TRANSMISSION OF POULTRY PARASITES BY BIRDS WITH SPECIAL REFERENCE TO THE "ENGLISH" OR HOUSE SPARROW AND CHICKENS

by

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INTRODUCTION

Poultry raisers have often suspected the "English" or house sparrow (Passer domesticus Linn.) as transporters of poultry pests from an infested to an uninfested pen, but there is no record or experimental work on this subject.

Since ectoparasites such as lice, mites, ticks, bedbugs, and sticktight fleas cause skin irritation, depluming, and a general rundown condition of the flock, they are of vital interest to poultry raisers and it is important to know how these parasites are disseminated.

A survey of the literature presents evidence that chicken mites and sticktight fleas may be transmitted by the sparrow. These parasites have been reported as occurring on this bird in nature.

Lice, mites, ticks, bedbugs, and fleas are flightless, parasitic arthropods and can live only for a short time away from the host. They are unable to crawl for long distances, and the hosts are thought to be specific. Since large numbers of sparrows often occur about chicken pens, this bird was chosen as the most likely means of transferring these poultry pests from one chicken pen to another.

HISTORY OF THE "ENGLISH" SPARROW (PASSER DOMESTICUS LINN.) IN THE UNITED STATES.

The "English" sparrow is a misleading name for the house sparrow (Passer domesticus Linn.). It did not have its source of origin in England as the name implies, but from the continent of Europe. The bird was referred to in the writings of Aristotle, and many other European writers of natural history; it also is thought to have been known to people long before the period of written history.

The sparrow, being particularly attached to human dwellings, does not seek habitation away from populated districts. The sparrow is cosmopolitan in distribution and has found its way to distant islands in the Indian and Pacific Oceans.

Eight pairs of "English" sparrows were introduced into the United States by Nicolas Pike, of Brooklyn, New York, in 1850. They were kept in captivity until the following spring and were then permitted freedom. These sparrows for unknown reasons did not thrive. In 1852 a second attempt was made and another series was introduced which proved to be more successful. In 1864 and 1868, it was introduced at Portland, Maine, and at Peacedale, Rhode Island, and a few birds were freed at Boston.

It was imported direct from Europe to eight different cities during the following ten years, and a single lot of 1,000 birds were sent to Philadelphia alone. The house sparrow was introduced to destroy insect pests, but it was later found to feed upon seeds and garden plants. Nestlings, however, are insectivorous, and large quantities of canker worms and other insects are brought to the nest daily.

The domestic habits of the "English" or house sparrow enable it to stay wherever found. It is the most prolific of all birds known to the ornithologist (Barrows, 1889). No instances on record according to this author show where any other bird has multiplied so rapidly or taken possession of such an extensive area in such a short time.

"It is a general rule in the animal kingdom that excessive multiplication tends to disease, and nearly all animals are subject to epidemics and parasites which tend to reduce their numbers when they become extremely abundant. But nothing of this kind is known among sparrows, and they seem to be among the hardiest and healthiest of birds." (Barrows, 1889).

The "English" sparrow is considered a town bird, but is also well known in the rural communities where it is found in large numbers about the barns, feed lots, and chicken pens. It does not wander far from these dwellings.

In case of food scarcity sparrows will go for considerable distances for grain. Russel, according to Barrows, says that he has known young sparrows to be fed with ripe wheat, and he was able to prove the old birds had to go half a mile for the grain. February and March are spent almost entirely in the vicinity of houses and farm yards, or any place where grain is to be found, unless, as previously mentioned, they are attracted to a distance by threshing operations.

The sparrow has become a serious pest in many localities and many states offer bounties to destroy them and their nests. In cities, buildings and shrubbery have suffered severe damage from its roosting habits.

Miller, according to Barrows, wrote the following in regard to the relation of the sparrow in chicken pens: "Among the complaints of miscellaneous injuries from the sparrow, one of the most frequent relates to its habit of robbing poultry of their food. At first sight the loss thus occasioned would seem to be trifling, but the complaints received show that this is far from being the case. The sparrows do not eat what the poultry leave; they eat with the fowls, and soon become so bold that they not only resist the attempts which the fowls make to drive them off, but even make unprovoked attacks on them, sometimes driving

them away from the food. As a sparrow eats more, in proportion to its size, than a hen, and as the sparrows about a farm-yard frequently outnumber the fowls ten to one, the grain which they thus steal day after day is an item of considerable importance."

Beard wrote the following in regard to the relation of the sparrows to chickens in their feeding habits: "I know to my sorrow that it lives all winter entirely on grain, for in buying chicken feed I allow two parts for the sparrows and one for the chickens." (Barrows).

Other observers have seen sparrows so abundant about chicken pens that they "rise in clouds" from hen-yards; while many witnesses have stated that when chickens are fed out of doors the sparrows get more than the fowls.

Skinner (1904) referred to an article written by the Topeka Journal on "an account of the first English sparrows brought to Kansas" as follows: "In 1864, Giles conceived the idea of importing some of these birds. He shipped in all 28 of them. They were confined in cages at his place in Topeka until all but five had died. At last the five were turned loose to take their chances of life or death, though Giles had no hope that they would live; they fooled him. They took up their home in the neighborhood. The following autumn there were 12 birds.

The second season found 60, and the third summer about 3,000. Then they increased so fast that no account could be kept, and in the twenty-five years which followed they spread all over the West."

METHODS

Large numbers of sparrows and some other birds found about chicken pens were secured; also, large numbers of sparrow's nests were examined.

Examination of all parts of the bird's body for parasites was made.

Number of each kind of parasite found was recorded.

The general status of the health of the bird was checked to see whether the ectoparasites caused any skin irritation.

Birds were checked at intervals for seasonal variation as to number and occurrence of parasites.

Birds were collected from several ecological points such as: in chicken pens, in or about barns, and in wheat fields and gardens.

Chicken houses and domestic poultry were examined to see if the ectoparasites of wild birds were of the same species as those of the domestic fowl.

Chicken pens were examined where sparrows frequent in large numbers and where few or no sparrows occurred.

The ectoparasites were removed from the recently killed or living birds, the feathers were checked for eggs, nymphs and adults.

Slides of the collected parasites were made.

Ectoparasites were identified by a specialist.

Ectoparasites of chickens were transferred to the "English" sparrow to see whether the parasites would live or remain for any length of time on their new host.

