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PUBLIC HEALTH PROBLEMS: TGE

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Transmissible gastroenteritis (TGE) is one of the five major diseases of concern to pork producers. The virus that causes the disease has an affinity for absorptive epithelial cells of the villi of the small intestine, primarily the jejunum. Infected cells are sloughed off, and the loss of absorptive activity results in salt imbalance, hyperkalemia, and dehydration in the pig. Death occurs in 60 to 100% of the diseased infant pigs.

Two forms of TGE exist in the United States: an enzootic form that has only recently been recognized as a serious problem, and an epidemic form that was first identified about 35 years ago. Epidemic TGE is characterized as being a seasonal disease, with outbreaks occurring primarily in winter months and especially after a snowfall. The same weather conditions are conducive to foraging by starlings in hog lots and consequently farmers, many veterinarians, and some researchers (Pilchard 1965) have concluded that the birds serve as vectors of the TGE virus (Bohl 1975). This research project was initiated to determine whether starlings do have a role in transmission of the pathogen.

METHODS

Starlings were trapped at five swine farms with pigs suffering from TGE, five areas without the disease, and one roost site. Winter roost sites in Iowa are structures such as silos, hay lofts and grain elevators, which serve relatively small numbers of birds. Attempts were made to pair control and diseased areas on the basis of size of the starling flock, and farms with small flocks (a few hundred) and with larger flocks (a few thousand) were both represented in the study. One farm served as a control site early in the study and as a site with TGE approximately one month later. At least 100 starlings were collected from each area.

A trapping site was pre-baited early in the morning with turkey grower ration which encouraged movement of starlings from hog lots to adjacent areas just outside of the pens. Dove-type, walk-in traps were placed over the baits at mid-morning (approximately 10 a.m.). Captured birds were removed from the traps at frequent intervals during the day, and swabs were taken from the beak and feet for attempts at isolation of TGE virus being mechanically transported on external surfaces.

Blood was drawn from each starling for seroanalysis of TGE viral antibodies. These antibodies would indicate that actual infection of the birds had occurred to the extent that the immunologic response mechanisms of the starlings were stimulated. A serum-virus neutralization plaque reduction assay was used for titration of antibodies (McClurkin & Norman, 1966).

The starlings were killed, classified as to age and sex (Kessel, 1957), and dissected to remove the four-inch segment of intestine proximal to the ventriculus for attempts at isolation and identification of TGE virus. This internal virus could be either actively (replication of virus in infected cells) or mechanically transported. The contents of the intestine were expressed into cell culture medium for isolation of virus. Impression smears then were prepared from the lumen of the intestine to be stained with fluorescein-conjugated specific antibody for indentification of TGE virus. Finally, the segment of the intestine was triturated with cell culture medium for isolation of the virus. Isolation of TGE virus from both the intestinal contents and the macerated intestine was in cell culture with the virus identified by plaque formation inhibited by hyperimmune antiserum (Thomas & Dulac, 1971).

RESULTS AND DISCUSSION

Internally carried TGE virus was isolated from all starlings captured in areas having an absence of the disease among swine with a greater frequency than from those birds at farms with sick pigs (Table 1). This higher rate of isolation is due primarily to results at two herds. Outbreaks of TGE occurred at the two control farms with the highest rates of virus isolation (1-c and 2-c) subsequent to trapping of the birds. One pork producer (1-c) believed that starlings were involved in introducing the virus to his herd and birds were captured from the premises again during th outbreak (5-TGE). At this second collection, approximately one month after the first, the rate of isolation of TGE virus had decreased to slightly less than one-half of the original (Table 2). Transmissible gastroenteritis virus

was believed to be brought into the other herd (2-c) by newly purchased hogs, so a second trapping was not done at that site. The rate of isolation of TGE virus from starlings at the remaining three control (non-diseased) sites was approximately that of the total rate for birds at farms with TGE among the swine.

The prevalence of TGE virus was greater in internal specimens from starlings than in external specimens. Also, the prevalence of the virus was greater in homogenates of the intestine than in the intestinal contents. Virus was isolated in cell culture more frequently than it was identified by staining with fluorescent antibody; this is the same situation as observed with swine. Seroconversion rates of 0 to 3% were similar to those observed in studies carried out during two previous years.

No external TGE virus was obtained from starlings captured at the roost site. Rates of isolation of internal virus were lower than for birds trapped at farms. Seroconversion, however, was observed more frequently in roost birds than in foraging birds. Nearly all starlings at the roost were captured for the study, and the removed birds were not replaced. Perhaps this indicates the population at the roost was a stable flock with the same history, which may have included previous infection with TGE virus. Unfortunately, only one roost site was included in the study.

