One line (P447) did not match anything in the database (Table 2). Thus it is likely that line P447 falls in an as of yet uncharacterized region of the second chromosome.

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Drosophila female receptivity to males with different sound parameters values.

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Drosophila males from the various species usually have specific displays during courtship (Spieth, 1974; Ewing and Benet-Clark, 1968); these, when detected by the females should stimulate them until they are physiologically ready to mate. Generally, potentially receptive females wait at least one complete courtship sequence before adopting an acceptance behavior. The most conspicuous courtship behavior is some form of wing movement that produces a specific acoustic stimulus (Ewing and Bennet-Clark, 1968; Spieth, 1974; Ewing, 1979). The importance of this sound stimulus for conspecific identification and successful mating has been shown, experimentally, using different methodologies for each of the several *Drosophila* species studied (Manning, 1967; Bennet-Clark and Ewing, 1967; Spieth, 1974; Schilcher, 1976; Ewing, 1978; Kyriacou and Hall, 1982; Ikeda *et al.*, 1981; Liimatainen *et al.*, 1992). The interpulse interval (IPl) and the fundamental frequency (FF) are the sound stimulus parameters considered most appropriate for identification, as they vary among the species but are characteristic to each one (Bennet-Clark and Ewing, 1969; Chang and Miller, 1978; Tomaru and Oguma, 1994).

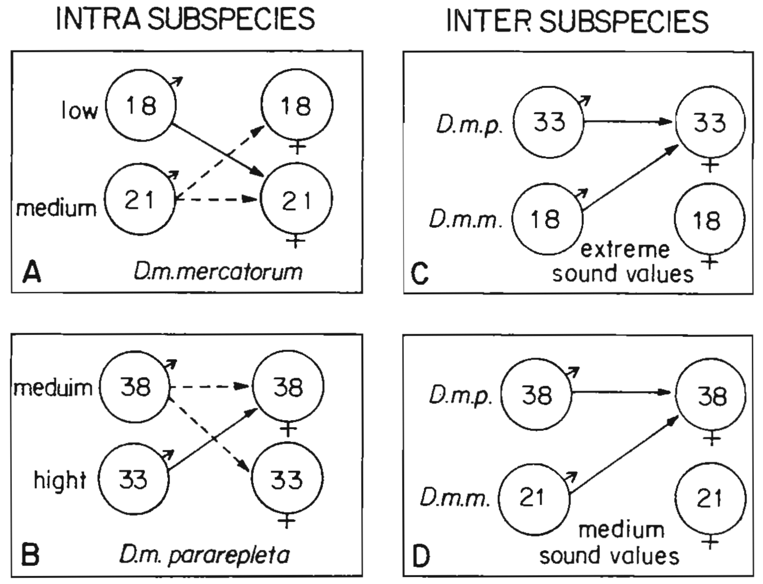

Figure 1. Graphical representation of *Drosophila mercatorum* female receptivity to males with different sound parameter values. A and B – crosses among lineages of the same subspecies with different values of sound parameters (Low, Medium and High) C and D – crosses among lineages of the two subspecies. The arrows indicate the results of crosses that were significantly more frequent. The numbers inside the symbols refer to the codes of the lineages.

—— – non casual mating, -------- - casual mating.

Drosophila mercatorum

Drosophila mercatorum (Paterson and Wheller, 1942) belongs to the *mercatorum* subgroup of the *repleta* group. The populations of this species are divided into two subspecies, typical and *D. m. pararepleta,* based on karyotype, chromosome inversions and geographic distribution (Dobzhansky and Pavan, 1943; Wharton, 1944).

The sound pattern of *D. mercatorum mercatorum* was initially described by Ikeda *et al.* (1980), who identified two types of sounds, A and B, which play a critical role in the female' sexual acceptance (Ikeda *et al.*, 1981). These sounds occur at different moments of courtship, vary in oscillogram, and it was suggested (Ewing and Myian, 1986) that sound A is related to species identification while sound B is the sexual stimulus. Manfrin *et al.* (1997) described the sound of the two subspecies and found that *D. m. pararepleta* have IPI and FF values for sound A significantly higher than *D. m. mercatorum.* Analysis of sound B proved to be complex but no significant difference was detected between subspecies.

