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OCCURRENCE OF *CAMPYLOBACTER JEJUNI* IN FREE-LIVING WILD BIRDS FROM JAPAN

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ABSTRACT: *Campylobacter jejuni* was isolated from 44 of 313 free-living birds from Japan. The highest isolation rate was found in 30 of 87 (34%) crows (*Corvus levaillanti* and *Corvus corone*), followed by 2 of 10 (20%) blue magpies (*Cyanopica cyanus*), 5 of 35 (14%) gray starlings (*Sturnus cineraceus*), 2 of 16 (13%) domestic pigeons (*Columba livia domestica*), 4 of 36 (11%) bulbuls (*Hypsipetes amaurotis*), and 1 of 62 (2%) eastern turtledoves (*Streptopelia orientalis*). One-fourth of the contents of the crop and stomach of the crows was human refuse. One-third of the crop and stomach contents of gray starlings and blue magpies consisted of insects. More than one-half of the contents of bulbuls and eastern turtledoves were seeds and plant material. These differences in food habits may be a primary factor in the varying prevalence of *C. jejuni* in these respective avian species.

Key words: *Campylobacter jejuni*, crows, blue magpies, gray starlings, bulbuls, eastern turtledoves, free-living birds, field study, prevalence.

INTRODUCTION

Free-living birds are thought to be significant reservoirs in the maintenance and dissemination of *Campylobacter jejuni* in nature because of their great mobility and high carrier rate for this bacterium. Although some reports on the isolation of the bacteria from free-living birds have been published (Luechtefeld et al., 1980; Kapperud and Rosef, 1983; Matsusaki et al., 1986), certain details concerning the epizootiology of *C. jejuni* remain obscure; such as the relationship between the transport of *C. jejuni* by wild birds and their feeding habits. The present study was intended to compare the prevalence of *C. jejuni* in a number of species of free-living birds as correlated with the feeding habits of these respective avian species.

MATERIALS AND METHODS

From August 1981 to March 1982, the contents of the small and the large intestines were collected from 313 free-living birds representing nine different species (Table 1). Crow samples were collected from two species (*Corvus levaillanti* and *C. corone*) without distinguishing them. Whole birds were taken to the laboratory (Tokyo University of Agriculture and Technology, Fuchu, Tokyo 183, Japan). The intestinal contents were sampled 1 to 2 hr after death of the birds. All birds were obtained by cooperating hunters in Inagi (35°38′N, 139°31′E), Itsukaichi (35°44′N, 139°15′E), Machida (35°32′N, 139°27′E) and Mizuho (35°46′N, 139°21′E) in the western suburbs of Tokyo, Japan.

Each sample was directly plated on blood agar which consisted of blood agar base Number 2 (Oxoid, Hampshire, England RG240PW), Skirrow *Campylobacter* spp. selective supplement (Oxoid) and 7% horse blood without any treatment of specimens. Incubation was performed at 43 C in a miroaerobic atmosphere (5% O_2, 10% CO_2 and 85% N_2). Isolates were identified as *Campylobacter* spp. on the basis of morphologic and biochemical characteristics according to the methods of a previous report (Yoshida et al., 1987).

The hunters shot the birds in the morning and the evening. The birds obtained in the morning were submitted only to bacterial culture because these birds' crop and stomach were empty. The birds obtained in the evening were submitted only to dietary examination. There was no overlap in birds between the groups submitted for bacterial culture and dietary examination.

Contents of the crop and stomach were wrapped in three pieces of gauze and soaked in 30% ethanol-in-water solution for >24 hr. The ethanol treated diets were then dried for several hours at 60 to 80 C before the identification of contents with a dissecting microscope as described by Korschgen (1971).

A chi-square test was performed to compare

TABLE 1. Prevalence of *Campylobacter jejuni* in free-living birds in Japan.

Birds species	Prevalence by region*				Total prevalence (%)
	Inagi	Itsukaichi	Machida	Mizuho	
Tree sparrow (*Passer montanus*)		0/1		0/7	0/8 (0)
Pheasant (*Phastanus colchicus tohkaidi*)			0/25		0/25 (0)
Chinese bamboo pheasant (*Bumbusicola thoracica thoracica*)	0/2	0/3	0/29		0/34 (0)
Eastern turtledove (*Streptopelia orientalis*)	0/21	0/15	0/17	1/9	1/62 (2)
Bulbul (*Hypsipetes amaurotis*)	0/4	2/15	2/17		4/36 (11)
Domestic pigeon (*Columba livia domestica*)		0/5		2/11	2/16 (13)
Gray starling (*Sturnus cineraceus*)	5/28	0/7			5/35 (14)
Blue magpie (*Cyanopica cyanus*)	2/10				2/10 (20)
Crow (*Corvus levaillanti* and *Corvus corone*)	13/22	2/10	0/24	15/31	30/87 (34)

* Values indicate the number of *Campylobacter jejuni*-positive birds/the number of birds examined.

the prevalence of the bacteria among species and sites.

