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Synanthropy of Muscidae (Diptera) in the City of Valdivia, Chile

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Sinantropia de Muscidae (Diptera) na Cidade de Valdivia, Chile

RESUMO - O objetivo do presente trabalho foi determinar o índice de sinantropia de adultos de espécies de Muscidae coletados em Valdivia, Chile (39°48'S; 73°15'W). Moscas adultas foram coletadas mensalmente entre setembro 1996 e agosto 1997 em três locais representado os ambientes urbano, rural e natural. Carcaças de rato, vísceras de galinha e vísceras de peixe foram utilizadas como isca. Foram coletadas seis espécies de Muscidae: *Psilochaeta chalybea* (Wiedemann) foi a espécie mais abundante nas áreas rural e urbana, sendo considerada hemissinantrópica. A segunda espécie em abundância foi *Hydrotaea acuta* (Stein), sendo hemissinantrópica, ocorrendo com mais freqüência no ambiente natural. *Ophyra ignava* (Harris) foi outra espécie coletada em números relativamente altos, apresentando um comportamento eussinantrópico. As três espécies restantes, *Musca domestica* L., *Palpibracus valdiviensis* (Couri & Pamplona), e *Muscina stabulans* (Fallén) foram capturadas em pequeno número. Foram determinados e discutidos os índices de sinantropia, as abundâncias mensais e a eficiência das iscas utilizadas na atração das moscas, bem como a importância médico-sanitária das espécies mais importantes.

PALAVRAS-CHAVE: *Psilochaeta chalybea, Hydrotaea acuta, Ophyra ignava*, mosca urbana, índice de sinantropia

ABSTRACT - The objective of the present study was to determine the index of synanthropy of adults of Muscidae species collected in Valdivia, Chile (39°48'S; 73°15'W). The flies were collected monthly between September 1996 and August 1997 at three different locations, representing urban, rural and natural environments. Rat carcasses, chicken viscera, and fish viscera were used as bait. Six species of Muscidae were collected: *Psilochaeta chalybea* (Wiedemann) was dominant in urban and rural habitats, being eusynanthropic. The second species in importance was *Hydrotaea acuta* (Stein), being hemisynanthropic and more abundant in the natural environment. *Ophyra ignava* (Harris) was another species captured in relatively large numbers, and showing eusynanthropic characteristic. The remaining three species, *Musca domestica* L., *Palpibracus valdiviensis* (Couri & Pamplona), and *Mu scina stabulans* (Fallén) were captured in low numbers. In addition to the indexes of synanthropy, monthly abundances were determined and discussed, as well as the efficiency of the different baits used to collect the flies. The medical and sanitary importance of the flies was also assessed.

KEY WORDS: *Psilochaeta chalybea, Hydrotaea acuta, Ophyra ignava*, urban fly, synanthropic index

It is well known that the occurrence of several animal species, known as synanthropic, is dependent upon human settlements, and the muscoid flies are a group where synanthropy is a very common and well defined phenomenon (Povolný 1971). In South America, the first studies on synanthropic flies were done in Brazil by Ferreira (1978, 1983) and Linhares (1981a, b). In Chile there are no ecological studies on the Family Muscidae, in spite of their potentially important role in the transmission of several pathogens to humans and animals (González 1995, Greenberg 1973).

Existing literature deals basically with the taxonomy (Carvalho 1989a,b, 1993; Palka-Rocha & Carvalho 1994; Lopes & Khouri 1996), and there are no data available on population biology, behavior or seasonality. In a recent publication, the present authors (Figueroa-Roa & Linhares 2002) reported the first studies on ecological aspects and synanthropy of Calliphoridae (Diptera) in the city of Valdivia (39°48'S; 73°15'W) in southern Chile. The present study extends the results to include the collected species of Muscidae (Diptera) from the same area.

Materials and Methods

Flies were collected with traps made from metal cans measuring 15 cm in diameter and 20 cm in height, as described by Ferreira (1978, 1983) and Linhares (1981a, b). Three kinds of baits were used: rat carcasses, chicken viscera, and fish viscera. The baits were left for at least 24h at environment temperature to allow putrefaction, and were changed at 24h intervals.

