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Surveys on the occurrence of flies (Diptera) from cow, horse and pig dung in Hokkaido, Japan

Mitsuhiro IWASA[1] and Tomomi WATANABE[1), 2)]

[1)]*Laboratory of Entomology, Obihiro University of Agriculture and Veterinary Medicine, Inada-cho, Obihiro, Hokkaido, 080–8555 Japan*
[2)] *Current address: Department of Physiology, School of Medicine, The University of Tokyo, Hongo 7–3–1, Bunkyo-ku, Tokyo, 113–0033 Japan*

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Abstract: Flies occurring from dung of cow, horse and pig were investigated in Hokkaido, Japan. A total of 53 species of the flies belonging to 8 families was reared in two localities; these species were 2 of Stratiomyiidae, 8 of Sepsidae, 11 of Sphaeroceridae, 2 of Scathophagidae, 6 of Anthomyiidae, 22 of Muscidae, and 2 of Sarcophagidae. Numbers of species emerged from droppings of cow, horse and pig were 44, 23, and 23 species, respectively. Cow droppings in Otofuke yielded a large number and a wide variety of species of Anthomyiidae and Muscidae. Information concerning faunal composition in dung and dung preferences for each species is provided.

Key words: dipterous flies, occurrence, dung, cow, horse, pig

INTRODUCTION

Cattle dung or droppings yield many species of flies including some important pests. Comparative studies of the flies emerging from different types of cattle dung have been performed by Hafez (1939), Bohart and Gressitt (1951), Schoof et al. (1954), Siverly and Schoof (1955), and Coffey (1966). Extensive studies of the flies associated with cow droppings have been conducted by Hammer (1941), Mohr (1943), Laurence (1954), Poorbaugh et al. (1968), and Blume (1970).

In Japan, some comparative studies of the flies occurring in domestic animal dung have been reported by Suenaga (1959), Nezu and Matsuhashi (1960), and Oshio et al. (1962), but these investigations were limited in main species of major families. Furthermore, there have been many collecting records of dung-frequenting flies (Shinonaga and Kano, 1971; Iwasa, 1980, 1984; Hayashi, 1986; Shinonaga, 2003), but breeding records of different types of animal dung are lacking. This paper presents comparative information of flies which breed in droppings of cows, horses and pigs in Hokkaido, Japan.

MATERIALS AD METHODS

During 31 May to 24 October 2000, cow droppings were collected in a 21-ha pasture at Obihiro University of Agriculture and Veterinary Medicine (Obihiro City) where about 80 milking Holsteins were held. Cow droppings (about 25 cm diameter) were marked with chopsticks (20 cm length) and were exposed to fly oviposition in the pasture for 7 days, after which they were collected and transferred from the pasture to a small area of grassland of the university campus. Horse droppings as roughly the same size as cow droppings were collected in a horse riding ground in campus and left on grass near the stable for 7 days. Pig droppings were collected on a pig farm located 1.5 km from the

University, and the same sized pats as cow droppings were made and kept on the grass near the pig pen for 7 days. After exposure, each of droppings of the three dung types was placed on a tray (35×27×6.6 cm) with sawdust 1–2 cm depth for pupation. Each tray was covered with a pyramid-shaped wire frame (35×27×65 cm) emergence trap from which emerging flies were collected daily.

In addition, unpublished breeding records (Iwasa, June–September 1978) of the flies from cow droppings in the National Livestock Breeding Center Tokachi Station, Komaba, Otofuke-cho, located 18 km from Obihiro are added. On this farm, about 600 breeding cows were maintained. Cow droppings (about 25 cm diameter) were marked and exposed in the pasture for 3 days as described above, and thereafter these were brought to the university and kept in a grassland on campus. Then, each of dropping was covered by a cubical wire frame emergence trap (40×40×25 cm) with basal metal plates on four sides (10 cm high); these plates were buried completely in the ground to prevent the mature larvae from escaping, and emerging flies were collected daily.

In identification of fly species from all locations, Nematocera species were not included; in Otofuke, Sphaeroceridae were also not evaluated, because taxonomic knowledge of this family was poor to us at that time.

Results and Discussion

Forty droppings were collected of each dung type from cows, horses and pigs, in Obihiro. In Otofuke, 120 cow droppings were also collected. A total of 53 Diptera species belonging to seven families were obtained from these dung pats (Table 1). Fly fauna in cow droppings was composed almost entirely of the Palaearctic species which have a wide geographic range and a few East-Asian species (*Ischiolepta draskovitsae* (Roháček et Papp), *Sepsis latiforceps* Duda and *Musca bezzii* Patton et Dragg).

