THE OPENING OF MILK BOTTLES BY BIRDS.*

BY

JAMES FISHER AND R. A. HINDE.

IN 1921 birds described as tits were observed to prise open the wax-board tops of milk bottles on the doorsteps in Swaythling, near Stoneham, Southampton, and drink the milk. This is the first known record of an act which has now become a widespread habit in many parts of England and some parts of Wales, Scotland, and Ireland, and which has to date been practised by at least eleven species of birds.

The spread of the habit is interesting, because of the problems of behaviour involved. How far did the individual birds learn the habit from each other, or invent it for themselves? If most of them learnt it, by what process did they do so? How did, and how do, they detect the presence of food inside the bottle?

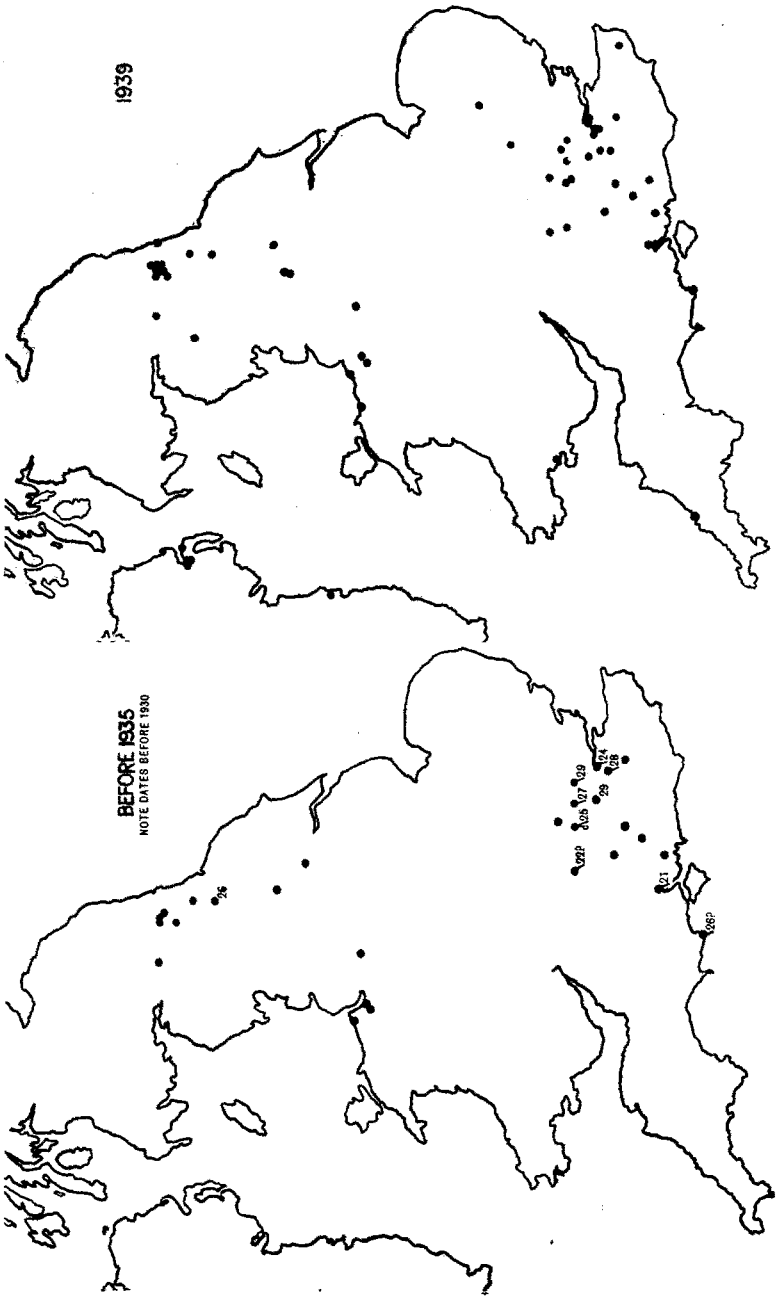
Proper answers to these questions can be obtained only from carefully controlled experiments on birds of known history—but the Research Committee of the British Trust for Ornithology supported the writers in their view that useful information could be derived from the collection of facts about the spread of the habit from members of ornithological societies and from the general public.