REVIEW OF PUBLISHED OBSERVATIONS ON CHICKEN MITES IN RELATION TO SPARROWS

Ainslie (1929) in the summer of 1927 found a seething mass of small mites in all stages of development in a nest of a house wren, Troglodytes aedon aedon Vieillot. Upon microscopic examination of the contents of the nest the following day after the birds had left, it was found to contain countless numbers of mites identified by Ewing as the common chicken mite, Dermanyssus gallinae L.

Since wrens have nothing in common with the domestic fowls, and the nearest chicken pen was at least 100 feet from the wren's nest Ainslie turned his attention to the sparrow as a means of transferring these mites to the wren nest.

The pair of wrens had been engaged in a continuous fight with the sparrow since the time of nest building. The sparrows made numerous attempts to seek entrance into the nest through the small hole and at different times were trapped at the opening and were unable to free themselves.

The wrens were never seen feeding about the chicken pen but secured insects and worms for their young from neighboring yards and gardens.

The wren house was thoroughly disinfected during the

fall 1927 and the following year the same pair of wrens returned to occupy the bird house. The sparrows were observed to annoy the wrens the same as the preceding year. After the young birds had left the nest, an examination of the box revealed a mass of mites, but a smaller quantity than was found the previous year.

Ainslie states, "It is a common observation that sparrows will flock to the spot where chickens are being fed to mingle with the chicks in order to obtain small grain and grass seed. No other bird in this region has this habit. It is evident that the transfer of mites from the chicks would be very easy, in view of this association of individuals and, once infested, these birds would naturally, automatically, be carriers to other locations. This is a possible explanation of the presence of the mites in the nest of the wren."

In his study of the life history and habits of the chicken mite, Wood (1917) found that the mites may be disseminated by transferring infested fowls to clean localities; by using boxes and crates in which infested fowls have been kept; by mechanical carriers, such as the clothing of man, the feathers of sparrows and pigeons, and the skin of domestic animals and some wild animals, such as foxes, skunks and weasels; and by the migration of mites to buildings in contact with or close proximity to infested premises.

Hirst (1916 b.) obtained the tropical fowl mite (Liponyssus bursa Berlese) from a sitting-hen and attacking man at Sydney, Australia. The collector suggested that in the latter case, the mites might have come from English starlings which were building in the house. The common chicken mite does not flourish in tropical and sub-tropical countries, and it is probable that when this species is recorded from such regions the tropical fowl mite is really concerned. The wide distribution of the tropical fowl mite may be the result of carriage by the common sparrow.

Roberts (1930) reports that considerable discomfort to people was caused by the tropical poultry mite.

The tropical poultry mite is usually found on the domestic fowl, causing great discomfort at times to the nesting hen, and capable, if unchecked, of bringing about fatal results among the newly hatched chickens. According to Roberts the tropical fowl mite has been found on the domestic pigeon and common sparrow as well as the domestic fowl, and that it is probably conveyed from one locality to another mainly by the former hosts. The tropical fowl mites are able to live only ten days away from their warmer-blooded hosts, and also appear incapable of breeding without feeding.

A mite, Liponyssus canadensis Banks, the type locality

of which is Guelph, Ontario, is known to occur on chickens. Its economic importance is unknown. It occurs however on such wild birds as the "English" sparrows, red-eyed vireos, meadow larks and kingbirds. Hirst (1916 a.) considered this species to be a synonym of the northern fowl mite Liponyssus silviarum C. & F., but Ewing gives it specific rank.

The northern fowl mite occurs both on sparrows and poultry in the United States, according to Hirst (1920), and is of some interest, for the species has not hitherto been recorded as a parasite of poultry. It differs from the very closely allied species, the tropical fowl mite, principally in having only one pair of long hairs at the extreme posterior end of the dorsal scutum, whereas in the tropical fowl mite there are always two quite long pairs in this position.

Hirst has examined specimens of the northern fowl mite from poultry from the following localities: Harvel and Raymond, Illinois; Lafayette, Indiana; Aberdeen, South Dakota; Beltsville, Maryland; Washington, D. C. This species was found to occur on sparrows in the following localities; Raymond, Illinois; Aberdeen, South Dakota; Dallas, Texas.

During the summer 1930, Rayner (1932) found the

northern fowl mite to be the only ectoparasite present on the "English" sparrow. It was found wide spread also among other species of birds. Its sudden appearance at different times at more or less isolated sections has been somewhat puzzling. The role which wild birds may be playing in the spread of this mite appears to be rather clearly indicated.

The tropical fowl mite has been reported by Hirst as occurring on poultry from numerous localities in the United States, Canada, and Australia as well as in Gharbia Province, Lower Egypt of which two lots of this species from domestic poultry, were collected in the autumn of 1918 by Aghion. The "English" sparrow was found to be the host for the tropical fowl mite at Dallas, Texas.

Hirst (1916 a.) has observed the common chicken mite from the sparrow nest found on the roof of the National History Museum, South Kensington, February 5, 1915. He has also taken the common sparrow mite Dermanyssus passerinus, Berl. and Trouess from sparrow nests. The major differences between the common chicken mite and the sparrow mite are that the posterior end of the scutum is truncated, the genito-ventral plate is wide, and the hairs on the dorsal scutum are short; whereas, the posterior

end of the dorsal scutum is rounded in the case of the sparrow mite. The common chicken mites are parasites on domestic fowl and other birds; the sparrow mites are parasitic on the common sparrow.

Hirst said, "I have carefully examined the specimens listed above and cannot find any real difference in structure between them. Examples from the nests of swallows and sparrows have the dorsal scutum shaped exactly as in those from domestic fowls, the posterior end being always truncated, and the distribution of the hairs on the scutum is also the same. The size of this species is very variable even in adult examples from the same locality. Length of peritreme is also rather variable, but is usually long even in specimens from swallows. The first leg is the longest, being about equal to the length of the dorsal scutum, although it may be a little shorter than it or slightly longer. It is probable that Herman's Acarus hirundinis and also Dermanyssus longipes, Berl. and Trouess (from the sparrow) are synonyms of the common chicken mite."

Ewing (1922) states that the common chicken mites are probably present in all localities all over the world where chickens are raised to any extent. The following American hosts are known: Chickens, canaries, pigeons, "English" sparrows, towhee (?). The species annoys also all domestic

animals and man, but seldom attacks a mammalian host. Dermanyssus americanus, a new species has been reported from the "English" sparrow from Washington, District of Columbia, December 19, 1913, by R. S. Shannon.