In horse droppings, the dominant family was the Sphaeroceridae composing also almost of the Palaearctic species. Fly fauna in pig droppings was characterized by the occurrence of large numbers of *Sepsis latiforceps* and a cosmopolitan species, *Musca domestica* Linnaeus.

Information concerning dung preferences for each species is described below.

Stratiomyiidae. *Ptecticus tenebrifer* (Walker) was reared from pig dung in relatively large numbers. Preference of this species to pig dung agreed with the results of Suenaga (1959).

Sepsidae. *Sepsis latiforceps* Duda was reared from cow droppings and pig dung in large numbers; this species has a wide range of dung preferences. *Saltella sphondylii* (Schrank), *Sepsis cynipsea* (Linnaeus), *Sepsis duplicata* Haliday and *Sepsis flavimana* Meigen are known to prefer cow dung in Europe (Pont and Meier, 2002). Records from the present study indicate that these five species mainly breed in cow droppings in Japan. *Sepsis nigripes* Meigen and *Sepsis thoracica* (Robineau-Desvoidy) also prefer cow droppings in Japan. According to Pont and Meier (2002), *Meroplius minutus* (Wiedemann) is a generalistic inhabitant of feces with a preference for exceptionally filthy habitats; its larvae have been reported from human feces (Hennig, 1949), a rabbit cage and pig dung (Lobanov, 1962), and rodent carcasses (Ozerov, 1989). Breeding records of *M. minutus* show that this species favors pig dung among the three dung types studied here.

Sphaeroceridae. Finding of *Coproica acutangula* (Zetterstedt) only in horse droppings agreed with the results of Coffey (1966) who found 94% of samples to be *C. acutangula* in horse dung among specimens from four types (horse, cow, swine and dog) of dung. *Lotobia pallidiventris* (Meigen) and *Norrbomya sordida* (Zetterstedt) were also bred mainly from horse dung, agreeing with collecting data by Hayashi (1986). According to Hayashi

(1986), adults of *Opalimosina mirabilis* (Collin) were found on dung of various domestic animals and decayed vegetable matter. Large numbers of *O. mirabilis* from cow, horse and pig dung show that this species has a wide range of larval

Table 1. Species and numbers of flies emerged from droppings of cow, horse and pig in two localities.

Species	Localities	Obihiro			Otofuke
	Animal species	Cow	Horse	Pig	Cow
	No. of droppings	40	40	40	120
Stratiomyiidae					
Ptecticus tenebrifer (Walker)		0	0	75	7
Sargus sp.		0	0	0	14
Sepsidae					
Saltella sphondylii (Schrank)		889	0	5	2,079
Meroplius minutus (Wiedemann)		4	0	75	0
Sepsis cynipsea (Linnaeus)		6	0	0	4,474
Sepsis duplicata Haliday		811	30	1	3,710
Sepsis flavimana Meigen		75	11	2	380
Sepsis latiforceps Duda		439	44	12,478	4,711
Sepsis nigripes Meigen		176	1	14	9
Sepsis thoracica (Robineau-Desvoidy)		0	0	0	194
Sphaeroceridae					
Sphaerocera curvipes Latreille		48	14	91	—
Sphaerocera pseudomonilis Nishijima et Yamazaki		0	1	8	—
Lotobia pallidiventris (Meigen)		0	60	1	—
Ischiolepta scabricula (Haliday)		2	0	0	—
Ischiolepta draskovitsae (Roháček et Papp)		4	5	0	—
Norrbomya sordida (Zetterstedt)		1	39	1	—
Coproica acutangula (Zetterstedt)		0	57	0	—
Chaetopodella scutellaris (Haliday)		32	4	5	—
Opalimosina mirabilis (Collin)		3,042	606	1,292	—
Spelobia bifrons (Stenhammar)		238	52	642	—
Spelobia luteilabris (Rondani)		19	10	49	—
Scathophagidae					
Scathophaga stercoraria (Linnaeus)		0	0	24	468
Scathophaga scybalaria (Linnaeus)		0	0	0	415
Anthomyiidae					
Emmesomyia villica (Meigen)		0	0	0	241
Emmesomyia oriens Suwa		0	0	0	6
Emmesomyia hasegawai Suwa		0	0	0	5
Emmesomyia sp.		4	58	6	0
Hylemya nigrimana (Meigen)		0	0	0	4
Paregle cinerella (Fallén)		0	0	0	237
Muscidae					
Azelia cilipes (Haliday)		0	0	0	11
Azelia monodactyla Loew		0	8	0	0
Hydrotaea albipuncta (Zetterstedt)		0	0	0	261
Hydrotaea ignava (Harris)		1	1	309	0
Hydrotaea meteorica (Linnaeus)		0	0	0	7
Hydrotaea parva Meade		0	18	0	0
Polietes domitor (Harris)		0	11	0	0
Polietes nigrolimbatus (Bonsdorff)		0	0	0	5
Musca bezzii Patton et Cragg		0	0	0	6,975
Musca domestica Linnaeus		0	1	5,993	0
Morellia asetosa Baranoff		0	0	0	12

