESUMÉ

Fugles opførsel over for myrer.

Fugle har en besynderlig opførsel over for myrer. Det ser ud som om de tager bad i myrer eller anbringer dem mellem fjerene. Skønt dette har interesseret ornithologer over hele verden i de sidste 20 år, ved man endnu ikke ret meget om det. Det er åbenbart en foreteelse, der ikke ses særligt hyppigt i naturen. Forf. har dog ofte set stære »myre« sig, når de går i græsset og søger føde.

Der blev gjort forsøg med en række forskellige fugle. Denne opførsel blev kun fundet hos spurvefugle, hvor den til gengæld er meget udbredt. Fuglenes opførsel over for røde skovmyrer (*Formica rufa*) og sorte havemyrer (*Lasius niger*) blev iagttaget. Fuglene tager en myre i næbbet og stryger den med meget hurtige bevægelser mod svingfjerene på den ene vinge, der holdes udbredt. Undertiden bruges også styrefjerene, men enten halen bruges eller ej, holdes den ud til siden og fremefter, så at fuglen ofte kommer til at træde på den og vælter omkuld. I mange tilfælde ender disse overraskende bevægelser med, at fuglen sluger myren; i nogle tilfælde kastes den dog væk. Hos drosler blev det iagttaget, at de æder myrer uden at opføre sig på den ovennævnte måde, men de har også en helt anden måde, at opføre sig på over for myrerne. Pludselig sætter de sig ned, hvor myrerne kravler omkring og lader dem kravle på sig, samtidig med at de tager myrer i næbbet og stryger dem gennem vinger og hale, hvorefter de kaster dem bort.

De bevægelser, fuglene foretager med myrerne i næbbet, er medfødte instinktbevægelser. Ved forsøg viste det sig, at de udløses af irritationer, der fremkommer ved, at myrerne sprøjter myresyre på fuglen, eller ved at myrerne bider. Bevægelserne kan også udløses bare ved synet af en myre. I forsøg viste det sig, at fuglenes specielle opførsel over for myrer kunne udløses af forskellige stoffer med stikkende lugt eller smag f. eks. naftalin og formalin. Der kendes også mange eksempler på, at fugle »myrer« sig med de mærkeligste ting f. eks. brændende cigaretter og sure frugter.

I tidens løb har der været fremsat mange mere eller mindre usandsynlige teorier med hensyn til den biologiske betydning af fugles mærkelige opførsel over for myrer. De fleste hælder til den anskuelse, at det at fuglene »myrer« sig skulle bevirke, at myresyren fra myrerne skulle fordrive parasitter i fuglenes fjer. Der er dog stadig ikke frem-

kommet noget endeligt bevis for eller imod denne eller andre teorier. Flere iagttagelser vil være af stor betydning for opklaringen af denne ejendommelige side af fuglenes biologi.

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