According to Wood (1920) the breeding places of both the tropical fowl mite and the common chicken mite in the case of the "English" sparrow takes place in the nests. Very few mites are found on sparrows flying around. There are, however, enough to start an infestation. Young sparrows not fully feathered and flightless may have many mites on them, but after they leave the nest they have only a few. Apparently the mite prefers the fluffy down of the hen feathers lining the nest to the feathers of the sparrow. This may also be the reason why few mites are ever found on young or half-grown chickens. Mites may be found on loose feathers on the floor of the hen house or in shady places in the yard. Wood found no mites on the grass or in sunny places. He found that mites occurring on a loose feather placed on a hen's back in the sun were so affected that some of them died before they could get under the hen's feathers.

Wood found mites only on poultry, in hen nests, or on loose feathers in the house or yard, and on "English" sparrows and in their nests. No mites were found on any

farm except one immediately adjoining the original infestation. Here a few mites were found on flying sparrows. In the locality which Wood studied he found another mite, the common sparrow mite, more or less abundant in some of the "English" sparrow nests which he examined.

Ainslie, Ewing (1922), and Wood (1917), have reported the common poultry mite of chickens to occur on sparrows. The tropical fowl mite of chickens was found on sparrows by Hirst (1916 b.), and Roberts (1930). Hirst and Rayner have taken northern fowl mites from sparrows.

REVIEW OF THE LITERATURE ON CHICKEN LICE AND THE "ENGLISH" SPARROW

Bedford (1924) stated that as a rule each kind of bird has its own species of parasite. For instance, lice on ducks confine themselves almost exclusively to these birds, and are not likely to be found on any other kind, except closely allied species, such as a goose. One would not expect to find duck lice on fowls, and if a duck succeeded in passing some of her lice on to a fowl by close contact or some other means, the insects would not survive for more than a few days at the most on their new host.

According to Geist (1935) it has been commonly stated in the literature that gregarious birds are more often parasitized than non-gregarious birds. He found that the

gregarious habit is probably an important factor in the transmission of Mallophaga from host to host.

Kennard (1924) states that one untreated bird is all that is required to reinfest the whole flock.

Peters (1928) has found that after the death of the host the parasites either attempt to leave the body, usually migrating slowly toward the head, or simply die on the body of the host. The death of those remaining on the host usually ensues in two or three days. He has observed the death of some in four or five hours, and on the other hand, has collected live parasites from a bird skin six or seven days old. The death of the parasite can hardly be caused by starvation, in view of their feeding habits, but rather must be attributed to the lack of animal heat to which they have been accustomed during the life of the host.

Geist performed some experiments in temperature response on Degeeriella vulgata (Kell.) taken from the "English" sparrow. Ten adult lice of this species were kept in the laboratory on "English" sparrow feathers at a temperature of 38° C. for ten days. The average temperature of the host of this louse is approximately 42° C. Another group of parasites of the same species was subjected to a temperature of 48° C. This latter group showed marked

irritation and all died within a few hours, while the controls lived 12 days at a temperature of 38° C.

REVIEW OF LITERATURE ON STICKTIGHT FLEAS ON POULTRY IN RELATION TO SPARROWS

Stewart (1932) found in his research that the following animals may serve as dispersal agents of the sticktight flea of hens (Echidnophaga gallinacea Westw.): Brewers blackbird (Euphagus cyanocephalus Wagl.), the "English" sparrow (Passer domesticus domesticus Linn.), the Texan bob-white (Colinus virginianus texanus Lawr.), and the Florida bob-white (Colinus virginianus Coues).

The sticktight flea is most common, and hence of greatest economic importance, in the United States primarily in the Southern States.

Stewart states that the injury resulting from its attack is most conspicuous in young chickens, and that they may die quickly when fairly heavily infested is well known. These ectoparasites cause death in adult birds when numerous, and when less numerous materially reduce the egg production, retard growth, and diminish the size. The occurrence of this flea is rather sporadic. Entire flocks of birds when placed in closely built houses, or when they roost or rest under large buildings, have been destroyed in a few week's time after the beginning of the infestation. In the South there is a considerable annual

loss due to the attacks of this flea and it has been reported as being noticeably injurious to poultry as far north as Kansas.

According to Stewart the hosts of the sticktight flea may be grouped into three classes. First, the normal hosts, domestic fowl, which are of economic importance; second, accidental hosts, which may or may not be of economic importance and which do not act as important agents of dispersal; and third, hosts which serve as efficient dispersal agents.

METHODS FOLLOWED IN THIS STUDY AND THE RESULTS OBTAINED

Examination of Birds for External Parasites

Five hundred and sixty-seven sparrows (Table 1) were collected from different habitats such as in or about chicken pens, in barns, in gardens on village properties, and in wheat fields at Winfield and Manhattan, Kansas. The birds which were trapped and shot were examined for parasites immediately after they were killed. Sparrows were found to be relatively free of ectoparasites. Seven birds were found infested with mites (ANALGESIDAE); twenty-eight were the host of the common sparrow mite (Dermanyssus passerinus); the common poultry mite (Dermanyssus gallinae L.) occurred on sixteen sparrows

and Liponyssus sp. was found on three of these birds. Degeeriella vulgata (Kell.) was found on three sparrows and Lipeurus heterographus N. on one sparrow and these were the only species of lice found on sparrows free in nature. Less than 10per cent of the sparrows examined were found to contain any parasites.

Table 1. Results of examinations for lice and mites of "English" sparrows trapped or shot in or near chicken pens, gardens, and wheat fields from March 25, 1936,to June 19, 1937, collected at Winfield and Manhattan, Kansas.

No. Indiv. Exam.	Date	Habitat	Parasite
3	3-25-'36	K. S. C. campus	Uninfested
1	3-29-'36	" "	" "
7	4-27-'36	Taken from bird house	Mites (ANALGESIDAE)
4	5-3-'36	From nests	Mites (Lost)
3	6-7-'36	K. S. C. campus	Uninfested
15	6-4-'36	Trapped from chicken house	1 Degeeriella vulgata (Kell.)
15	6-7-'36	" "	Uninfested
3	6-9-'36	" "	1 eggs of D. vulgata (Kell.)
22	6-11-'36	" "	Uninfested
17	6-13-'36	" "	" "
11	6-16-'36	Caught on nest in barn	" "
21	6-17-'36	On chicken house	" "
6	6-23-'36	Caught on nest in barn	" "
23	6-29-'36	On chicken house	" "
7	7-10-'36	Shot in a garden	" "
2	8-4-'36	Prairie land	" "
2	8-13-'6	Chicken pen	" "

Table 1. Con't.