RESULTS

Table 1 shows the isolations of *C. jejuni* from the birds across regions. *Campylobacter jejuni* was isolated from 44 birds representing six species. The prevalence of the bacteria ranged from 2 to 35% among the six species from which it was isolated. The prevalence was highest in crows (*C. levaillanti* and *C. corone*) and lowest in

TABLE 2. Dietary items in the crop and the stomach of free-living birds from Japan.

Bird species	Number of birds examined	Average dry weight percentage of diet items in the crop and stomach			
		Vegetation	Human garbage	Insects	Unidentified
Tree sparrow (*Passer montanus*)	7	59	0	0	41
Pheasant (*Phastanus colchicus tohkaidi*)	7	56	0	<1	44
Chinese bamboo pheasant (*Bumbusicola thoracica thoracica*)	22	69	0	2	30
Eastern turtledove (*Streptopelia orientalis*)	263	66	1	<1	32
Bulbul (*Hypsipetes amaurotis*)	66	86	2	3	9
Domestic pigeon (*Columba livia domestica*)	46	28	0	<1	72
Gray starling (*Sturnus cineraceus*)	28	23	1	37	39
Blue magpie (*Cyanopica cyanus*)	9	65	1	31	3
Crow (*Corvus levaillanti* and *Corvus corone*)	42	24	26	10	40

eastern turtledoves (*Streptopelia orientalis*). The prevalence of *C. jejuni* in the crows was significantly higher ($P < 0.05$) than that in gray starlings (*Sturnus cineraceus*), bulbuls (*Hypsipetes amaurotis*) or eastern turtledoves. There were no isolates from crows in the Machida region and the differences between this region and both Inagi and Mizuho was significant ($P < 0.01$).

Table 2 shows dietary items in the crop and stomach contents of the birds. More than one-half of the crop and stomach contents of sparrows (*Passer montanus*), pheasants (*Phasianus colchicus*), Chinese bamboo pheasants (*Bumbusicola thoracica*), eastern turtledoves and bulbuls were seeds of crops and wild-living plants, fruits of grapes, cherries and other wild-living plants, burdock roots, etc. Most of 27% of domestic pigeon's (*Columba livia*) crop and stomach contents were identified as seeds of crops and wild-living plants. One-fourth of the contents of crows was human refuse (garbage) of boiled rice with or without curry powder, soy cake, etc. In the three crows from the Mizuho region, almost 100% of crop and stomach contents was garbage.

DISCUSSION

Matsusaki et al. (1986) reported that the isolation rate of *C. jejuni* from crows was much higher than that from tree sparrows, eastern turtledoves and pheasants in Yamaguchi, Japan. In the present study, the prevalence of *C. jejuni* in crows was significantly higher than that of other birds in rural areas of Tokyo, Japan. Crows are omnivorous scavengers of garbage on refuse dumps. Furthermore, it was shown that there was a regional difference in the prevalence of *C. jejuni* in crows between the Itsukaichi and Mizuho regions. Almost 100% of the diet of crows from Mizuho was garbage, because in that region there is a large municipal garbage dump; almost one-half of the crows were infected with *C. jejuni*. The dump is located on a hill surrounded by forests. Since this was an open dump site, the birds were able to feed freely without restraint in the dump. This suggests that crows acquired infection with *C. jejuni* from the garbage dump. Because these crows came from areas near human residences and farms, they may serve as possible reservoirs of infection for humans and domestic animals. In Norway, gulls (*Larus ridibundus*) captured in urban areas showed much higher prevalences of the bacteria than did those captured in rural areas (Kapperud and Rosef, 1983). The relationship between the carrier state of *C. jejuni* and diet of particular avian species warrants further investigation.

Since *C. jejuni* was isolated also from 5 of 165 specimens of herbivorous wild birds (bulbuls, Chinese bamboo pheasants, eastern turtledoves, pheasants and sparrows), *C. jejuni* may be reservoired by herbivorous birds but at much lower prevalences. Kapperud and Rosef (1983) reported that herbivorous domestic pigeons showed a significantly lower prevalence of *C. jejuni* than did crows (*Corvus corone cornix*) and gulls (*Larus ridibundus*) in Norway. Luechtefeld et al. (1980) found that herbivorous waterfowl showed a low prevalence of *C. jejuni* in Colorado (USA). A low prevalence of this bacterium in pheasants and sparrows has been already reported in Japan (Matsusaki et al., 1986). Further investigation will be needed to clarify whether or not the low prevalence of *C. jejuni* in herbivorous birds is due to their feeding habits or to their susceptibility to the bacterium.

Campylobacter jejuni was isolated from 2 of 10 blue magpies (*Cyanopica cyanus*) and 5 of 35 gray starlings; both these species are insectivorous. Although the occurrence of *C. jejuni* in insectivorous birds might be due to the food habits of these birds, it is unknown whether or not *C. jejuni* in the insectivorous birds originate from insects.

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