Questionnaires were distributed therefore to members of the British Trust for Ornithology. These were filled in by 126 members, giving 141 records of bottle-opening by species of tits. (Records of other birds are noted at the end of this paper.) Eighteen replies were received from members of local Natural History Societies, and 43 as a result of appeals in the *British Medical Journal* and the *Lancet*. Thus about 200 records were obtained from ornithologists (mostly amateur) or from people with a scientific training. Over 200 further useful replies were obtained as the result of paragraphs in the daily or Sunday press or by personal interrogation: these confirmed the results of the preliminary enquiry.

In 223 cases the observer was able to state the year in which he first noted the habit, and to state also that he would have been in a position to note the habit in the previous year had it been occurring at his house. The remaining observers provided evidence of when and where the habit was known, but could not state the first year in which it occurred in their district.

The records of all species of tits together are shown on the accompanying maps. The 1/1¼M. National Atlas Outline Map was used for the original plot, each of the squares formed by the 5 km. national grid lines, in which the habit was known to occur, being occluded by a circular spot, of area about 15 sq. miles. The spread of the habit so far as known up to 1930, 1935, 1939, 1941, 1943, 1945 and 1947 is shown in this way on the maps.

* A publication of the British Trust for Ornithology



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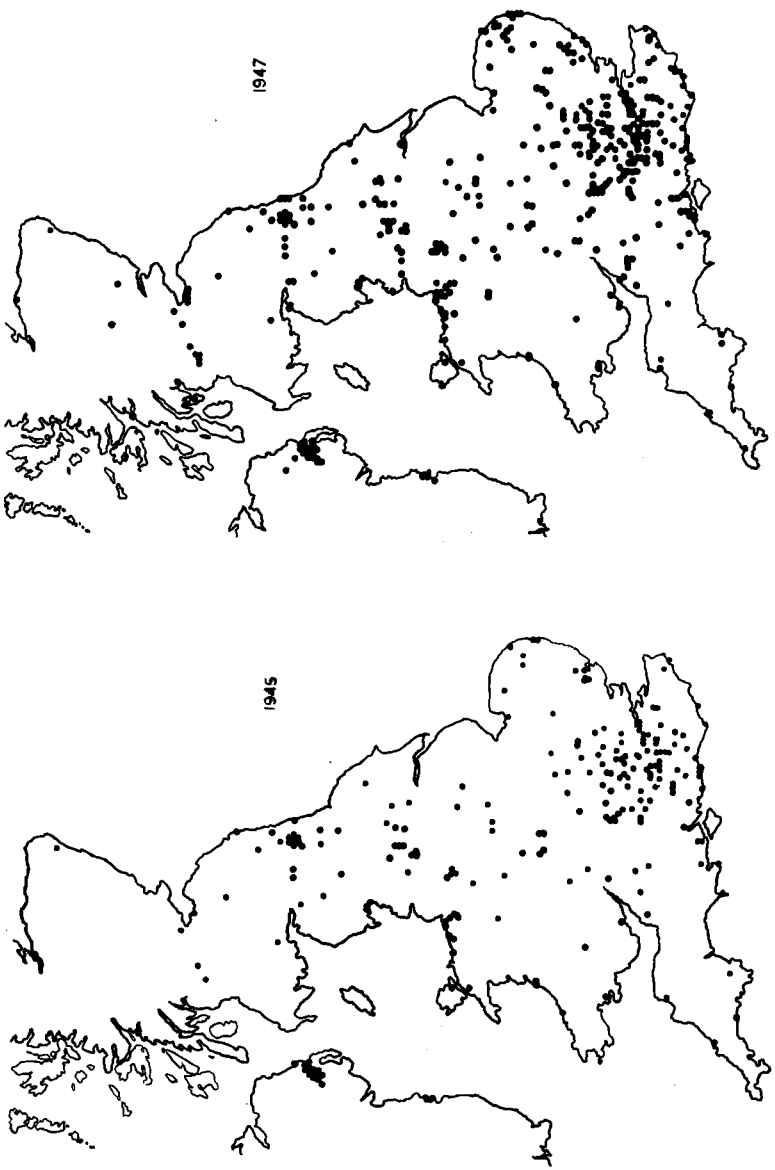

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The occurrence of the habit is naturally limited primarily by whether or not milk is distributed in bottles in the district. Thus the fact that the habit is unknown in most of the country districts of Ireland is undoubtedly due to the fact that bottles are not yet widely used there. There is, however, good evidence in many cases that the habit may not develop in a district for several years after the use of bottles has become almost universal there—this is known to have been the case in at least 23 out of 30 districts for which the year in which milk bottles were introduced is more or less accurately known. (See addendum).