Since the male courtship must be recognized by the female and her acceptance plays an important part in the evolution of the behavior of the male, the development of a specific pattern should depend on the variability of the male signals and on the females capacity to discriminate them. Thus, this work investigates if the variation in some parameters of sound A, observed among subspecies and geographic populations of *D. mercatorum*, interferes on the male's capacity to be accepted by the females.

Materials and Methods

Two isofemale lines of *D. m. pararepleta* (D33F43 - Cristalina, GO, BRAZIL and D38N62 -Luiz Antonio, SP, BRAZIL) and two lines of *D. m. mercatorum* (1521.18 - Rochester, NY and 1521.21 - Pupukea, Oahu, HI), which differ in their IPI and FF, were used (Table 1).

Experiments of the mating choice were carried out using one male and two females. The tests were done with virgin females, six to seven days old. During sexual maturation, the males were kept individually isolated, in 80 ml flasks, and the females were kept together in 105 ml flasks, both with banana culture medium. Each line was marked with a color of Radiant Color Powder Paint to differentiate the females, 24 hours before the experiment was carried out. To conduct the experiment, two females from different isolines and a male from one of the isolines were aspirated into an 80 ml glass flask containing culture medium. The three flies were observed for 60 minutes, or until copulation took place.

Three types of pairing were carried out using lines with values of IPI and FF statistically tested at level of 0.05 (Manfrin *et al.*, 1997).

1) between lines of the two subspecies, with different extreme values (33×18);
2) between lines of the two subspecies, with similar values (38×21);
3) between lines of the same subspecies: 33×38 (*D. m. pararepleta*) and 18×21 (*D. m. mercatorum*).

The Stalker index (Stalker, 1942) was used to determine the degree of isolation; it was calculated from the data by taking the difference between homogamic (among individuals of the same lineage) and heterogamic (among individuals of different lineage) matings and dividing by the total matings. Its significance (consistency) was calculated by the proportions method (Woolf, 1968, Ohta, 1978).

Results

During the experiments, homogamic and heterogamic crosses were observed, intra as well as inter subspecies (Table 2). When the two subspecies were compared, we could see that the *D. m. pararepleta* females are more receptive to the males of both subspecies than the *D. m. mercatorum* females. Further, asymmetry was also observed among lines of the same subspecies, since males with extreme IPI and FF values crossed preferentially with females from lines with average values for these parameters (Figure 1).

Discussion

The crossings observed in this work, intra as well as inter subspecies, show that, in general, the receptivity of the females was not casual. The data obtained up to now, however, do not show whether the crosses pattern represented in Figure 1 is a direct consequence of the sound differences among the lineages.

Ikeda *et al.* (1980) observed significant differences in the sound A IPI values in *D. m. mercatorum* lines three times smaller than the ones that were used in this report. In crosses involving those lines, Ikeda *et* *al.* (1980) observed asymmetric matings and suggested that these patterns could be a consequence of the difference in IPI of the sound A.

Tomaru *et al.* (1998) studied the courtship behavior and the effects of courtship song in inter- and intraspecific crosses in the four sympatric species of the *D. auraria* complex and suggested that courtship songs are of great importance in mate discrimination and the sexual isolation between the species of this complex.

Table 1. Interpulse interval (IPI) and fundamental frequency (FF) characteristics of the lines of *D. mercatorum* used in the present study.

Lines	Codes	Subspecies	IPI (ms)	FF (Hz)
D33F43	33	*D. m. pararepleta*	10.8	419
D38N62	38	*D. m. pararepleta*	10.0	405
1521.21	21	*D. m. mercatorum*	10.3	359
1521.18	18	*D. m. mercatorum*	9.3	374

The asymmetric matings observed could also be a consequence of the intraspecific variation in the pattern of the female receptivity and male mating success that are not directly related to differences in sound IPI and FF values.

Some studies suggest that other courtship parameters must be acting on the establishment of the female *Drosophila* sexual preferences, for example, anal droplets (Ritchie and Kyriacou, 1994) and chemical signs (Scott, 1994; Liimatainen and Hoikkala, 1998). According to Scott (op. cit.) besides the sound parameters could be involved the speed and frequency of the copulations. In the *Ceratitis capitata* fly, mating success depends on the variation of the sexual activity among males (number of courtships, copulation attempts) and on the courted female (Whitties *et al.*, 1994).