Transmissible gastroenteritis virus was isolated most frequently early in the winter of 1978-79 (Table 3). This may reflect the situation at the specific areas being trapped at the time rather than an overall trend. However, if the starling is indeed a vector that introduces the TGE virus into the swine farms, isolations would be expected early in the epidemic.

More starlings identified as males were captured than females and more adults birds than juveniles. This may be the result of selection in trapping rather than population distribution. There was little difference between sexes or ages in rate of isolation of TGE virus.

CONCLUSIONS

The rate of isolation of TGE virus from starlings foraging in hog lots at Iowa farms was sufficient for them to be regarded as a potential vector of the pathogen. Whether or not they are involved in the epidemiology of the disease depends upon a number of factors that need further study:(1) movement of the birds among farms, (2) amount of TGE virus transmitted relative to a pig infectious dose, and (3) alteration of TGE virus during passage through the abnormal host (porcine-virus in an avian species).

SUMMARY

Starlings were captured at five farms with pigs suffering from TGE, five disease-free areas, and one roost. Transmissible gastroenteritis virus was isolated as an internally-harbored virus from 13% of the birds on farms with disease, 21% of the birds on farms without TGE, and 7% of the birds at the roost. External virus was detected in 5% and 3%, respectively, of the starlings at farms with and without TGE on the premises; no external virus was observed on birds at the roost. At a single farm, from which starlings were trapped both in the presence and in the absence of TGE among swine, twice as many isolations of virus were obtained prior to the outbreak as when pigs were ill. A higher rate of isolation of TGE virus from starlings was obtained early in the winter of 1978-79 than later in the season.

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TABLE 1. Isolation and identification of TGE virus in starlings captured at farms in the presence and absence of TGE.

A. Swine farms with active TGE virus among pigs.

		Number of Birds				
Farm	TGE Status of Birds	External Virus	Internal Virus - SI[a]	IW[b]	FA[c]	Seroconversion
1-TGE	TGE-neg		69	61	90	86
	TGE-pos		14(17%)	7(10%)	2(2%)	2(2%)
	Total		83	68	92	88
2-TGE	TGE-neg	89	79	91	90	90
	TGE-pos	2(2%)	8(9%)	4(4%)	2(2%)	3(3%)
	Total	91	87	95	92	93
3-TGE	TGE-neg	42	80	82	91	89
	TGE-pos	6(12%)	5(6%)	7(8%)	1(1%)	1(1%)
	Total	48	85	89	92	90
4-TGE	TGE-neg	25	89	101	119	22
	TGE-pos	0(0%)	14(14%)	14(12%)	2(2%)	4(15%)
	Total	25	102	115	121	26
5-TGE	TGE-neg	49	97	104	117	125
	TGE-pos	3(6%)	19(16%)	9(8%)	4(3%)	3(2%)
	Total	52	116	113	121	128
Total	TGE-neg	206	414	439	507	412
	TGE-pos	11(5%)	60(14%)	41(9%)	12(2%)	13(4%)
	Total	217	474	480	519	425

B. Farms without clinical TGE on the premises.

Number of Birds

Farm	TGE Status of Birds	External Virus	Internal Virus SI[a]	IW[b]	FA[c]	Seroconversion
1-C	TGE-neg		61	57	120	116
	TGE-pos		37(38%)	33(37%)	3(2%)	2(2%)
	Total		98	90	123	118
2-C	TGE-pos	61	80	92	115	115
	TGE-neg	0(0%)	24(23%)	18(16%)	0(0%)	0(0%)
	Total	61	104	110	115	115
3-C	TGE-neg	49	76	81	90	97
	TGE-pos	0(0%)	14(16%)	11(12%)	1(1%)	0(0%)
	Total	49	90	92	91	97
4-C	TGE-neg	45	79	84	89	108
	TGE-pos	5(12%)	9(10%)	5(6%)	0(0%)	0(0%)
	Total	50	88	89	89	108
5-C	TGE-neg	30	76	80	97	99
	TGE-pos	0(0%)	13(15%)	12(13%)	0(0%)	0(0%)
	Total	30	89	92	97	99
Total	TGE-neg	185	372	354	511	535
	TGE-pos	5(3%)	97(21%)	79(17%)	4(0.8%)	2(0.4%)
	Total	190	469	473	515	537

C. Rocxl site

Number of Birds	External Virus	Internal Virus SI	IW	FA	Seroconversion
TGE-neg	41	75	85	92	68
TGE-pos	0(0%)	6(7%)	6(6%)	3(3%)	7(9%)
Total	41	81	91	95	75

[a]Virus isolated from homogenized epithelium of intestine
[b]Virus isolated from lumen contents of intestine
[c]Virus identified in epithelium of intestine by staining with fluorescent antibody

TABLE 2: Isolation and identification of TGE virus at a swine farm six weeks prior to an outbreak of TGE and at the time of the outbreak.