Most British tits, and certainly the three species known to open milk bottles—the Great Tit (*Parus major*), the Blue Tit (*P. cæruleus*) and the Coal-Tit (*P. ater*)—are resident, and do not normally move, even in winter, more than a few miles from their breeding place. A movement of as much as fifteen miles is exceptional. It is probable that most of the birds which do move more than a few miles are in their first year. It would seem, therefore, that new centres and records more than fifteen miles distant from any place where the habit has been recorded previously probably represent new " discoveries " of the habit by individual birds.

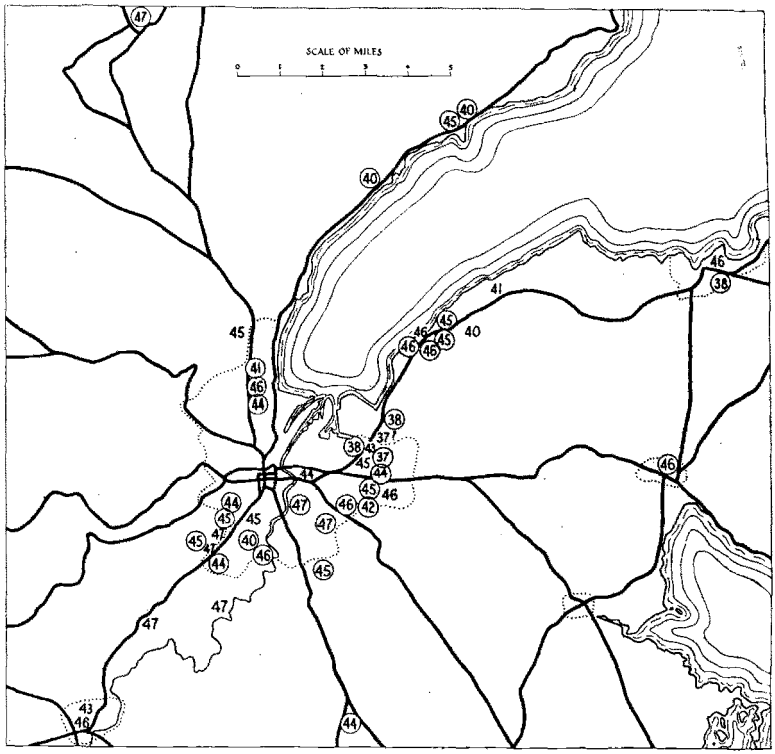
The distribution of the records is consistent with the view that this source of food was actually discovered *de novo* by only a small proportion of the tit population, and was then passed on in some way to other individuals. Thus before 1930 there were ten records of the habit, in nine separate vice-counties, but at the present time there are very few isolated records. The majority of observations made after 1930 are either from near the pre-1930 localities, or else from independent areas in which the habit has subsequently become widespread.

By 1947 there were 89 records from places more than fifteen miles from any other place where the habit had been recorded previously. Seventy-four of these records were from England and Wales, twelve from Scotland and three from Ireland. In England and Wales, then, it seems likely that the habit has arisen *de novo* on an average at least once per vice-county, and may have arisen more often than this.

The spread of the habit from a number of centres is illustrated particularly well in East Anglia. The first record was at Lowestoft, Suffolk, in 1941 ; this was followed in 1942 by a further record from the same place. In 1943 there was another report from Lowestoft and three from Norwich. In 1945 there was a record from King's Lynn, and in 1946 a further Norwich record and four county records. In 1947 there were eight scattered county records and the habit was apparently widespread in most districts. In 1943 there was a record from near Ipswich, and by 1947 there were ten more records from within fifteen miles of the same place.

Reports from Ireland indicate a similar spread. Forty-seven records were obtained from Belfast and district : two for 1937, three

for 1938 and forty-two for subsequent years. The two records for 1937 and two of the three 1938 records were all from points lying within an area of less than one third of a square mile in the north-eastern suburbs of the city. There are indications of a fairly orderly spread from this area to other suburbs and neighbouring urban areas, as can be seen from the map.



MAP OF BELFAST AND DISTRICT SHOWING YEARS IN WHICH OPENING OF MILK BOTTLES BY TITS WAS FIRST RECORDED. FIGURES IN CIRCLES INDICATE THAT THE OBSERVER WAS PRESENT IN THE DISTRICT IN THE PREVIOUS YEAR AND SO COULD HAVE OBSERVED THE HABIT IF IT HAD OCCURRED THEN. THE DOTTED LINE INDICATES APPROXIMATE BOUNDARY OF THE BUILT-UP AREA.

