Seasonal Abundance of Stable Flies, *Stomoxys calcitrans* (L.) (Diptera: Muscidae), at Glenlea, Manitoba

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Seasonal abundance of stable flies, *Stomoxys calcitrans* (L.) was studied at Glenlea, Manitoba in 1988 and 1989, using modified Williams traps with Tanglefoot® as an adhesive. Flies were trapped at an animal confinement facility and on the beef pasture at the Glenlea Research Station. There were 7.5X more stable flies trapped at the animal confinement site than at the pasture in 1988, and 2.1X more in 1989. Trap catches exceeded 50 flies/trap from 16 June to 30 August, 1988 and 23 June to 15 September in 1989 at the animal confinement site. Trap catches on pasture exceeded 50 flies/trap on only 4 occasions during the same period in 1988, and 8 occasions in 1989.

INTRODUCTION

The stable fly, *Stomoxys calcitrans* (L.), is one of the major livestock pests world-wide (Steelman 1976; Morgan *et al.* 1983). This fly was introduced into North America from Europe by 1776 and was commonly found in south-

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ern Canada by 1900 (Brues 1913). Stable fly infestations are typically severe in and around animal confinement facilities (McNeal and Campbell 1981; Hall *et al.* 1983; Scholl *et al.* 1985). The fly breeds in spilled feed, soiled bedding and manure which often accumulate in such situations (Meyer and Petersen 1983).

Stable fly populations have been monitored using various techniques, *e.g.* visual counts on cattle legs (Mullens and Meyer 1987), animal-baited traps (Harley 1965), suction traps (Semakula *et al.* 1989) and alsynite panels covered with adhesive (Williams 1973; Broce 1988). Sticky traps have generally proven superior for sampling the stable fly (Ruff 1979; Patterson 1981). Trapping efficiency using fibre glass traps was reported to vary with changes in weather (Berry *et al.* 1981; Agee and Patterson 1983). Temperature, solar radiation and relative humidity seem to have a major influence on the trap effectiveness (Berry *et al.* 1986).

Despite the occurrence of the stable fly in large numbers during the summer in Canada, there are few published accounts on its activity in the field. Hearle (1938) discussed stable flies in general as pests of livestock, and Teskey (1960) briefly considered its status and abundance in Ontario. The only detailed studies to date are those of Lysyk and Schaalje (1992) and Lysyk (1993, 1995). In contrast, in the United States, the stable fly has been the subject of numerous field studies (*e.g.* Berry and Campbell 1985; Scholl 1986; Mullens and Meyer 1987; Skoda *et al.* 1991). Our objective was to describe and compare the seasonal abundance of stable flies in an animal confinement facility and a beef cattle pasture at Glenlea, Manitoba.

MATERIALS AND METHODS

This research was conducted in the University of Manitoba's Glenlea Research Station (49° 38′N, 97° 08′W), *ca.* 20 km south of Winnipeg. The farm lies in the Red River flood plain, where drainage is poor as a result of the fine textured Osborne clay soils and topography (Economic Atlas of Manitoba 1960; Barto and Vogel 1978). Cultivated cropland is dominant, with extensive deciduous vegetation along the river margins, and where planted as shade trees or shelter belts.

Two study sites were chosen on the research station: the animal confinement facility, with barns and open sheds which housed 133 dairy cattle, 10-20 beef cattle, five horses, >600 pigs, and 30-60 sheep and the beef cattle pasture. The pasture covered *ca.* 310 ha and was divided into 12 paddocks, 19-72 ha each. Beef cattle (184 cows and calves in total) were held in at least three

paddocks throughout the study. Cattle were held in the paddock where traps were placed from May to 8 July in 1988 and from May until the termination of the study on 15 September, 1989.

Trapping Regime. Flies were sampled from 17 May to 16 September, 1988 and from 29 May to 15 September, 1989. Modified Williams Sticky Traps were used to sample adult stable flies at both study sites. Each trap consisted of four 34 X 30 cm alsynite panels. The four panels were fastened to a 4 X 4 cm wooden stake with screws and washers. The lower edges of the panels were 50 cm above the ground.

Tanglefoot Paste® was used as an adhesive. The adhesive was pre-thinned with 95% ethanol (4 parts Tanglefoot Paste to 1 part alcohol) and applied directly on each face of the panel using a paint brush. At the end of each trapping day, the panels were removed and cleaned in the laboratory using 95% ethanol. Grass was trimmed as needed around the traps. Twelve traps were used: six traps were placed in the animal confinement site and six were used in the pasture. Traps were set for nine hours (0700h-1600h) on each sampling occasion.