Sampling was carried out simultaneously in three areas having different ecological characteristics: urban area, rural area, and natural area, all located near the "Universidad Austral de Chile" in the vicinity of the "Isla Teja" campus, Valdivia, Chile. Two traps were used with each bait at each collection site, one placed in the shade and the other under direct sunlight, totaling 18 traps for the three sites. Collection was carried out simultaneously at the three locations, for five consecutive days each month from September 1996 to August 1997. The synanthropic index was determined using the formula of Nuorteva (1963): SI = (2a + b - 2c)/2, where a = percentage of individuals of a given species collected in the urban area; b = percentage of the same species collected in the rural area; c = percentage of the same species collected in the natural area.

Statistical analysis was performed using the SAS® (Statistical Analysis System) software. A three-way ANOVA was used to make comparisons among variables, using the GLM (general linear models) procedure. The independent variables were the site of collection, the insolation regime and bait type, and the response variable was the abundance of flies. REGW multiple comparisons test was used in cases where significant differences among the variables were observed (SAS Institute 1986). More detailed descriptions of the capture locations, methods, and analysis may be found in Figueroa & Linhares (2002).

Results

Table 1 presents the list of Muscidae species captured in this study, and their abundances. The species classification is based on Carvalho (2002).

Psilochaeta chalybea (Wiedemann) has a Neotropical distribution, occurring in Brasil (Rio Grande do Sul), Chile (Valparaiso, Santiago, Concepcion, Llanquihue, Chiloe), Argentina (Buenos Aires) and Uruguay (Malloch 1934, Stuardo 1946, Carvalho 1989a) This species was collected in smaller numbers during the cooler months than in warmer months (Fig. 1), and was caught mostly in traps exposed to direct sunlight (78.8%). Its synanthropic index of +58.7 shows that it prefers human environment, although it was caught predominantly in rural areas ($F = 6.96$; $P < 0.005$). Apparently, this species is attracted basically to fish viscera, for 56.5% of the specimens were caught in this type of bait (Table 2).

Hydrotaea acuta (Stein) has a Neotropical distribution, and most records of this species are in Chile (Palka-Rocha & Carvalho 1994). Most specimens were caught during warm months (Fig.1) and 70.5% in sun-exposed traps. The most attractive bait was fish viscera (60.5%). Its synanthropic index at +4 suggests that it is independent from human environments, with most specimens (62.5%) caught in rural areas and only 5.1% occurring in urban areas ($F = 5.17$; $P < 0.05$) (Table 2).

Table 1. Species abundances and percentages of Muscidae captured in the Valdivia area from September 1996 to August 1997.

Species	Abundance	%
Subfamily Azeliinae		
Tribe Azeliini		
Hydrotaea acuta	751	30.7
Ophyra ignava	539	22.0
Muscina stabulans	4	0.2
Subfamily Azeliinae		
Tribe Reinwartdtiini		
Palpibracus valdiviensis	24	1.0
Psilochaeta chalybea	1049	42.8
Subfamily Muscinae		
Tribe Muscini		
Musca domestica	81	3.3
Total	2448	100

Ophyra ignava (Harris) has a cosmopolitan distribution, and was captured only during warm months, disappearing during the cold months (Fig.1). Approximately 66% of the specimens were caught in traps exposed to sunlight ($F = 4.67$; $P < 0.005$), and 66% were attracted to fish viscera. Its synanthropic index was +63.9%, evidencing that this species prefers human environments. About 61% of the specimens were caught in the urban environment and 29% in the rural zone ($F = 5.44$; $P < 0.005$) (Table 2).

Musca domestica L. was captured only during the warmer months (Fig. 1), and approximately 82% of the specimens were collected in traps exposed to sunlight. Its synanthropic index was high +62.8, evidencing its eusynanthropic behaviour (Table 2).