No. Indiv. Exam.	Date	Habitat	Parasite
3	8-21-'36	Shot from chicken house	One louse Lipeurus heterographus N.
5	2-27-'36	Shot from chicken fence	Uninfested
23	8-29-'36	Chicken pen	" "
9	9-7-'36	" "	" "
4	11-11-'36	Shot in chicken pen	" "
3	11-17-'36	" "	" "
1	11-30-'36	" "	" "
9	12-17-'36	" "	" "
3	1-16-'37	" "	" "
1	1-28-'37	" "	" "
8	2-3-'37	" "	" "
7	2-4-'37	Garden lot	" "
2	2-10-'37	" "	" "
1	3-1-'37	" "	" "
3	3-17-'37	" "	" "
1	3-26-'37	" "	" "
2	4-3-'37	" "	" "
1	4-7-'37	" "	" "
2	4-11-'37	" "	" "
2	4-21-'37	" "	" "
4	5-4-'37	" "	" "
7	5-8-'37	K.S.C. campus	" "
3	5-13-'37	" "	" "
4	5-15-'37	" "	" "
5	5-24-'37	Garden lot	" "
3	5-27-'37	K.S.C. campus	" "
9	5-28-'37	" "	3 with mites 1 D. gallinae L. 2 D. passerinus Berl. and Trouess
2	5-31-'37	Wheat field	Uninfested
4	6-3-'37	" "	1 with mites D. passerinus Berl. and Trouess
2	6-4-'37	" "	Uninfested
7	6-9-'37	" "	2 with mites D. passerinus Berl. and Trouess

Table 1 Con't.

No. Indiv. Exam.	Date	Habitat	Parasite
58	6-10-'37	Wheat Field	17 with mites 11 D. passerinus Berl. and Trouess 5 D. gallinae L.
38	6-14-'37	" "	2 with mites D. gallinae L. 1 with louse D. vulgata (Kell.)
54	6-15-'37	" "	7 with mites 1 D. passerinus Berl. and Trouess 1 Liponyssus sp. 5 D. gallinae L.
36	6-16-'37	" "	Uninfested
27	6-18-'37	" "	4 with mites 1 D. gallinae L. 1 D. passerinus Berl. and Trouess 2 Liponyssus sp.
11	6-19-'37	" "	2 with mites D. gallinae L.

Total number of sparrows examined = 567

Sparrows possessing D. gallinae L. = 16

" " D. passerinus = 28

" " Liponyssus sp. = 3

" " Lipeurus heterographus N. = 1

Sparrows parasitized = 54

" uninfested = 513

Percent of sparrows parasitized = 9.53 per cent

The following birds were also examined for poultry parasites: the barn swallow, turtle dove, brown thrasher,

domestic pigeon, northern shrike, great horned owl, American bittern, Lapland longspur, European starling, and the robin.

Table 2. Other birds examined for poultry parasites.

Kind of Bird	No. Exam.	Date	Locality	Parasite found
Barn Swallow (Hirundo erythrogastra)	1	6-7-'36	Manhattan, Kansas	Philopterus sp.
Turtle dove (Turtur communis)	1	6-7-'36	Winfield, Kansas	Columbicola columbae (L.)
Brown thrasher (Toxostoma rufum)	4	6-7-'36	" "	Uninfested
Turtle dove (Turtur communis)	1	6-11-'36	" "	" "
" "	1	6-16-'36	" "	Columbicola columbae (L.)
" "	4	9-5-'36	" "	Degeeriella sp.
Domestic pigeon	3	9-11-'36	" "	Goniocotes bidentatus Scop.
Northern shrike (Lanius borealis)	1	3-27-'36	" "	Menacanthus sp.
Great horned owl (Bubo virginianus)	1	12-27-'35	" "	Philopterus sp.
American bittern (Botaurus lentiginosus)	1	10-21-'35	Manhattan, Kansas	Ardeicola botauris (Osb.)
Lapland longspur (Calcarius lapponicus)	1	1-14-'37	" "	Ricinus sp.
European starling (Sturnus vulgaris)	2	2-7-'36	" "	Menacanthus sp.
Robin (Planesticus migratorius)	1	3-23-'36	" "	Degeeriella vulgata (Kell.)
Turtle dove (Turtur communis)	2	6-17-'37	" "	Dermanyssus gallinae L.

Examination of Sparrow Nests

Thirty-eight sparrow nests were examined for harboring

parasites of which two sparrow nests removed from bird houses were found to be heavily infested with mites (ANALGESIDAE). Both the young and adult sparrows which were on the nest were infested with these mites. The nests were examined at night April 27, 1936, and the mites were feeding on the sparrows and were engorged with blood. The nests were lined with chicken feathers which the sparrows had collected some distance away as there were no chicken pens near.

A similar situation as the preceding occurred when a nest was removed from the eves of a house and was found to be infested with mites. It was lined with feathers and was mildly infested with parasites. Three nests built in a four inch pipe used to suspend a clothes linewhich were examined the same evening were constructed of grass and contained no parasites.

Seventeen sparrow nests concealed and suported by English ivy vines were removed from the horticulture building at Kansas State College, Manhattan, Kansas, on May 25, 1937. All nests which were lined with chicken feathers except two contained mites, Dermanyssus gallinae L., the red poultry mite, and Dermanyssus passerinus Berl. and Trouess, the common sparrow mite. Fourteen of the remaining nineteen nests examined were not lined with chicken feathers

and contained no mites and five nests which were lined with feathers were mite free.

Sparrows are often seen in chicken houses, and chicken pens collecting feathers for use in nest construction. A sparrow was seen picking up a feather from a chicken pen and was traced to its nest three blocks away. The nest later was examined for parasites, as well as the chickens from which the feather came, but neither were found to harbor parasites.