Traps were placed in the confinement area according to the classes of animals housed. In the pasture, all six traps were placed on two sides of one of the paddocks. Traps were placed 120 m apart along the edge of the pasture.

Trapped stable flies and other insects were removed from the traps with a pair of forceps at the end of a predetermined exposure period of one hour or more. Stable flies were put into labelled plastic vials, and stored on ice in a cooler until transported to the laboratory. Flies were stored at -15°C±1C° until sexed (based on frontal distance between the compound eyes and on genitalia) using a dissecting microscope and counted.

Statistical Analyses. Statistical analyses were done using The System for Statistics (Wilkinson, Leland. SYSTAT: The System for Statistics. Evanston, IL: SYSTAT INC. 1988). Seasonal abundance data were subjected to a Chi square test to determine if there were any differences in attractance to the traps based on sex of the flies.

RESULTS AND DISCUSSION

Seasonal Abundance, 1988. Numbers of adult stable flies collected using the Williams sticky traps were consistently greater in the animal confinement site compared to the pasture (Figs. 1 vs 2, respectively). A total of 38,051 adult stable flies was collected during 1988. The first flies were collected during the week ending on 4 June and the last were collected on 14 Septem-

ber. The experiments were terminated on 16 September when no flies were captured on the traps located at the pasture. The traps had been in place two weeks (from 17 May) prior to the collection of the first flies. Totals of 33,577 (>88%) and 4,474 (<12%) stable flies were collected at the animal confinement site and at the pasture, respectively. Although the animal confinement area and pasture were within two km of each other, stable flies differed in abundance and in duration of relative peak numbers. Peak captures occurred from 16 June through 30 August at the animal confinement site when daily mean number of flies per trap exceeded 50. The largest number of flies, 138 flies/trap/h, was collected on 28 June at the animal confinement site. Peak numbers of flies were collected from 17 June through 26 August at the pasture when the daily mean capture per trap was more than 15 flies. On 28 July, 18 flies/trap/h were collected at the pasture. There was a single peak in abundance at both animal confinement and pasture sites in 1988.

Seasonal Abundance, 1989. Seasonal distribution patterns of stable flies at the animal confinement site for the 1989 season (Fig. 3) were different from those in 1988 in terms of duration and occurrence of peak abundance. Traps were set on 29 May and the first adult flies were collected on 2 June. Trap catches were comparable to the 1988 season except that the highest capture rate was observed two to three weeks later (28 July) than in 1988. Daily catches were low until the end of June and then a considerable increase occurred from 7 July attaining the highest level on 28 July. Daily trap catches averaged >50 flies per trap from 23 June through 15 September. From the animal confinement site, 26,747 (68% of seasonal total) were collected. In total, 12,610 stable flies (32% of seasonal total) were caught at the pasture site in 1989, more than 3.5-fold the 1988 total catch at the pasture when one takes into consideration the total number of hours of sampling for both years.

The pattern of seasonal abundance at the pasture was similar for both years. Peak numbers of stable flies occurred during the last week of July (Fig. 4), as in 1988. However, 76 flies/trap/h were obtained in 1989 compared to 18 in 1988.

Stomoxys calcitrans occurred from May to September at Glenlea. The seasonal abundance is similar to that observed in the western part of the United States by Petersen and Greene (1989) in that seasonal peak abundance occurred in summer. The duration of the stable fly season in southern Manitoba is shorter than in the United States. For example, in eastern Nebraska, the fly season lasted from late March to late November (Scholl *et al.* 1985). There was a single peak in abundance in June and July, depending on the spring weather conditions, particularly temperature and precipitation. Peak stable fly populations in southern Manitoba were similar to those of the central United States, *e.g.* Missouri (Hall *et al.* 1983), Nebraska (McNeal and Campbell 1981; Scholl 1986) and Iowa (Dahm and Raun 1955), except that a second