Similarly the whole of the spread in the London area, extending into parts of Essex and Herts, all Middlesex, and part of Bucks, Berks, Surrey, Sussex and Kent, can be derived, without anywhere jumping a gap of more than ten miles, from three points only—Dartford, Kent (1924), Chalfont St. Giles, Bucks (1925), and Richmond, Surrey (1929). We do not suggest that these were the only centres from which the habit spread—that seems unlikely—but the orderly way in which the spread of the habit can be traced from them,

through the suburbs and garden-suburbs, branching down main roads, and filtering through the housing estates, wherever there are houses with small gardens, is extremely suggestive.

It might be argued that the pattern of distribution of the observations reflects, simply, the distribution of observers. In densely populated areas there are, of course, more observers, but there are also more milk bottles. Further, there are many densely populated areas from which no record of the habit has yet been received, or from which negative records have been received. Moreover the time interval between the introduction of milk bottles and the first occurrence of the habit, referred to above, more than justifies us in rejecting this argument.

The records show that the areas in which the habit was known remained comparatively restricted until the early war years, and then increased more rapidly with each succeeding year. It would, of course, be expected in an enquiry of this nature that more records would be obtained for recent years than for earlier ones. On the other hand, the area in which the habit occurred, as well as the actual number of records, increased more rapidly each year; this does seem to support the view that, when the habit has been acquired by one tit, it can then be spread through the population by some form of imitation or learning.

The records show that even when the habit is known to be widespread in a given area it may still be unknown in some households. This is the case in parts of Belfast, for instance. This may be due to such factors as differences in the method of delivering milk or variation in learning ability among the different members of the tit population; or it is possible that the spread may be limited in some way by the structure of the tit populations. However, in spite of this it is true to say that once the habit has been recorded by one observer in a given district it usually becomes nearly universal there within a few years. In Coventry, for example, a few isolated cases were noted for the first time in 1940, and within a few years the habit had become very common in the area. In part of Llanelly the habit was first noted in 1939 at one house only amongst a group of about three hundred near a wooded area. By 1946, and possibly earlier, all these houses had had milk taken. Even when the habit is universal in one area, it may be unknown in neighbouring districts and several records have been received showing that it may be very common in one village and unknown in another only a few miles away. For example, a milk roundsman reported that in 1946 bottle opening had been common for some years in Little Aston, near Birmingham, but was unknown in Streetly and Sutton Coldfield near by.

Thus, although the nature of the investigation makes it impossible to supply any proof, it can be said that the records entirely support the view that the practice has been begun by comparatively few individual birds and that the vast majority of tits have learned it in some way from others.

Although the habit occurs throughout the year, a large proportion of observers record that it is more prevalent during the winter months than in the summer. This may be due to the increased need which the birds have for fats during severe weather, but many observers record that tits are much commoner in winter in urban or semi-urban areas than they are in summer, and this is undoubtedly also a factor of importance.

The bottles are usually attacked within a few minutes of being left at the door. There are even several reports of parties of tits following the milkman's cart down the street and removing the tops from bottles in the cart whilst the milkman is delivering milk to the houses.

The method of opening employed varies greatly. When the milk bottle is closed by a cap of metal foil the bird usually first punctures the cap by hammering with its beak and then tears off the metal in thin strips. Sometimes the whole cap is removed, sometimes only a small hole is made in it. Cardboard caps may be treated in a variety of ways. The whole top may be removed, or only the press-in centre, or the cardboard may be torn off layer by layer until it is thin enough for a small hole to be made in it; the milk may be taken through this hole or the bird may insert its beak in the hole and flick off the remainder of the top. The records show that several different methods may be used in any one district, and that more than one method may be employed by one individual. For example, Margaret Campbell watched a Great Tit tap out half the small central disc and take a few sips of milk. The bird was then disturbed, but returned in a minute or two. This time it alighted on another bottle " on which the stopper was slightly crooked; it made no attempt to peck but inserted its beak under the raised part and flicked it off in one movement . . . " It is therefore quite certain that the process which has been learnt is the whole business of obtaining milk from milk bottles, and not any particular technique for opening bottles.

