

BODY SIZE AND MATING SUCCESS IN *DROSOPHILA IMMIGRANS*: A FIELD STUDY. Sofija Pavković-Lučić and V. Kekić. Institute of Zoology, Faculty of Biology, University of Belgrade, 11000 Belgrade, Serbia:

Key words: *Drosophila immigrans*, body size, sexual selection, field study, Serbia

UDC 595.773.4:591

Sexual selection arises from "the advantages that certain individuals have over others of the same species and sex, in exclusive relation to reproduction" (Darwin, 1871). Nowadays, sexual selection is recognized as a special form of natural selection and is usually defined as selection that arises from differences in mating success (Arnold, 1994). Sexual selection related to body size has been investigated with a number of insect taxa (Thornhill and Alcock, 1983). In many species, male mating success and female fecundity, which represent major fitness components, are positively correlated with body size. For example, in many investigations in fruit flies (*Drosophila melanogaster*), in both laboratory and field conditions, larger males were more successful in mating than smaller males (Partridge et al., 1987a, 1987b; Markow, 1988; Taylor and Kekić, 1988; Bangham et al., 2002), while larger females had significantly higher fecundity than smaller ones (Robertson, 1957; Byrne and Rice, 2006). However, the number of papers reporting that mating success of males was not correlated with their size has grown with increase in the number of investigated *Drosophila* species (Markow et al., 1996; Pavković-Lučić and Kekić, 2007).

In this study, we examine the influence of body size on mating success and mating pattern as related to body size in a natural population of *Drosophila immigrans*. The given species is cosmopolitan and domestic; it belongs to the subgenus *Drosophila* and is a typical member of the *immigrans* group of species (Bächli et al., 2004). As far as we know, similar investigations on *D. immigrans* have not been previously conducted, either in the field or in laboratory conditions. The only paper considering the mating behavior of this species was published by Polak and Stillabower (2004): the authors found that among individual males, there was a significant positive relationship between positional fluctuating asymmetry (PFA) in sternopleural bristles and copulation latency and duration, but not copulation frequency.

The work presented here was conducted in Sremska Kamenica, on Fruška Gora Mountain (Serbia). *Drosophila* flies were collected on October 7th, from 8:00 to 11:00 h on large aggregations of fruit remnants (grapes and plums) left over after home-made brandy distillation. This specific habitat turned out to be very attractive for domestic *Drosophila* species (Kekić, 2002). Mating pairs as well as control samples of "unmated" flies were collected by aspirator. After capture of flies and species determination, a total of 60 pairs of *D. immigrans in copula* were identified, as well as 110 single flies: 79 males (60 of them, randomly taken, were scored for size) and 31 females.

Mating pairs and "non-mates" were preserved in ependorphes filled with 70% ethanol until their wing length was measured. Wing length was used as an index of adult body size

(Partridge et al., 1987a) and was determined using a binocular microscope fitted with an ocular scale (1 mm = 71 measurement scale units); all measurements were made by a single person. One wing (right) per fly was measured; the t test was used to determine if there is significant difference in mean wing lengths between mating and single, non-mating flies. The coefficient of phenotypic correlation (Pearson's r) was used to estimate phenotypic likeness of the mating males and females and thus the degree of assortative mating.

Mean wing lengths of males and females collected *in copula*, as well as those captured as "single" flies (control samples) are presented in Table 1. Although both males and females captured *in copula* were larger, on average, than those collected as single flies, those differences were not significant. Assortative mating for body size was not recorded: the coefficient of linear correlation (r) between sizes of females and males in copulation was positive, but not statistically significant ($r = 0.19$; $df = 58$; $P > 0.05$).

Our results suggest that, in natural conditions, larger *D. immigrans* males were not more successful in mating than smaller males. Naturally, it is possible that the control sample of males included males which were previously mated during that morning at some other place, and their presence in the control group may influence the results. However, since copulation in *D. immigrans* lasts quite long (47 minutes up to even one hour; Spencer, 1940; Spieth, 1952), which is much longer than in the majority of *Drosophila* species (Markow and O'Grady, 2006), we suppose that the number of such males in the control group was not great. On the other hand, it is logical to assume that sexual selection occurs when males are in competition, in other words, when the number of males which are ready to mate is larger than the number of receptive females, i.e., when the operational sex ratio (OSR) is skewed toward (more) males (Emlen and Oring, 1977). Thus, we do not know precisely the value of OSR in the "microhabitat" in which flies were captured. However, to judge from the sex ratio in control groups of flies (79 males: 31 females), we believe that there existed conditions for male-male competition and sexual selection.

Traditional models of sexual selection predict that in most animal species, males will be less discriminating in their choice of mating partners than females, because their investment in offspring is much lower (Trivers, 1972). If *D. immigrans* males expend more energy in gamete production than females and/or invest more energy during courtship and copulation, males could be expected, according to the parental investment theory, to be more eligible and to choose those females with which they would have a great number of offspring. As the most obvious trait influencing the reproductive value of a female is her fecundity (Bonduriansky, 2001), which in *Drosophila* is in

Table 1. Mean wing length in copulating and single *D. immigrans* males and females (means \pm standard error, in measurement units). Abbreviations: M = males; F = females; 1 mm = 71 measurement scale units.

Sex	N	Copulating flies $\bar{x} \pm$ S. E.	N	Single flies $\bar{x} \pm$ S. E.	t	df	P
M	60	147.92 \pm 1.28	60	145.02 \pm 1.27	1.61	118	0.11
F	60	158.33 \pm 1.17	31	154.39 \pm 3.28	1.38	89	0.17

positive correlation with body size, it could be expected that males choose larger females. Recent behavioral research on *D. melanogaster* in laboratory conditions assuredly revealed that males vary greatly in their level of interest in females, providing evidence that males have also evolved to mate selectively (Gowaty et al., 2003). Furthermore, if *D. melanogaster* males had a simultaneous choice between small and large virgin females, they preferentially mated with larger, more fecund, females. Moreover, after males had recently mated, they showed a stronger preference for larger females (Byrne and Rice, 2006).

According to results presented in this paper, the difference in mean wing length between mated and single females was also not significant (Table 1). Does it really mean that *D. immigrans* males are indiscriminate with respect to body size of females? This is always hard to say on the basis of only one investigation, which was, at that, conducted in the field. To be specific, it is not an unusual circumstance that in field experiments, different samples from the same or various habitats and from different seasons and/or years suggest completely different conclusions concerning correlation between body size and male mating success (Partridge, 1987b; Aspi and Hoikkala, 1992; James and Jaenike, 1992).

Finally, it is important to note that much information about the mating system of *D. immigrans* is lacking. This applies to behavioral tactics used by both sexes, the age structure of copulating and non-copulating flies, the female remating interval, the operational sex ratio in natural conditions, and male ejaculatory characters, all important in the "arena of sexual selection" [pre-mating or post-mating, as extensively discussed by Markow (2002)].

Acknowledgment — This work was funded by the Serbian Ministry of Science and Technological Development (Grant No. 146023).

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