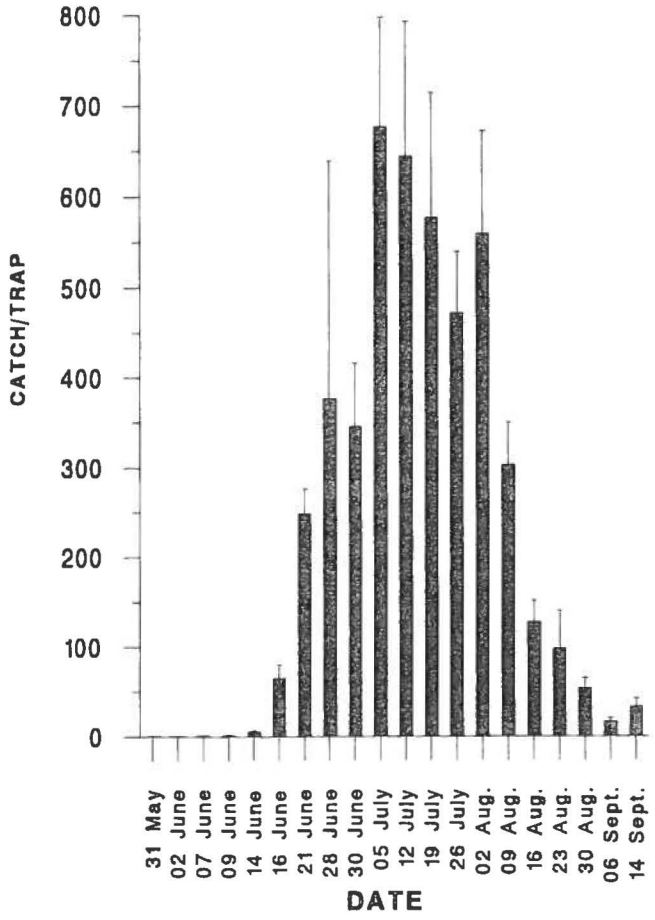

Fig. 1. Mean (± standard error) numbers of stable flies caught per sticky trap per day (n=6) at the animal confinement site in 1988, Glenlea Research Station.

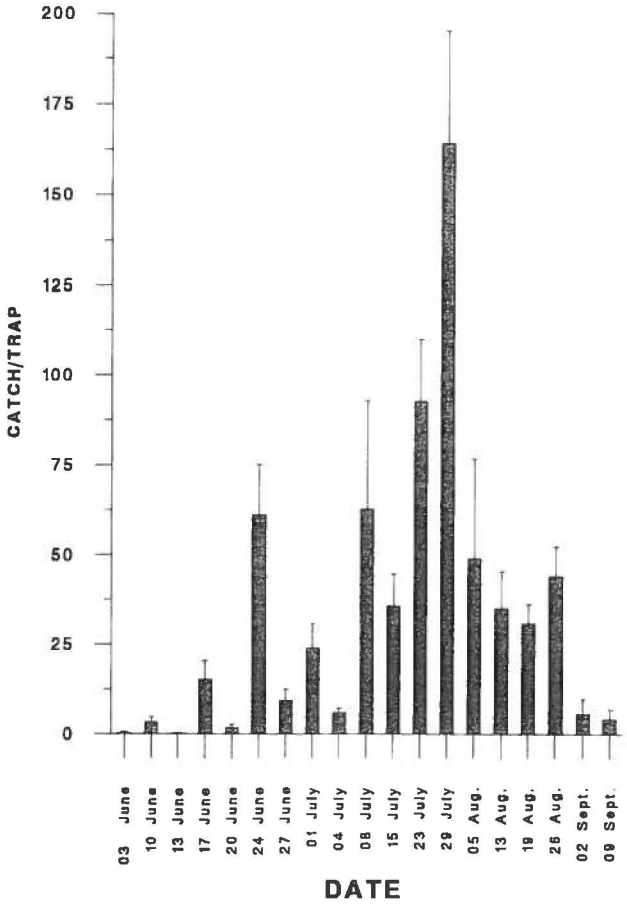

Fig. 2. Mean (± standard error) numbers of stable flies caught per sticky trap per day (n=6) at the pasture site in 1988, Glenlea Research Station.