If the cap is removed whole it is often carried away and held in the claw while the semi-solid cream is pecked away from the under surface. Many observers have found quite large piles of cardboard stoppers under neighbouring trees or behind hedges. Two observers placed their milk bottle tops outside daily and found that the tits still pecked at them. When the birds drink from the bottle direct, up to 1½ in. or 2 in. of milk may be taken. Several cases are known of Blue Tits being found drowned head first in the bottle, presumably because they tried to drink too deep and lost their balance.

In areas where the opening of milk bottles is common, it is often a considerable nuisance to the inhabitants, and milkmen are instructed to invert tins or jars over the tops of the bottles. This procedure is almost invariably effective, but in some cases, where tin lids were used, less success was achieved. Thus, one observer records that a paint tin lid 6-7 in. in diameter was removed by the tit perching on

its edge. Another observer saw a Blue Tit remove a flat stone from the top of a bottle three times in succession. At another house a Blue Tit managed to reach the milk in spite of a tea cloth which had been spread over the bottles. Of course, these are not necessarily instances of insight learning, but they do represent persistent attempts to reach the milk when the top of the bottle was no longer visible to the bird.

In many areas bottles containing milk of different grades are distinguished by having caps of different colours. Although no reference was made to the subject in the questionnaires, no less than fourteen observers, who had milk of more than one type delivered at their house, reported that the tits attacked only bottles with one particular type of stopper, and four others record an almost invariable preference for one type. There seems to be no rule as to which colour is preferred—in some districts gold, in others silver, red, blue, green or brown. In these cases it would thus appear that the differentiation on the part of the tits between bottles with different coloured stoppers is due to a habit formed perhaps on the first occasions when bottles were attacked.

Without performing proper experiments, it is impossible to decide which senses are of use to the birds in indicating the presence of food. Several of our correspondents have found that bottles filled with water, and even empty bottles, are still attacked, but this tells us nothing if the previous history of the birds is not known. Walter (1943), in an extensive series of experiments on a number of species, was unable to demonstrate a sense of smell in birds, and doubts the value of the work of earlier authors who claim to have done so. Dr. Lack has suggested to us that white objects may have a particular significance—white objects seem to be most effective as bait when trapping tits.

We received over 450 separate records of tits opening milk bottles in all, regarding openings at the same place by different kinds of tits (when known) as separate. The observers have not always identified the species of tit concerned, though they were often able to identify the openers as " tits " as opposed to other kinds of birds.

Exactly 400 identifications of the kind or kinds of tit concerned in opening bottles at a definite place were made, on which we have felt we could rely. Of these, 246 were of Blue Tits, 142 of Great Tits, 11 of Coal-Tits and one of a Marsh-Tit (*Parus palustris*). Of the Coal-Tit records, seven came from south-eastern England, one from Somerset, one from South Wales and two from the Central Highlands. The single Marsh-Tit record was from St. Leonard's, Sussex, in 1942, at a place where Great, Blue and Coal-Tits had been opening milk bottles since 1941. There is no record of the Willow-Tit (*Parus atricapillus*) opening milk bottles.

The habit is, however, by no means confined to the Paridae. Several other species have been seen drinking from bottles, but, whereas in some cases it is known that these species actually open

the bottles for themselves, in others it is possible that they are merely drinking at bottles already opened by tits. The number of places from which records of these other birds opening bottles have been obtained are given below (species for which only one record has been received not included). Since some of the records are from non-ornithological observers, it is possible that some of the Hedge-Sparrow records refer to House-Sparrows.

	Seen to open bottles	Seen drinking from bottles which they did not necessarily open themselves
House-Sparrow	19	23
Blackbird	12	11
Starling	13	8
Robin	8	9
Chaffinch	3	9
Song-Thrush	4	2
Hedge-Sparrow	1	2

To what extent it would be correct to refer to the behaviour of those individuals which "invented" the habit for themselves as "insight learning" is a problem which it is justifiable to discuss only briefly on the present evidence. Thorpe (1943 and 1944) has discussed the ability of certain species to pull up food suspended by a thread; he takes the view that this behaviour probably represents some sort of insight learning and is not dependent on a fully formed inborn automatism. The opening of milk bottles can be divided into two parts :—(1) The recognition by the bird of the milk bottle as a potential supply of food; and (2) The technique of opening the bottle. As far as the second of these is concerned, we have seen that each individual may vary his technique from bottle to bottle, and, although the techniques may in some cases bear a superficial resemblance to those used by tits opening nuts, so that instinctive acts (in the sense used by Lorenz, 1937) *may* form a part of them, it is clear that the primary learning process is concerned with the recognition of the bottle as a food supply. Now it is possible that those birds which first drank from milk bottles without having previously seen others do so, drank from bottles which had already been opened, or from bottles in which the top was awry. One or two occasions of this type may have been enough to produce an association between the milk bottle and food. In this case the learning process would appear to resemble an advanced type of trial and error learning rather than insight learning. All that can be said, therefore, is that our present data are insufficient to *prove* the use of insight learning. On the other hand, if it is assumed that the first occurrences of the habit were not dependent on some accident such as a misplaced bottle top, then it would seem that in each district the milk bottles presented equal sensory clues to all birds which came near them, that only certain rather exceptional birds were able to profit by them, and that the subsequent learning of the habit by other individuals in the same district took place