On May 8, 1937, while examining a chicken house for mites and lice, a sparrow on two different occasions entered the chicken house and took a feather for its nest. No mites were found on the feathers lying about the chicken house, but a few lice were found crawling on some of the feathers and also under a nesting box. Two lice were found between the boards of the roost. This indicates that lice leave the chicken temporarily, for a short time at least, and crawl about in search for another suitable host.

REMOVAL OF PARASITES AND PREPARATION FOR STUDY

Dunn (1932) found the following method for collecting ectoparasites from live animals and birds to be effective: A piece of tape or rubber band was placed about the neck of the animal or bird. Chloroform was liberally sprinkled

on a towel which was wrapped about the bird's body. The vapor of the chloroform being heavier than air penetrated through the towel to the bottom of the jar. The ectoparasites leave the feathers near the body and come to the surface where they may be collected with a camel hair brush or forceps.

A modification of the preceding method was made by the writer which was found to be successful. A parasite removing chamber (Fig. 2) composed of a wide mouth gallon jar and a small platform was made on which to rest the bird's body. This method was used only when the bird was killed. When the bird was to remain alive the head was held above the neck of the jar where it could get sufficient oxygen. Chloroform or carbon bisulfide were placed on the bird's body and a towel was used to cover the top of the jar. The vapor of chloroform and carbon bisulfide is heavier than air and goes to the bottom of the container. The parasites crawl from the body of the bird onto the platform and some fall on a piece of white paper placed in the bottom of the jar. The few remaining parasites on the bird's body were easily removed by a thorough combing.

Mites and lice were also collected by ruffing the bird's feathers and they crawled on the hands and arms of

the collector where they were brushed up and placed in vials of alcohol. Parasites, when attached to feathers, were removed by plucking the feather and placing it into alcohol. Lice and mites were also removed with small forceps or a dampened toothpick. It was necessary to handle them carefully to prevent crushing.

The lice and mites were placed in 95 per cent alcohol and were dehydrated for twenty-four hours. They were then removed from the alcohol and placed in carbo-xylol for clearing for twenty-four hours after which the carbo-xylol was then replaced and left for an equal period of time. The parasites were then removed and placed in xylol for fifteen minutes. The cleared specimens were taken from the xylol and mounted on slides.

PARASITE TRANSMISSION

Direct Transmission

Ten common chicken lice, Menopon gallinae L., were carefully removed from a chicken infested with these parasites on February 18, 1937 with a camel hair brush and placed on the feathers of a sparrow. The lice when placed on the feathers of the sparrow crawled excitedly over the bird's body in search of concealment. Since sparrows are nervous and excitable, they fly against the cage and kill

themselves. In order to prevent flying against the cage, the wing and tail feathers were clipped close to the body.

The purpose of this experiment was to see if the chicken lice would remain on the sparrow for a time long enough to be transported from one flock of chickens to another. Two lice in this experiment remained on the sparrow for forty-four and forty-six hours respectively. More than one-half of the lice crawled off the sparrow within twenty-four hours.

Since the clipping of the wing and tail feathers of the sparrow did not provide the normal amount of protection for the lice as occurred in nature, the experiment was again repeated on May 10, and June 1, with sparrows having wing and tail feathers unclipped. The lice were found to remain on the sparrow for a longer period of time as they were provided with better protection. The maximum length of time the chicken lice remained on the sparrow was for nine days.

The following table indicates the results obtained in the three experiments:

Table 3. Experimental result when ten chicken lice were directly transferred to sparrows.

Exam. Interval	Mortality or Escape		
Number of Hours	2-18-'37	3-10-'37	6-1-'37
8	3	1	0
12	1	0	3
24	2	3	2
38	1	1	---
44	1	2	---
46	1	---	---
48	---	---	1
72	---	1	0
144	---	1	2
170	---	0	---
188	---	---	1
192	---	0	---
208	---	---	1
216	---	1	---
Total	10	10	10

The possible cause of the disappearance of many of the lice was probably due to disturbance by ruffling the feathers when the examinations were made. The lice were well attached to the base of the feathers and were more or less inactive until the feathers were ruffled and then they crawled excitedly about the feathers seeking concealment. Some crawled out on the coverts and escaped from the host.

Indirect Transmission

Two chickens heavily infested with lice were caged with five parasite free sparrows on February 17, 1937, to test for transmission of chicken lice from chicken to

sparrow by contact or through the dust bath. A dust bath was constructed at one end of the cage in which both chickens and sparrows were observed to dust themselves frequently. The sparrows were examined at intervals of two or three days, but no lice appeared on the sparrows until March 20. The sparrows were examined on March 3, and were not examined again until March 20. Upon examination of the single remaining sparrow it was found to harbor one half-grown louse, Menopon gallinae (L.) along with four minute recently hatched individuals. Empty nit cases were found attached to the feathers on the neck and vent of the sparrow.

On May 29, the experiment was repeated under similar conditions as the preceding. Five parasite free sparrows and two lice infested chickens were placed in a screened cage about six feet long, three feet wide and three feet high. The ground was loosened so the chickens could make a dust wallow.

Upon examination of the sparrows June 1, each sparrow was found to contain from three to eight chicken lice. Two lice were also found in the dust bath where both sparrows and chickens were observed dusting themselves. On several occasions the sparrows were seen sitting upon the backs of the chickens. Transmission could have been made

also through body contact as well as through the dust bath. The lice remained on three of these birds until the sparrows died five days later. The lice of the two remaining birds were removed for preservation. The experiment was repeated again on June 7, and the lice were found on two of a series of twelve sparrows on June 8.

Table 4. Indirect transmission of chicken lice to the sparrow through dust bath or proximity.

Date	No. Birds at Start	Date Lice Occurred	No. Birds with Lice	No. Lice
March 3, 1937	5	March 20, 1937	1	5
May 29, 1937	6	June 1, 1937	5	27
June 7, 1937	12	June 8, 1937	2	7

On February 25, 1937, three sparrows which had chicken lice placed on them were caged about two feet away from two sparrows free of lice. The following day the birds were examined for parasites. In the meantime the birds possessing the lice had died and the lice had crawled off their bodies and three of them were found on the bodies of the parasite free sparrows. The lice evidently left the dead birds and sought the sparrows in the other cage for body warmth and protection. Four of the remaining lice were found dead along the cracks of the bench as they had not found the host.

Eight sparrows were captured at Winfield, Kansas, February 1, and were shipped to the writer for examination.