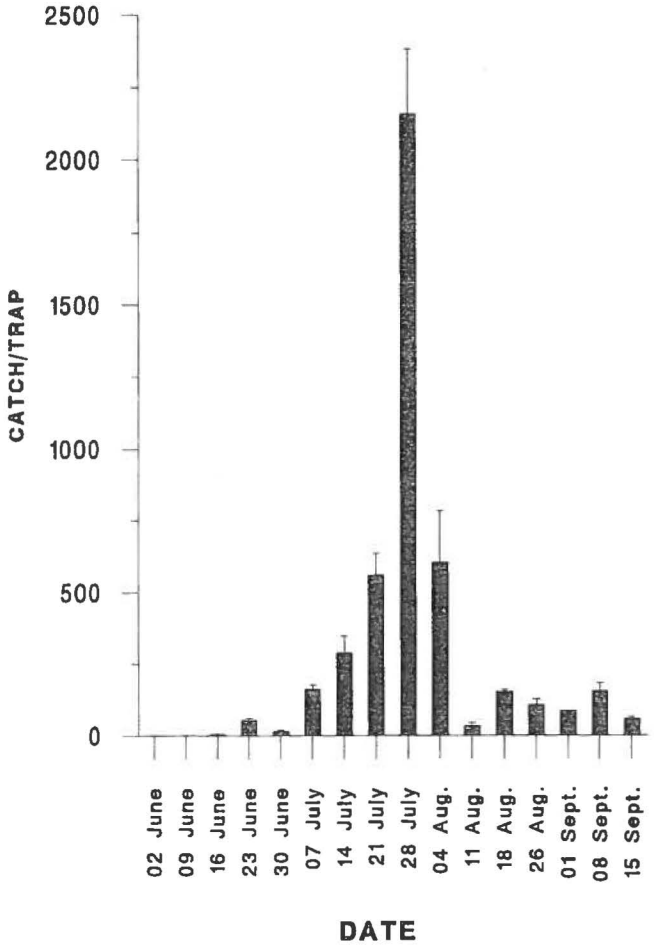

Fig. 3. Mean (± standard error) numbers of stable flies caught per sticky trap per day (n=6) traps at the animal confinement site in 1989, Glenlea Research Station.

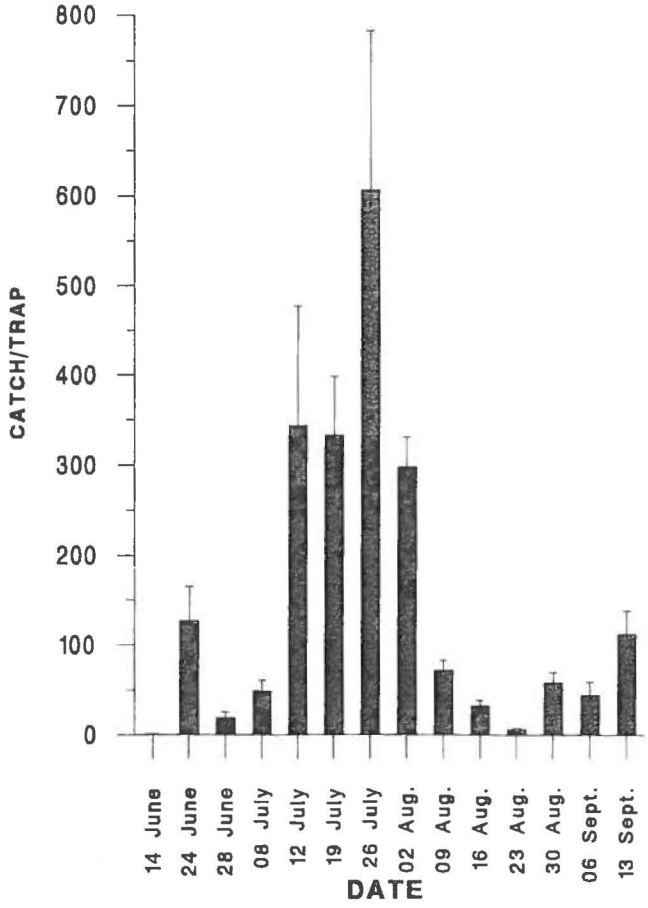

Fig. 4. Mean (± standard error) numbers of stable flies caught per sticky trap per day (n=6) at the pasture site in 1989, Glenlea Research Station.

peak abundance occurred in Nebraska in early September (Stage and Petersen 1981). In Alberta, stable flies were collected May to October around dairy barns, reaching peak abundance later in the season, in August and September (Lysyk 1993).

Thomas *et al.* (1989) reported a seasonal abundance pattern in southwest Nebraska very similar to the one reported here. Peak abundance occurred during the last week in June to the second week in July. It is interesting that, unlike eastern Nebraska, no second peak in abundance was observed in autumn in the southwest region of Nebraska (Thomas *et al.* 1989). Even though two peaks in seasonal abundance occur in some U.S. states, *e.g.* California and eastern Nebraska, the autumn peak is inconsistent and dependent on moisture availability (Mullens and Meyer 1987). Stable fly numbers decreased substantially in August, 1988, even though temperatures remained high, probably because of the lack of moisture in the breeding sites. Temperatures declined sharply in September, 1988 and stable flies virtually disappeared, especially at the pasture. Since the pasture was an open site, flies were exposed more to wind and cold conditions which resulted in a sharp decline in numbers of flies compared to the animal confinement site which was surrounded by trees and buildings.