In the crosses involving different *D. mercatorum* subspecies, the females were more receptive to *D. m. pararepleta* males, regardless of their IPI and FF values (Table 2). This suggests that characteristics possessed by *D. m. pararepleta* males may be more attractive for females than those of the *D. m. mercatorum* males. Besides, *D. m. pararepleta* females were more receptive to any males than *D. m. mercatorum* females. The observed result may indicate divergence in relation to sexual behavior among subspecies, as happens with other characteristics.

Considering that *D. m. mercatorum* originated from marginal *D. m. pararepleta* populations (Wasserman, 1982; Sene, 1986), the asymmetry observed in the crosses involving these subspecies would not be expected according to Kaneshiro's hypothesis (Kaneshiro, 1976). According to this hypothesis, derived

Table 2. Results of crosses between lines of the two *D. mercatorum* subspecies with known IPI and FF values.

Different subspecies, with extreme values of IPI and FF										
Male	IPI and FF	Females	N	NC	%NC	HOM	HET	I	C	TYPE
33 Dmp	high	33 + 18	65	23	35	31	11	0.38	3.80	homogametic
18Dmm	low	33 + 18	124	86	69	9	29	-0.53	5.79	heterogametic
Different subspecies, with similar values of IPI and FF										
Male	IPI and FF	Females	N	NC	%NC	HOM	HET	I	C	TYPE
38 Dmp	medium	38 + 21	45	14	31	21	10	0.35	2.41	homogametic
21 Dmm	medium	38 + 21	64	34	53	5	25	0.67	5.28	heterogametic
Same subspecies, with extreme values of IPI and FF										
Male	IPI and FF	Females	N	NC	%NC	HOM	HET	I	C	TYPE
33 Dmp	high	33 + 38	36	19	53	8	22	-0.46	2.52	heterogametic
38 Dmp	medium	33 + 38	33	3	9	18	12	0.20	0.57	random
21 Dmm	medium	18 + 21	31	8	25	13	18	-0.16	0.89	random
18 Dmm	low	18 + 21	31	-	-	7	24	-0.55	3.0	heterogametic

SPP = subspecies, N = number of crosses, NC = number of crosses without mating, I = isolation index (Stalker 1942), C = consistency.

populations simplify their behavior in courtship as a result of founder effects. Thus, females in the ancestral population discriminated against males from the derived population, while females from the derived population not only accepted courtship with males from the ancestral population, but sometimes even preferred them over males from their own population. Similar results for *D. mercatorum* subspecies were observed by Koeper and Fensten (1991), who found asymmetric mating between different geographic strains of *D. mercatorum*. However, their results did not allow to accurately infer direction of evolution between *D. mercatorum* subspecies.

The asymmetries observed in the intrasubspecific crosses show that males from lines with extreme IPI and FF values are accepted preferentially by females from lines with medium values for these parameters. This suggests a stabilizing selection on sound A. This fact agrees with the prediction made by Ewing and Myian (1986) after analyzing the sound of the species from the *repleta* group. According to these authors, sound A may be considered an isolating or identifying signal in the species that takes place at the beginning of courtship. It is unambiguous and subject to stabilizing selection.

Our results show that there is variation in the sexual behavior of *D. mercatorum* and it could not be explained by an exclusive hypothesis, instead it should be a byproduct of the modifications of the evolutionary process involving this species.

Acknowledgments: We thank Dulce Rocha and Denise Kuhn who reviewed the manuscript. This research was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), Financiadora de Estudos e Projetos (FINEP) and Universidade de São Paulo (USP).

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The attractiveness of *Drosophila* bait to arachnid predators and hymenopteran parasitoids.

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Introduction

When trapping drosophilids in the field it is not unusual to collect a number of hymenopteran parasitoids in the same traps. The parasitoids are attracted to olfactory cues from their host's resource in order to locate hosts for their larvae (*e.g.*, Carton *et al.*, 1986; Vet *et al.*, 1984; van Alphen *et al.*, 1991).

During a survey of drosophilids in New Zealand orchards, it was noticed that spiders and harvestmen were often found in the fruit-baited traps. *Drosophila* are often used as food for spiders maintained in