The sparrows had been examined previous to shipment for lice and were found lice free. Chicken lice (Lipeurus heterographus N.) were placed on the sparrows amidin the box in which they were shipped. When the sparrows arrived they were examined. One sparrow was living and the remaining seven were dead. The living sparrow had nine living lice on its body, and two dead sparrows had two and three living lice respectively on them. The examination was made two days after the lice were transferred to the sparrow.

Chicken Lice Longevity Separated from the Chicken as Host

Chicken lice have remained on the sparrow for a period of nine days as indicated in table 3.

On February 18, 1937, a vial of twenty-five lice, Menopon gallinae (L.) was used in an experiment in which the lice were kept secluded from a host. A freshly plucked chicken feather was placed in the vial for the lice to feed upon. The vial was carried in the vest pocket of the experimenter in order to maintain a more or less constant temperature which was about 94° F. All of the twenty-five lice died within twenty-seven hours. More than one-half died at the end of the twelve hour period as indicated in table 5.

The experiment was repeated on May 10 and June 1. Seventy-two hours was the maximum time in which the lice lived in a vial with the feather. More than one-half died between eight and sixteen hours.

Table 8. Experimental results of twenty-five lice placed in a vial containing a chicken feather.

Exam. Interval	Mortality		
Number of Hours	2-18-'37	5-10-'37	6-1-'37
5	---	0	---
8	12	---	7
10	---	12	---
12	3	---	4
16	4	1	---
22	---	---	3
24	4	3	---
27	2	---	---
28	---	---	5
36	---	5	---
37	---	---	3
48	---	2	2
64	---	2	---
72	---	---	1
Total	25	25	25

Chicken Lice Placed in a Vial of Dust

Twenty-five chicken lice were placed in a vial of dust on February 18, 1937, and were carried in the vest pocket of the experimenter. All of the twenty-five lice died within five hours after the time they were placed in the vial of dust. The experiment was repeated on May 10, and June 1. On May 10, six of the lice had died at the end of

the five hour period, but about seventy-five percent died within twelve hours. The same results were obtained in the repeated experiment on June 1, as shown in table 6. The maximum length of time that a louse was kept alive in the vial of dust was twenty-seven hours.

Table 6. Experimental results of twenty-five lice placed in a vial containing dust.

Exam. Interval Number of Hours	Mortality 2-18-'37	5-10-'37	6-1-'37
5	25	6	---
8	---	---	7
10	---	12	---
12	---	---	8
16	---	6	---
22	---	---	9
24	---	1	---
27	---	---	1
Total	25	25	25

Chicken Lice Placed in an Empty Vial

Twenty-five chicken lice were placed in an empty vial on February 18, and were carried in the vest pocket of the experimenter. Nearly fifty per cent of the lice died within twelve hours and all died within nineteen hours. The experiment was repeated on May 10, and June 1. In these experiments fifty percent of the lice died within twelve hours and all twenty-five lice died within 31 and 30 hours respectively as indicated in table 7.

Table 7. Experimental results of twenty-five lice placed in an empty vial.

Exam. Interval	Mortality		
Number of Hours	2-18-'37	3-10-'37	6-1-'37
6	---	---	4
8	7	5	---
12	4	7	10
15	10	---	---
19	4	---	---
20	---	6	---
22	---	---	9
24	---	4	---
27	---	---	0
28	---	2	---
30	---	---	2
31	---	1	---
Total	25	25	25

Chicken Parasites Found on Sparrow in Nature

On August 21, 1936, a sparrow was shot from the fence of the chicken pen and a single louse, Lipeurus heterographus N. was taken from the under surface of the wing feathers. The chickens in the pen had been examined at intervals previous to this time and were free of lice. On September 11, 1936, when the chickens were again examined, a rooster and two hens of a flock of nine were found to have a small number of chicken lice. The chickens were penned and no new individuals were introduced into the flock. Since the chickens were penned and no new individuals were introduced, it is most probable that the

lice were transferred to these chickens by the common sparrow through the dust bath.

Both chicken lice and chicken mites have been found on the sparrow under natural conditions which presents a valid indication that it is possible for the sparrow to act as an intermediate host in transferring lice and mites from a chicken pen infested with these poultry pests to one uninfested.

Dust Baths as a Source of Lice Infestations

Upon a number of occasions chickens have been observed wallowing in a dust pit and shortly after sparrows appear at the same pit to bathe. Chickens shake lice from their feathers into the dust bath and lice are unable to withstand large quantities of dust. Sparrows shortly after wallow in the same dust bath, attract the lice by giving them body warmth and protection. The chicken lice which have been shaken in the dust pits attack the feathers of the sparrow with great fervor. They may remain on the sparrow for as long as nine days or become detached within a short while if a suitable host is found.

During the month of August, 1936, sparrows congregated in large numbers about the chicken pen where the chickens were feeding. They were often observed wallowing in

the dust pits where the chickens dusted themselves frequently. Sparrows were often seen dusting in the same dust baths.

As dust baths are known to have insecticidal value, the lice being unable to withstand large quantities of dust are shaken from the chicken's body into the dust pits. In order to get the necessary warmth and protection, it is probable that the lice cling to the sparrow when chances afford an opportunity for them to do so.

External Body Temperature of Chicken and Sparrow

The external body temperature of the birds was taken with a fever thermometer under the thigh. The thermometer was held in position for three minutes to obtain as accurate and uniform reading as possible in each case. The temperatures were taken each day for a ten day period during two different seasons and an average temperature was obtained. The purpose of this experiment was to see what relation the external body temperature of the chicken was to the sparrow. If the temperatures of the sparrows and chickens do not differ much, it would likely indicate that the lice of chickens would be attracted to the sparrow for body warmth. Tables 8 and 9 give the external body temperatures of the chicken and sparrow.

Table 8. External body temperature in degrees F. of chicken under thigh.