Numbers of trapped flies differed considerably at the animal confinement site and pasture between years of this study. In 1988, catches of stable flies at the animal confinement site were 7.5-fold greater than on pasture, and in 1989 were 2.1-fold greater than the pasture catches. More flies were trapped on pasture in 1989 than in 1988, perhaps because of changes in animal management or differences in climatic conditions. The cattle were fed silage in addition to pasture grass, and hence spent most of the time closer to the traps, resulting in higher numbers of flies captured on average than in 1988. In 1989, no beef cattle were kept in the barn and all beef cattle were held at the pasture. It has been shown that stable fly abundance at a location may be a reflection of host activity and abundance, and availability of oviposition sites (Gersabeck and Merritt 1983).

The differences in abundance between the two Glenlea sites supports the hypothesis that pasture populations are comprised mainly of dispersers. Flies dispersed to the pasture, probably to procure blood meals from the cattle kept in the pasture. Hall *et al.* (1983) observed that in a year with above-average rainfall, populations of flies were higher on pastures than during a dry year. Stable fly breeding sites were also found around large round hay bales (Hall *et al.* 1982). Unlike in the studies referred to here, no breeding sites were found at the pasture site, even in 1989 in our study. On the other hand, many breeding sites were located in both years at the animal confinement site, particularly along fences, below waterers and feed bunkers.

Sex Ratios. The proportions of males from both collection sites were higher than those of females (Table 1). The average male/female ratio of trap-collected flies was 2.6:1 at the animal confinement site and 1.3:1 for the pasture. The male/female ratios increased slowly (from 1.9:1 in June) over the season and was at its highest (3.8:1) in September for traps at the confinement site. Ratios of males/females were generally lower on pasture. In June and September, 1988, there were occasions when females were equal or more abundant than males in the collections (0.8:1 and 0.9:1, respectively) (Table 1).

The average proportion of males/females for traps at the animal confinement was 1.9, and 1.5 at the pasture in 1989 (Table 1). Males were predominate in traps at the animal confinement site. Females were equally represented in trap catches on the pasture site only during June, 1989.

These observations are consistent with previous observations made in the United States by Buschman and Patterson (1981). Females apparently avoid prominent spots such as light-coloured walls or traps, and also, males use such sites for basking while waiting for females. Gravid females may spend most of the time searching for oviposition sites. Once the females are inseminated, they tend to avoid male harassment near mating sites (Harris *et al.* 1966; Buschman and Patterson 1981). The male/female ratios were slightly lower in pasture trap samples compared to animal confinement samples and there was no clear increase as the season progressed. Pasture populations may have consisted primarily of dispersing flies. As in other insect populations, dispersers may be predominantly females (Johnson 1966; Hogsette and Ruff 1985). The observed overall average sex ratios (Table 1) were similar to ratios observed by other workers; for example, a 60:40 (M:F) sex ratio was reported on traps by Buschman and Patterson (1981); Scholl *et al.* (1985) reported a sex ratio of 55:45 (M:F).

Stable flies are a serious pest of livestock in Manitoba, despite the relatively short season for adult activity. With their late appearance in sticky traps, it is conceivable that many flies disperse into the province from the south, or from isolated overwintering sites in Manitoba. Research needs to be conducted on potential for overwintering and origins of stable flies in Manitoba.

Table 1. Observed monthly sex ratios (male:female) for stable flies collected using Williams sticky traps at the animal confinement and pasture sites at the University of Manitoba Glenlea Research Station during 1988 and 1989.

		Animal Confinement Site			Pasture Site		
		No. of Males	No. of Females	Sex Ratio	No. of Males	No. of Females	Sex Ratio
1988	June	8052	4216	1.9:1.0*	244	304	0.8:1.0*
	July	9879	4270	2.3:1.0*	1388	924	1.5:1.0*
	August	4740	2119	2.2:1.0*	995	559	1.8:1.0*
	September	238	63	3.8:1.0*	28	32	0.9:1.0
1989							
	June	250	256	1.0:1.0*	429	456	0.9:1.0
	July	13283	5831	2.3:1.0*	4985	3002	1.7:1.0*
	August	3522	1838	1.9:1.0*	1644	1151	1.4:1.0*
	September	1216	551	2.2:1.0*	602	341	1.8:1.0*

*Sex ratios are significantly different ($X^2_{1, 0.05}$) from 1:1.

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