by some sort of imitation similar to that referred to by Buxton (1948), though we have no evidence as to the precise nature of the process. It is interesting to note that Thorpe and many other writers have commented on just such a variability of learning ability among individuals.

We would like to thank the many Trust members and other informants for their help and Miss Alison Birch for drawing the map on p. 352.

Photographs illustrating the habit under discussion, by Mr. V. L. Breeze, are published on plates 71 and 72.

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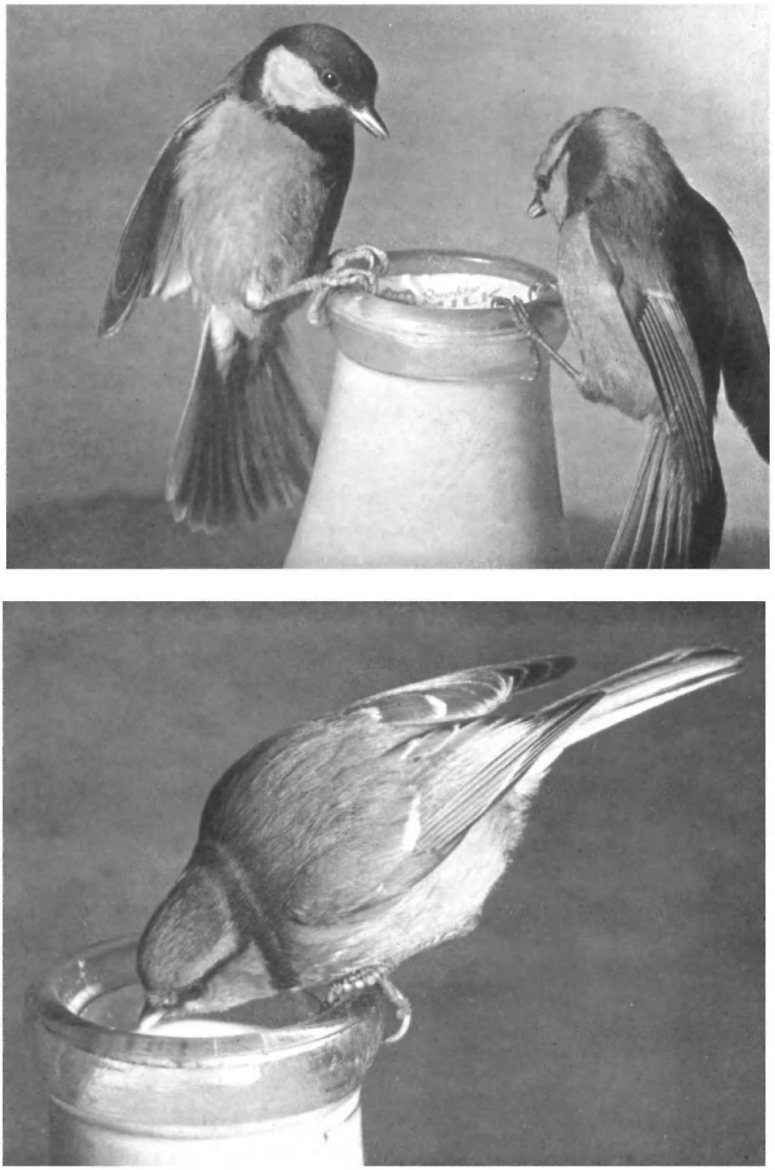
ADDENDUM.

Since this was written Drs. N. and L. Tinbergen have informed us that the habit of opening milk bottles by birds is unknown to them in Holland, where the use of milk bottles with metal foil stoppers is widespread.

STUDIES ILLUSTRATING THE OPENING OF MILK-BOTTLES BY BLUE AND GREAT TITS.
(*Photographed by* V. L. Breeze).



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