Date	Chicken Numbers 41	42	45	46	Room Temp.
2-22-'37	106°	104°	102°	104°	68°
2-23-'37	102°	104°	104°	104°	60°
2-24-'37	104°	102°	104°	102°	59°
2-25-'37	104°	106°	106°	106°	60°
2-26-'37	104°	106°	104°	104°	58°
2-27-'37	104°	104°	106°	106°	61°
2-28-'37	104°	106°	106°	106°	62°
3-1-'37	104°	106°	106°	104°	61°
3-2-'37	104°	106°	104°	104°	59°
3-3-'37	104°	104°	104°	106°	60°
5-29-'37	106°	104°	104°	106°	84°
5-30-'37	104°	106°	106°	104°	78°
5-31-'37	106°	104°	106°	104°	80°
6-1-'37	106°	106°	106°	104°	76°
6-2-'37	106°	105°	106°	106°	82°

Date	1	2	3	4	Room Temp.
6-3-'37	104°	106°	106°	106°	70°
6-4-'37	104°	105°	106°	104°	72°
6-5-'37	106°	106°	105°	104°	80°
6-6-'37	104°	106°	106°	104°	78°
6-7-'37	104°	104°	106°	106°	68°

Temperature for 8 chickens for 80 readings = 104.74° F.

Average room temperature = 69.8° F.

Table 9. External body temperature in degrees F. of sparrow under thigh.

Date	Sparrow Numbers 1	2	3	4	5	Room Temp.
2-18-'37	106°	106°	106°	106°	104°	70°
2-19-'37	102°	106°	104°	106°	106°	75°
2-20-'37	104°	*---	102°	104°	106°	68°
2-22-'37	106°	*---	*---	*---	106°	72°
2-23-'37	101°	*---	*---	*---	102°	71°
2-24-'37	106°	*---	*---	*---	104°	69°
2-25-'37	108°	*---	*---	*---	108°	65°
2-26-'37	108°	*---	*---	*---	102°	66°
2-27-'37	106°	*---	*---	*---	108°	86°
2-28-'37	106°	*---	*---	*---	106°	65°

Date	6	7	8	9	10	Atmos.Temp.
5-20-'37	106°	106°	104°	105°	104°	78°
5-21-'37	104°	106°	104°	106°	106°	80°
5-22-'37	104°	106°	104°	106°	106°	74°
5-23-'37	106°	106°	106°	106°	104°	86°
5-24-'37	106°	104°	104°	106°	106°	84°
5-25-'37	106°	106°	105°	*---	104°	80°
5-26-'37	105°	*---	106°	*---	104°	82°
5-28-'37	104°	*---	106°	*---	106°	80°
5-29-'37	106°	*---	104°	*---	107°	78°
5-30-'37	104°	*---	106°	*---	106°	84°

Temperature for 10 birds for 71 readings = 104.83° F.

Average atmos. temperature = 75.65° F.

* Sparrows died during the experiment.

Dust Baths as a Source of Lice Infestations

Chickens were observed wallowing in dust pits and shortly after sparrows appeared at the same pit to bathe. Chicken lice have been found in the dust bath where they were shaken and they were unable to withstand large quantities of dust. Lice when shaken in dust were found to be attracted to the sparrow which furnishes them with body warmth and protection.

Statement from Poultryman in Regard to the Relation of Sparrows and Chickens

The writer received the following letter on February 6, 1937, from C. B. Wiley, an experienced poultryman who operates a hatchery at Winfield, Kansas: "Regarding our conversation of recent date as to the possibilities of sparrows carrying lice to chickens, we are of the opinion and most sure that it is possible.

At one time when we were on the farm, we built a new hen house made all of new lumber on new grounds. Before placing the hens in this new house, we were positive they were free from lice as we had treated them both with dust and dipping. We had one inch chicken wire in the front. The chicken house was near to the cattle feed lot in a grove and there were lots of sparrows. The sparrows were so

bad about getting in the house through this wire that we were compelled to put on different frontage. Upon examination of the hens later, we found they were full of lice. After treating them again and shutting out the sparrows, we were not bothered any more."

SUMMARY AND CONCLUSIONS

The following conclusions are indicated by these observations:

1. Chicken lice have lived for nine days on the sparrow which is long enough to be transmitted from one flock of chickens to another.

2. Chicken lice have been found to reproduce on the sparrow as the nits and empty egg cases were found on them.

3. Eight parasite free sparrows have become infested with chicken lice from bird to bird contact or through the dust bath through indirect transmission on three different occasions.

4. Lice have been kept on the sparrow for a maximum of two hundred and sixteen hours.

5. Chicken lice placed in a vial with a freshly plucked chicken feather lives a shorter time than on the sparrow as host.

6. Lice placed in an empty vial died within thirty-one hours.

7. Chicken lice shaken in a dust bath and permitted to wander at random in a vial died within twenty-four hours which indicates that the dust is injurious to lice.

8. The external body temperature of the sparrow and the chicken correlate so closely that the chicken lice possibly seek the sparrow as well as the chicken for protection and body warmth.

9. The dust bath is a probable source where the sparrow collects the chicken lice and transmits them from one flock of chickens to another.

10. The body chicken louse (Lipeurus heterographus N.) was found on the sparrow in nature on August 21, 1936.

11. The common chicken mite has been reported taken from the sparrow by the following: Ainslie, Ewing, and Hirst as well as the writer.

12. The following have reported the tropical poultry mite as occurring on the sparrow; Roberts (1930), Hirst (1916 b.).

13. The northern fowl mite has been recorded by the following: Hirst, (1916 a.), Rayner, (1932) as well as the writer.

14. Stewart (1932) reported the sticktight flea of poultry as occurring on the sparrow and that it may serve as a dispersal agent from one flock of chickens to another.

The evidence at hand indicates that the common "English" or house sparrow is a source for transmission of poultry parasites such as mites, lice, and sticktight fleas from an infested flock of chickens to one non-infested.

ACKNOWLEDGEMENTS

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LITERATURE CITED

1. Ainslie, C. N.
   Note on the occurrence of the mite, Dermanyssus gallinae, L. in the nest of a house wren. Canad. Ent. 61(2):39-40. Feb. 1929.

2. Barrows, Walter B.
   The English sparrow (Passer domesticus) in North America. U. S. Dept. Agr. Bul. 1. 405 p. 1889.

3. Bedford, G. A. H.
   The external parasites of poultry, with measures for their control. Dept. Agr. Union S. Africa, 9(2):123-140. Aug. 1924.

4. Dunn, L. H.
   An effective method for collecting ectoparasites from live animals and birds. Psyche, 39(1-2): 26-29. 1932.

5. Ewing, H. E.
   The dermanyssid mites of North America. Proc. U. S. Nat. Mus. 1, 26 p. 1922.

6. --------
   A manual of external parasites. Thomas. Springfield, Ill. 225 p. 1929.

