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Research Note

Habitat preference of carrion-breeding calliphorid and sarcophagid flies in central Japan

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Abstract: Periodical surveys using traps baited with minced pork were carried out once a month in 1990-1992 in central Japan. In this study, 8 calliphorid and 10 sarcophagid carrion-breeding species were collected. In general, calliphorid species preferred forests, while sarcophagid species preferred open areas.

INTRODUCTION

Calliphorid and sarcophagid flies use a variety of resources for breeding, e. g., carrion, dung, living animal or insect tissues (as myiasis or parasitoids) (Ferrar, 1978). Among them, carrion is one of most often used resource (Ferrar, 1978; Kano et al., 1967; Kano and Shinonaga, 1968). For example, among 42 calliphorid and 54 sarcophagid species so far recorded in Saitama prefecture, central Japan (Tamaki, 1997), 16 calliphorid and 19 sarcophagid species breed on carrion (Kano et al., 1967; Kano and Shinonaga, 1968; Mitsui, unpublished data). In addition, a single patch of carrion is usually used by a number of calliphorid and sarcophagid species (Denno and Cothran, 1975, 1976; Hanski, 1980, 1987; Ives, 1991). However, little is understood how these species coexist. The present study aims to clarify the difference in their habitat preference as a first step to understand the mechanisms of their coexistence.

STUDY AREA AND METHODS

Periodical trap collections were carried out once a month from February to November or December in 1990-1992 in Tokorozawa, Saitama in central Japan. Collections were made at four (A-D) sites which were located at the northern edge of Sayama Hill. This hill is covered with deciduous broad-leaved forests of ca. 3,500 ha and has two lakes. Sites A and B located in the same forest and were apart 800 m from each other. Site A is more heavily influenced by

human activities than site B. Site C located on a lawn 100 m apart from site A. Site D located in a marshy grassland 100 m apart from Site B.

Traps used were cylindrical with 25 cm in length and 18 cm in diameter, and its half part (entrance side for flies) was made of opaque plastic and the other half part was made of semitransparent plastic. One trap baited with 30 g minced pork was set at each site. Traps were hung on trees at a height of 1.5 m above the ground. Trapped flies were captured after two weeks and preserved in 70% ethanol.

Relative preference to forests and open areas was examined by the Preference Index (PI). In this analysis, the data at nearby sites (i.e., A-C and B-D) was combined and the preference index (PI) was obtained by the following formula, $(A-C)/(A+C)$ and $(B-D)/(B+D)$, where A, B, C, or D are numbers of flies collected at each site.

Table 1. Numbers of Calliphorid and Sarcophagid flies trapped from Feb.1990 to Nov. 1992 at 4 trapping sites.

Calliphoridae	Trapping site					Sarcophagidae	Trapping site				
	A	B	C	D	total		A	B	C	D	total
<i>Aldrichina grahami</i> (Aldrich)	1990 3	2	7	2	14	<i>Boettcherisca peregrina</i> (Robineau-Desvoidy)	1990		2	2	4
	1991 1		4	5	10		1991 1		4		5
	1992 3		2	1	6		1992				
<i>Calliphora nigribarbis</i> Vollenhoven	1990 18	45	4	9	76	<i>Boettcherisca septentrionalis</i> Rohdendorf	1990 3	3	1		7
	1991 14	39	12	12	77		1991 6	8		1	15
	1992 13	25	5	9	52		1992 1	7	1	1	10
<i>Triceratopyga calliphoroides</i> Rodendorf	1990					<i>Helicophagella melanura</i> (Meigen)	1990 1		1	24	26
	1991						1991 1			14	15
	1992			3	3		1992			8	8
<i>Lucilia papuensis</i> Macquart	1990		1		1	<i>Kramerea schuetzei</i> (Kramer)	1990 3	8			11
	1991		1		1		1991 3		1		4
	1992						1992	3			3
<i>Lucilia porphyрина</i> (Walker)	1990 53	163		8	224	<i>Parasarcophaga harpax</i> (Pandelle)	1990	1			1
	1991 67	277		15	359		1991				
	1992 44	66	2	6	118		1992				
<i>Lucilia ampullacea</i> Villeneuve	1990 4	14			18	<i>Parasarcophaga kobayashii</i> (Hori)	1990 1			2	3
	1991 1	11		6	18		1991		4		4
	1992 8	12		1	21		1992		1		1
<i>Lucilia caesar</i> Linnaeus	1990 5	20		3	28	<i>Parasarcophaga similis</i> (Meade)	1990 1	2	21	48	72
	1991 8	53	1	9	71		1991 4	5	14	85	108
	1992 11	40		4	55		1992 10	1	26	38	75
<i>Chyasomya pinguis</i> (Walker)	1990 11	125		37	173	<i>Parasarcophaga albiceps</i> (Meigen)	1990 4	15	16	48	83
	1991 1	167	1	20	189		1991	10	8	21	39
	1992 35	81	3	18	137		1992 13	11	12	23	59
						<i>Phallosphaera graveyi</i> (Senior-White)	1990 1	4		3	8
							1991 5		1		6
							1992 8	7	3	2	20
						<i>Sarcorohdendorfia antilope</i> Boettcher	1990 16	14	5	6	41
							1991 9	15	5	6	35
							1992 18	23	10	4	55