The genus *Palpibracus* (Rondani) has a highly restricted distribution, which is the Andean regions of Chile and Argentina (Carvalho 1989 b, Lopes & Khouri 1996). *Palpibracus valdiviensis* Pamplona & Couri was the only collected species, and was described by Pamplona & Couri (2000) from specimens collected in this work. It is heliophilic, with about 68% of the specimens caught in sun-exposed traps. Its synanthropic index was +14.6, with 70.8% of the specimens caught in the rural area (Table 2).

Muscina stabulans (Fallen) is a cosmopolitan species and was caught in very small numbers.

Discussion

Only three of the species occurred in appreciable numbers in the study area. *P. chalybea* was the most abundant, and was present during most of the year, being

Table 2. Absolute and relative frequencies of species of Muscidae and their synanthropic indexes (SI) in three collections areas in Valdivia, Chile from September 1996 to August 1997.

Species	Urban area		Rural area		Natural area		SI	Total
	N	%	N	%	N	%		
P. chalybea	349	33.3	644	61.4	56	5.3	+57.6	1049
H. acuta	38	5.1	470	62.6	243	32.3	+4	751
O. ignava	326	60.5	154	28.6	59	10.9	+63.9	539
M. stabulans	3	75.0	1	25.0	- -	-----		4
M. domestica	44	54.3	29	35.8	8	9.9	+62.8	81
P. valdiviensis	1	4.2	17	70.8	6	25	+14.4	24
Total	761	31.1	1315	53.7	372	15.2		2448

more abundant during warmer months. It was collected in higher numbers in the rural area and low numbers in the forests, and due to its eusynanthropy, it should be considered a potential risk in the transmission of infectious diseases in the Valdivia area. Carvalho (1989 a) suggested that this species has a distribution restricted to the South American cone, with most records from Chile, and may play an important epidemiological role in local human environments. In Curitiba, Brazil, Carvalho *et al.* (1984) caught few individuals of this species, where it was considered to be asynanthropic, having a local synanthropic index of -22.37.

The second species of numerical importance in Valdivia was *H. acuta*, being also more abundant in warmer months. The species preferred the rural environment even though increases in temperature in the warmer months caused an increase in capture numbers in wooded areas. It was not typically present in the proximity of human environments, having a synanthropic index of only +4. These data suggest that the fly is not attracted to human activities, thus having no importance in disease transmission. Palka-Rocha & Carvalho (1994) described this species from both Chile and the United States.

The third most collected species in Valdivia was *O. ignava*. As with the preceding species, it were caught during the warmer months and disappeared during the