Time of Collection of starlings	TGE Status of birds	Number of Birds External Virus	Internal Virus SI[a]	IM[b]	FA[c]
Prior to TGE outbreak (1-C)	TGE-neg		61	57	120
	TGE-pos		37(38%)	33(17%)	3(2%)
	Total		99	90	123
At time of TGE outbreak (5-TGE)	TGE-neg	49	97	104	117
	TGE-pos	3(6%)	19(15%)	9(8%)	4(3%)
	Total	52	116	113	121

[a]Virus isolated from homogenized epithelium of intestine
[b]Virus isolated from lumen contents of intestine
[c]Virus identified in epithelium of intestine by staining with fluorescent antibody

TABLE 3: Rate of isolation of TGE virus from starlings during weekly intervals over the time period of the field of study

Week Beginning	Area of capture of starlings: TGE-positive	TGE-negative	Poost	Total
12/18/78		10/37(27%)		10/37(27%)
12/25/78		60/151(40%)		60/151(40%)
1/1/79	6/57(11%)			6/57(11%)
1/8/79	15/75(20%)	4/26(15%)		19/100(19%)
1/15/79			4/95(4%)	4/95(4%)
1/22/79				
1/29/79	9/131(7%)	5/13(38%)	3/36(8%)	17/180(9%)
2/5/79	9/145(6%)	1/54(2%)	3/24(12%)	13/223(6%)
2/12/79	30/208(15%)	19/92(21%)	2/15(13%)	51/315(16%)
2/19/79	5/37(14%)	42/230(18%)	0/3(0%)	47/270(17%)
2/26/79	4/111(4%)	39/377(10%)		43/488(9%)
3/5/79	9/163(5%)			9/163(5%)

TABLE 4: Prevalence of TGE virus in birds identified by sex and age.

Area of Capture	ADULT Male	ADULT Female	Total Adult	JUVENILE Male	JUVENILE Female	Total Juvenile	Total Male	Total Female
TGE-Positive								
1-TGE	NI	NI		NI	NI			
2-TGE	2/43(5%)	1/14(7%)	3/57(5%)	1/10(10%)	2/4(50%)	3/14(21%)	3/53(6%)	3/18(17%)
3-TGE	4/61(7%)	3/28(11%)	7/78(8%)	0/18(0%)	0/10(0%)	0/28(0%)	4/79(5%)	3/38(8%)
4 TGE	1/25(4%)	0/24(0%)	1/49(2%)	0/9(0%)	0/2(0%)	0/11(0%)	1/34(3%)	0/26(0%)
5-TGE	11/39(28%)	4/25(16%)	15/64(23%)	3/23(13%)	6/28(21%)	9/51(18%)	14/62(23%)	10/53(19%)
Total	18/168(11%)	8/91(9%)	26/259(10%)	4/50(8%)	8/34(24%)	12/84(14%)	22/218(10%)	16/125(13%)
						pd	8/63(13%)	17/74(23%)
TGE-Negative								
1-C	NI	NI		NI	NI			
2-C	14/63(22%)	18/49(37%)	32/112(29%)	3/20(15%)	1/15(7%)	4/35(11%)	17/83(13%)	19/64(30%)
3-C	10/83(12%)	7/48(15%)	17/131(13%)	8/30(27%)	0/15(0%)	8/45(18%)	18/113(16%)	7/63(11%)
4-C	8/87(9%)	2/38(5%)	10/125(8%)	1/29(3%)	1/9(11%)	2/38(5%)	9/116(8%)	3/47(6%)
5-C	13/89(15%)	8/47(17%)	21/136(15%)	4/30(13%)	0/9(0%)	4/39(10%)	17/119(14%)	8/56(14%)
6-C				0/1(0%)	0/1(0%)	0/2(0%)	0/1(0%)	0/1(0%)
Total	45/332(14%)	35/183(19%)	80/504(16%)	16/110(15%)	2/49(4%)	18/159(11%)	61/432(14%)	37/231(16%)
						pd	1/7(14%)	5/11(0%)
Roost	2/8(25%)	0/5(0%)	2/13(15%)	0/2(0%)	0/4(0%)	0/6(0%)	2/10(20%)	0/9(0%)
Total all areas	65/489(13%)	43/278(15%)	108/776(14%)	20/162(12%)	10/87(11%)	30/249(12%)	85/660(13%)	53/365(15%)
						pd	9/70(13%)	17/85(20%)

NI = Not identified
pd = *Passer domesticus*, house sparrow