RESULTS AND DISCUSSION

A total 2,369 carrion-breeding flies belonging to 8 calliphorid and 10 sarcophagid species were collected in the present survey (Table 1). Among them, three species of Calliphoridae, *Lucilia porphyryna* (29.6 %), *Chrysomya pinguis* (21.1 %), and *Aldrichina grahami* (8.7%), and two species of Sarcophagidae, *Parasarcophaga similis* (10.8%) and *Pa. albiceps* (7.6%), were predominated.

Preference Index (PI) was calculated for 11 abundant species (Table 2). PI of two species of Sarcophagidae, *Pa. similis* and *Helicophagella melanura*, were remarkably less than 0. Thus, these two species are assumed to prefer open areas. PI of *Pa. albiceps* (Sarcophagidae) and *Aldrichina grahami* (Calliphoridae) were also somewhat less than 0. On the other hand, PI of the remaining 7 species (5 calliphorid and 2 sarcophagid species) exceeded 0, especially in 4 species of Calliphoridae, *Lucilia porphyryna*, *L. ampullacea*, *L. caesar* and *C. pinguis*, indicating that they prefer forests. Thus, calliphorids generally prefer forests, while sarcophagids do open areas. Ohkuma and Beppu (1987) observed a similar tendency in Nagano prefecture.

There are many studies demonstrating severe competition among carrion-feeding calliphorid and sarcophagid flies (Denno and Cothran, 1975, 1976; Hanski, 1980, 1987; Ives, 1991). Denno and Cothran (1976) have shown that competition with calliphorids is the principal factor limiting the sarcophagid populations in a riparian woodland in California, U.S.A. A number of studies have been made to understand how these species coexist. Some studies have shown resource partitioning with regard to carcasse size; i. e. calliphorids prefer large carcasses, while sarcophagids prefer small ones (Denno and Cothran, 1975; Braak, 1987). In this study, it appeared that calliphorid species predominated in forests and sarcophagid species prefer open areas. Thus, niche partitioning with regard to habitat is also assumed as a factor which facilitates the coexistence of sarcophagid and calliphorid species.

Table 2. Relative preference to forests (site A and B) and open areas (site C and D).

Preference index (PI)	Calliphoridae						Sarcophagidae				
	grah.	nigr.	porp.	ampu.	caes.	ping.	mela.	simi.	albi.	grav.	anti.
1990	-0.4	0.636	1			1	-0.91		-0.6		0.524
(A-C)/(A+C)	1991	0.077	1				-0.56				0.286
	1992	0.444	0.913		1	0.842	-0.44	0.04	0.455		0.286
	1990	0.667	0.906	1	0.739	0.543	-1	-0.92	-0.52		0.4
(B-D)/(B+D)	1991	0.529	0.897	0.294	0.71	0.786	-1	-0.89	-0.35		0.429
	1992	0.471	0.833	0.846	0.818	0.636		-0.95	-0.35		0.704
average	-0.4	0.471	0.925	0.713	0.817	0.762	-1	-0.78	-0.36	0.455	0.438

Abbreviations; grah.: *A. grahami*, nigr.: *Ca. nigribarbis*, porp.: *L. porphyryna*, ampu.: *L. ampullacea*, caes.: *L. caesar*,

ping.: *Ch. pinguis*, mela.: *H. melanura*, simi.: *P. similis*, albi.: *P. albiceps*, grav.: *Ph. graveleyi*, anti.: *S. antilope*.

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