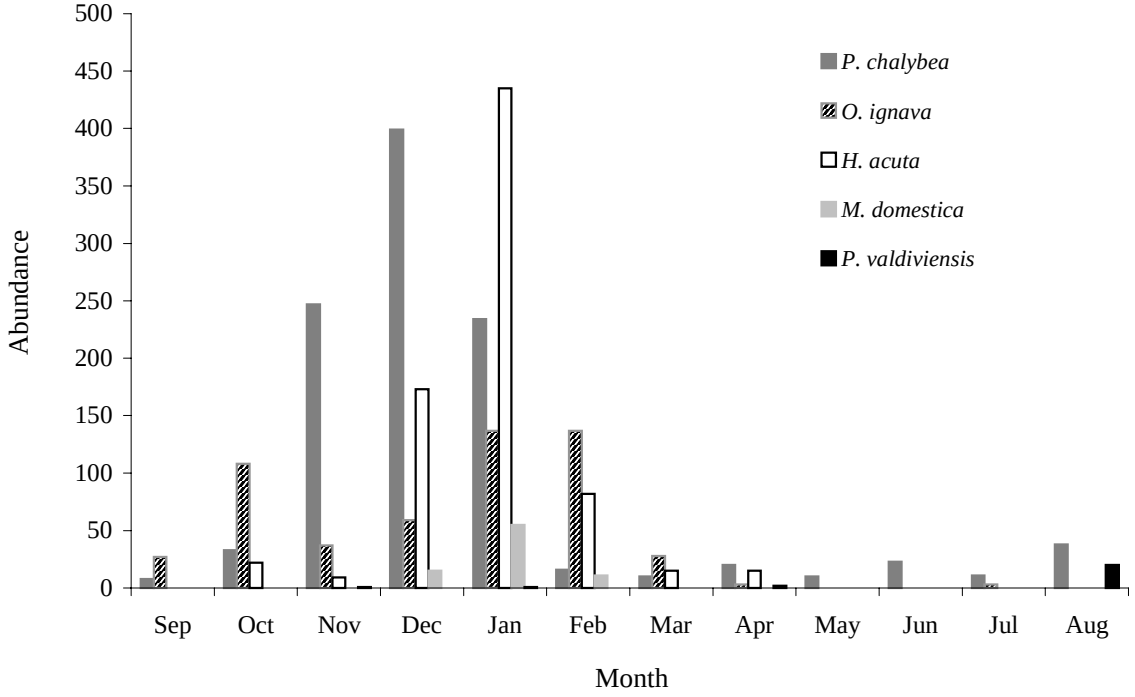

Figure 1. Monthly distribution of the main species of the Muscidae in Valdivia, Chile. from September 1996 to August 1997.

remainder of the year. Although being a sun-loving species, its numbers decreased somewhat in January and February (austral summer). It was collected in larger numbers in the urban zone and its synanthropic index was +63.9. These characteristics lead us to consider this species as eusynanthropic, and potentially important in the mechanical transmission of pathogens to humans. Barrat (1991) discussed the possibility that this species was displacing *M. domestica* in some areas of the world, citing England and Australia as examples. Other authors have discussed the use of this species as a potential agent for the biocontrol of *M. domestica* (Farkas *et al*. 1990).

Some data suggest that flies of this genus belong to a complex of species attracted to animal carcasses, in which the first larval stages are necrophagous, and the second and third larval stages prey on the dominant necrophagous species (Smith 1986). In our region, the dominant necrophagous species include the calliphorids *Calliphora vicina* Robinaeu-Desvoid and *Lucilia sericata* (Meigen) which were collected in higher numbers in November and January-February (Figueroa-Roa & Linhares 2002). The monthly distibution of *O. ignava* (Fig. 1) indicated that peaks of abundance occurred in October and January-February. More studies are necessary on the necrophagous fauna in our region in order to determine whether the coincidence of maximum abundance of *C. vicina* and *O. ignava* results from selective predation, which in some cases may be an advantage for competing species (Smith 1986).

Many species of Muscidae are coprophilic (Greenberg 1971, Linhares 1981b). The used baits primarily attract necrophagous species, and secondarily species from the genera *Hydrotaea* and *Ophyra* which act as predators of the necrophagous species (Smith 1986). The bait used in the present study may have been one of the reasons for our low catch rates of muscid flies. It is interesting to note that we caught few (81) *M. domestica*, although this fly is strongly associated with urban areas throughout the world (Greenberg 1973). In spite of its small numbers, this species should always be considered as an important mechanical vector for the transmission of infectious diseases (Greenberg 1973) due to its eusynanthropic behaviour, endophilia, and high degree of sociality. New studies are necessary in order to determine the eventual displacement of *M. domestica* either by flies from the region (Farkas *et al*. 1990, Barratt 1991) or by the pteromalids *Spalangia endius* Walker, *S. cameroni* Perkins, *Muscidifurax raptor* Girault & Saunders, *Pachycrepoideus vindemmiae* (Rondani), and the staphylinids *Creophilus erytrocephalus* (Fabricius) and *C. maxillosus* L. All these species were introduced for the control *M. domestica* (Ripa *et al*. 1990). *P. valdiviensis* was collected in low numbers, mostly in the rural and forested locations. Therefore, this species may not be important in the transmission of pathogenic agents.

M. stabulans, a social and eusynanthropic species is always found near human environments, particularly in rustic, primitive rural neighborhoods, but is scarce in towns (Greenberg 1971, Linhares 1981b). It was the least collected fly in the present study.

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