7. Gibson, A.
   Insect and other external parasites of poultry in Canada. Sci. Agr. 11(4):203-220. Dec. 1930.

8. Geist, Robert M.
   Notes on the infestation of wild birds by Mallophaga. Ohio Jour. Sci. 35(2):93-100. Mar. 1935.

9. Hirst, S.
   a. Notes on parasitic Acari. Jour. Zool. Research, 1(2):59-89. June, 1916.

10. --------
    b. On the occurrence of a tropical fowl mite (Liponyssus bursa Berlese) in Australia, and a new instance of its attacking man. Ann. Mag. Nat. Hist. 18(104):243-244. Aug. 1916.

11. ———
Notes on acari parasitic on birds with descriptions of two new species. Ann. Mag. Nat. Hist. 31:121-122. July, 1920.

12. Kennard, D. C.
Chicken lice and mites. Ohio Agr. Exp. Sta. Bul. 9(5-6):100-104. May-June, 1924.

13. Peters, H. S.
Mallophaga from Ohio birds. Ohio Jour. Sci. 28:215. 1928.

14. Rayner, J. A.
Parasites of wild birds in Quebec. Sci. Agr. 12(5):307-309. Jan. 1932.

15. Roberts, F. H. S.
A poultry mite infesting dwellings. Queensland Agr. Jour. 34(6):595-596. Dec. 1930.

16. Skinner, J. O.
The house sparrow. Ann. Rept. of Smithsonian Inst. 1904:423-428. 1904.

17. Stewart, H. A.
Dispersal of the sticktight flea of hens (Echidnophaga gallinacea). Jour. Econ. Ent. 25(2):164-167. Apr. 1932.

18. Wood, H. P.
The chicken mite: its life-history and habits. U. S. Dept. Agr. Bul. 553, 14 p. Aug. 1917.

19. ———
A tropical fowl mite Liponyssus bursa in the United States, with notes on life history and control. U. S. Dept. of Agr. Dept. Cir. 79, 8 p. Jan. 1920.

FIGURES

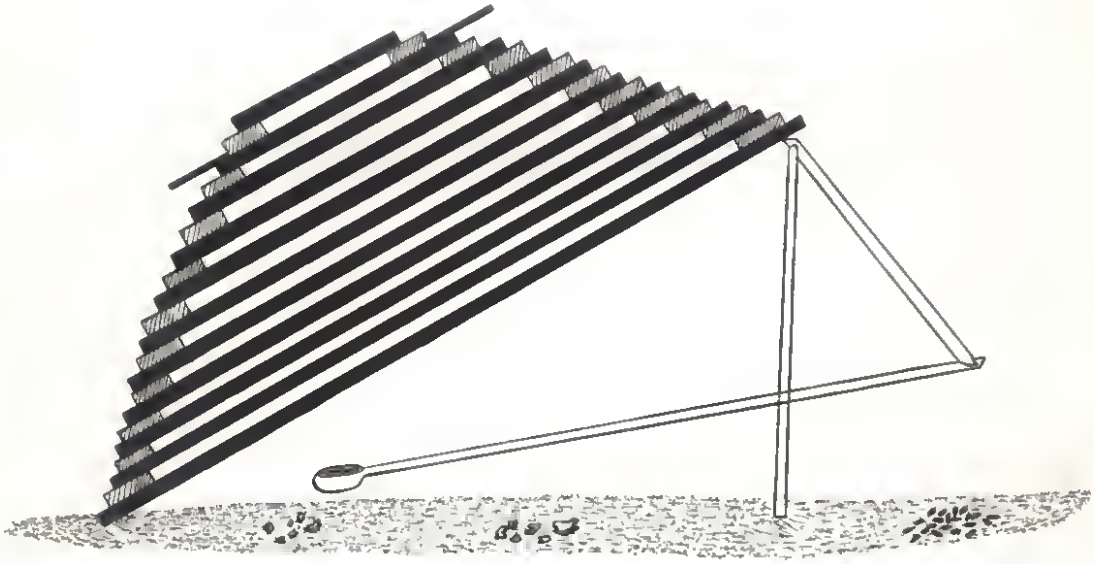

FIG. 1. BIRD TRAP

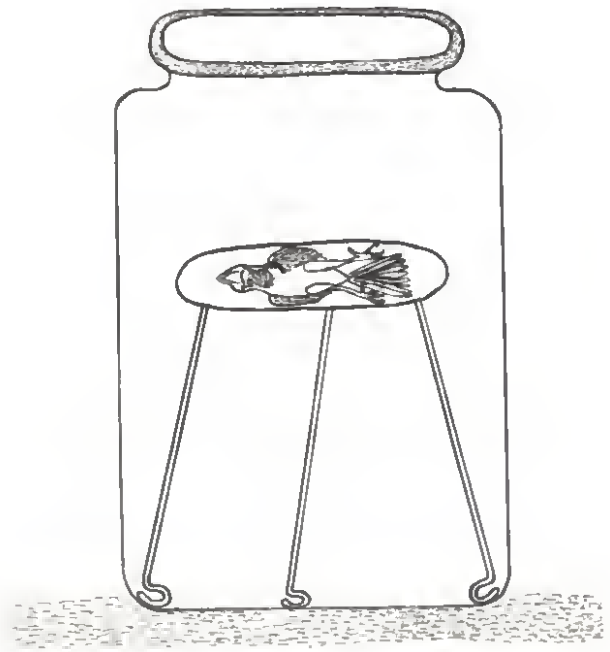

FIG. 2. PARASITE REMOVING CHAMBER

Fig. 3. Male "English" or House Sparrow (Passer domesticus Linn.). Taken from "The National Geographic Magazine" 24(6):683. June 1913.

Fig. 4. Eggs and Louse (Degeeriella vulgata (Kell.) taken from the "English" Sparrow.

Fig. 5. Eggs of the Common Chicken Louse (Menopon gallinae L.) in Cluster Arrangement.

Fig. 6. Eggs of the Common Chicken Louse (Menopon gallinae L.) in Linear Arrangement.

Fig. 7. Lice Eggs (Menacanthus sp.) taken from the European Starling.

Fig. 8. Eggs and Louse (Philopterus sp.) taken from the Barn Swallow.