Table 1. (continued)

Species	Localities	Obihiro			Otofuke
	Animal species	Cow	Horse	Pig	Cow
	No. of droppings	40	40	40	120
Morellia hortorum (Fallén)		0	0	0	3
Neomyia cornicina (Fabricius)		43	0	0	7,789
Pyrellia vivida Robineau-Desvoidy		0	84	0	0
Eudasyphora cyanicolor (Zetterstedt)		0	0	0	912
Stomoxys calcitrans (Linnaeus)		0	0	87	0
Haematobia irriatans (Linnaeus)		10	0	0	113
Helina deleta (Stein)		0	0	0	6
Helina reversio (Harris)		0	0	0	1
Mydaea urbana (Meigen)		0	0	0	1
Myospila meditabunda (Fabricius)		0	0	0	110
Hebecnema umbratica (Meigen)		5	1	1	808
Sarcophagidae					
Parasarcophaga albiceps (Meigen)		8	0	18	1
Ravinia striata (Fabricius)		28	13	1	155
Total		5,885	1,129	21,178	34,124

breeding habitats. Breeding records for *Spelobia bifrons* (Stenhammar) show that this species also has a wide range of larval media but may prefer cow droppings and pig dung.

Scathophagidae. Two species of *Scathophaga* prefer cow droppings, but *S. stercoraria* was also bred in pig dung.

Anthomyiidae. Coffey (1966) obtained *Paregle cinerella* (Fallén) mainly from pig dung, and to a smaller extent from sheep, cow, and horse dung, whereas, Hennig (1966–1976) noted it as a regular breeder only in cow dung. The only occurrence from cow droppings in Otofuke shows that this species may prefer cow droppings in Japan. Hennig (1966–1976) noted that *Emmesomyia villica* (Meigen) has the same life history as that of *E. socia* (Fallén) which breeds in feces in Europe, but the report did not indicate what kinds of animals. The present results show that *E. villica* breeds in cow droppings. *Hylemya nigrimana* (Meigen) was recorded under tree bark (Perry and Stubbs, 1978) and as an occasional breeder in cow dung (Skidmore, 1978). In Japan, this species is also a very rare species in cow droppings.

Muscidae. *Hydrotaea albipuncta* (Zetterstedt), *Musca bezzii* Patton et Cragg, *Neomyia cornicina* (Fabricius), *Eudasyphora cyanicolor* (Zetterstedt), *Haematobia irritans* (Linnaeus), *Myospila meditabunda* (Fabricius) and *Hebecnema umbratica* (Meigen) were obtained from cow droppings in large numbers in Otofuke. These species are the Palaearctic members inhabiting cow droppings in Europe except for *Musca bezzii*; they are all prefer cow droppings in Japan also. *Musca domestica* Linnaeus, *Hydrotaea ignava* (Harris) and *Stomoxys calcitrans* (Linnaeus) occurred mainly in pig dung. Though *Azelia cilipes* (Haliday), *Hydrotaea meteorica* (Linnaeus), *Polietes nigrolimbatus* (Bonsdorff), *Morellia asetosa* Baranoff, and *M. hortorum* (Fallén) were bred from cow droppings in small numbers, they may also be members of the cow-dropping community in Japan. According to Shinonaga (2003), adults of *Azelia monodactyla* Loew frequented horse dung in northern Japan. Results of the present study confirmed that *A. monodactyla* is a horse dung breeder. Horse dung is only known larval pabulum of *Pyrellia vivida* Robineau-Desvoidy, although adults visited carrion (Skidmore, 1985). Our records show that this species also is a horse dung specialist in Japan. *Hydrotaea parva* Meade was recorded from

horse dung by Michelsen (1977), but Shinonaga (2003) collected adults of this species from cow dung in Japan. The present results show that this species prefers horse dung as a larval medium. *Polietes domitor* (Harris) was also obtained only from horse dung, showing this species is a horse dung breeder; this agreed with the observation by Portchinsky (1910).

Sarcophagidae. A number of species of the genus *Ravinia* breed in dung from cows and other animals (Coffey, 1966). *Ravinia striata* (Fabricius) was bred from cow droppings and horse dung, but it may have a preference for cow droppings. *Parasarcophaga albiceps* (Meigen) breeds in animal carcasses, animal dung, human feces, and garbage (Kano et al., 1967), but cow droppings and pig dung also comprise a portion of its larval breeding media.

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